NTDC
Indicative Generation Capacity Expansion Plan (IGCEP) 2047

A Critical Review

Khalid Faizi *FCA (Eng. & Wales); FCA ICAP*
EOBI House, 6th Floor,
G-10/4, Islamabad.
kfaizi@hotmail.com
+92 3005001633

Table of Contents

IGCEP 2047 - a critical review

IMMEDIATE ATTENTION REQUIRED

1. **Bring back Diamer Bhasha to 2029 to sync with WAPDA construction program**
2. **Classify large hydropower as a Renewable Energy source**
3. **Classify AJ&K/GB hydel, especially on R. Neelum opposite LOC as strategic**
4. **Classify Projects with LOI/LOS issued by GOP as committed**
5. **Bring Ashkot and Athmuqam hydropower projects on R. Neelum back to 2026**
6. **Recognise real cost of solar/wind over Rs 25/kWh**
7. **Add costly Thar coal with caution; levy carbon tax to check emissions**

Table 1-A Snapshot of IGCEP 2047

Category / Technology	Total MW	Committed MW	Candidate MW	Generic Candidate MW	Total MW	Candidate MW	Generic Candidate MW	Grand Total MW
	2020-30				2031-47			
Solar	**12,394**	394	-	12,000	**14,128**	-	14,128	**26,522**
Wind	**9,231**	899	-	8,332	**-**	-	-	**9,231**
Bagasse	**655**	655	-	-	**-**	-	-	**655**
Hydropower	**10,830**	8,199	2,625	6	**35,095**	35,095	-	**45,925**
Thar Coal	**5,804**	2,970	1,320	1,514	**26,893**	-	26,893	**32,697**
Imp. Coal	**1,620**	1,620			**-**	-	-	**1,620**
CCGT/OCGT	**4,888**		20	4,868	**20,959**	-	20,959	**25,847**
CASA	**1,000**	1,000			**-**	-	-	**1,000**
Nuclear	**3,300**	3,300			**-**	-	-	**3,300**
RLNG	**1,263**	1,263			**-**	-	-	**1,263**
Total	**50,985**	20,300	3,965	26,720	**97,075**	35,095	61,980	**148,060**

NOTE: Committed: *achieved FC/under construction/strategic*; **Candidate**: *named*; ***Generic***: unnamed blocks

Executive Summary

a) Do we realize that IGCEP 2047, under the pretext that Thar coal generation has the least cost, has prioritised highly polluting Thar coal with Levelized Cost of Electricity (LCOE) of US¢ 10.45/kWh, over clean and cheap hydropower with LCOE US¢ 8.74/kWh?

b) Do we understand that 26,522 MW solar, 9,231 MW wind together with 25,827 MW OCGT, as a combined package, will **cost more than PKR 25/kWh**, and turn out the most expensive electricity in the country? Is this a plan to sabotage cheap renewable energy?

c) Is it our intention, contrary to stated Government policy that in the period 2031-2047, some 26,893 MW of Thar coal, to push back 30,781 MW of cheap and clean hydropower beyond 2041 (effectively killing many mature projects and leaving the rest with no chance of seeing the light of day)?

d) Do we know that the planned Thar coal generation will entail 75-80 Million tons/year of lignite mining in Thar desert with major ecological and environmental repercussions?

e) Have we considered the many damaging effects of coal, and the link between coal fired air pollution, and numerous health defects ranging from cancer to neurological problems, as well as the environmental damages and havoc it causes?

f) Do we appreciate that a typical 660 MW coalfired plant uses 19 Million Gallons/Day of water for cooling alone; combined with mining, processing, and coal burning this figure rises into triple digits?[1]

g) Balancing variability and intermittency of solar/wind requires very fast response back-up generation support. Are we aware that hydropower is the fastest response generation technology with a response time in seconds? Compared with fastest response thermal which is 5-10 minutes, making hydropower the best generating technology to balance solar/wind intermittency. Has this been thoroughly studied?

h) Before deciding on thousands of MW of OCGT using imported LNG for generation to balance solar/wind intermittency, have we studied all other avenues including impact of geographically dispersed and hybrid plants, storage technologies, demand response, demand despatch and peak shaving concepts?

i) Has IGCEP 2047 considered how this huge planned power capacity will be financed? Especially in view of Commercial Code, market de-regulation and major transition planned in the power sector compounded by the highly publicised IPP controversy? Where will the private investment of tens of billions of US$ be forthcoming from to construct these plants?

We have tried to answer these questions and more in the following paragraphs: -

1. Why is generation tariff not indexed to give real cost of power over time?

IGCEP 2047 uses a reference US$ to PKR exchange rate of US$ 1 = PKR 156.7 but why has this not been extrapolated over the study period to get the real price of imported fuel power generation in an environment of continuous PKR devaluation over past 70 years? As an example, the fuel cost of RLNG plant Haveli Bahadur Shah increased over 100% in 3 ½ years from PKR 4.48/kWh (NEPRA reference tariff determination 8 August 2016) to PKR 9.45/kWh (NEPRA quarterly fuel price adjustment dt. 24 February 2020) which is mainly attributable to PKR devaluation.

But such an important impact has not been factored in the study and thus fails to show the real rupee cost of imported fuel thermal generation, and further such an approach distorts comparison with hydropower in favour of thermal and thus does not give a fair and useful assessment. If least cost tariff is the main goal of IGECP then the tariff must be properly indexed.

2. What is the real cost of solar and wind in IGCEP 2047?

"Furthermore, the GOP envisages to aggressively include 20% and 30% renewable energy generation by capacity by the year 2025 and 2030. However, these two energy resources due to their intermittency cannot be considered as firm capacity, at all points in time or all around the clock; therefore, appropriate amount of back up generation is also required to provide reserve requirements of the system" (IGCEP 2047, p. 27)

"A total of 26,921 MW candidate solar and 10,327 MW candidate wind are optimized by the year 2047. In a bid to cater for the intermittent nature of RE's and systems reserve requirements 25,828 MW of candidate OCGT's are selected by the tool" (IGCEP 2047, p. xxvi)

"*These OCGTs are selected to provide reserve requirements of the system but they are not readily despatched in normal operation, thus remain at almost zero annual plant factor."* (IGCEP 2047, p. 97)

In the study period 26,522 MW of solar and 9,241 MW of wind will be constructed and 25,827 MW of open cycle gas turbines (OCTG) added to balance the variability of solar/wind at a huge investment of over US$ 11 billion. The OCGT plants, operating at very low plant factors (under 1%), are required exclusively to balance solar/wind variability **with no other purpose**. The cost of OCGT must therefore be imputed to cost of solar/wind to determine the real total cost. **Do we know that this will give a combined solar/wind /OCGT cost of over PKR 25/kWh**, killing the dream of cheap renewable energy? This is hardly least cost optimisation, the stated purpose of IGCEP 2047; but do the decision makers understand and realize this?

NEPRA is presently determining solar and wind tariffs at around US¢ 4/kWh while the LCOE of the OCTG plants operating at a plant factor of 5% (actual plant factor is < 1%) based on IGCEP 2047 construction cost of US$ 439/kW for OCGT has been calculated as a minimum of US¢ 11.5 kWh (excluding fuel cost), in line with international standards of US¢ 12-15/kWh for peaking power thus the actual cost of solar/wind, together with OCGT to balance intermittency, would be approx. US¢ 15.5/kWh or around PKR 25 /kWh (excluding fuel cost) [2].

Table 2-LOCE calculation for OCGT excluding fuel

Cost category	PMT US$	Rate	PV US$	Nper	FV	GWh	LCOE
Construction cost	($19,345,513)	10%	175,600,000	25	0	175,200,000	-11.042
Operation cost	($710,293)	10%	6,447,360	25	0	175,200,000	-0.405
LCOE (US¢/kWh)							**-11.447**
Assumptions: OCGT cost US$ 438,000/MW; PLF 5%; O&M 0.30 ¢/kWh; life 25 yrs							

"It is evident through the results that there is a wide disparity of thousands of MW between the projected demand and nominal capacity. It is pertinent to mention here that this gap is due to heavy induction of thermal generation source i.e. RLNG and other thermal options having high capacity factors and reserve provisioning characteristics to cope up with the intermittent nature of variable renewable energy" (IGCEP 2047, p. 95)

Why have as much as 25,827 MW highly expensive (and polluting) candidate OCGT plants, operating on imported LNG been added to balance solar/wind intermittency, defying the Government ban on imported fuel power plants? What about the ongoing import cost and Pakistan's scarce foreign exchange resources? Is this another example of different Government department's working at cross purposes with each other? Have the initiatives to reduce thermal generation and restrict import of fuel for power generation gone out of the window!

Why haven't the thousands of MW of new CCGT RLNG plants (Haveli Bahadur Shah, Trimmu, Balloki and Bhikki) which remain almost idle, at 5-7% plant factor (instead of designed 92%) been considered for RE intermittency balancing before adding thousands of MW of expensive imported fuel OCGT thermal LNG plants?

3. Why hasn't hydropower been considered to balance wind/solar intermittency?

While proposing thousands of MW of OCGT to balance wind/solar intermittency, why has it escaped the attention of the planners that the vastly superior, flexible hydropower enables better integration of Variable Renewable Energy (VRE) into the grid by utilizing excess generation and being ready to produce power during low wind and solar generation periods?

On a very short timescale, from sub-seconds to minutes the challenges of VRE integration in the operation and management of the grid, can be provided by hydropower; which has the ability to quickly ramp up electricity generation in response to periods of peak demand, one of its key features, specially to support high volumes of solar and wind in the grid.

Grid support ancillary services such as frequency and voltage regulation, fault ride through, spinning reserve, system restoration, load-following and flexibility reserve,

energy imbalance service and black start (restoration) service are well suited to be provided by hydropower [3].

While one can criticise, that hydropower has a varied generation profile during the year i.e. in summer, with maximum water availability hydropower operates at full load and in winter with substantially reduced generation profile. However, on the one hand it depends on the hydropower plant sizing at which it is designed, for example a hydropower plant could be designed as a base-load plant with maximum plant factor to run most of the time of the year at full load or at economic sizing to achieve minimum unit cost of generation out of it and on the other hand hydropower generation profile matches hugely with the demand profile i.e. in winters when hydropower generation is low the demand also reduces to its minimum while in summer when hydropower generation is at its maximum it very well matches the system demand.

4. Methods to balance wind/solar intermittency?

Instead of blindly relying on expensive OCGT thermal generation to balance solar/wind, why were other options not considered ? these could include load flexibility through *demand response* whereby grid operators can dispatch an aggregated unit of demand reduction, "shaving" the peak and reducing the amount of expensive peak power that must be produced.

The shift to more despatchable demand has important consequences. To the extent consumption can be controlled, the big peaks and spikes of demand can be reduced. That, in turn, reduces the need for overbuilding of power plants, potentially saving US$ billions and reducing unnecessary carbon emissions.

This is especially important due to rapid planned growth in renewables, which would create intermittency in supply as well as occasional supply spikes that lead to curtailment (shutting wind and solar off temporarily). Demand response can move quickly (providing ancillary services to smooth out micro-fluctuations), and it can also help soak up excess renewable energy in times of surplus. Both of these will help the grid absorb more renewables. It appears the decision to add thousands of MW of imported fuel OCGT plants was **not well thought out and appears faulty.**

Solar and wind intermittency can be partially mitigated by the geographical spread, hybrid wind/solar and hybrid floating solar/hydro configurations. Although the wind may not blow and the sun may not shine at a particular location at a given point in time, when hundreds of locations are considered, the intermittency of weather conditions will be "smoothened", giving a more steady stream of electricity and reliability. Were these aspects carefully studied and considered before the massive quantity of OCGT imported fuel LNG power plants was decided? Is the love affair with thermal generation and hydrocarbon fuel import to be pursued at all cost?

5. Why has the report totally negated hydropower?

Hydropower is Pakistan's lifeline; it is the most precious and underutilised resource with some 60,000-80,000 MW of untapped hydel resources available in the country. However, IGCEP 2047 has favoured the much more expensive coal and pushed valuable hydropower back by more than 20 years, which, if the hydro development cycle is considered means killing and abandoning the projects as no investor would wait or stretch the development period to 20 years! Therefore, pushing back these projects must be considered as a conscious anti-indigenous renewable energy bias.

The "PLEXOS" planning tool cannot be blamed as the *"garbage in garbage out"* axiom must be borne in mind. Results of planning tools cannot be blindly followed without a "common sense" check. There is a serious disconnect between different departments of the GOP which are working at cross purposes to one another; resulting in many inconsistencies and less than optimal planning and decision making.

In what seems to be a random approach, many active hydropower projects with LOI, feasibility, power evacuation and environmental studies completed and credible sponsors in place for e.g. 450 MW Athmuqam and 300 MW Ashkot, in AJ&K, have been pushed back 20-25 years while inactive projects such as 132 MW Rajdhani and 500 MW Chakoti Hattian that are yet to be advertised and begin their development journey, have been prioritized in earlier years. Though in fact considering the advanced development for the first two and AJ&K location for the second two, all these projects should have been prioritized and pushed for completion earliest.

6. Why has hydropower working life been taken as 50 years?

IGCEP 2047 has taken hydropower and nuclear working life as 50 years and 70 years, respectively. Working life is a key variable in the economic evaluation of different generating technologies. Hydropower has the longest working life of all generation technologies. Some 80% of hydropower cost is civil works and hydraulic steel structures having a life in excess of 100 years; remaining 20% cost comprises generating plant i.e. turbine/generators operating at 300-400 RPM (long life) compared with gas turbine which operate at over 3000 RPM, thus giving hydro turbines a long working life. A limiting factor in hydropower projects may be reservoir life but the project continues as a run-of-the river scheme even if the reservoir is fully silted up.

With periodic major overhaul (included in O&M cost) the plant life can match the civil works life. The life of hydropower projects is circa 100 years as experienced worldwide and in Pakistan. Mangla hydropower project which was built with a design life of 100-110 years in 1960, has been in operation for 55 years, however, due to watershed management, and Mangla Raise completed in 2009, the 100-year design life is now 200+ years [4]. With 12% increased power generation and 60% increase in water storage by conservative estimates [5] [6]. Hydropower working life is the longest of any

generating technology and its economic value should be measured as 100 years; IGCEP 2047 should consider this ground reality in their analysis.

7. Why has an un-achievable target for Solar and Wind been committed in the plan?

Notwithstanding the Government desire, the target of 20,332 MW (2,541 MW/year) of solar/wind projects in an 8-year period (2023-2030) is just not achievable. There are issues of land, capacity, investors, and environment which must first be navigated before these projects see the light of the day, especially in view of the state of the power sector today.

Pakistan has developed only 300-400 MW annually in past decade; and may boost its capacity to develop a maximum of 1,000 MW capacity per year if a concerted and huge effort is made. If this is the case, then the IGCEP 2047 plan is clogged with some 12,000 MW of unachievable capacity which will cause disruption somewhere in 2028-29 when it would be too late to add new generating capacity, except thermal, to fill the void. Nominating large hydropower as a renewable technology, a common practice **worldwide**, would make this target more achievable. Plans can be aggressive but must be achievable to be effective.

8. Why have strategic hydropower projects such as Diamer Bhasha been pushed back?

Strategic projects such as Diamer Bhasha are vital for flood control, water storage and cheap power generation. Some 8.1 MAF (6.40 MAF live) additional water storage and 4,500 MW power would be added. Dam water storage capacity internationally reduces by about 1% per year and Tarbela water storage capacity has diminished by over 40% since commissioning some 45-50 years ago. Continued silting will result in loss of electricity generation at Tarbela and Ghazi Barotha besides the loss of water storage for irrigation purpose causing losses of US$ billions per annum.

Instead of accelerating construction of Diamer Bhasha dam which is vital not only in its own right but also critical for Tarbela, by extending Tarbela's life by 35 years, leading to economic gain in the billions of US$ as well as power, water storage and irrigation benefits. The project has been pushed back over 20 years in IGCEP 2047. This **does not appear to be a very wise decision**, displaying a clear dichotomy between planner and implementers.

Just recently *(12th of May 2020)* the Hon. Prime Minister of Pakistan directed WAPDA to expedite all outstanding issues and immediately start construction activities of the Diamer-Bhasha dam, as water security is the foremost priority of the country and the government. How can a department working within the Federal Government be so ill informed of the GOP's strategic plans and objectives? Why is there such a serious

disconnect between the MOE (controlling dept of NTDC) and the Federal Government?

9. Why are AJ&K and GB hydropower projects not considered as strategic?

Under its geospatial bill our neighbour has declared AJ&K and GB as part of its territory [7]. As a result, international multilateral financial institutions have stopped financing hydropower projects in AJ&K and GB. While on the other hand India is massively focussing on large hydropower, especially in occupied Kashmir. The criticality of this has escaped our decision makers as they continue to block and discourage investment in AJ&K and GB hydropower projects. While India is developing thousands of MW hydel capacity in IOK and utilizing the common water resources, Pakistan is dragging its feet like as it did with Neelum Jhelum HPP, losing rights to water of the Neelum River in the process.

As a clear example 450 MW Athmuqam and 300 MW Ashkot hydropower projects on the Neelum River in the AJ&K, were issued letters of interest, completed their bankable feasibility studies, power evacuation and environmental studies and are ready to take-off and achieve COD In 2026/27 as indicated for Ashkot in IGCEP 2040, but have been pushed back more than 20 years, to 2047.

Power development, especially hydropower, is a sequential, consecutive, and continuous process which culminates in financiers becoming available and ready to finance the projects. Any disruption in the process would seriously affect the ability to arrange project finance and keeping the financiers willing and available, thus leading to potential failure of the projects. The investors engaged in active project development in the AJ&K, already encountering financing difficulties, and on top facing direct shelling on the project sites, were stunned to see the projects pushed back more than 20 years! Whose interests are we serving?

10. Why don't we designate large hydropower as a renewable resource?

Our neighbour has recently declared large hydropower as a renewable energy resource (previously for decades under 25 MW was treated as RE) while targeting 75,000 MW of hydropower installation by 2030 from the current 45,000 MW with thousands of MW in IOK thus aligning itself with the rest of the world [8]. *"For decades India considered hydropower projects over 25 megawatts in capacity as conventional power projects. Over the last few years, however, there has been an effort by various ministries in the government to re-classify even large hydropower projects as renewable energy projects. Almost all other countries treat all hydropower as a renewable energy resource."*

They are now pushing to complete thousands of MW of hydropower projects **in** 10 years while we are pushing **out** thousands of MW of hydropower in 10 years! Does this make any sense? Pakistan needs a radical shift in thinking to align national policy between the different opposing departments. There is an unnecessary tussle between

solar/wind and large hydropower when in fact they are complementary to each other. India has also made it mandatory for States to purchase hydropower generation [8] [9].

The highly aggressive target of solar/wind for projects has been inserted in the plan as "priority" projects but yet have no site, sponsor, or feasibility and must pass through a long development process, including land acquisition before they are issued LOI. The Punjab Government set up Quaid e Azam Solar Park with 1,000 MW capacity and could only install 200 MW in 5 years; now GOP wants to construct thousands of MW solar in 8 years, which is effectively an unachievable target for many reasons.

Reclassifying large hydel as a renewable energy source, which it is, will end this tussle and help achieve the Government's target of renewable energy generation, by capacity, of 25% by 2025 and 30% by 2030. On the other hand, relegating the hydropower projects to the end of the queue is a big risk as neither will the huge solar and wind target be achieved nor will the deferred hydropower projects ever make it to the finishing line. The strategy will ensure failure of both solar, wind and hydropower leaving a gap for expensive fuel imported thermals, a story of repeated in Pakistan's past. This would be a great catastrophe and national loss.

Thus, large hydropower should be re-categorized as Renewable Energy with VRE redefined as wind, solar, bagasse & hydropower (all sizes). Revised targets should be developed allowing maximum push for each technology, minimizing risk of missing targets, if one category slips.

All efforts should be made to promote these large hydropower projects in Pakistan's strategic interest. Mature hydropower projects that have been pushed back by more than 20 years including Athmuqam 450 MW, Ashkot 300 MW and Dhudnial 960 MW should be reinstated to be completed before 2030 depending on the project progress. This applies especially for 300 MW Ashkot which is ready for take-off with LOI issued by AJ&K, bankable feasibility done, power evacuation and environmental studies in place, it was scheduled for COD in 2026 under IGCEP 2040, but in IGCEP 2047 COD was pushed to 2047. The projects' COD date should be restored to 2026. Also 450 MW Athmuqam should be reconsidered as it was not considered in IGCEP 2040 ignoring the completed feasibility study and LOI, has now been considered in IGCEP 2047 but with COD in 2047.

11. Why is there Planning Model muddle?

IGCEP 2040 used the WASP IV tool to elaborate electric power demand and optimize potential generation options but it had many limitations. IGCEP 2047 instead uses the PLEXOS planning tool to nominate least cost, long term generation expansion technologies. However, this optimization tool also has limitations and, further, NTDC is trying to achieve excellence inhouse, though a commendable thought, is not easily achievable due to lack of experience.

Modelling of a country's electricity demand and selection of generation options is a very serious business and will have repercussions for decades if not centuries. There must, therefore, be a more serious and professional approach to the planning exercise. Inexperienced, NTDC cannot be blamed for the somewhat lacklustre result.

The power sector stakes are so high and impact on the country so great - going into the PKR trillions, to avoid a monumental damage, in the future we must not be frugal with comparatively minor planning costs and must allocate more resources to the exercise, which preferably should be external to NTDC rather a separate wing under the Ministry of Planning.

Custom made integrated software, run by specialists should be developed, which should give a holistic organic view of the power sector integrated with economic parameters, power sector statistics and the Country's long term priorities, to compute demand and then select the least cost economic generation sources to meet the demand.

A country's planning is not the same as a utility's planning which is PLEXOS primary design scope. Capacity expansion models can be divided between **National Scale:** National Energy Modelling System (NEMS), Regional Energy Deployment System (ReEDS), Integrated Planning Model (IPM), Haiku, MARKAL (MARKetAllocation) or **Utility Scale:** Resource Planning Model (RPM), Aurora, System Optimizer, Strategist, PLEXOS [10].

12. Is coal the cheapest generation option?

"due to the higher construction cost of many hydropower plants, few hydropower plants are optimized by PLEXOS in the early years of plan horizon. This is why contribution of local coal, in the overall energy mix, increases from 3% in 2020 to 13% by year 2030" (IGCEP 2047, p. XXVII*). "Local coal – 660MW is the least cost option. Therefore, the screening curve analysis suggests that local coal is the least cost option wherever the units operate at a capacity factor of 23% or more"* (IGCEP 2047, p. 88)

But as a global standard, construction cost is just one element of evaluating and ranking power generating technologies. LCOE, which looks at construction cost *plus* operating cost, is the gold standard to compute the cost of generating technologies.

Computation of LCOE and ranking of different generating technologies is computed and shown in the following table:

Table 3-LCOE comparsion by technology

LEVELISED COST OF ENERGY (LCOE)			
Category	**Nuclear** US ¢/kWh	**Hydropower** US ¢/kWh	**Thar Coal** US ¢/kWh
Construction cost	7.15	6.70	2.07
Production cost	2.46	2.04	8.38
Total LCOE	9.62	8.74	10.45
Ranking			
Construction cost	3	2	1
Production cost	2	1	3
Total LCOE	2	1	3

The details for the calculations in table 3 are as follows:

Table 4-Nuclear LCOE calculation

PMT	Rate	PV	Nper	FV	GWh	LCOE
($422,034,392)	10%	4,215,000,000	70.00	0.00	6,920,400,000	-7.15
($170,511,065)	10%	$1,702,951,591	70.00	0.00	6,920,400,000	-2.46
						-9.62

Table 5-Hydropower LCOE calculation

PMT	Rate	PV	Nper	FV	GWh	LCOE
($250,316,958)	10%	2,500,000,000	70	0.00	4,380,000,000	-6.70
($89,214,061)	10%	$891,010,957	70	0.00	4,380,000,000	-2.04
						-8.74

Table 6-Thar Coal LCOE calculation

PMT	Rate	PV	Nper	FV	GWh	LCOE
($138,963,815)	10%	1,310,000,000	30	0.00	7,446,000,000	-2.07
($623,940,117)	10%	$5,881,830,111	30	0.00	7,446,000,000	-8.38
						-10.45

Computations performed in tables 4-6 use the following variables:

Table 7-Variables assumed for tables 4-6

ASSUMPTIONS			
Category	**Nuclear**	**Hydro**	**Thar Coal**
Plant Factor	79%	50%	85%
Fuel + O&M (¢/kWh)	1.219	1.008	5.000
Annual escalation	5%	5%	5%
Discount rate	10%	10%	10%
Constr. cost ($ m/MW)	4.215	2.500	1.310
(IGCEP Table 6.7)			

The analysis shows that Thar coal has the lowest construction cost, as IGCEP 2047 rightly points out, followed by hydropower and then Nuclear. However, hydropower has the lowest production cost followed by nuclear and then coal. Resultingly

hydropower has the lowest LCOE, followed by Nuclear and then in **Thar coal which has the highest LCOE**.

Thus, the rationale of selecting and building over 32,000 MW of Thar coal capacity appears defective and flawed. The analysis shows that even nuclear with a construction cost over 300% higher than coal has a lower LCOE due to its very low fuel cost.

Hydropower cost can go up to US$ 3,130/kW and still remain below the US¢ 10.45/kWh LCOE of Thar coal as shown in table 8.

Table 8- Sensitivity analysis of hydropower LCOE

PMT	Rate	PV	Nper	FV	GWh	LCOE
($313,396,832)	10%	3,130,000,000	70	0.00	4,380,000,000	-8.39
($89,214,061)	10%	$891,010,957	70	0.00	4,380,000,000	-2.04
						-10.43

Coal is not only expensive from a generation cost aspect but also in terms of the environmental toll it carries on the local habitat, water resources and human population which should also be loaded onto the LCOE for a true and fair analysis. Lignite generation will produce serious emissions comprising CO2, SO2 and NOx. The planned Thar coal capacity of 32,697 MW, at full capacity, will emit over 300 billion kg of CO2, over 2 million kg of SO2 and over 1 million kg of NOx. It is important to recognise the pollution impact through levy of a carbon tax, as done by country's worldwide.

The world, including countries with significant indigenous reserves, is moving away from Coal. Pakistan has massive local coal resources, but forward-looking planning should ensure that future generations do not suffer from today's decisions. There is a need to cut the planned Thar coal capacity by at least 50% and substitute it with hydropower, solar and wind.

13. Should Thar coal replace hydropower?

Some 32,697 MW Thar coal generating capacity is planned in IGCEP 2047 but because of the defective Thar coal mining strategy and the small scale lignite mining, we turn out a very high cost compared with international standards and following the present strategy Thar coal generation will never be cheap.

The century old German lignite mining sector producing more than 100 million tons of lignite annually on massive industrial scale turns out lignite a cost of US$ 23/MT compared with Thar at US$ 68/MT (indexed to US$). Taking approximately the same stripping ratio and Pakistan's lower labour costs and overheads, Thar coal cost should be between US$ 15-20 Per Metric Tonne (PMT), but is some 300% to 450% more expensive. Even though lignite is the lowest thermal generation cost, Germany is

winding down the century old industry for environmental and health safety reasons. [11] [12]

The current and future generations of Pakistan will suffer numerous serious health conditions such as asthma, cancer, heart and lung ailments and neurological problems. Another well researched subject is the coal caused environmental phenomena of acid rain and global warming. These multifarious damages have not been factored in. The planned 32,697 MW Thar coal generation would use billions of Gallons Per Day (GPD) of scarce Thar water, competing with flora, fauna, and human population.

Even if dry-cooling systems are used instead of the wet-recirculating systems, currently employed, water requirement for system maintenance, cleaning, and blowdown will remain significant [13]; despite all these drawbacks and shortcomings Thar coal is still not cheap!

As some proportion of Pakistan's power generation is likely to be based on Thar coal, it is in Pakistan's interest to optimize Thar coal mining strategies and add coal power generation with utmost caution while considering other factors, such as environmental issues and costs. Pakistan should in accordance with international trends, wind down thar coal plants in the future.

Figure 1 shows Thar coal addition displacing hydropower (IGCEP 2047)

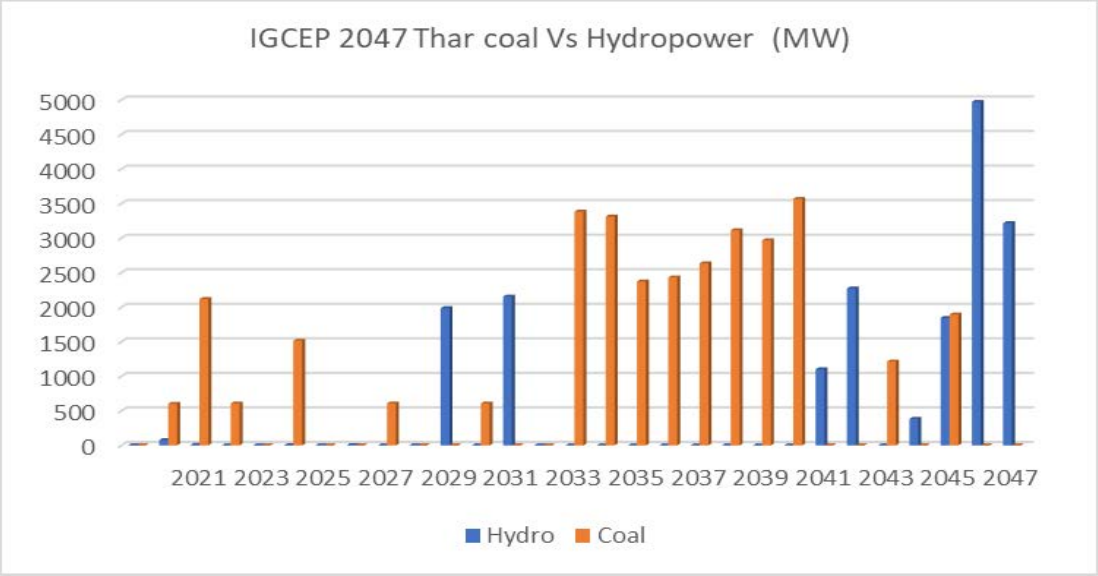


Figure 1-Thar coal displaces hydropower

Figure 2 shows thar coal and renewables are pushing out hydropower (IGCEP 2047)

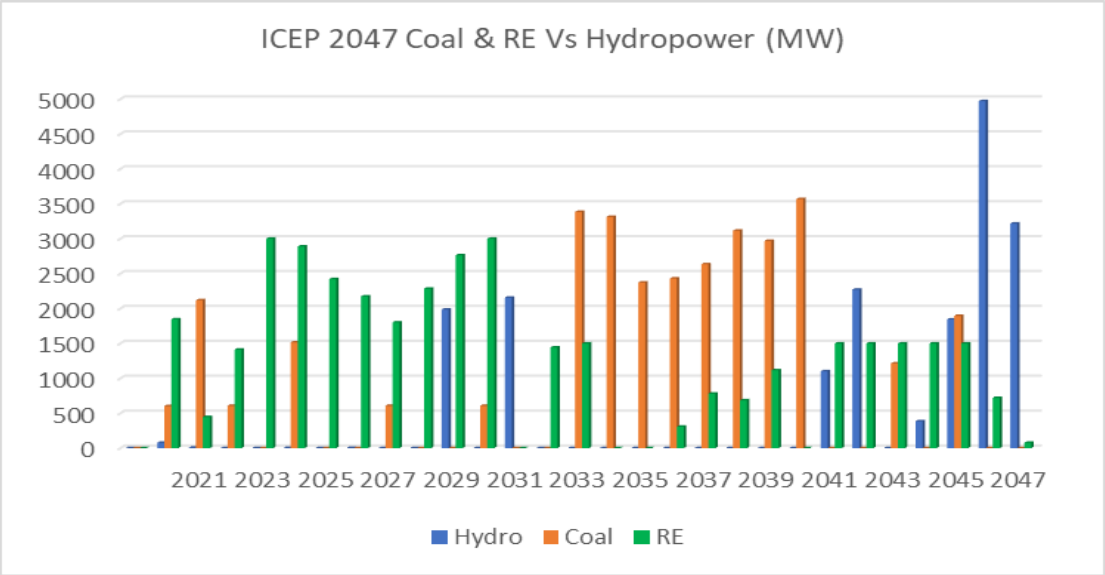


Figure 2- Thar coal and ARE's displace hydropower

From *Figure 1-2* we can see that hydropower capacity has been pushed to one side; and visually we would expect to see much more blue spread across the IGCEP 2047 plan horizon!

14. Why doesn't IGCEP recognise and give priority to power projects with LOI / LOS?

In its planning approach, IGCEP 2047 claims that it recognizes LOI/LOS issued by other Government departments however in practice the approach has been fragmented and disconnected, mostly ignoring LOI/LOS issued by the Federal Government, when allocating project priority and timeframe.

Thus, projects which PPIB envisages achieving COD in 2026-27 have been pushed forward 20 years to 2047. There must be better coordination between Government departments. Projects, with feasibilities, sites, land and investors being implemented by Federal bodies, Provincial governments or private investors should not be delayed or held back.

Once a project has been issued LOI/LOS by the Federal Government, it should be recognised as a priority project by IGCEP 2047 and adjustment only made on the tracked progress from one year to the next, it should not be allowed to be thrown out unless the project is cancelled by the GOP. On this basis hydropower projects in IGCEP 2040 should be re-instated with the same COD dates in IGCEP 2047.

15. How will the huge IGCEP 2047 capacity be financed especially in view of Commercial Code and market de-regulation?

Do the decision makers realize that inducting such massive volumes of generation capacity would entail huge investment? With GOP's resource constraint, Pakistan's limited capacity and small capital markets this would be expected to be mostly foreign private investment. To attract investment would require commercial concessions prevalent in the power sector similar to the following:

- **Capacity payments/take or pay** covering debt, equity and fixed costs to be paid whether the plant is despatched by the Government or not; these are standard to achieve financial close;[a]
- **Debt Interest rate**: terms of 12-15 years (without Government/multilateral credit enhancement) with spread 3% to 4% (matched with Government borrowing rates) are likely to be achieved[b]
- **Debt tenor:** For both thermal and hydropower projects the tenors of available ECA credits and commercial loans is considerably less than the asset life. For thermal projects, the loans may extend up to 12 years from the commissioning date, compared with the asset life of perhaps 20 years; thus 20 year loan tenors are highly unlikely to be achieved[c]
- **Interest During construction (IDC)**: Interest capitalized during the construction period as banks cannot be paid when the asset is not earning any revenue
- **Return on equity**: computed under Capital Asset Pricing Model (CAPM) which recognizes Pakistan's risk-free rate, country risk, project risk and beta in turning out equity returns presently computed to be between around 20%[d]
- **Return on equity during construction (ROEDC):** either included in ROE or computed separately to compensate for equity return that would be earned for a normal investment but is not earned when the project is being constructed[e]

---

[a] The loans raised by Government to finance the plants would have to be repaid and serviced during the loan term, whether the plants were operated or not. This led to the capacity payment concept with Government continuing to carry the risk of non-operation especially as Government was effectively given control of the constructed plants holding the authority to despatch the power plants to meet the needs of the power system which it controlled and operated.

[b] Debt raising would always follow the market and if Pakistan issued 2017-2027 Euro bonds at a coupon of 6.875% (current yield 6.64%). So, with US LIBOR at 2.0%, finance raised by the power sector would have a spread of around 4.5-5% so that the final total borrowing cost approach the cost of Government borrowing.

[c] *Limited availability of export credit financing:* The high level of civil work content of most hydro schemes severely limits availability of export credits. Where commercial loans are available, they are often expensive and of short tenor – unless extended by Partial Guarantees.

[d] The switch to private financing would mean that a proportion of the project cost would be raised through equity; equity bears all the project risk and there are established methods in financial literature to compute equity return. One such method is Capital Asset Pricing Model (CAPM) which looks at risk free return, project risk and country risk etc. to compute a return. This objective method is used in Pakistan and internationally to compute equity return.

[e] The same concept as IDC is applied to the equity which is contributed during construction when the asset is not earning any return. ROEDC would be computed based on equity drawdowns during construction and added to the equity return during operations or the ROE can include a nominal additional return to compensate for equity invested during the construction period.

Rupee devaluation: protection through US$/PKR indexation or alternatively, Rupee CPI indexation is essential as long term, fixed price contract cannot be commercially valid without a price revision mechanism during the long life of the contract

Foreign direct investment in the power sector would be unlikely without such or similar incentives under long term power purchase arrangements.

Alternative - the future wholesale market: The current methodology underlying IGCEP 2047, would change once a wholesale power market evolves. If we follow UKs example the Electricity Boards (DISCOS in Pakistan's context) were privatised in 1990. After an initial wait-and-see period which saw few new entrants in the market and tepid price competition, in 2001 a set of wholesale energy trading reforms were launched dubbed the 'New Electricity Trading Arrangement', (NETA). These reforms were aimed at weakening suppliers' continued grip on the wholesale market. With NETA, it was declared that the deregulation process was over and end of price controls in the domestic energy sector were declared.

Since 2001, the cost of energy in the UK has been set by the market. PPA's still continue but the buying party is no longer Government and could be a utility, trader or a corporate. However, where the Government wants to promote a particular generation technology, they may announce a strike price with "contracts for difference" (difference between market and strike price) being traded. For example, recently the UK Government announced a strike price of £ 180/MWh for geothermal projects, £ 39.65/MWh for offshore wind and £ 92.50/MWh for Hinkley Point nuclear.

But Pakistan is moving in a very disorganised manner as instead of focussing and working on privatising the DISCOS, which are the core of most of the ills facing the power sector, the Government is focussing on IPPs which have become subject of huge controversy and furore, being accused of corruption and dishonesty without any proof. In this climate new power sector investment will be a huge challenge.

16. What is the official standing of IGCEP 2047?

IGCEP 2047 plan is preliminary and undeveloped however, bodies like CPPA-G are treating it as gospel, throwing the governments writ and its issued LOS's to the side, stopping development of power projects in the name of IGCEP 2047 which by its very definition is only an indicative.

At present IGCEP 2047 looks like a university students' thesis with a base case and twelve scenarios. The results of the "tool" have been forwarded without a common-sense review which is essential to gauge whether the tool has performed in accordance with overall Government objectives and goals. Most is left to the reader to make up his own mind and draw conclusions, the document presented should be final and definitive with a carefully drawn out national plan proposed after studying all the scenarios and options.

Bibliography

[1]: Macknick, J., Newmark, R., Heath, G. and Hallett, K., 2012. Operational water consumption and withdrawal factors for electricity generating technologies: a review of existing literature. *Environmental Research Letters*, 7(4), p.045802.

[2]: LeighFisher Ltd, 2016. Electricity Generation costs And Hurdle Rates. BEIS, UK government.

[3]: Ringkjøb, H., Haugan, P. and Solbrekke, I., 2018. A review of modelling tools for energy and electricity systems with large shares of variable renewables. *Renewable and Sustainable Energy Reviews*, 96, pp.440-459.

[4]: The Express Tribune. 2020. *Mangla Dam's Life Increases By Another 100 Years | The Express Tribune*. [online] Available at: https://tribune.com.pk/story/932988/live-longer-mangla-dams-life-increases-by-another-100-years/.

[5]: Wapda.gov.pk. 2020. *Mangla DAM Raising Project*. [online] Available at: http://www.wapda.gov.pk/index.php/projects/hydro-power/o-m/mangla/item/65-mangla-dam-raising-project.

[6]: The Nation. 2020. *Mangla Dam, Power House Safe After Earthquake: Wapda*. [online] Available at: https://nation.com.pk/27-Sep-2019/mangla-dam-power-house-safe-after-earthquake-wapda.

[7]: The Express Tribune. 2020. *Google Maps Shows Azad Kashmir As Indian Territory In Latest Gaffe | The Express Tribune*. [online] Available at: https://tribune.com.pk/story/1163447/google-maps-shows-azad-kashmir-indian-territory-latest-gaffe/.

[8]: CleanTechnica. 2020. *India Proposes Mandatory Procurement Of Hydro Electricity | Cleantechnica*. Available at: https://cleantechnica.com/2020/05/04/india-proposes-mandatory-procurement-of-hydro-electricity/.

[9]: Energyupdate.com.pk. 2020. *India Proposes Mandatory Procurement Of Hydro Electricity – Energy Update*. Available at: https://www.energyupdate.com.pk/2020/05/06/india-proposes-mandatory-procurement-of-hydro-electricity/.

[10]: Boyd, E., 2016. *Power Sector Modeling 101*. Department of Energy –Office of Energy Policy and Systems Analysis.

[11]: & Co Consultants, B., 2014. *Understanding Lignite Generation Costs In Europe*. New York, New York, United States.

[12]: National Electric Power Regulatory Authority, 2020. *Decision Of The Authority In The Matter Of Fuel Price Adjustment For Engro Powergen Thar (Pvt.) Ltd. (EPTPL) [Case # NEPRA/R/TRF-301/EPTPL-20151*. Islamabad: NEPRA.

[13]: Smart, A. and Aspinall, A., 2009. *Water And The Electricity Generation Industry*. Canberra: National Water Commission.

AZAD GOVERNMENT OF THE STATE OF JAMMU & KASHMIR
ELECTRICITY/ POWER DEVELOPMENT ORGANIZATION
DEPARTMENT, MUZAFFARABAD

No. E/PDO/ 5092-97 2020 Date: 11-5-2020

The Chairman,
National Electric Power Regulatory Authority (NEPRA),
NEPRA Tower, G-5 Islamabad.
TEL: 051-9206500
FAX: 051-9200021

Subject: - COMMENTS ON INDICATIVE GENERATION CAPACITY EXPANSION PLAN (IGCEP) 2047

Kindly further to this office letter No. SE/PDO/758-63/2020 dated 28th April 2020 following additional comments on IGCEP 2047 are submitted for consideration please:

2. We appreciate the task undertaken by NTDC to produce IGCEP to achieve least cost generation considering various permutations of demand scenarios. However, we believe that there are some inadequacies in this planning. AJ&K considers it important to highlight key aspects those require attention of the Learned Authority to drive the planning process in the right direction:

i. Optimization on the basis of least cost options appears not to have been done on an equalized footing. As an example, the life cycle cost of hydropower is not considered and the costs as provided in respective feasibility studies or as intimated by the implementing agencies indexed to December 2019 are taken for the purpose of analysis resulting hydropower as the most expensive options. Hydropower resources have been exploited everywhere on priority; being cheaper, renewable, and most importantly providing ancillary services such as frequency control, grid stability, generation option during peak demand and close to zero cost of generation.

ii. Hydropower has been given an economic life of 50 years but to the best of our knowledge, it has a life of approximately 100 years; proven by projects constructed over 100 years ago which are still in service and also shown by Mangla and Tarbela which are approaching 60 years but still have substantial remaining useful life; in comparison nuclear has been given a 70 year service life; this anomaly needs to be corrected, as it negates the real value of hydropower's very long working life and close to zero generation cost over this period.

iii. A majority of the AJ&K hydropower projects have credible identified sponsors, feasibility studies and are ready to take-off such as 450MW Athmuqam and 300MW Ashkot, in addition to many small hydropower projects of less than 50MW capacity at various stages of development. These projects, due to a flawed optimization methodology, have been replaced by more than 20,000 MW of wind and solar PV proposed up to year 2030 in order to comply with ARE Policy 2019. More than 93% of these ARE projects are

of candidate status, for which there are no identified sponsors, sites, or feasibility studies.

iv. Hydropower is not being considered as renewable energy whereas worldwide both large and small hydropower projects are termed as renewable. There is a need to re-categorize hydropower and accordingly prioritize it in the planning process, considering its long gestation and implementation timelines. All other generation options should be worked around hydropower commissioning timelines in order to extract maximum benefit from this God-given indigenous resource which in the long run shall be generating electricity at negligible cost.

v. Twelve small hydel projects (< 50MW) totaling 338 MW, managed by the AJ&K and three large hydel projects totaling 1,250 MW, managed by PPIB on behalf of and for ultimate transfer to the State have been pushed back more than twenty years making these projects unviable and leading to their inevitable failure; see Annex-A for project details.

vi. Hydropower projects have a unique development cycle which stretches many years and, except for 500 MW Chakothi Hattian yet to be advertised by PPIB, all the deferred projects are in the pipeline and are being actively processed and pursued by investors who have put in years of time, effort and expense including long periods of uncertainty. Pushing the COD 20 years ahead at this critical stage will effectively seal the fate of these projects and eliminate them from our portfolio as no investor with valid LOI/LOS in hand and engaged in active development can defer their efforts for 20 years and then start off again at a push of a button. This is not in conformity with the realities of power project development.

vii. Large hydropower requires massive resources and investment. Recently under the pressure from our neighbor, especially after their geospatial bill claiming the AJ&K as part of their territory, international multilateral financial institutions have declined to finance hydropower projects in the State.

viii. Many of the projects are directly in the enemy's line of fire and such investors who are still endeavoring to develop the projects, are hard to come by, 450MW Athmuqam and 300MW Ashkot on the River Neelum are two such projects which are well under development with Letter of Interest issued, feasibility study completed and sponsors in place. Pushing the COD of these projects 20 years ahead will effectively kill the projects and wreck the substantial time, effort and resources invested by the sponsors and the State causing it irreparable loss.

ix. Hydropower should be given priority above all other generation options and allowed implementation at fast pace even earlier than the planned commissioning wherever practically achievable. In this effort all hydropower projects but more importantly hydropower in AJ&K should be pushed to be implemented in the greater interest of our future generations and their security.

3. Considering the above we would request that:

a) COD of hydropower projects should be planned considering real progress and accordingly the projects in Annexure-A should be immediately brought back for COD between 2025 and 2030, based on their actual status;

b) Consistency should be exercised in IGCEP, from one year to the next and projects included in one year should not be pushed out in the next as this will give confused signals to developers;

c) Hydropower is the most prevalent renewable source of energy worldwide and should be classified as such in AJ&K/Pakistan; and

d) IGCEP's wrong classification of hydropower as an expensive generation option only on basis of construction cost, without considering lifecycle cost and fuel cost of thermal, should be corrected.

Secretary

Copy to:

1. The Secretary Energy, (Power Division), Government of Pakistan, Islamabad.
2. The Chief Secretary, Government of AJ&K, Muzaffarabad.
3. Managing Director Private Power and Infrastructure Board, Islamabad.
4. Managing Director, Power Development Organization, Muzaffarabad.
5. Director General Private Power Cell, Muzaffarabad.

AJ&K Hydropower projects stalled due to impractical commercial operation dates:

Name	Capacity MW	IGCEP 2047 COD
Chakoti Hattian	500	2046
Ashkot	300	2047
Athmuqam	450	2047
Gaumat Nar	50	2047
Luat	49	2047
Shounter	48	2047
Dowarian	40	2041
Harigehl	40	2045
Jagran-III	35	2045
Nagdar	35	2045
Jagran-IV	24	2045
Kathai-II	8	2047
Jhing-II	6	2047
Ghail	2	2047
Kathai-III	1	2047

IMMEDIATE

HQ Frontier Works Organization
(Dams Dte)
509 Kashmir Road, R.A Bazar
Rawalpindi
Telephone: 9271370
Fax: 9271820
Dams/3xChitralHPPs/NERPA/03
12 May 2020

To: The Chairman
National Electric Power Regulatory Authority (NEPRA)
NEPRA HQ Islamabad

Info: Member KPK
National Electric Power Regulatory Authority (NEPRA)
NEPRA HQ Islamabad

Info: The Chief Executive Officer
Pakhtunkhwa Power Development Organization (PEDO)
PEDO HQ Peshawar

Subject: **IGCEP 2020-2040 and 3 x Chitral HPPs**

Draft IGCEP 2020-2040 by NTDC / NEPRA refers.

1. It is submitted that draft IGCEP 2020-2040 issued by NTDC/NEPRA, said document have serious observations which are going to affect the power generation, particularly HPP and need to be addressed. Besides power potential of Pakistan it has adversely affected the KPK potential particularly Projects being developed through PPIB. FWO is also perusing development of **three HPPs (Shogosin 137 MW, Shushgae Zhendholi 144MW and Laspur Murigram 230 MW)** in Chitral region. Following comments are proffered to pursue at your end:-

a. LOI to FWO has been issued on **1st January 2018** for three HPPs in Chitral HPPs, since than FWO has spent heavy amount **around Rs. 420 Million out of committed amount i.e. Rs. 900 Mn (Approx)** for development of HPPs which include Purchase and Revision of Feasibility Studies including **additional studies** necessitated **due to GLOF 2015.**

b. FWO is perusing the projects very seriously with progress as:-

(1) Approval of Panel of Expert (PoE) on revised feasibility study of Shogo-Sin (137MW) HPP has been granted on **25th Jan 2019**.The ESIA - NOC has also been issued on **26th April 2019** by EPA, KPK.

(2) **Tariff Petition** and **Application for Generation License** for Shogo-Sin 137 MW Hydropower Project has been submitted to NEPRA on **9 August 2019**.

(3) Feasibility Studies of other two projects i.e. Shushgae Zhendholi and Laspur Murigram HPPs **with added scope and studies** due to Irrigation Scheme and Rosh Gol are in process.

(4) FWO has **negotiated** with no of **Foreign Partners** for **financing** of projects and Provision of **E&M components**.

c. **Hydropower Projects** with approved sites and available Finances **are pushed back** in favor of Wind and Solar plants that have no sponsors, planning or grid evacuation studies.

d. **HPPs** is a potential **Life Saver for Pakistan**, Yet only 15% of its over 60,000MW has been developed and further being delayed.

e. Serious **Energy mix issue**, more dependency on **imported fuel**, Based on US Dollar.

f. Despite high initial costs and long gestation periods, **HPP** have almost **no fuel cost** and have **Operational life over Century**, all other power – generating technologies have up to 30 years of project life and need up to four times Expensive plant replacement.

g. **HPPs** generate **cheap Energy** at Rs 8-10 per unit, compared to Thermal power plants Rs 15-20 per unit. Moreover **HPPs has the lowest life-cycle cost** of any generation Technology.

h. Advantages **of HPPs** like Frequency control, grid balancing, water storage, quick start and peaking services **are not comparable** with Wind and Solar which solely relies on Weather.

i. It will be **highly unjustified to delay or abandon large privately funded HPPs** being developed **without any government investment** and having fixed approved tariff with cost of delays and overruns borne by the Developers.

2. Above in view, **it is requested for kind consideration to reshchulde HPPs** (including 3 x Chitral projects of FWO) in earlier time frame to Utilize Pakistan's Potential, maximize the advantages of HPPs and have balance of energy mix.

Timely support from PEDO in this regard will be highly appreciated.

Brigadier (Retired)
Director Dams
(Tariq Mahmood)

BOT Dte (Dams Cell) HQ FWO
No.....
Date....

AASAL POWER

AASAL HYDROTECH & STEELS (PVT) LTD.

For information pl.
- SA(Tech)
- SA(T)
- DG(M&E)
- ADG(Lic)
Copy to:
- MF
cc:
- Chairman
- V.C/M(M&E)
- M(T)
- M(CA)
- M(Lic)

28/5/20

Ref: AHTS/KPK/HPP/001-2/20
Date: 20/05/2020

The Registrar
National Electric Power Regulatory Authority,
NEPRA Tower, Ataturk Avenue (East)
G-5/1, Islamabad

Subject: Comments of AASAL Hydrotech & Steels (Pvt.) Ltd (Owner of Two HPP Projects 20.4 MW & 6.8 MW, KPK) and Abdul Basit Javed (Owner of Four HPP Projects of 45 MW, 65 MW, 100 MW and 100 MW, KPK), in the Matter of Indicative Generation Capacity Expansion Plan 2047 (IGCEP)

Dear Sir,

In compliance with the provision (PC-4 and PC-4.1) of Planning Code of the Grid Code, National Transmission and Despatch Company Limited (NTDC) has prepared the IGCEP and submitted it for review and approval of the Authority (NEPRA).

In this regard, I as Abdul Basit Javed in individual capacity as well as CEO of AASAL Hydrotech & Steels (Pvt.) (AHTS) Ltd are submitting our comments on the IGCEP. Two of our projects are being developed through AHTS while four LOIs are being issued under my personal name, for which Project Company shall be incorporated in due course of time.

Issue # 1: Bias towards Hydropower and its Screening Issues

- It is contemptuous to note that despite several meetings between the officials of PEDO and NTDC, only 5,652MWs of hydropower projects initiated by PEDO have been included in the total planned generation of 127,659MWs, whereby, 5,481MWs of hydropower projects are considered for development after 2031 i.e., mostly after 2045 which is very disappointing and major set-back to Private Sponsors like us and PEDO.
- All upcoming Hydel projects including projects with LOI and Tariff have been categorized as Candidate projects, while Category I & II solar/wind/bagasse Projects have been listed as committed projects.
- Hydel capacity addition has been considered pre-dominantly through inclusion of public sector hydel projects. Almost all private sector projects have been dragged to 2046 which in fact means that all these projects are being shelved.

REGISTRAR
Dy. No: 7562
Dated: 28-5-20

House # 28, Street # 2, Sector E-11/1, MPCHS, Islamabad
tel: +92 51 873 4203; fax: +92 51 873 4204; e: info@javed-group.com; w: www.javed-group.com

- Candidate projects have varying challenges apart from their costs and these challenges should be kept in mind while putting forward their candidacy. e.g. many projects suffer grid constraints, very large projects may have financing issues, some projects do not have active sponsor, public sector agencies may have constraints on simultaneous development of projects.
- IGCEP takes the targets of VREs given in the draft Renewable Energy Policy (the Draft RE Policy) as inviolable. On the other hand it does not treat the targets and approvals given to the hydropower projects under federal and provincial power policies at par.

Issue # 2: Comparison with other Technologies

- IGCEP plans to develop 29,621MWs of local coal fired plants and 25,827MWs open cycle turbine to support the development of ambitious target of 26,128MWs solar and 8,332MWs wind projects for which no steps have been taken till date i.e., neither any sites or sponsors have been identified, and are being prioritized over the hydropower projects of PEDO for which feasibilities have been completed and very high profile sponsors including large state owned companies of China, are keen to progress further.
- As such, IGCEP contemplates to abandon all the ongoing hydropower projects of PEDO. This approach completely negates the vision of the honorable Prime Minister and Chief Minister for being supportive to PEDO for exploiting hydropower potential of the country, which is most preferred in terms of affordable, reliable and clean energy.
- To induct thermal power (coal and open cycle turbines) of over 50,000MWs will have serious negative consequences in terms of environment, unaffordable tariff due to fuel costs and the related indexation mechanisms, whereby, recently local coal projects are also allowed foreign indexation which nullifies the benefits of local coal in terms of its cheap cost.
- It must be remembered that solar and wind are "intermittent" and do not provide the reliability, voltage, frequency control and quick start capability that hydropower gives; thus these three technologies need to be developed in parallel as they complement each other, add value to the Grid and provide much needed energy security.
- Hydropower is the lifeline for Pakistan, providing cheap renewable power and security. Today the overall electricity basket price is in somewhat reasonable shape

exclusively because of hydro plants that were constructed in last century and are providing electricity at less than Rs. 1 per unit.

- Hydropower projects entail complex processes such as land acquisition, resettlement and huge civil works which cannot be started and stopped at a whim. It has a long development and construction period but that is rewarded by a very long life and whereas thermal projects with a life of 25-30 years have undergone 3-4 expensive plant replacements during the hydropower, projects single 100-year life span.

Issue # 3: Definition of Renewable Energy

The present government has been declaring its intent to promote and increase the share of renewable energy in generation mix. However, IGCEP 2047 report seems to view only wind, solar, bagasse and, less than 50 MW hydro, as renewable energy. This has probably happened because of the arbitrary administrative division: 50MW (AEDB) and over 50MW (PPIB). Due this anomaly large hydro has been excluded as a renewable energy resource. This inconsistency should be immediately removed and for planning purposes large hydropower should be classified as a renewable resource.

Issue # 4: Breach of clause PC-4 of the Grid Code

NTDC is obligated to prepare and deliver to NEPRA a ten year plan, however in this instance case the planning horizon has been extended to 2047. Such planning cannot be accurately done for an such long-term horizon especially when it is based on ever-changing wide range of assumptions, such as volatility of fuel prices for thermal plants either produced indigenously (e.g. Thar coal) or imported (e.g. furnace oil, RLNG etc.)

Issue # 5: Least Cost Generation:

IGECP states *"least cost generation planning is one of the most important element of overall integrated plan of electricity sector"*

In order to get true tariff perspective, tariffs must be: a) indexed, b) based on project life cycle. Determinations when viewed without indexation provide a highly misleading picture. The 25-30 year Nepra tariff determinations assume no devaluation of PKR against USD, zero inflation / CPI, etc. When the same tariff is indexed, on basis of indexation provided in Tariff determination order, based on last 30 or 50 year indices, we

get a more realistic perspective. New Projects are being added on Annualized Construction Cost, which creates a number of issues:

Optimizing based on Cumulative CAPEX prioritizes projects with lower CAPEX. Examples being, Hydel projects being parked end of the horizon (Pg. 133) and RLNG projects in Open Cycle being prioritized over Combined Cycle projects.

CAPEX investment is a faulty criteria as it disregards the plant factor e.g. $2million/MW Hydel project with 70% plant factor will not be selected over US$1.2million/MW wind project with a plant factor half of it.

Issue # 6: Optimization Not Done on Equal Footing

It appears that in IGCEP the basis of least cost options appears not to have been done on an equalized footing. The life cycle cost of hydropower is not considered and the costs as provided in respective feasibility studies or as intimated by the implementing agencies indexed to December 2019 are taken for the purpose of analysis resulting in hydropower shown as the most expensive options, per the IGCEP conclusion.

Hydroelectric has been given an economic life of 50 years but a life of hydro plant is well beyond 100 years. We have Mangla and Tarbela constructed over 100 years ago which are still in service. In 1995 WAPDA / Water & Power Ministry have invited world renowned hydro consultant from USA to visit the two projects and look at safety / operations & maintenance SOP's and give an estimate of remaining productive life of these two hydro projects. The Consultant has reported that these products will be fine until 2090.

The anomaly about economic life needs to be corrected, as it negates the real value of hydropower's very long working life and close to zero generation cost over this period.

Thermal, wind, solar have economic life and PPA of 25-30 year term and are developed under BOO regime, while hydro projects have minimum life of 100 years and are processed under BOO model; at end of 30 year PPA term project is transferred to gov't at no cost. The gov't thus acquires an asset at no cost with 70 year of remaining economic life with negligible fuel cost. This important element must be factored in IGCEP model while determining least cost option.

Issue # 7: Suppressed "Load Forecast"

Linear model is assumed for demand projection based on historic figures. In 2017-18 after generation constraint removal, generation demand was added (Chart 3-4). Another one-time adjustment is due to reflect true demand without grid constraints.

Pakistan is significantly under-served in terms of Per Capita Energy Consumption. Substantial demand is being catered through off grid generation (Section 3.1) that needs to be brought online.

381,910 applications (majority by domestic followed by commercial) are pending for connection to grid. This is latent demand not accounted for.

Issue # 8: Why Retain Expensive Old Thermal Plants:

In the demand supply analysis carried out in the report, all old RFO plants are retained until their economic life / PPA term. This is a grave mistake. If we lock in our existing capacity, then we are locking ourselves into very expensive generation mix and leave no opening for entry of cheaper options to optimise the generation mix and lower the price of power. Some may say abandoning thermal plants would cause huge capacity payments (CPs). This is a misplaced concern. The average CP cost of old plants range between Rs.2.0 - 3.5/Kwh. If we can get electricity at Rs.7-10 from renewable sources, and add the CPs of these closed plants, we are still better off. Retaining the existing highly toxic thermal portfolio of old 21,387 MW thermal plants is suicidal. The monthly NTDC Merit Order list shows that out of 133 thermal plants the Variable Cost/Energy Purchase price 73 thermal plants just the fuel cost is between Rs. 18 to Rs. 33 per unit. We are better off by just paying the Capacity Charges and not despatching plants whose fuel & variable O&M cost is more than Rs. 18/kWh.

The Authority must direct NTDC to factor this important aspect in IGCEP report.

Issue # 9: Cater for Delays in Public Sector Hydropower Projects:

As per IGECP report around 7,000 MW of public sector Hydro projects are supposed to come on line by 2025. While work on Tarbela 5th extension, Dasu and Mohmand Dam has started, however it is yet to be seen if these projects can achieve commercial operations at the contracted timelines or become another example of mismanagement like Neelum Jhelum which reached commercial operation after 5 years of delay. The national power plan must keep provision for COD delays in public sector funded projects.

Issue # 10: Hydropower IPP's are in a Way Public-Private Partnership Projects:

Hydropower IPPs are developed, financed and constructed by private sector for Government and transferred free of cost to Government after the 30-year lease term. It is a classic form of public-private partnership. It would not make any sense to abandon large privately funded hydropower projects, developed without any Government

investment, having a fixed NEPRA approved tariff, with all cost of time delay/cost overrun borne by the private sponsor.

Issue # 11: Highly Ambitious and Unrealistic VRE Targets:

25% (36,253 MW) of the new capacity addition has been planned from "Variable Renewable Energy" (VREs), constituting wind and solar. 20,332 MW of solar and wind projects planned between 2023 and 2030. The highly aggressive target represents projects with no site, sponsor, feasibility or financing.

Issue # 12: VREs Come At High Cost by Way Introduction of massive MWs Open Cycle Gas Turbines to Compensate the Intermittency:

While the generation cost of such VREs are at the low and have continuous decreasing trend but these VREs come at a cost. Since wind and solar do not provide constant power, the intermittency has been balanced in IGECP report by introducing 25,828 MW of highly expensive open cycle gas turbine (OCGT) plants running on imported LNG! IGCEP report itself states at various places as follows:

"In a bid to cater for the intermittent nature of REs and system's reserve requirements, 25,828 MW of candidate OCGTs are selected by the tool; these OCGTs are selected to provide reserve requirements of the system but they are not readily despatched on normal operation, thus, remain almost at zero annual plant factor".

It is not intelligent to invest huge foreign exchange in new capacity, only to balance out VREs, which also shall stand underutilized as stated in the IGCEP.

The proposal of NTDC to use thermal Open Cycle plants for stability is most illogical. When hydropower can provide services including frequency control, grid balancing, water storage, quick start and peaking service why not use hydro plants for stabilization! Why not use hydro and existing installed RLNG plants which will hardly be dispatched after Must Run condition expires? Deferring valuable indigenous resource hydropower projects that have approved sites, available finances, and strong sponsors are being pushed back decades thus effectively killing/shelving the projects.

Issue # 13: Reliance on Local Coal:

The world is moving away from Coal while we are planning as much as 33,000 MW of coal! Three aspects have perhaps been over looked while including such a large MWs of Thar coal power plants:

A) If least cost tariff is one of the main criteria of IGCEP than the tariff should be properly indexed. The tariff determination as given by Nepra for Engro Powergen Thar project

when indexed is the most expensive indigenous fuel option as Thar coal price is linked to UD dollar. All the advantage of Thar coal being indigenous coal is lost when we have to pay the coal price in US dollar terms. B) Has the cost of mining been included as part of Thar coal electricity tariff? C) Has consideration been given from where will water required for cooling turbines come from and where will such huge ash be disposed?

IGCEP report shows that during period 2030-2040 coal projects 25,105 MW will be set up, while during this period not a single hydro project has been scheduled. It is ironic that coal projects targeted during 2030-2040 have no feasibility study or sponsor are being proposed instead of environmental friendly projects which have completed feasibility studies and identified sponsors already carrying out project development activities.

Thar coal is an important resource and should not be confined to power generation at mine mouth. It can perhaps also be used for gasification and pumping it to industrial zones in Sindh.

SUBMISSIONS FOR AUTHORITY'S CONSIDERATION:

1. NTDC should confine the Indicative Generation plan to only 10 year period, i.e, up to 2030.
2. Large hydropower should be categorized as Renewable Energy and included in quota / target set out for clean renewable energy.
3. IGCEP's wrong classification of hydropower as an expensive generation option only on basis of construction cost, without considering lifecycle cost and fuel cost of thermal, should be corrected
4. Large hydropower is the original renewable energy resource and rather than create conflict between wind, solar, bagasse and large hydro there is a need to re-categorise large hydro as a renewable.
5. This re-categorization would ensure that one renewable energy resource is not developed at the cost of another.
6. Revised targets should be developed allowing maximum push for each technology, minimizing risk of missing targets, if one category slips.
7. Projects, with feasibilities, sites, land and investors, being implemented by Federal bodies, Provincial governments or private investors should not be delayed / held back.
8. Hydro Projects with similar development status should also be assigned "Committed" status. Public Sector projects should also be dealt on merit with

Private projects. Projects, despite being in CPEC or GTG but with little progress, shouldn't be considered as "Committed". Candidate projects should be additionally categorized based on Availability of Sponsors / Lenders, Project award and development status, Distance from Grid, Development phasing by the Sponsor agency.

9. New projects should be screened based on their tariff as per NEPRA methodology and not annual incremental CAPEX
10. A one-time adjustment in demand forecast is needed to account for (i) grid constraint removal (ii) latent demand and (iii) win back of captive producers.

Peaceful,

AASAL HYDROTECH & STEELS

Abdul Basit Javed
CEO
AASAL Hydrotech & Steels (Pvt.) Ltd & Javed Solar Park (Pvt.) Ltd
(Owners of 7 Projects in KPK, 6.8 MW HPP, 20.4 MW HPP, 45 MW HPP, 65 MW HPP, 100 MW HPP, 100 MW HPP, 49.5 MW Solar Project)

Government of Pakistan
Alternative Energy Development Board (AEDB)

B/3/1/Tech-Reports/2020 May 19, 2020

The Registrar
National Electric Power Regulatory Authority
Islamabad.

Subject: **Indicative Generation Capacity Expansion Plan 2047 (IGCEP) submitted by National Transmission and Despatch Company Limited**

This is with reference to NEPRA letter no. NEPRA/ADG(Lic)/LAT-01/11451-501 dated April 28, 2020 on the subject.

2. The comments of AEDB on the subject study are as under:

a. In order to have meaningful comparison between various scenarios considered in the analysis, the generation cost per unit (and its constituent's capacity component and energy component) should have been estimated for each financial year;

b. ARE Policy 2019 provides for addition of ARE projects not just based on capacity needs but also through displacement of more expensive fossil energy as long as they are cheaper in order to lower the basket price of electricity. For the purpose, it would be prudent that the per unit generation cost (capacity component and energy component) of each existing generation facility/ project be incorporated in the IGCEP;

c. The sensitivity analyses should also incorporate a scenario wherein all the generation facilities/ technologies are made available for free picking by the PLEXOS purely on the basis of economic dispatch/ least cost generation;

d. Only around 11,000 MW of thermal capacity plants have been retired while other plants are ignored. For example, all the existing wind projects under operation having project term of 20 years, never get retired and are dispatched till 2047;

e. The option of using existing thermal capacity as reserves (even after expiry of their PPAs) has not been considered in the analysis. Many assets have useful life even after the end of their PPAs and using such plants as reserve capacity would help save costs and defer new investments. The VRE Integration and Planning Study of the World Bank also recommends to utilize older combustion engines (though uneconomical for generation) as they can provide contingency reserve;

f. The report proposes hybridization (solar PV & Wind) and addition of battery storage to renewables to address issues of intermittency. An alternative economic comparison must also be done between hybridizing

renewables / addition of utility scale batteries against the proposed spinning reserve thermal plants;

g. As per the VRE study carried out by the World Bank for NTDCL, domestic coal is not called on by PLEXOS until 2033, despite the low costs ignoring external damages. This is due to the even lower costs of VRE in combination with the existing power plant fleet and further hydropower projects. However, it has been noted from the results of Scenario-III (No VRE Policy) of the IGCEP that local coal is replacing the wind projects. The same is required to be looked into while approving the IGCEP;
h. Since the least cost optimization of power system with regards to capacity expansion has been done considering price forecasting, it is therefore important to consider the impact of global fuel price reduction in the recent past and reduction of electricity demand due to the covid-19 crises, on the outputs of the IGCEP;
i. Currently, transmission forms a major bottleneck in Pakistan's electricity sector. Therefore, it is prudent that the study is complemented by a Transmission Expansion Plan in order to ensure that the capacity addition proposed by the software can be dispatched in reality;
j. Regression analysis has been used to predict demand. This is tantamount to a statistical extrapolation of demand from the past and does not take into account scenarios where the nature of the demand changes. For example, currently gas subsidies and load shedding have suppressed demand by forcing industrial users to captive generation options. Abolition of gas subsidies could force industrial generation onto the grid, resulting in a surge in demand. The regression equation does not seem to capture such factors.

(Sheeraz Anwar Khan)
Director (Wind)

Copy to:

a. SPS to Chairman AEDB/ Minister for Energy (Power Division), Islamabad.
b. SPS to Secretary, Ministry of Energy (Power Division), Islamabad
c. PS to Chairman NEPRA, Islamabad.
d. PS to CEO AEDB

ARTISTIC MILLINERS (PVT) LTD.

MANUFACTURERS & EXPORTERS OF YARN, DENIM FABRIC & FASHION GARMENTS

Plot No. 4 & 8, Sector 25, Korangi Industrial Area, Karachi-74900 Pakistan.

GST # 17 - 50 5205-002-82, **NTN #** 2645727-0

Tel : (9221) 35072586-88, 35075337-39 Fax: (9221) 35075446 Email: artisticho@cyber.net.pk, corporate@artisticmilliners.com

Ref: AM/KPK/HPP/001-2/20

Date: 20/05/2020

The Registrar
National Electric Power Regulatory Authority,
NEPRA Tower, Ataturk Avenue (East)
G-5/1, Islamabad

Subject: Comments of Artistic Milliners (Pvt.) Ltd in the Matter of Indicative Generation Capacity Expansion Plan 2047 (IGCEP)

Dear Sir,

In compliance with the provision (PC-4 and PC-4.1) of Planning Code of the Grid Code, National Transmission and Despatch Company Limited (NTDC) has prepared the IGCEP and submitted it for review and approval of the Authority (NEPRA).

In this regard, Artistic Milliners (Pvt.) (AMPL) Ltd being Sponsor and developer of 63 MW hydropower project in the name of Artistic Hydro I Pvt Ltd and 55 MW hydropower project in the name of Artistic Hydro II (Pvt) Ltd are submitting our comments on the IGCEP.

Issue # 1: Bias towards Hydropower and its Screening Issues

- It is contemptuous to note that despite several meetings between the officials of PEDO and NTDC, only 5,652MWs of hydropower projects initiated by PEDO have been included in the total planned generation of 127,659MWs, whereby, 5,481MWs of hydropower projects are considered for development after 2031 i.e., mostly after 2045 which is very disappointing and major set-back to Private Sponsors like us and PEDO.
- All upcoming Hydel projects including projects with LOI and Tariff have been categorized as Candidate projects, while Category I & II solar/wind/bagasse Projects have been listed as committed projects.

Manufacturing Locations

Spinning Mill	471 - 472, Deh Landhi, Bin Qasim Town, Karachi	Ph:	92213-5023706 - 8	Fax:	35022883
Denim Mill	Plot No. 8, Sector 25 Korangi Industrial Area, Karachi-74900	UAN:	111 263 646	Fax:	35069298
Garment Factory	Plot No. 4, Sector 25 Korangi Industrial Area, Karachi-74900	Tel:	92213-5072586-8	Fax:	35075446
Denim Mill	Plot No. 10,11,14,15 & 104, Deh Khanto Tappo Landhi Bin Qasim Town, Karachi.				

ARTISTIC MILLINERS (PVT) LTD.
MANUFACTURERS & EXPORTERS OF YARN, DENIM FABRIC & FASHION GARMENTS
Plot No. 4 & 8, Sector 25, Korangi Industrial Area, Karachi-74900 Pakistan.
GST # 17 - 50 5205-002-82, NTN # 2645727-0
Tel : (9221) 35072586-88, 35075337-39 Fax: (9221) 35075446 Email: artisticho@cyber.net.pk, corporate@artisticmilliners.com

- Hydel capacity addition has been considered pre-dominantly through inclusion of public sector hydel projects. Almost all private sector projects have been dragged to 2046 which in fact means that all these projects are being shelved.
- Candidate projects have varying challenges apart from their costs and these challenges should be kept in mind while putting forward their candidacy. e.g. many projects suffer grid constraints, very large projects may have financing issues, some projects do not have active sponsor, public sector agencies may have constraints on simultaneous development of projects.
- IGCEP takes the targets of VREs given in the draft Renewable Energy Policy (the Draft RE Policy) as inviolable. On the other hand it does not treat the targets and approvals given to the hydropower projects under federal and provincial power policies at par.

Issue # 2: Comparison with other Technologies

- IGCEP plans to develop 29,621MWs of local coal fired plants and 25,827MWs open cycle turbine to support the development of ambitious target of 26,128MWs solar and 8,332MWs wind projects for which no steps have been taken till date i.e., neither any sites or sponsors have been identified, and are being prioritized over the hydropower projects of PEDO for which feasibilities have been completed and very high profile sponsors including large state owned companies of China, are keen to progress further.
- As such, IGCEP contemplates to abandon all the ongoing hydropower projects of PEDO. This approach completely negates the vision of the honorable Prime Minister and Chief Minister for being supportive to PEDO for exploiting hydropower potential of the country, which is most preferred in terms of affordable, reliable and clean energy.
- To induct thermal power (coal and open cycle turbines) of over 50,000MWs will have serious negative consequences in terms of environment, unaffordable tariff due to fuel costs and the related indexation mechanisms, whereby, recently local coal projects are also allowed foreign indexation which nullifies the benefits of local coal in terms of its cheap cost.

ARTISTIC MILLINERS (PVT) LTD.
MANUFACTURERS & EXPORTERS OF YARN, DENIM FABRIC & FASHION GARMENTS
Plot No. 4 & 8, Sector 25, Korangi Industrial Area, Karachi-74900 Pakistan.
GST # 17 - 50 5205-002-82, NTN # 2645727-0
Tel : (9221) 35072586-88, 35075337-39 Fax: (9221) 35075446 Email: artisticho@cyber.net.pk, corporate@artisticmilliners.com

- It must be remembered that solar and wind are "intermittent" and do not provide the reliability, voltage, frequency control and quick start capability that hydropower gives; thus these three technologies need to be developed in parallel as they complement each other, add value to the Grid and provide much needed energy security.
- Hydropower is the lifeline for Pakistan, providing cheap renewable power and security. Today the overall electricity basket price is in somewhat reasonable shape exclusively because of hydro plants that were constructed in last century and are providing electricity at less than Rs. 1 per unit.
- Hydropower projects entail complex processes such as land acquisition, resettlement and huge civil works which cannot be started and stopped at a whim. It has a long development and construction period but that is rewarded by a very long life and whereas thermal projects with a life of 25-30 years have undergone 3-4 expensive plant replacements during the hydropower, projects single 100-year life span.

Issue # 3: Definition of Renewable Energy

The present government has been declaring its intent to promote and increase the share of renewable energy in generation mix. However, IGCEP 2047 report seems to view only wind, solar, bagasse and, less than 50 MW hydro, as renewable energy. This has probably happened because of the arbitrary administrative division: 50MW (AEDB) and over 50MW (PPIB). Due this anomaly large hydro has been excluded as a renewable energy resource. This inconsistency should be immediately removed and for planning purposes large hydropower should be classified as a renewable resource.

Issue # 4: Breach of clause PC-4 of the Grid Code

NTDC is obligated to prepare and deliver to NEPRA a ten year plan, however in this instance case the planning horizon has been extended to 2047. Such planning cannot be accurately done for an such long-term horizon especially when it is based on ever-changing wide range of assumptions, such as volatility of fuel prices for thermal plants either produced indigenously (e.g. Thar coal) or imported (e.g. furnace oil, RLNG etc.)

ARTISTIC MILLINERS (PVT) LTD.

MANUFACTURERS & EXPORTERS OF YARN, DENIM FABRIC & FASHION GARMENTS

Plot No. 4 & 8, Sector 25, Korangi Industrial Area, Karachi-74900 Pakistan.
GST # 17 - 50 5205-002-82, **NTN #** 2645727-0
Tel : (9221) 35072586-88, 35075337-39 Fax: (9221) 35075446 Email: artisticho@cyber.net.pk, corporate@artisticmilliners.com

Issue # 5: Least Cost Generation:

IGECP states *"least cost generation planning is one of the most important element of overall integrated plan of electricity sector"*

In order to get true tariff perspective, tariffs must be: a) indexed, b) based on project life cycle. Determinations when viewed without indexation provide a highly misleading picture. The 25-30 year Nepra tariff determinations assume no devaluation of PKR against USD, zero inflation / CPI, etc. When the same tariff is indexed, on basis of indexation provided in Tariff determination order, based on last 30 or 50 year indices, we get a more realistic perspective. New Projects are being added on Annualized Construction Cost, which creates a number of issues:

Optimizing based on Cumulative CAPEX prioritizes projects with lower CAPEX. Examples being, Hydel projects being parked end of the horizon (Pg. 133) and RLNG projects in Open Cycle being prioritized over Combined Cycle projects.

CAPEX investment is a faulty criteria as it disregards the plant factor e.g. $2million/MW Hydel project with 70% plant factor will not be selected over US$1.2million/MW wind project with a plant factor half of it.

Issue # 6: Optimization Not Done on Equal Footing

It appears that in IGCEP the basis of least cost options appears not to have been done on an equalized footing. The life cycle cost of hydropower is not considered and the costs as provided in respective feasibility studies or as intimated by the implementing agencies indexed to December 2019 are taken for the purpose of analysis resulting in hydropower shown as the most expensive options, per the IGCEP conclusion.

Hydroelectric has been given an economic life of 50 years but a life of hydro plant is well beyond 100 years. We have Mangla and Tarbela constructed over 100 years ago which are still in service. In 1995 WAPDA / Water & Power Ministry have invited world renowned hydro consultant from USA to visit the two projects and look at safety / operations & maintenance SOP's and give an estimate of remaining productive life of

ARTISTIC MILLINERS (PVT) LTD.
MANUFACTURERS & EXPORTERS OF YARN, DENIM FABRIC & FASHION GARMENTS
Plot No. 4 & 8, Sector 25, Korangi Industrial Area, Karachi-74900 Pakistan.
GST # 17 - 50 5205-002-82, NTN # 2645727-0
Tel : (9221) 35072586-88, 35075337-39 Fax: (9221) 35075446 Email: artisticho@cyber.net.pk, corporate@artisticmilliners.com

these two hydro projects. The Consultant has reported that these products will be fine until 2090.

The anomaly about economic life needs to be corrected, as it negates the real value of hydropower's very long working life and close to zero generation cost over this period. Thermal, wind, solar have economic life and PPA of 25-30 year term and are developed under BOO regime, while hydro projects have minimum life of 100 years and are processed under BOO model; at end of 30 year PPA term project is transferred to gov't at no cost. The gov't thus acquires an asset at no cost with 70 year of remaining economic life with negligible fuel cost. This important element must be factored in IGCEP model while determining least cost option.

Issue # 7: Suppressed "Load Forecast"

Linear model is assumed for demand projection based on historic figures. In 2017-18 after generation constraint removal, generation demand was added (Chart 3-4). Another one-time adjustment is due to reflect true demand without grid constraints.

Pakistan is significantly under-served in terms of Per Capita Energy Consumption. Substantial demand is being catered through off grid generation (Section 3.1) that needs to be brought online.

381,910 applications (majority by domestic followed by commercial) are pending for connection to grid. This is latent demand not accounted for.

Issue # 8: Why Retain Expensive Old Thermal Plants:

In the demand supply analysis carried out in the report, all old RFO plants are retained until their economic life / PPA term. This is a grave mistake. If we lock in our existing capacity, then we are locking ourselves into very expensive generation mix and leave no opening for entry of cheaper options to optimise the generation mix and lower the price of power. Some may say abandoning thermal plants would cause huge capacity payments (CPs). This is a misplaced concern. The average CP cost of old plants range between Rs.2.0 - 3.5/Kwh. If we can get electricity at Rs.7-10 from renewable sources, and add the CPs of these closed plants, we are still better off. Retaining the existing highly toxic thermal portfolio of old 21,387 MW thermal plants is suicidal. The monthly NTDC Merit Order list shows that out of 133 thermal plants the Variable Cost/Energy

ARTISTIC MILLINERS (PVT) LTD.
MANUFACTURERS & EXPORTERS OF YARN, DENIM FABRIC & FASHION GARMENTS
Plot No. 4 & 8, Sector 25, Korangi Industrial Area, Karachi-74900 Pakistan.
GST # 17 - 50 5205-002-82, NTN # 2645727-0
Tel : (9221) 35072586-88, 35075337-39 Fax: (9221) 35075446 Email: artisticho@cyber.net.pk, corporate@artisticmilliners.com

Purchase price 73 thermal plants just the fuel cost is between Rs. 18 to Rs. 33 per unit. We are better off by just paying the Capacity Charges and not despatching plants whose fuel & variable O&M cost is more than Rs. 18/kWh.
The Authority must direct NTDC to factor this important aspect in IGCEP report.

Issue # 9: Cater for Delays in Public Sector Hydropower Projects:

As per IGECP report around 7,000 MW of public sector Hydro projects are supposed to come on line by 2025. While work on Tarbela 5th extension, Dasu and Mohmand Dam has started, however it is yet to be seen if these projects can achieve commercial operations at the contracted timelines or become another example of mismanagement like Neelum Jhelum which reached commercial operation after 5 years of delay. The national power plan must keep provision for COD delays in public sector funded projects.

Issue # 10: Hydropower IPP's are in a Way Public-Private Partnership Projects:

Hydropower IPPs are developed, financed and constructed by private sector for Government and transferred free of cost to Government after the 30-year lease term. It is a classic form of public-private partnership. It would not make any sense to abandon large privately funded hydropower projects, developed without any Government investment, having a fixed NEPRA approved tariff, with all cost of time delay/cost overrun borne by the private sponsor.

Issue # 11: Highly Ambitious and Unrealistic VRE Targets:

25% (36,253 MW) of the new capacity addition has been planned from "Variable Renewable Energy" (VREs), constituting wind and solar. 20,332 MW of solar and wind projects planned between 2023 and 2030. The highly aggressive target represents projects with no site, sponsor, feasibility or financing.

Issue # 12: VREs Come At High Cost by Way Introduction of massive MWs Open Cycle Gas Turbines to Compensate the Intermittency:

While the generation cost of such VREs are at the low and have continuous decreasing trend but these VREs come at a cost. Since wind and solar do not provide constant

ARTISTIC MILLINERS (PVT) LTD.
MANUFACTURERS & EXPORTERS OF YARN, DENIM FABRIC & FASHION GARMENTS
Plot No. 4 & 8, Sector 25, Korangi Industrial Area, Karachi-74900 Pakistan.
GST # 17 - 50 5205-002-82, NTN # 2645727-0
Tel : (9221) 35072586-88, 35075337-39 Fax: (9221) 35075446 Email: artisticho@cyber.net.pk, corporate@artisticmilliners.com

power, the intermittency has been balanced in IGECP report by introducing 25,828 MW of highly expensive open cycle gas turbine (OCGT) plants running on imported LNG! IGCEP report itself states at various places as follows:

"In a bid to cater for the intermittent nature of REs and system's reserve requirements, 25,828 MW of candidate OCGTs are selected by the tool; these OCGTs are selected to provide reserve requirements of the system but they are not readily despatched on normal operation, thus, remain almost at zero annual plant factor".

It is not intelligent to invest huge foreign exchange in new capacity, only to balance out VREs, which also shall stand underutilized as stated in the IGCEP.

The proposal of NTDC to use thermal Open Cycle plants for stability is most illogical. When hydropower can provide services including frequency control, grid balancing, water storage, quick start and peaking service why not use hydro plants for stabilization! Why not use hydro and existing installed RLNG plants which will hardly be dispatched after Must Run condition expires? Deferring valuable indigenous resource hydropower projects that have approved sites, available finances, and strong sponsors are being pushed back decades thus effectively killing/shelving the projects.

Issue # 13: Reliance on Local Coal:

The world is moving away from Coal while we are planning as much as 33,000 MW of coal! Three aspects have perhaps been over looked while including such a large MWs of Thar coal power plants:

A) If least cost tariff is one of the main criteria of IGCEP than the tariff should be properly indexed. The tariff determination as given by Nepra for Engro Powergen Thar project when indexed is the most expensive indigenous fuel option as Thar coal price is linked to UD dollar. All the advantage of Thar coal being indigenous coal is lost when we have to pay the coal price in US dollar terms. B) Has the cost of mining been included as part of Thar coal electricity tariff? C) Has consideration been given from where will water required for cooling turbines come from and where will such huge ash be disposed?

IGCEP report shows that during period 2030-2040 coal projects 25,105 MW will be set up, while during this period not a single hydro project has been scheduled. It is ironic

ARTISTIC MILLINERS (PVT) LTD.
MANUFACTURERS & EXPORTERS OF YARN, DENIM FABRIC & FASHION GARMENTS
Plot No. 4 & 8, Sector 25, Korangi Industrial Area, Karachi-74900 Pakistan.
GST # 17 - 50 5205-002-82, NTN # 2645727-0
Tel : (9221) 35072586-88, 35075337-39 Fax: (9221) 35075446 Email: artisticho@cyber.net.pk, corporate@artisticmilliners.com

that coal projects targeted during 2030-2040 have no feasibility study or sponsor are being proposed instead of environmental friendly projects which have completed feasibility studies and identified sponsors already carrying out project development activities.

Thar coal is an important resource and should not be confined to power generation at mine mouth. It can perhaps also be used for gasification and pumping it to industrial zones in Sindh.

SUBMISSIONS FOR AUTHORITY'S CONSIDERATION:

1. NTDC should confine the Indicative Generation plan to only 10 year period, i.e, up to 2030.
2. Large hydropower should be categorized as Renewable Energy and included in quota / target set out for clean renewable energy.
3. IGCEP's wrong classification of hydropower as an expensive generation option only on basis of construction cost, without considering lifecycle cost and fuel cost of thermal, should be corrected
4. Large hydropower is the original renewable energy resource and rather than create conflict between wind, solar, bagasse and large hydro there is a need to re-categorise large hydro as a renewable.
5. This re-categorization would ensure that one renewable energy resource is not developed at the cost of another.
6. Revised targets should be developed allowing maximum push for each technology, minimizing risk of missing targets, if one category slips.
7. Projects, with feasibilities, sites, land and investors, being implemented by Federal bodies, Provincial governments or private investors should not be delayed / held back.
8. Hydro Projects with similar development status should also be assigned "Committed" status. Public Sector projects should also be dealt on merit with Private projects. Projects, despite being in CPEC or GTG but with little progress, shouldn't be considered as "Committed". Candidate projects should be additionally categorized based on Availability of Sponsors / Lenders, Project

ARTISTIC MILLINERS (PVT) LTD.

MANUFACTURERS & EXPORTERS OF YARN, DENIM FABRIC & FASHION GARMENTS

Plot No. 4 & 8, Sector 25, Korangi Industrial Area, Karachi-74900 Pakistan.
GST # 17 - 50 5205-002-82, **NTN #** 2645727-0
Tel : (9221) 35072586-88, 35075337-39 Fax: (9221) 35075446 Email: artisticho@cyber.net.pk, corporate@artisticmilliners.com

award and development status, Distance from Grid, Development phasing by the Sponsor agency.

9. New projects should be screened based on their tariff as per NEPRA methodology and not annual incremental CAPEX
10. A one-time adjustment in demand forecast is needed to account for (i) grid constraint removal (ii) latent demand and (iii) win back of captive producers.

Sincerely,

For & On Behalf of
Artistic Milliners (Private) Limited

Rafique Khanani
Authorised Representative
Artistic Milliners (Pvt.) Ltd

Manufacturing Locations

Spinning Mill	471 - 472, Deh Landhi, Bin Qasim Town, Karachi	Ph:	92213-5023706 - 8	Fax:	35022883
Denim Mill	Plot No. 8, Sector 25 Korangi Industrial Area, Karachi-74900	UAN:	111 263 646	Fax:	35069298
Garment Factory	Plot No. 4, Sector 25 Korangi Industrial Area, Karachi-74900	Tel:	92213-5072586-8	Fax:	35075446
Denim Mill	Plot No. 10,11,14,15 & 104, Deh Khanto Tappo Landhi Bin Qasim Town, Karachi.				

ADG (Lic)

ASSOCIATED TECHNOLOGIES (PVT) LTD.

(DEVELOPERS OF RENEWABLE ENERGY PROJECTS)

2/1/2020

ATL-020/316

28 May 2020

NEPRA
Licensing Department
Diary No:
Date:

To: **The Chairman,**
National Electric Power Regulatory Authority
NEPRA Tower, Opposite to Federal Flood Commission,
East Ataturk Ave, G-5,
Islamabad.

IGCEP Team

Subject: **INDICATIVE GENERATION CAPACITY EXPANSION PLAN 2020-2047 PRIORITIZATION OF HYDROPOWER POTENTIAL OVER THERMAL, SOLAR AND WIND RESOURCES IN PAKISTAN**

Refer the Indicative Generation Capacity Expansion Plan (IGCEP) 2020-2047 report of Pakistan by National Transmission and Dispatch Company (NTDC).

CHAIRMAN
Dy No. 3266
Date: 01.06.2020

1. The report has been prepared and submitted to NEPRA for future energy prospects. The IGCEP was developed, under the NEPRA Grid code 2005, which is a momentous achievement for the entire Power Sector of Pakistan. In this regard few suggestions are submitted below:

a. The existing energy mix of the country is heavily biased towards thermal power plants which is mainly operating on imported fossil fuel. Fossil fuel not only creates pressure on foreign exchange reserves of the country, but is also an environmental concern. Therefore, in order to achieve sustainable development, it is imperative that indigenous renewable energy resources to be given priority for electric power generation and their development must be encouraged.

Registrar

b. **Hydropower projects** have an extended life of 70 - 80 years as compared with solar and wind projects having an average life of 25 years, with comparatively much higher maintenance cost. As per IGCEP report, while working on the financials based on discount factors and Net Present Values (NPV) the "real" benefit of hydropower after 25 years is completely ignored

DIR
DD
AD
T/A/ES/OA-I/OA-II

21-L Model Town Extension, Lahore- Pakistan Telephone: +92-42-35178801-4, Fax: +92-42-35178805
Email: atl@atlpvt.com Website: www.atlpvt.com

in the calculations of cost and tariff. The example of Mangla and Terbella Dams can be considered as these were constructed around 50 years ago and after paying off their capital cost are still producing electricity for less than a rupee per unit.

c. The issue highlighted with Hydro Power is considering its current tariff very high as compared to other power projects while ignoring some major constraints associated with it. The locally produced Hydro Power Project (HPP) tariff, as compared with neighboring countries has a variance because of different interest rates and Water Usage Surcharge. It does not seem befitting to partially neglect Hydro Power Projects on the basis of high tariff and comparing them with projects of 25 years life span.

d. To support in favour of Hydro Power Projects, it is also reinforced that:

i. Hydropower projects have dynamic importance in preventing and controlling floods.
ii. Hydropower sector brings large scale employment covering labor and skilled staff.
iii. It promotes purchase of local materials in all sectors.
iv. These projects are of large durations which benefits the local population.
v. Such projects create large water bodies around the area and develop tourism spots that brings prosperity not only in that area but also in the country.
vi. Hydropower sectors helps developing the area aesthetically that encourage tourist places and the economic viability.

e. Hydropower development, under small hydropower schemes, has played vital role to achieve the energy demands of the country. Few major projects are in development phase under the PPIB, PPDB and PEDO.

21-L Model Town Extension, Lahore- Pakistan Telephone: +92-42-35178801-4, Fax: +92-42-35178805
Email. atl@atlpvt.com Website: www.atlpvt.com

f. It has been observed that the data entry of the projects in IGCEP report is not correct, e.g. power plant and annual energy data (Ref: Page 84 of 237, Sr. # 92, Meher Hydropower Project) that reduces the cost/benefit ratio of the projects and pushed them to the 2040 - 2047 period of the IGCEP. This will create huge set back to the resource development which are basically environmental friendly and cost effective.

g. You are requested to correct the data charts (para e above) of the hydropower projects as provided by the Sponsor(s). The possible corrections can bring back the hydropower projects to the commissioning year till 2030.

Lieutenant Colonel
Malik Muzaffar Ahmed Majoka, TI(M), (Retd)
GM Corporate Affairs & Administration

Copy to:

1. Chief Engineer NTDC, 2nd Floor, Hall No. 2, Shaheen Complex, Egerton Road, Lahore, Pakistan.
2. MD PPIB, Emigration Tower, Plot No. 10, Mauve Area, G-8/1, Islamabad, Pakistan
3. MD PPDB, Energy Department, 1st Floor, Irrigation Secretariat, Old Anarkali, Lahore, Pakistan
4. MD PEDO, Plot # 38, Sector B-2, Phase 5 Hayatabad, Peshawar, Pakistan

21-L Model Town Extension, Lahore- Pakistan Telephone: +92-42-35178801-4, Fax: +92-42-35178805
Email: atl@atlpvt.com Website: www.atlpvt.com

Atlas Power

April 28, 2020

The Registrar
National Electric Power Regulatory Authority,
NEPRA Tower, Attaturk Avenue (East),
Sector G-5/1,
Islamabad

Subject: **MAIN REPORT INDICATIVE GENERATION CAPACITY EXPANSION PLAN (IGCEP) 2047 FOR COMMENTS OF STAKEHOLDERS / GENERAL PUBLIC**

Dear Sir,

In continuation to our letter dated December 20, 2019 on the above subject (copy attached), We, M/s. Atlas Power Limited, write with reference to the subject matter wherein the Authority sought comments from the stakeholders / general public.

Government of Gilgit Baltistan (GoGB), one of the stakeholders mentioned in the IGCEP 2047, is developing following projects jointly with M/s Sinohydro:

100MW KIU HPP Project	• The feasibility study of KIU Project completed in 2003 • The detailed design report was completed in 2012. • On February 8, 2017, MOU was signed to develop the project. • In the 5th JWG on Energy and 8th JCC meeting, both China and Pakistan sides agreed to study and develop the Project in IPP mode under China-Pakistan Economic Corridor (CPEC)
80MW Phandar HPP Project	• **The feasibility study of Phandar completed in 2003** • **The detailed design report was completed in 2012.** • **On February 8, 2017, MOU was signed to develop the project.** • **In the 5th JWG on Energy and 8th JCC meeting, both China and Pakistan sides agreed to study and develop the Project in IPP mode under China-Pakistan Economic Corridor (CPEC)**

Please note that Phander HPP is already included in the IGCEP 2047, ***section 6.11 New Generation Options (Sr. 21)*** and ***table 7 (page 118, sr. 93)*** nonetheless KIU HPP was inadvertently missed in the said plan.
Therefore, we request the Authority to include KIU project in the final IGCEP 2047 to tap the GB's hydro potential for the development of this remote and scenic place in order to bring economic prosperity of the community and enhance image of Pakistan. We are available in case of any query.

Yours faithfully,

Maqsood Ahmad
Director

Atlas Power Limited
Registered Office: 26/27 km, Lahore Sheikhupura Road, Sheikhupura.
Ph: (92-56) 3406192-94, (92-42) 37332610 **Fax:** (92-42) 37332812

Atlas Power

December 20, 2019

The Registrar
National Electric Power Regulatory Authority,
NEPRA Tower, Attaturk Avenue (East),
Sector G-5/1,
Islamabad

Subject: **DRAFT INDICATIVE GENERATION CAPACITY EXPANSION PLAN (IGCEP) 2018-2040 FOR COMMENTS OF STAKEHOLDERS / GENERAL PUBLIC**

Dear Sir,

We, M/s. Atlas Power Limited, write with reference to the subject matter wherein the Authority sought comments from the stakeholders / general public. Government of Gilgit Baltistan (GoGB), one of the stakeholders mentioned in the IGCEP 2018-2040, is developing following two projects jointly with Sinohydro:

80MW Phandar HPP Project	• The feasibility study of Phandar completed in 2003 • The detailed design report was completed in 2012. • On February 8, 2017, MOU was signed to develop the project. • In the 5th JWG on Energy and 8th JCC meeting, both China and Pakistan sides agreed to study and develop the Project in IPP mode under China-Pakistan Economic Corridor (CPEC)
100MW KIU HPP Project	• The feasibility study of KIU Project completed in 2003 • The detailed design report was completed in 2012. • On February 8, 2017, MOU was signed to develop the project. • In the 5th JWG on Energy and 8th JCC meeting, both China and Pakistan sides agreed to study and develop the Project in IPP mode under China-Pakistan Economic Corridor (CPEC)

Please note that Phander HPP was included in the IGCEP 2018-2040, ***section 6.10 Hydro Projects and Screening*** and ***table 7-10 Future generation capacity Additions*** nonetheless KIU HPP was inadvertently missed in the said plan which is on the same stage of development like Phander Project.

Therefore, we request the Authority to include KIU project in the final IGCEP 2018-2040. We are available in case of any query.

Yours faithfully,

Maqsood A. Basraa
Director

Copy to: MD-NTDCL

Ref: GUHP /1/2020/12
21 May 2020

The Registrar,
National Electric Power Regulatory Authority
NEPRA Tower,
Islamabad, Pakistan

Comments on "Indicative Generation Capacity Expansion Plan 2047" of NTDC
(82MW Gabral Utror HPP, 36MW Bankhwar HPP, 16MW Sakhra (I & II) and 45MW Wari HPP)

Dear Sir,

We are pursuing a 82MW Gabral Utror hydro power project under the terms of a Letter of Intent ("**LOI**") issued by Pakhtunkhwa Energy Development Organization ("**PEDO**"). Markhor Gabral Utror HPP (Private) Limited, a company incorporated under the laws of Pakistan is a Joint Venture project of M/s InfraCo Asia, Singapore and M/s Markhor Energy, Pakistan.

In addition to Gabral Utror HPP (82MW); we are also pursuing Bankhwar HPP (36MW), Sakhra –I HPP (8MW), Sakhra-II HPP (8MW) under the terms of LOIs issued by PEDO and Wari (45MW) HPP for which LOI is awaited.

We are one of the very few hydro power projects currently under development in Pakistan by an international investor having strong presence in various countries.

InfarCo Asia funded by four sovereigns (Governments of UK, Switzerland, Australia and the Netherlands) is keen in developing the hydro power project by following international best practices. In order to maximize the usage of available hydel resource at the Project Site; JV Partners have engaged internationally reputable technical consultants for the development of the feasibility studies. We are glad to inform that so far progress of the development of our projects is on track, and feasibility studies are near completion though we have to put on hold certain on-sites activities due to COVID-19 and lockdown at the project sites in particular and in the country in general.

Power System Planning ("**PSP**") of National Transmission and Despatch Company ("**NTDC**") submitted an "Indicative Generation Capacity Expansion Plan 2047" ("**IGCEP**" or the "**Plan**") to NEPRA in April 2020 whereon NEPRA has solicited comments from the stakeholders on IGCEP.

We have reviewed IGCEP in detail and have observed that all the hydro power projects of private sector have been pushed to Year 2046 onward, which is beyond comprehension and apparently without any solid basis. Ignoring cheap and reliable electricity from hydro power projects has significantly diluted the overall impact of the Plan and resultantly makes the conclusions defective. It is important to note that a number of important aspects are not adequately covered in it, Plan of 'National Transmission and Despatch Company' has almost everything related to the power sector except 'transmission and despatch' related matters.

Please note below our comments on IGCEP for your kind consideration;

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

1. As per the Foreword of the Plan; NTDC has prepared the IGCEP and once it is approved then on the basis of approved generation Plan; NTDC will prepare a 'Transmission System Expansion Plan'. The success of a long term strategically important plan is highly dependent on the adopted methodology and on the envisaged sequence of events under the plan. Here, the sequence of events is exactly opposite to what it ought to be. Rationally, NTDC should only prepare 'Transmission System Expansion Plan' on the basis of information provided to it by the Ministry of Power of GoP, PPIB, AEDB, and all provincial agencies. NTDC is apparently not supposed to; determine the cost of a generating unit; even determination of demand and supply forecast; and devising a strategy for either utilizing indigenous resources or to reliance on imported fuels. Instead, it should only focus on developing a technical and financial plan on how to evacuate power from a power project and what would be the cost of transmission line thus NEPRA, Ministry of Power of GoP, PPIB, AEDB, and all provincial agencies could take a comprehensive decision of procuring power from any particular project or from a cluster of projects and take a view on how to utilize the available resources resultantly bringing down the cost of electricity.

2. On one side, IGCEP shows the hard work and dedication of PSP team in developing the Plan while on the other, it also shows lack of guidance thus it has distracted from its original objective and the very intent of the Plan. The Plan has apparently trespassed into implementing agencies (i.e. PEDO as approving authority of feasibility studies) and NEPRA as a Regulator in issuing the tariff to a project. It is humbly suggested that let implementing agencies and NEPRA do the math and NTDC should provide its input on evacuation only.

3. While performing simulations, a lot of emphases have been given to various technologies except hydro power from private IPPs while it assumes procuring power from all sources except from hydro power till Year 2046. IGCEP has considered least cost solution (a combination of CAPEX, OPEX and Capacity factors) for input in the software. While doing so; IGCEP has conveniently ignored to add the cost of transmission line and related losses, dispatch requirements, and consumption patterns. As per the Plan; 1500MW, 1500MW and 1000MW have been assumed as commissioned in Year 2023 from solar, wind and CASA-1000 respectively. Without going into the merits and de-merits of solar, wind and CASA-1000, these are just 'Generic Candidate' projects for which even no decision has yet been taken. Considering this 4,000MW of 'Generic Candidate' projects in Year 2023 simply erodes the possibility of utilizing huge hydro potential in KP province of Pakistan. As per the Plan; 27,316MWs will come from 'Generic Candidate' Solar projects from Year 2023 to 2046. Pakistan has a potential of solar/wind projects but that should not be assessed in isolation. Without considering load centers, load requirements and evacuation strategy; the potential of solar/wind is good for nothing. It is encouraging to see that NTDC is emphasizing on induction of renewable power plants in the system but without any legal framework, power policy, and mechanism to initiate (solicited or un-solicited) a project, adding thousands of MWs of 'Generic Candidate' in the system planning study and consequently pushing the real projects such as hydro power does not provide a meaningful analyses.

4. Below table ONLY shows 'Generic Candidate Projects' from different technologies (as given in Annexure E of the Plan) where basis/ location/ any specific information for massive 84,139MWs potential power projects from Year 2023 to 2046 have not been provided.

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

Year	Solar	Wind-Mid	Wind-North	Wind-South	CASA	Coal - Local	RLNG	Year Total
2023	1,500	300	200	1,000	1,000	-	-	4,000
2024	1,500	-	-	-	-	1,988	-	3,488
2025	1,500	-	-	-	-	-	-	1,500
2026	1,500	-	-	-	-	-	-	1,500
2027	-	-	-	-	-	236	-	236
2028	1,500	-	-	-	-	103	2,020	3,623
2029	1,500	-	-	-	-	158	908	2,566
2030	1,500	-	-	-	-	917	3,010	5,427
2031	1,500	-	-	-	-		901	2,401
2032	1,500	-	-	-	-	7	1,204	2,711
2033	1,500	-	-	-	-	3,919		5,419
2034	567	-	-	-	-	3,360	633	4,560
2035	-	-	-	-	-	2,248	2,719	4,967
2036	742	-	-	-	-	2,375	2,831	5,948
2037	1,354	-	-	-	-	2,551	2,058	5,963
2038	669	-	-	-	-	2,963	2,202	5,834
2039	1,124	-	-	-	-	3,206	2,572	6,902
2040	360	-	-	-	-	3,528	2,933	6,821
2041	1,500	-	-	-	-	32	270	1,802
2042	1,500	-	-	-	-	1,237	2,102	4,839
2043	1,500	-	-	-	-	-	-	1,500
2044	1,500	-	-	-	-	1,125	-	2,625
2045	1,500	-	-	-	-	7	-	1,507
2046	-	-	-	-	-	-	-	-
TOTAL	**27,316**	**300**	**200**	**1,000**	**1,000**	**29,960**	**26,363**	**86,139**

NOTE: [As per Annexure E, No VER Policy]. *The above table ONLY includes "Generic Candidate" power projects and doesn't include already identified power projects having name and project site.*

From the above Table, without even going into the document; one can assess that the Plan is based on weak assumptions. So much so, Plan is assuming to take additional power from a new power plant in certain years even without considering the efficiencies of the machines and sizes of the turbine. For example; is it even worth it to develop and install a 7MW coal power plant or less than 1200MW RLNG based power plant, when latest model of turbines have bigger size and higher efficiencies. Turbines of thermal power plants come in fixed sizes unlike in case of hydro, where machines are designed on the basis of requirements.

It seems from the above numbers that local coal and RLNG are being considered as peakers and will be operated to take the load when solar/wind is not available. As a practice, no bank will finance and no investor will either invest in a greenfield infrastructure project without first knowing the revenue stream and the security package. In this situation, a generation Plan on the basis of misunderstanding can create more issues and will definitely choke the already troubled power sector.

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

5. Instead of first determining the electricity requirement of an area, allocation of a resource for meeting the requirement and thereafter determining the best possible option; the whole exercise is going in cycles. There is a very high possibility that once NTDC completes its 'Transmission System Expansion Plan', post approval of IGCEP, a large number of assumed least cost generating facilities would technically become unviable (due to transmission line cost and away from the load centers). Therefore, in this situation, what is the intended purpose of IGCEP. It is therefore, requested the honorable Authority to advise NTDC to focus on relevant aspects of the generation plan only rather than adding irrelevant information and doing analyses for the sake of analyses.

6. No explanation is given in Table E.11 - 'Summary of Total Generation Cost Comparison of all Scenarios'. Probable intention of calculating NPVs of CAPEX and OPEX is to see how much a particular Scenario will cost the system but there are many other factors, which actually determine the total cost of electricity for the system operator. Anyhow, while looking at the NPV numbers alone as given in Table E.11 - 'Summary of Total Generation Cost Comparison of all Scenarios'; it is interesting to note that NPV of CAPEX and OPEX under 'Base Case' is US$ 69.8 whereas NPV of CAPEX and OPEX under 'HPP Free' Scenario is calculated as US$ 69.5 billion. The difference between two NPVs of CAPEX and OPEX is well under the margin of error and can be due to rounding off the numbers. There is hardly any additional CAPEX and OPEX on developing hydro power plants therefore, pushing hydro power plants to the tail end of the generation plan will not serve the country well. We need to be mindful of the fact that; indexation of fuel and fixed O&M have not been considered in the Plan thus eventually cost to the system under 'HPP Free' Scenario would be much higher. Therefore, it is submitted to consider injecting more hydro power projects in the system as early as possible.

7. Pushing all hydro power plants currently under advanced stage of development to Year 2046 onward means NTDC is not even considering private sector's participation in hydro power plants. While looking at the list of PEDO's hydro power plants; total is around 5,500MW, which also includes around 5 hydro power plants totaling 2,000MW. Hydro power project pursued by PEDO are real and are on ground with name, size, site and are with well-known sponsors rather than just a 'Generic Candidate' power projects without any background.

8. In order to illustrate the real issue with the structure and methodology of the Plan; Plan says 1500MW of solar to be injected in the system without assessing the area of these solar projects. What if an Economic Zone in KP province requires electricity and NTDC plans to provide super cheap solar power but the possible solar site is in Rahim Yar Khan area of Punjab (i.e. best solar resource of say 23% annual average capacity factor) or from local coal or RLNG. In this case, how NTDC will be transmitting power to KP Province from Rahim Yar Khan? Will that even be technically and economically viable option to develop a solar project in that area or will Government of Pakistan abandon the economic zone right on the route of CPEC? Therefore, it is requested to do the exercise systematically instead of wasting time and energy of all the stakeholders. Besides this will seriously affect the investment climate of Pakistan and can also hamper foreign direct investment.

9. The overall concept of evaluation on the basis of CAPEX and OPEX of a project is defective. It doesn't provide an apple to apple comparison as per MW cost of a hydro might be higher (and O&M cost mostly in local currency is on the lower side) than any other power plant but if, Fixed

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

O&M and fuel tariff is indexed; variation in yield curves and cost of transmission line and related losses are considered then there is a probability that hydro power projects might be the least cost generation units.

10. We respect the decision of Ministry of Power GoP to include CASA-1000 project in their medium term forecast but in comparison to huge potential of hydro power plants; importing power of 1000MW from Central Asia will seriously affect the development of local hydro power industry in Pakistan and such ambiguous projects can distract the focused discussion.

11. As a practice, Public Sector hydro power projects start with the funding from annual funds allocation in Public Sector Development Program (PSDP) and thereafter due to various budgetary constraints; the construction gets slowed or stopped and project gets delayed. We have seen in case of Neelum Jhelum Hydro Power Project, where a project of national importance was first remained on papers for over 20 years and thereafter commissioning delayed by at least 5 years. The cost overrun has now put huge financial burden on the state and the objective of developing a cheap and least cost generating facility has completely ruined. Similar instances are being observed in case of Nandipur Thermal, Trimmu RLNG project and Jamshoro Coal Project. Delays and cost over runs are quite normal in case of public sector power projects. Due to limited resources of the country; it is suggested that public sector projects must not start construction before the financial close as is done by the private IPPs, unless there is a project of a national strategic importance (e.g. diamer-bhasha dam). NEPRA has already laid down guidelines for the selection of an EPC Contractor and has also set tariff mechanism process therefore, it is suggested to encourage private sector to take the risk and invest in the power sector especially in the hydro power and transmission line sectors. This would not only be cost effective but will also help brining generation facility online within a given timeframe.

12. During summer months, demand of electricity in the country increases while these are also high water months therefore, it is in Pakistan's benefit to utilize high water months and get cheap electricity from hydro power plants. During high water months, capacity factor even goes to 90% in case of hydro power plants, which is not possible in wind/solar in their high time. All other technologies have unique limitations, be it limited to day time only (solar) or high yield at dawn (wind) or high cost of imported fuel (RLNG) or inefficient and polluted generation (coal). It is also to be noted that arrangement of debt for coal and big public sector hydro power projects would be a huge challenge in coming years. Without securing finances to develop a power project will heavily cost the government.

13. Following aspects have completely been ignored while determining the demand forecast;

    a. CPEC projects have been given priority in the Plan where, we must not forget that CPEC is a live national importance project hence any power project can be added or removed in or from CPEC list of projects any time during the development. Therefore, it is requested not to give special status to CPEC projects so that every project could be evaluated on its own merits.

    b. Economic and Industrial Zones under CPEC or under any other government special schemes have not been considered.

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

c. Rural electrification has not been considered which can effectively revive the stressed DISCOs.

Our hydro power projects are at an advanced stage of development and we expect that we would be able to achieve financial close in 2021, if everything goes as per plan. Sponsors have already lined up equity and debt would be arranged from the international lenders in due course. Sponsors of the Project have international presence and are confident to arrange a longer term debt which would bring down the overall tariff. Total construction time of our hydro power projects is estimated to be 3.5 years and COD can be achieved in 2024. In this situation, it is humbly submitted to revise the Plan and preference should be given to such projects for early power evacuation.

Pakistan has huge potential of hydro power and it is in the best interest of the country to utilize this resource. There is no doubt that developing hydro power projects especially small to medium will help Pakistan to bring down the cost of electricity. It is also requested to please add real projects of serious investors in the evacuation plan instead of relying on arbitrary and imaginary projects.

We look forward to working with Ministry of Power GoP, NEPRA, NTDC, CPPA(G), PEDO, PPIB, AEDB and all other stakeholders in bringing our hydro power project online in minimum possible time which will also provide cheap and clean electricity.

Yours Sincerely,

Arooj Asghar
Project Lead

c.c. Director Hydro Power, PEDO, Peshawar, KP Province.

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

ADG (Licensing)

FROM :

FAX NO. :

Apr. 26 2009 06:18AM P1

IGCEP committee

30/4/2020

AZAD GOVT. OF THE STATE OF JAMMU & KASHMIR
SECRETARIAT ELECTRICITY/ POWER DEVELOPMENT ORGANIZATION
MUZAFFARABAD

NO. SE/PDO/ 758-63 /2020 Date/ 28 / 04 /2020

The Chairman,
National Electric Power Regulatory Authority (NEPRA),
NEPRA Tower, G-5 Islamabad.

Tel: 051-9206500
Fax: 051-9200021.

CHAIRMAN
Dy No. 2862
Date: 28-04-2020

Registered

Subject: - COMMENTS OF GOAJ&K ON INDICATIVE GENERATION CAPACITY EXPANSION PLAN (IGCEP) 2047.

This is with reference to NEPRA's notice vide No-PID(I)5860/19, I would like to draw your kind attention to a report recently outlined and submitted on Indicative Generation Capacity Expansion Plan (IGCEP) 2047 by NTDC for various categories of Hydro Power Projects in Provinces and AJK, which if firmed up / approved by the competent forum would practically block the prospects of attracting investment from Private Sector and donors in AJK.

2. As you may be aware, hydro potential is a major natural resource of AJK whose priority development can play a leading role towards the socio-economic turn around and uplift of our area. This sector of our economy is very promising and its multi dimensional benefits will potentially provide many direct / indirect benefits that include employment opportunities for rural communities, promoting infrastructure development, growth of cottage industry, adventure tourism and related commercial activities.

3. Ever since the power sector was deregulated and the private sector was invited for prospecting hydro potential of AJK, many small and medium (Less than 50 MW) projects were proposed under various Policy Frameworks of Federal Government. AJK has been in the forefront for facilitating the private investors and a number of hydro IPPs have already been completed, being constructed and are under implementation. While providing energy to National grid from renewable and Indigenous source, a reasonable income is also deposited in State treasury providing much needed fiscal space to the Government. Investment in hydro Power Projects of AJK offers many obvious and major advantages of which some are as under;

- Low cost of power evacuation and interconnection
- Comparatively low cost of project development
- Availability of Extended 132 kV grid network, which could be conveniently upgraded to 220 and 500 kV to accommodate future interconnections for power evacuation.
- Availability of Capacity and Energy in summer months when the urban and Industrial demand on National Grid is at its peak.
- Peaceful and Conducive environments for project development.

4. The Letter of Interest/Letter of Support (LOIs/LOSs) for most of these projects were issued under Power Generation Policy 2002, which authorized the Provincial / AJK Governments to process and deal with all investment proposals for projects less than 50 MW in their respective areas themselves. As a result, a number of projects are now in the pipeline and are being actively processed and pursued. The investors have put in years of time, efforts and borne expenses. This includes the long and indefinite wait during periods of uncertainty. Now that most of ambiguities have finally been removed, the investors appear to have regained their confidence and are moving forward. But circulation of IGECF by NTDC at this critical stage will once again dampen their efforts surely and all hopes of early completion of the projects will vanish.

5. As conveyed by NTDC in their proposal, time frame for most of our projects have been pushed down by almost twenty five years from now and they will be considered for development in years 2040-2045. This proposal totally ignores the spade work that has so far been carried out in maturing the projects and bring them to a stage where the investors were confidently aiming to initiate tariff negotiations with CPPA G. Unless the NTDC is directed to reconsider and revise the proposed IGCEP and accommodate hydro power projects of AJK for an early harvesting period, it will frustrate the project sponsors and will negatively impact the prospects of attracting investments in future. It is therefore requested that the NTDC may please be directed to revise its IGCEP and allow hydro IPPs of AJK an early (2022-2030) harvesting time. Your support and intervention in this case would be highly desired and appreciated.

Secretary
Electricity/PDO

Copy to:

1. The Secretary, Ministry of Energy (Power Division), GOP.
2. The Chief Secretary GoAJ&K Muzaffarabad.
3. Managing Director, NTDCL, WAPDA House, Lahore.
4. Managing Director PPIB, GOP.
5. Chief Executive Officer, Central Power Purchase Agency Guarantee Limited, Islamabad.

KHNP
KOREA HYDRO & NUCLEAR POWER CO., LTD
1655 Bulguk-ro, Yangbuk-myeon, Gyeongju-si, Gyeongsangbuk-do, Korea, 38120
Tel: +82-54-704-7850 / Fax: +82-54-704-7799
http://www.khnp.co.kr e-mail : ilkyung.choi@khnp.co.kr

HLKL/PN-200001L

May 26, 2020

Reply Required ☒Yes ☐No

The Registrar
National Electric Power Regulatory Autority(NEPRA)
NEPRA Tower, Attaturk Avenue (East), G-5/1, Islamabad, Pakistan

Subject: Comments for the Indicative Generation Capacity Expansion Plan 2020-47

Dear Sir,

Korea Hydro & Nuclear Power Company ("KHNP") is in process of developing 496MW Lower Spat Gah Hydropower Project ("LSG") in Public-Private Partnership mode with government of Khyber Pakhtunkhwa ("KPK"). KHNP is associated with LSG since mid-2018 and has already developed the feasibility study of the project as per terms and conditions of Memorandum of Understanding ("MoU") signed between KPK and KHNP. A Notice to Proceed ("NTP") has already been issue to KHNP by Pakhtunkhwa Energy Development Organization ("PEDO") for submission of detailed technical proposal of the project on December 2019.

As per previous IGCEP report (2018-40), LSG was scheduled to be commissioned in year 2028[1]. This motivated the KHNP & PEDO to expedite the progress on the project. In this regard, KHNP has already completed the feasibility study and financial model of the project. Major milestone for approval of investment, from Korean Government has also been achieved in May 2020. Tentative financing arrangements with leading multilateral development banks are also in process and much progress has been made in this regard as well. As per initial terms of the MoU, government of KPK will have ownership of 26% shares in the project.

However, as per revised IGCEP 2020-47, the scheduled commissioning of the LSG has been shifted to year 2047 from year 2028[2]. The adjournment of project for 19 years is quite a setback for developers of the project because this will annul the progress already made by both parties. Moreover, the approval of investment issued by Korean Government will also lapse due to this delay.

[1] Table 7.3 of IGCEP 2018-40

[2] Table 7.5 of IGCEP 2020-47

- SA(Tech)
- SA(T)
- DG(M&E)
- ADG(Lic)
- SAA(LLP)
- MF

CC: Chairman
V.C/M M&E
- M(T)
- M(CA)
- M(Lic)

REGISTRAR
Dy. No:
Dated: 28-5-20

KHNP
KOREA HYDRO & NUCLEAR POWER CO., LTD
1655 Bulguk-ro, Yangbuk-myeon, Gyeongju-si, Gyeongsangbuk-do, Korea, 38120
Tel: +82-54-704-7850 / Fax: +82-54-704-7799
http://www.khnp.co.kr e-mail : choonsul.lee@khnp.co.kr

HLKL/PN-200001L

Keeping in view above, we request kindly all relevant stakeholders of power sector in Pakistan to reconsider the methodology for screening of projects and provide relief to numerous feasible projects which have been neglected in the IGCEP 2020-47.

We would like to thank you in advance for your support and cooperation.

Sincerely yours,

IL-KYUNG CHOI
Vice President of Global Business Department
Korea Hydro & Nuclear Power Co., Ltd.

CC: MD of NTDC, 2nd Floor, Hall No. 2, Shaheen Complex, Egerton Road, Lahore
MD of PPIB, Emigration Tower, Plot No. 10, Mauve Area, G-8/1, Islamabad
MD of PEDO, Plat No. 38, Sector B-2, Phase 5 Hayatabad, Peshawar
Head/Principal Officer, Pakistan Branch Office of Lotte E&C

Attachment: 1. Comments for IGCEP 2020-47 by KHNP
2. Memorandum of Understanding ("MoU") between KPK and KHNP
3. Notice to Proceed issued by PEDO

P E D O

PAKHTUNKHWA ENERGY DEVELOPMENT ORGANIZATION
Government of Khyber Pakhtunkhwa Peshawar
Room # 332, Plot # 38 / B-2, PEDO House, Phase-5, Hayatabad, Peshawar, Tel: 091-9217488

No. 1733-35 / PEDO / CEO
Date: 09th December 2019

To

M/s Korea Hydro & Nuclear Power Co. Ltd
1655 Bulguk-ro, Yongbuk-myeon, Gyeongju-si, Gyeongsangbuk-do,
Korea, 38120

Attn: Byung Soo. Jung
GM Global Hydropower Business Office

Subject: CONDITIONAL NOTICE TO PROCEED (NTP) FOR DEVELOPMENT OF 496 MW LOWER SPAT GAH HYDROPOWER PROJECT (HPP) AT DISTRICT UPPER KOHISTAN, KHYBER PAKHTUNKHWA (KP)

Whereas

The Government of Khyber Pakhtunkhwa (GoKP) through the Pakhtunkhwa Energy Development Organization (PEDO) has initiated the development of 496 MW Lower Spat Gah Hydropower Project (HPP) at District Upper Kohistan, Khyber Pakhtunkhwa ("the Project") under Public Private Partnership (PPP) mode.

2. In this regard, the Government of Khyber Pakhtunkhwa signed a Memorandum of Understanding (MoU) with M/s Korea Hydro & Nuclear Power Co. Ltd (KHNP) on November 05, 2018.

3. M/s KHNP submitted its preliminary proposal in accordance with the clause 1.5 (10) vii of the KP Hydropower Policy 2016 & associated Guidelines, which includes:

i. Project parameters
ii. Project timelines
iii. Arrangement of financing through equity and debt
iv. Qualification of the Applicant as a foreign state owned enterprise

REGISTRAR
Dy. No:
Dated:

4. The MoU expired on November 05, 2019.

Now Therefore

5. M/s KHNP shall be the sponsor for the development of the Project in accordance with the KP Hydropower Policy 2016 read with the Guidelines for processing of hydropower generation projects in Private Sector, 2016 (**Guidelines**).

6. M/s KHNP is advised to provide and fulfil the following conditions within four (4) months from the date of issuance of this letter;

i. Submission of detailed technical and financial proposal of the Project as per EOI/QD;
ii. Submission of Financial and Technical worth of the Applicant and its consortium partners as per the EOI/ QD;
iii. Undertaking with regards to the maintenance of majority shareholding (51%) by the Applicant in the Project for the lock in period;
iv. Submission of Bank Guarantee as per the Policy;
v. Updating feasibility study, if required

7. M/s KHNP shall also be required to provide undertaking that the GoKP, PEDO and their officers and officials shall be held harmless, shall indemnify them and bear all the costs, expenses and penalties in case of any adverse decision or action arising out of this conditional NTP.

8. This NTP shall be effective subject to extension of the MoU by the Government of Khyber Pakhtunkhwa.

Director Renewable Energy
Private Power, PEDO

CC:

1. CEO, PEDO, Peshawar.
2. PS to Secretary to GoKP, Energy & Power Department, Peshawar.

Director Renewable Energy
Private Power, PEDO

Attachment 1. Comments for IGCEP 2020-47 by KHNP

This is with reference to the Indicative Generation Capacity Expansion Plan (IGCEP) 2020-2047 report of Pakistan by National Transmission and Despatch Company ("NTDC"), submitted to NEPRA, for review and approval.

During our review of IGCEP 2020-47, we have observed certain declarations which according to our understanding have caused misplacement of major hydropower project. We would like to draw your kind attention to following points and request you to consider these during public hearing of the report and before final approval of the plan.

1. Unrealistic Allocation of Capacity Development

As per our analysis of data presented in base case of report, we have observed that during Phase-1 i.e. 2020-30, only 10,830 MW (21% of total capacity developed in Phase-1). Most of the hydropower development is postponed to Phase-2.

Fuel Type	Phase-1	Phase-2	Grand Total
BAGASSE	655		655
CROSS BORDER	1,000		1,000
GAS	20		20
HYDRO	10,830	35,099	45,929
IMP. COAL	1,620		1,620
LOCAL COAL	5,804	26,893	32,697
NUCLEAR	3,300		3,300
RLNG	6,131	20,959	27,090
SOLAR	12,394	14,128	26,522
WIND	9,241		9,241
Grand Total	50,995	97,079	148,074

Table 1: Installed Capacity by Fuel Type (MW)

Most interesting part of the analysis is about allocation of hydropower development to different implementing agencies. As shown in Table 2 below, WAPDA is supposed to be major stakeholder

of hydropower sector of country by developing 33,765 MW of total planned 45,929 MW of hydroelectric capacity (It is evident from below table that approximately 74% of the total proposed hydropower capacity is planned to be developed by WAPDA.) Most of the balance capacity is already in development phase in the form of committed projects as defined by the IGCEP.

Implementing Agency	Phase-1	Phase-2	Grand Total
AJK	25	339	364
PEDO	387	5,269	5,656
PPDB		398	398
PPIB	3,479	1,547	5,026
PPIB/AJK	720		720
WAPDA	6,219	27,546	33,765
Grand Total	10,830	35,099	45,929

Table 2: Hydropower Development by Implementing Agencies (MW)

Keeping in view the investment requirements of developing this huge capacity, it seems unrealistic that a public sector organization can arrange this level of funding. All over the world, governments encourage the participation of private sector investments in major infrastructure projects like hydropower development.

2. Inequitable Cost Comparison between Public & Private Sector Hydropower Projects

WAPDA has provided data and costs related to its planned hydropower project which as per report are accepted as it is. However, for private sector hydropower projects, CPPA was consulted and updated indexed costs have been assumed for analysis.

It should be noted that all projects, both public and private were competing each other on cost basis to qualify for development. It would be better to hire an independent consultant for cost comparison of all projects before inclusion in PLEXOS. Similarly for renewable projects, latest costs as approved by Nepra are taken as benchmark. This shows variation of methods for determination of project costs to be used for comparison.

In addition to above, Table 6.12 of the report shows the salient features of the candidate hydropower projects. However, an in-depth review of these features shows some figures which does not seem correct based on other available public data. For example,

Reference	Description of Report Contents	Query
Table 6.12, #4	Plant Factor of Mahl HPP is shown as 66%.	As per NEPRA Tariff Determination [1] the Plant Factor is 52.33%
-do-	Annual Energy of Mahl is 3,720 GWh	As per NEPRA Tariff Determination the Annual Energy is 2,904 GWh
-do-	Tariff of Mahl is shown as PKR. 5.18/KWh	As per NEPRA Tariff Determination the approved Tariff is PKR. 6.69/KWh
Table 6.12, #87	Cost of Athmuqam HPP is taken as $ 2,944/KW	As per Tariff proposal submitted by Project to CPPA, cost is $ 2,776/KW

Table 3: Incorrect Data Regarding Project Features

3. Flawed Assumptions for Candidate Projects

As per section 6.7 of the main report of IGCEP 2020-47, a project is considered as committed one provided the project fulfills at least one of the following conditions.

i. The project is already under construction
ii. Have already achieved financial close
iii. Has strategic importance like CPEC projects
iv. A G to G project

There are many projects which have been issued LOIs or NTPs by relevant federal and provincial authorities and considerable progress has been made while huge amount of funds already spent on these projects by respective sponsors. It is therefore unfair to exclude these from list of committed projects. Excluding these projects from list of committed projects and delaying construction/ development will not only shatter the confidence of local and international investors, it will also increase the construction cost of these projects over time due to inflation and change in other economic variables.

[1] https://nepra.org.pk/tariff/Tariff/CPPAG/Mahal%20Hydropower%20Project/2019/IPT-04%20MPCL%2023-01

MEMORANDUM OF UNDERSTANDING

FOR THE DEVELOPMENT OF
496 MW LOWER SPAT GAH HYDROPOWER PROJECT
IN DISTRICT KOHISTAN, PAKISTAN

BY AND BETWEEN

THE GOVERNMENT OF KHYBER PAKHTUNKHWA

AND

KOREA HYDRO & NUCLEAR POWER CO., LTD

Dated: Monday, 5th November, 2018
Peshawar, Pakistan

AASAL POWER

JAVED SOLAR PARK (PVT) LTD

Ref: JSPPL/KPK/SPP/001-2/20
Date: 20/05/2020

The Registrar
National Electric Power Regulatory Authority,
NEPRA Tower, Ataturk Avenue (East)
G-5/1, Islamabad

Subject: Comments of 49.5 MW Javed Solar Park (Pvt.) Ltd, in the Matter of Indicative Generation Capacity Expansion Plan 2047 (IGCEP)

Dear Sir,

In compliance with the provision (PC-4 and PC-4.1) of Planning Code of the Grid Code, National Transmission and Despatch Company Limited (NTDC) has prepared the IGCEP and submitted it for review and approval of the Authority (NEPRA).

In this regard, Javed Solar Park (Pvt.) (AHTS) Ltd is submitting its comments on the IGCEP. We have already submitted our comments on hydropower, this document is only specific to our Solar Power Project.

Issue: Our Project not included in IGCEP despite inclusion of 1,500 MW of Solar each year starting from 2023.

We received our Generation License (SPGL/31/2020) on 10th January 2020 for 49.5 MW Javed Solar Park (Pvt.) Ltd. Consequently we received our Tariff on 22nd February 2020 with the financial closure deadline of 21st February 2021. This would mean that our Commercial Operation Date has to be January 2022.

PESCO has already approved our Grid Interconnection Study and issued Evacuation Certificate. This means that Grid is already available for our project. Similarly our Grid is also included in the Ready Interconnection Zones (RIZ) for competitive bidding under ARE Policy 2019.

During the Council of Common Interest meeting on 23rd December 2019 (minutes attached), Government of KPK has already given its reservations on ARE Policy

2019, stating that Solar Projects of KPK for which GL and Tariff are issued, they should be dealt with under clause 8.7.1 of RE Policy 2006.
On 21st April 2020, Chief Secretary KPK again reiterated in his response (letter attached) on ARE Policy 2019 that the Solar Projects of KPK for which GL and Tariffs are issued, they should be dealt with under the old regime of Cost Plus Tariff.

Despite all the above requests and advancements in our project, NTDC has ignored our project just because the Federal Government through a Cabinet Committee on Energy decision on 27th February 2019 has put us in Category 3 of competitive bidding. Notwithstanding the fact that ARE Policy 2019 is still not enacted and a considerable time has lapsed with CCOE decision on 27th February 2019 till date.

SUBMISSIONS FOR AUTHORITY'S CONSIDERATION:

We request the Authority to kindly look into this matter and intervene for our project. Knowing that this is the first ever Solar Power Project of KPK in the most terrorism struck region of Pakistan. Especially the fact that our Grid Study is approved, GL and Tariffs are also issued thus qualifying the criteria for inclusion in Category 2 of CCOE decision.

We request the Authority to kindly make sure that our Category is changed and we are given a go ahead for issuance of Letter of Support and to reach financial close on our deadline of 21st February 2021.

Peaceful,

Abdul Basit Javed
CEO
Javed Solar Park (Pvt.) Ltd

CHIEF SECRETARY KHYBER PAKHTUNKHWA

D.O NO. E&P/CPO/PO-III/REP/2020
Dated Pesh: ____ April, 2020

SUBJECT: ALTERNATE AND RENEWABLE ENERGY POLICY (ARE) 2019.

My Dear Sir,

اسلام علیکم

Reference your letter No. IPP-1(15)/2018 dated: 24th January 2020 on the subject cited above and to state that Government of Khyber Pakhtunkhwa has shared comments on Draft ARE policy 2019 with Ministry of Energy (Power Division) Vide letter dated: 22nd July 2019, 26th August 2019 and 30th September 2019.

2. The new ARE policy envisages open bidding of RE projects. Khyber Pakthunkhwa is at a comparative disadvantage compared to other provinces in case of solar and wind projects due to higher cost of land, low irradiation, relatively lower wind speed and inadequate interconnection infrastructure. As such Khyber Pakhtunkhwa will be deprived of its due share in ARE projects. In order to ensure equitable development and distribution of projects of all provinces, it is suggested that Provincial quota should be established for future projects. Open bidding will be conducted on regional quota at provincial level. Such quota shall be reflected in the policy/guidelines.

3. Govt. of Khyber Pakhtunkhwa initiated five solar projects of total 249.5 MW under RE policy 2006. These projects are located in Kulachi (D.I.Khan) at the confluence of various merged districts which are economically backward and also worst hit by terrorism. The feasibility study of these projects have been approved and LOI's issued by PEDO. NEPRA has already granted generation license and tariff of 4.3 cents approved. Huge investment has already been made in these projects. In order to safeguard the foreign direct investment and to improve the socio economic profile of the terrorism hit areas these project should be protected in the new ARE policy.

4. The Government of KP is positively inclined to support the Federal Government in its effort to exploit the Alternate energy sources and would approve the ARE policy 2019, provided its genuine concerns are addressed and its economic interests are safeguarded.

5. It is once again requested that Government of Khyber Pakhtunkhwa should be given quota in RE projects and our 5 projects which are in advance stage should be processed as per 2006 ARE policy or saving and repeal clause should be inserted in new ARE policy to safeguard them.

With profound regards.

Yours sincerely,

(Dr. Kazim Niaz)

Mr. Irfan Ali,
Secretary Energy (Power Division),
Government of Pakistan,
Islamabad.

C.c

Advisor to Chief Minister on Energy and Power, Peshawar.

Immediate
By Special Messenger/By UMS
Secret

GOVERNMENT OF PAKISTAN
MINISTRY OF INTER PROVINCIAL COORDINATION
(Secretariat of Council of Common Interests)
<><><>

No.2(207)/2018-CCI Islamabad, the 6th January, 2020

Subject: **MINUTES AND DECISIONS OF 41st MEETING OF THE COUNCIL OF COMMON INTERESTS (CCI).**

A copy of the Minutes and Decisions of the 41st meeting of the Council of Common Interests (CCI), held on 23rd December, 2019, duly approved by the Prime Minister/Chairman, CCI, is sent herewith **for further necessary action** in terms of rules 6 and 11 of the Rules of Procedure of the Council of Common Interests, 2010. Action to implement the aforesaid decision(s) may please be intimated to this secretariat accordingly.

2. The enclosed certificate of acknowledgment of receipt of the CCI's Minutes and Decision(s) may please be returned, duly completed and signed.

(Syed Mudassar Hussain Shah)
Section Officer (CCI)
Ph: 051-9103532

1. The Secretary, Law and Justice Division, Islamabad.
2. The Chief Secretary, Punjab.
3. The Chief Secretary, Sindh.
4. The Chief Secretary, Khyber Pakhtunkhwa.
5. The Chief Secretary, Balochistan.

Copy for information to:-

1. The SPS to Secretary, IPC, Islamabad.
2. The SPS to Additional Secretary, IPC Division, Islamabad.
3. The Section Officer (Progress), IPC Division, Islamabad.

Section Officer (CCI)

Immediate
By Special Messenger/By UMS
Secret

GOVERNMENT OF PAKISTAN
MINISTRY OF INTER PROVINCIAL COORDINATION
(Secretariat of Council of Common Interests)

<>

No.2(207)/2018-CCI Islamabad, the 6th January, 2020

Subject: **DECISIONS OF 41st MEETING OF THE COUNCIL OF COMMON INTERESTS (CCI).**

A copy of the Decision(s) taken in the 41st meeting of the Council of Common Interests (CCI), held on 23rd December, 2019, duly approved by the Prime Minister/Chairman, CCI, is sent herewith **for necessary action** in terms of rules 6 and 11 of the Rules of Procedure of the Council of Common Interests, 2010. Action to implement the aforesaid decision(s) may please be initiated under intimation to this Secretariat accordingly.

2. The enclosed certificate of acknowledgment of receipt of the CCI's Decision(s) may please be returned, duly completed and signed.

(Syed Mudassar Hussain Shah)
Section Officer (CCI)
Ph: 051-9103532

1.	Attorney General for Pakistan	Case No.CCI.1/1/2019 (1-g)
2.	Secretary, Cabinet Division	Case No.CCI.15/1/2019
3.	Secretary, Finance Division	Case No.CCI.3/1/2019 Case No.CCI.4/1/2019 Case No.CCI.5/1/2019
4.	Secretary, Planning, Development & Special Initiative	Case No.CCI.1/1/2019 (1-a) Case No.CCI.12/1/2019
5.	Secretary, Ministry Water Resources	Case No.CCI.1/1/2019 (1-a) Case No.CCI.1/1/2019 (1-g) Case No.CCI.7/1/2019 Case No.CCI.8/1/2019
6.	Secretary, Petroleum Division	Case No.CCI.1/1/2019 (1-b) Case No.CCI.1/1/2019 (1-c) Case No.CCI.9/1/2019 Case No.CCI.10/1/2019 Case No.CCI.15/1/2019
7.	Secretary, Ministry of Science & Technology	Case No.CCI.1/1/2019 (1-d)
8.	Secretary, Ministry of Privatization	Case No.CCI.1/1/2019 (1-e)
9.	Secretary, Ministry of National Health Services, Regulation and Coordination	Case No.CCI.1/1/2019 (1-f) Case No.CCI.2/1/2019
10.	Secretary, Ministry of Federal Education & Professional Training	Case No.CCI.1/1/2019 (1-h) Case No.CCI.13/1/2019

11.	Secretary, Power Division	Case No.CCI.1/1/2019 (1-a) Case No.CCI.6/1/2019 Case No.CCI.11/1/2019
12.	Secretary, Ministry of Overseas Pakistanis and HRD	Case No.CCI.14/1/2019
13.	Chairman, Federal Board of Revenue	Case No.CCI.3/1/2019 Case No.CCI.4/1/2019 Case No.CCI.5/1/2019
14.	Chief Secretary, Govt. of the Punjab	Case No.CCI.4/1/2019
15.	Chief Secretary, Govt. of Sindh	Case No.CCI.5/1/2019 Case No.CCI.6/1/2019
16.	Chief Secretary, Govt. of Balochistan	Case No.CCI.3/1/2019

Copy for information to:-

1. The PS to Federal Minister for IPC, Islamabad.
2. The SPS to Secretary, IPC, Islamabad.
3. The SPS to Additional Secretary, IPC Division, Islamabad.
4. The Section Officer (Progress), IPC Division, Islamabad

Section Officer (CCI)

Agenda No. 11:

Case No.CCI.11/1/2019 Dated 23.12.2019	**Approval of Alternative & Renewable Energy Policy 2019 ("ARE Policy 2019")**

DECISION

101. The CCI considered the Summary dated 26th November, 2019 submitted by Ministry of Energy (Power Division) and approved in-principle the Alternative and Renewable Energy (ARE) Policy, 2019, subject to incorporating observations of Governments of Sindh and KP in the Policy. In the event of any unresolved observation of either of the province, the policy shall be resubmitted before the CCI.

Mr. Hafeez Ullah Khan,
Deputy Registrar,
National Electric Power Regulatory Authority (NEPRA),
NEPRA Tower, Attaturk Avenue (East),
G-5/1,
Islamabad.

Ref No. KE/BPR/NEPRA/2020/569
June 10, 2020

Subject: **Indicative Generation Capacity Expansion Plan 2047 (IGCEP) Submitted by National Transmission and Despatch Company Limited**

Dear Sir,

This is with reference to NEPRA's letter dated April 28, 2020 received in this office on May 04, 2020, soliciting stakeholder comments on the Indicative Generation Capacity Expansion Plan 2047 ("IGCEP 2047") submitted by National Transmission and Despatch Company Limited.

In this regard, please find our comments on the IGCEP 2047 enclosed as **"Annexure A"** to this letter. Further, please note that the delay in filing of comments is due to the prevailing COVID-19 pandemic and Eid Holidays, and therefore, we humbly request NEPRA to condone the delay and consider our comments.

REGISTRAR
Dy. No. 1782
Dated: 15-06-20

Sincerely,

Ayaz Jaffar Ahmed
Director – Finance & Regulations

For info & n/a pl.
- ADG (Lic) 15/6/2020
Copy to
- SA (Tech)
- SA (T)
- DG (M&E)
- ME

cc: Chairman
- V.C/M (M&E)
- M (T)
- M (CA)
- M (L)

Encl: Annexure A

Cc: Registrar, NEPRA, Islamabad.

The preparation of Indicative Generation Capacity Expansion Plan 2047 ("IGCEP 2047") is a major development towards proactive planning for future electricity needs and security of supply in context of the local power sector as planning oversights from the past have already and continues to cost the sector heavily, and therefore, we appreciate the efforts of NTDC in preparation of the IGCEP 2047.

Further, with respect to the IGCEP 2047, we would like to submit the following observations / comments for consideration, which we understand would enable a more integrated approach and yield better results in the long-term.

a. Study of KE Area as an Independent System

Within the IGCEP 2047 study, KE system has been considered to the extent of 650 MW being currently supplied to KE from the National Grid, and the same is subsequently increased to 1,150 MW after FY 2022, assuming that supply to KE from K2/K3 projects will be available from FY 2023 onwards. Further, IGCEP 2047 states that KE system will be considered as an independent system and a separate study shall be undertaken, the results of which will be shared by NTDC shortly. Responsible for end-to-end planning of the entire value chain, KE is collaborating for provision of required information with NTDC including projected demand growth in KE's service area, KE's planned generation additions etc., and understands that to be meaningful, the results would be discussed with KE for necessary review before submitting to NEPRA.

Here, we would like to highlight that as the only private vertically integrated power utility and serving the commercial hub of the country, to manage the anticipated growth in power demand, and the fact that KE's system was not considered / included in the planning process, along with the uncertainty even around the existing supply from the National Grid, KE had planned capacity additions across the value chain for which KE has already invested considerable time and resources. However, considering that now there is surplus capacity in the National Grid, tariff notification for KE's 700 MW Coal Project has been put on hold by the Government of Pakistan ("GoP") and KE is being asked to absorb the surplus capacity available in the National Grid by pursuing additional power from the National Grid.

It is pertinent to mention here that while KE has been in continuous engagement with relevant stakeholders since 2018, despite a lapse of considerable period, discussions around additional supply to KE from the National Grid are still in progress, and upon their finalization, related interconnection and grid works will commence which may take up to 3 years before such additional power can be evacuated from the National Grid. As a result, with KE's planned generation projects put on hold and delays in additional supply to KE from the National Grid, smooth and reliable supply of power to consumers may be adversely impacted in the short to medium term.

Further, we would like to reiterate that as a vertically integrated utility responsible for planning of the entire value chain, KE remains committed to its planned projects, subject to required approvals, and the consideration for off-take of additional power from the National Grid by KE is in the greater national interest, as this would help reduce the burden of idle capacity payments against already contracted capacity at the national level, which has been a major contributing factor towards circular debt. Moreover, considering the surplus capacity in the National Grid, we would like to highlight that supply of additional power to KE from the National Grid does not require any new commitments to be made by CPPA-G or NTDC.

Moreover, it is important to take into account that the arrangement for additional supply to KE from the National Grid will be of long-term nature and the additional capacity will be utilized to the extent of commitments made under the agreements, and any shortfall in the rest of Pakistan will not be met through any reduction in the commitments made to KE.

b. Must Run Status of Renewable Projects and Intermittent Generation

From planning perspective, it is imperative to take into account the intermittent nature of renewable projects and accordingly plan for contingencies such as sudden unavailability of renewable plants or their variable generation profile. Additionally, due to the must run status of renewable plants, careful considerations should be given to seasonal demand of proximate load centers, choice of renewable technology for a given location, variation in renewable generation and the overall mix of renewable with the baseload generation flowing through the relevant transmission system.

The IGCEP 2047 study envisages over 26,000 MW candidate solar and over 8,000 MW candidate wind projects to be optimized by the year 2047. In addition, the study also optimizes over 37,000 MW candidate hydro projects till the year 2047. However, considering the intermittent nature of renewable projects and system requirements, around **26,000 MW of candidate Open Cycle Gas Turbines (OCGT)** are selected, which are not readily despatched under normal conditions, and thus remain almost at zero plant factor. While from planning perspective, it is important to have a reserve margin in line with prudent utility practices, a holistic analysis of demand projections in view of the external factors along with existing and future capacity additions is necessary to ensure better optimization of planned additions as well as to avoid further over contracting of the capacity, which would otherwise result in aggravation of capacity commitments, culminating with further accumulation of circular debt.

In addition, specifically with respect to solar plants, it is important to take into consideration the possibility of the 'Duck Curve' problem, which suggests that as increasing amounts of solar generation is added into the system, to prevent oversupply of electricity, conventional plants may have to be shutdown. However, moving further into the day, as solar energy starts to fall rapidly, conventional generators may have to be ramped up quickly. A possible issue with this is that conventional plants, may not have the capability to ramp up so fast, which means that even at the time of peak solar generation, these conventional plants will still be required to remain in operation and would add to inefficiency when used at part or minimum load.

Therefore, while the decreasing trend in cost of Renewable Energy (RE) technology along with the targeted shift in fuel mix may be the factors driving aggressive RE addition along with optimization of candidate hydro projects, it is imperative that limitations with respect to variability in their generation profile, especially RE projects are taken into account and accordingly, the overall economic benefit must be considered before new RE projects are added to the network to avoid capacity redundancy as the added cost would be borne by consumers given the nature of existing Power Purchase Agreements (PPA) / Energy Purchase Agreements (EPA).

Accordingly, NEPRA and other stakeholders including Ministry of Energy (Power Division) must take the above into consideration while implementing aggressive targets for RE projects, as assumed within the IGCEP 2047 study and NTDC should also run scenarios for optimal targets of RE capacity in the network, independent of the RE targets set by the GoP, and if there are any possible limitations in following the set RE policy targets, the same must be highlighted to NEPRA and the policy makers. Further, considering the requirement of OCGT plants to cater for the intermittent nature of RE plants, NEPRA and policy makers must also consider and provide clarity with regard to the tariff regimes for these OCGT plants. In addition, a cost benefit analysis should also be undertaken as part of the IGCEP study to evaluate the economic and commercial viability of OCGTs against the possibility of having hybrid RE projects, as being adopted in other markets.

Further, it is pertinent to note here that due to delays in the availability of network transmission capacity as well as low system demand during the last winter, the renewable wind projects in Jhimpir and Gharo corridors faced significant curtailment. The issue of low despatch / idle capacity due to transmission constraints was also highlighted by CPPA-G stating that due to transmission network congestions, expensive generators are despatched while cheap generation remains idle owing to said constraints, thus increasing the overall energy purchase price for the system.

Therefore, care must be exercised in integrated planning to ensure that the transmission network is timely available prior to awarding tariffs and signing EPAs with upcoming renewable projects.

c. Network Capacity Constraints – Transmission & Distribution

Due to lack of integrated planning and little focus on Transmission and Distribution (T&D) segment, adequate investments have not been made in the T&D network. As a result, while the country has surplus in power generation, as also concluded in IGCEP 2047 study, the issue of transmission and distribution capacity constraints continue to impact smooth and reliable supply of power to the load centers.

Therefore, to ensure an integrated planning of the overall power sector, IGCEP must also include the existing T&D capacity and constraints, and related infrastructure requirements to ensure secure and reliable power supply in the future.

d. Proposed Study related to Thar Coal

Under the IGCEP 2047, it is assumed that by the year 2021, 4,000 MW of power generation from local coal of Thar will be evacuated via HVDC transmission line from Matiari to Lahore. However, with respect to Thar coal, the IGCEP 2047 also highlights certain issues such as availability of sufficient water, estimation of optimal amount of mining, etc. and recommends that the same must be considered and evaluated by Private Power Infrastructure Board ("PPIB") through undertaking the required studies in addition to studies by NTDC with respect to power evacuation and transmission of power to the load centers.

Accordingly, we request NEPRA to ensure that in line with NTDC's recommendation in IGCEP 2047, the proposed study is undertaken by PPIB at the earliest, as going forward, there is significant dependence on local coal within the overall energy mix (c. 19% share of local coal in the overall generation mix in 2025 which increases to c. 47% in 2040), and therefore, any possible issues may have a serious impact on the overall electricity security in the country. Further, it is suggested that transportation issues / availability of infrastructure to transport Thar Coal to generation sites at different locations including Karachi, should also be considered for optimal planning.

e. Reliance on Local Coal Projects

Within the existing study, there is significant reliance on local coal power plants contributing around 47% towards the overall projected generation mix in 2040. In addition to issues related to local coal (Thar coal) as discussed above (point d), the possibility of any future international moratorium / restrictions on coal power plants in view of their impact on the environment should also be accounted for from planning perspective and a suitable contingency plan should be in place accordingly.

f. Retirement of Old Existing Plants

Currently, the IGCEP 2047 assumes retirement of 11,511 MW of generation capacity based on expiry of their respective PPAs. It is important to note that as per the data reported in NEPRA's State of Industry Report 2019, some of these plants have efficiency levels of around 40% to 45% and therefore, these plants may be continued rather than going for new generation which would only result in an increase in capacity payments through additional debt / RoE payments.

Similarly, to ensure better planning, it is suggested that retirement of plants should not only be tied with the expiry of PPA, instead existing plants which may become redundant through obsolescence, poor efficiency, or environmental damage should also be evaluated in terms of their reliable despatch towards the overall projected power demand.

g. Technology Selection and Location of Generation Projects

The choice of technology and location of new generation projects is important for long-term reduction in cost of generation. Considering the low plant factor of renewable projects, the distance from generation to the grid needs to be minimal to minimize transmission losses and justify the length of transmission lines to be laid for renewable projects, and accordingly, the same must also be taken into account for optimal planning. It is therefore suggested that the IGCEP should be integrated with Variable Renewable Energy (VRE) locational study and the upcoming transmission network expansion plan, which would help identify specific zones and transmission network availability for prospective RE projects.

Similarly, for thermal projects, the supply of fuel such as coal and LNG needs to be in close proximity to the generation plant to reduce transportation cost of fuel and investment requirement for transmission and distribution infrastructure.

h. Demand Forecast / Demand Side Management

The IGCEP 2047 study does not consider demand side management or planned interventions in this regard, including the impact of Net Metering, Competitive Trading Bilateral Contracts Market ("CTBCM") Model, wheeling of power by Bulk Power Consumers etc. Considering the changing dynamics as explained above along with impact of COVID-19, the demand and load characteristics of energy users may change significantly and therefore, the demand forecasting needs revisions. Further, for better planning, it is important to derive a mechanism to estimate the impact of demand side management initiatives on the projected demand growth.

In this regard, considering the significant growth projected in solar rooftop, not only the expected impact of the same be included for optimal planning, but policy guidelines on the pricing of energy purchased from these rooftop solar must be issued as well. Under the existing regime, select consumer categories having high consumption and low losses which cross-subsidize low-end consumers are being incentivized, and the same may culminate with an adverse impact on DISCOs' consumer mix tilting towards consumers where there is susceptibility of theft and low recovery levels, thus having a significant impact on DISCOs' business sustainability.

In addition, for the purpose of demand forecasting, it is also important to take into account the pending new connection applications. As per NEPRA's State of Industry Report 2019, a total of over 320,000 new connection applications were pending across different DISCOs (as of June 30, 2019), and the same can have a material impact on the actual power demand in the future.

i. Planning Horizon

Considering the rapidly evolving power sector and changes to the regulatory landscape, it is important that planning and strategy must take into account these factors and be reflective of the same. Accordingly, it is suggested that instead of the 5-year review / update period as proposed by NTDC, IGCEP study should be reviewed / updated after every 2 to 3 years.

Further, to enable better and effective planning, the IGCEP must be dynamic such that some level of sensitivity analysis is included to account for delays in commissioning dates of planned projects or change in consumption patterns influencing the overall projected demand levels, as the same could otherwise materially impact the projected demand-supply outlook.

j. Availability of Plant-wise Average Annual Tariff

As the IGCEP 2047 is based on least cost generation, it is suggested that for each of the scenarios included within the study, plant-wise average annual tariff (cents/kWh) in terms of fuel cost, variable O&M and fixed cost should also be reflected in the study which would help analyze the basis for decision making, and will provide greater transparency and visibility into the overall planning and decision-making process.

KOREA SOUTH-EAST POWER CO.

KOREA SOUTH-EAST POWER COMPANY
32, Sadeul-ro 123beon-gil, Jinju-si, Gyeongsangnam-do, KOREA
Tel : +82-70-8898-1000, FAX : +82-50-5027-1001

No. KOEN/NEPRA/IGCEP /2020 **Dated: May 28, 2020**

The Registrar,
National Electric Power Regulatory Authority (**"NEPRA"**),
NEPRA Tower, Attaturk Avenue (East), G-5/1,
Islamabad

Subject: **Comments in the matter of Indicative Generation Capacity Expansion Plan (2047)**

Dear Sir,

We refer to the Indicative Generation Capacity Expansion Plan 2047 (**"IGCEP"**) and NEPRA's notice dated April 25, 2020 for submission of comments on IGCEP within 30 days of publication (the **"NEPRA Notice"**).

Korea South-East Power Co. Ltd. (**"KOEN"**) is the premier generation company of South Korea owning and operating a power generating capacity of more than 10,000 MW worldwide. KOEN is the wholly owned subsidiary of Korea Electric Power Co. Ltd. (**"KEPCO"**), which in turn generates more than 70,000 MW generation capacities worldwide with an asset base of more than USD 150 billion.

Korea and Pakistan enjoy result-oriented and constructive relationships. Korean companies have significantly contributed towards the economic development of Pakistan by way of numerous infrastructure and power sector projects. Examples of such projects are the Lahore – Islamabad Motorway (the first motorway of Pakistan), New Bong Hydropower (the first hydro IPP of Pakistan), Patrind Hydro (the 2nd hydro IPP of Pakistan), Gulpur Hydro (the 3rd hydro IPP of Pakistan), Golen Gol hydro and Lowari Tunnel, UCH 2 thermal project, PTA manufacturing and Daewoo Bus service. Moreover, Korean companies have invested in the local auto industry and participated by allowing the use of their brand names such as KIA and Huyndai with their local partners.

Due to the successful and fast-tracked development of the aforementioned projects, Pakistan became a strategic investment destination for Korean investment. At a time when there was no noticeable foreign investment in the hydropower sector of Pakistan, our parent company KEPCO, through its GENCO subsidiaries which include KOEN and KHNP, decided to move forward with an investment of USD 4.5 billion with an aggregate capacity of 2,000 MW.

Moreover, KOEN successfully developed and completed its pilot project 102 MW Gulpur Hydropower Project (**"Gulpur Project"**) near Kotli District, AJ&K under the federal government's Policy for Power Generation, 2002 through the one window facility of the Private Power Infrastructure Board (**"PPIB"**). The Project is now in its operational phase since March 10, 2020. KOEN acquired this dormant project back in January 2013 and achieved financial closing in 2015 with the Gulpur Project financed by leading multilateral banks such as Asian Development Bank (**"ADB"**), International Finance Corporation (**"IFC"**), Korea Export-Import Bank (**"K-Exim"**) and CDC UK.

The KPK government, in a bid to utilize their heretofore neglected water resources, initiated numerous important hydel projects including *inter alia* the 215 MW Asrit-Kadam, 197 MW Kalam-Asrit, 496 MW Lower Spat Gah and 545 MW Kaigah Projects under the KPK Hydropower Policy 2016. The KPK government signed Memorandums of Understanding (**"MOUs"**) with KOEN and KHNP in 2017 and 2018 under the Government to Government (**"G2G"**) mode for fast track development of above projects. The KPK government, through the one window facility of the Pakhtunkhwa Energy Development Organization (**"PEDO"**), and pursuant to the provisions of the KPK Hydropower Policy 2016, issued LOIs/NTPs to the developers and hefty amounts were spent by KOEN and KHNP in the preparation/up-gradation of feasibility studies to ensure the bankability of such projects in addition to processing Korean government approvals for these important investments. It should be noted that Korean companies have played a significant role in these projects as can be seen by the provision of financing, including one hundred percent investments, from multilateral development banks such as ADB, IFC, IDB and K-Exim and injecting technical expertise, capabilities and first-hand experience with these long-term, capital intensive power projects.

In light of the above, particularly given the advanced stage of development of the majority of projects established through the unstinted participation of Korean companies, we are dismayed to note that the present iteration of the Integrated Generation Capacity Expansion Plan 2047 (**"IGCEP 2047"**) prepared by the National Transmission and Dispatch Company (**"NTDC"**) and released in April 2020, has resulted in private sector hydro power projects, especially those established under the auspices of the KPK government, Korean companies and/or the PPIB, being placed on the backburner. In fact, such projects have been pushed to the end of the time-frame covered by the IGCEP 2047, i.e. to 2045-2047. We strongly feel that this removal of support from the Government of Pakistan (**"GOP"**) will shatter the incentive of committed investors to continue investing in Pakistan and may also derail future investments in the power sector if the IGCEP 2047, as it is currently compiled, is allowed to represent the growth trajectory of power projects in the country.

We highlight that the IGCEP 2047, by prioritizing proposed public sector projects over private sector investments and "candidate" projects over "committed" projects, has failed to take into account the unfortunate delays, red tape and inefficiencies that typically accompany public sector projects. By relegating private sector projects, particularly hydropower projects that are accompanied by an international and local team of seasoned project finance and technical experts, to a subordinate status the Authority risks plunging the country into power shortages equivalent to those experienced in 2011-2013. The shortfall in power generation would result in Pakistan being forced to set up thermal projects based on imported fuel such as RLNG and coal located near to the load centers and such projects, mirroring events in 2011-2013, would act as a drain upon scarce foreign exchange reserves.

Accordingly, and in pursuance of the terms of NEPRA's Notice, we present our initial review of, and comments, on the IGCEP 2047 **(please see Annex-A)**. However, we stress that a detailed technical review by a well-known technical consultant is imperative in analyzing the inputs and outputs of PLEXOS. We are aware that the recent epidemic of COVID-19 may have interfered with carrying out a detailed technical review; however, we are hopeful that, given the degree of

KOREA SOUTH-EAST POWER CO.

KOREA SOUTH-EAST POWER COMPANY
32, Sadeul-ro 123beon-gil, Jinju-si, Gyeongsangnam-do, KOREA
Tel : +82-70-8898-1000, FAX : +82-50-5027-1001

direct foreign investment that underpins the power development sector of Pakistan and the varied number of stakeholders in the sector, the Authority will ensure that no final approval of IGCEP 2047 shall be issued without conducting a detailed technical review of the same.

We look forward to full cooperation of the Authority in the issuance of a fair, balanced and transparent IGCEP 2047 and would respectfully suggest the participation of a third party with reputed credentials operating under the umbrella of NEPRA to assist in preparation of the same.

We assure the Authority and KPK that KOEN has firm plan and in placed arrangements to commission the Asrit-Kedam Hydropower Project by 2027 and Kalam-Asrit Hydropower Project by 2028.

Best regards,

KOSEP POWER CO., Ltd. KOREA SOUTH-EAST

Kim Kyung Sik
Vice President KOEN
Director Pakistan Branch Office
Chief Executive Officer, KOAK Power Limited (Asrit-Kedam SPV)

C.c. i. The Chairman NEPRA, Sector G-5/1, Islamabad
ii. The CEO PEDO, Plot # 38, Sector B-2, Phase-V, Hayatabad, Peshawar

KOREA SOUTH-EAST POWER CO.

KOREA SOUTH-EAST POWER COMPANY
32, Sadeul-ro 123beon-gil, Jinju-si, Gyeongsangnam-do, KOREA
Tel : +82-70-8898-1000, FAX : +82-50-5027-1001

ANNEX A
INITIAL COMMENTS ON IGCEP 2047

1. In the IGCEP 2047, the pre-determined targets of renewables (solar and wind) set by the GOP has been added and, to balance and mitigate the intermittency of the national grid and to ensure the spinning reserves, open cycle gas turbines, RLNG turbines and local coal fired plants have been added in the initial years in lieu of hydropower. This assumption is unfair and against transparency. Interestingly, the IGCEP 2047 also assumes that these OCGT and RLNG units will not be "must run" which raises the fundamental question of how the financing of these projects will be arranged when they are not financially viable.

2. This fundamental question of "availability of financing" of projects has been ignored in the PLEXOS and IGCEP 2047. In fact, the GOP plans to add significant coal projects in the initial years for which availability of financing is almost impossible while, on the other hand, substantial financing is available for hydropower projects particularly private sector sourced financing.

3. A surprising assumption of the IGCEP 2047 is the narrow categorization of projects as "committed" projects based on the following characteristics:

    i. Projects that have achieved Financial Closing;
    ii. G2G projects of federal government;
    iii. Under construction projects; and
    iv. CPEC projects.

    The above characteristics of "committed" projects completely ignore *inter alia* those projects that have been (i) issued NTP, LOI or LOS by provincial agency or federal agency (e.g. PEDO/PPIB) or (ii) those projects that have signed the Power Purchase Agreement(s) before Financial Closing. In our opinion, all projects of PPIB and PEDO that have acquired an LOI or award should be included in the "committed" project class, as failing to do so, particularly where the private sponsors have already invested a huge amount of money in such projects, makes no commercial or legal sense. Further, delaying these projects without the consent of PEDO undermines the fundamental right of provinces to assess their own power generation needs and manner of satisfying such needs as well as weakening the role of PPIB as a one window facility.

4. An additional issue with the haphazard categorization of "committed projects" is the clear discrimination between CPEC projects, such as Azad Pattan and Mahal, being included as "committed" projects (even when such projects have failed to achieve Financial Close) when projects such as Kalam Asrit and Asrit Kadam, that are not CPEC projects but are in similar stages of development, are denied such status by the IGCEP 2047.

KOREA SOUTH-EAST POWER CO.

KOREA SOUTH-EAST POWER COMPANY
32, Sadeul-ro 123beon-gil, Jinju-si, Gyeongsangnam-do, KOREA
Tel : +82-70-8898-1000, FAX : +82-50-5027-1001

5. We also observe the alarming fact that public sector hydropower projects have been prioritized over private sector hydropower projects and that the basis for such designation is illogical. For example:

   (i) A total of 8,000 MW of public sector hydropower projects are projected to be operational in the next 5 to 10 years (namely, 1410 MW Tarbela-V, 1686 MW Thakot, 800 MW Mohmand Dam, 2160 MW Dasu, 2154 MW Thakot-I, 128 MW Keyal, 66 MW Dubair Kaley and 46 MW Naral Dubair). This is practically impossible and unrealistically optimistic. We raise the important question of how the financing of approximately USD 18-20 billion for these projects will be arranged by the GOP given the current scenario.

   (ii) Additionally, we highlight the inherent inefficiencies and delays of public sector projects; thus, a recent example is the Neelum Jehlum hydropower project which had an initial price-tag of USD 1.2 billion and concluded at the cost of above USD 5.0 billion accompanied by several years of delay. Accordingly, we respectfully suggest that the Government should declare what the mix of public and private sector hydropower projects should be, keeping in mind the availability of financing, inefficiencies of large public sector projects and the need to attract foreign direct investment.

   (iii) Three RLNG projects constituting 4,868 MW are projected to be operational within the next ten years while 1620 MW of imported coal are coming online within the next five years. This would also require around USD 10 billion from government exchequer which, again, raises the question of how such financing will be secured.

   (iv) Three projects constituting 3,300 MW of nuclear power are also planned to be operational within the coming ten years in public sector, and once again, require funding from the public exchequer.

   (v) Overall, the projected public sector spending in the suggested public sector hydropower, imported coal and RLNG projects would require an investment of USD 30 to USD 40 billion, accompanied by the stringent caveat that such projects were meticulously planned and smoothly implemented by the public sector.

6. There are flaws in the input values of IGCEP 2047 which has resulted to take out the desired output for NTDC/WAPDA and neglect private hydropower sector. An example is that there are variations in the input data which can certainly affects project priorities like energy generation, plant factor and change in the project costs. Moreover, the wind and solar blocks have been considered in view of draft Renewable Policy 2019 pushing another important indigenous resource to end of plan.

7. We would like to stress that the IGCEP 2047, by postponing the development of hydropower projects, has ignored fundamental benefits of hydropower and which include *inter alia*:

(i) Compared with technologies such as solar, wind and thermal, with such plants consisting of approximately 25 years operational run, hydropower projects have a far longer operational life of 70 to 80 years.

(ii) Additionally, the financial costs of hydropower projects are also lesser compared to other technologies. Thus, while working on the financials based on discount factors of 10% and NPVs, the "real" benefit of hydropower after 25 years is completely ignored in the calculations of cost and tariff. For example, the Mangla and Tarbela Dams which were constructed around 50 years back are producing electricity for less than a rupee as their capital cost has been paid. The IGCEP 2047 has completely overlooked this financial benefit to a country as cash-strapped as Pakistan which, in turn, directly undermines the long-term energy security of the country.

(iii) The "capacity trap" is one of the key issues plaguing the Pakistan power sector, i.e. the situation whereby the Power Purchaser is required to pay capacity payments to those thermal projects which are sitting idle in winter since the demand of electricity drops to around 10,000 MW (as opposed to 30,000 MW demand in summer). Renewables, such as wind and solar, produce electricity whenever there is availability of wind or sunlight with the accompany intermittency that reliance on such factors creates. However, hydropower projects produce minimum electricity in winter due to low flows and produces maximum electricity in summer when there is huge demand. We regretfully note that this unique demand-supply satisfaction by hydropower projects has not been assumed in the IGCEP 2047 at all.

(iv) Almost all hydropower projects produce power ranging from a few hours to few days when it is needed known as "peaking power". In Pakistan, the demand of electricity is high in the evening when hydropower can produce much-needed electricity while storing water during the day time. DISCOs normally charges high electricity rates during peaking hours while hydropower projects sell electricity during these hours at the flat rate and therefore at lower prices. Again, we are of the view that this benefit to the consumers has not been taken into account in the IGCEP 2047.

(v) Hydropower has been considered the best option for grid stability as it produces up to 20% MVARs for the system/grid stability. It is surprising that the IGCEP 2047 has visualized adding thermal projects in order to control the intermittency of renewables projects but that the inherent benefit of hydropower vis-à-vis grid stability is simply ignored. We note that many countries have a separate tariff for reactive power i.e. MVARs while in Pakistan hydropower give this huge benefit free of cost.

(vi) Almost 70% to 80% of the cost of hydropower, predominantly civil works cost, is spent locally which significantly contributes to the GDP growth and local economy. The GOP is now considering the launching of huge housing projects to stimulate the construction industry and the economy; on the other hand, hydropower projects already provide this stimulus. The civil works cost of hydropower projects can be contrasted favorably with that of competing technologies such as thermal, wind and solar where approximately 80% to 90% of the cost is spent off-shore and these foreign exchanges never come to Pakistan nor contribute in any manner to the country's economy. As such, the huge exposure to dollar-based imported fuel coupled with price volatility that is entailed by such technologies is another financial pitfall for the country. Once again, the savings caused by hydropower projects have been overlooked in the IGCEP 2047 as is evident from the secondary status that such projects have been assigned in the plan.

(vii) While the IGCEP 2047 considers the hybrid solution of wind and solar, we note that the combination of solar and hydropower is a perfect hybrid solution. This is due to solar producing electricity during the day while hydro project will store the water in day time for peak hours occurring in the evening. This hybrid solution will convert the project into essentially a base load plant replacing the role of thermal projects in this capacity. Once again, the IGCEP 2047 has completely glossed over this benefit that naturally accrues from the existence of hydropower projects.

8. IGCEP 2047 has erroneously declared the option of hydropower projects as costly, ostensibly due to its capital-intensive nature while failing to compare it with thermal alternatives as its correct counterpart in terms of cost-benefit analyses.

9. We would like to highlight that the Rajdhani Hydropower Project has been included in the IGCEP 2047 even though it was terminated two years ago due to non-performance. This project would require fresh advertisement by PPIB and it is not possible for the same to be tapped within this decade.

10. Private sector hydropower projects have been excluded from just consideration in the IGCEP 2047 by removing them from the renewable energy category on the basis that the upcoming Renewable Energy Policy does not cover development of hydel projects. We are of the view that such a distinction is artificial and fails to take into account the characteristic of renewable energy that all hydropower projects inherently possess and we assert that the renewable nature of hydel project should be accurately assessed in the IGCEP 2047.

11. Last year, the NTDC finalized a similar IGCEP study (2018-2040) based on WASP generation planning application software and repeated the study in 2020 based on PLEXOS. We note that, per the WASP study, the Lower Spat Gah was set to be commissioned by 2028 as it was understood to be as public sector project. However, in

the IGCEP 2047, the same project has been pushed all the way back to 2047. We are puzzled as to how the status of the project could have shifted so rapidly from being a public sector project on the brink of being commissioned to one that has been pushed far back to 2047 and are hesitant to attribute uncharitable motives to NTDC that the IGCEP 2047 otherwise seems to indicate.

12. Finally, in light of the objectives of the 18th Amendment to the Constitution of Pakistan, we are of the view that the KPK government initiatives for G2G and CPEC-related projects should be respected and should be considered as "committed" projects particularly since the required investments in terms of equity and financing are already locked in place.

16 June 2020
No. LEI/NEPRA/20-0616-01

Chairman
NEPRA ("The Authority")
NEPRA Tower, Attaturk Avenue (East), G-5/1 Sector,
Islamabad

SUBJECT: **COMMENTS ON THE DRAFT IGCEP 2047**

Dear Sir,

Pursuant to the Authority's invitation to stakeholders for submitting comments on NTDC's draft Indicative Generation Capacity Expansion Plan ("**IGCEP 2047**"), LUMS Energy Institute ("**LUMS EI**") is pleased to provide its comments for the Authority's consideration, which are attached to this letter as Annex-I. We acknowledge the efforts the NTDC has made for producing another version of the IGCEP. We earnestly feel that it will pave the way for evidence-based power planning and decision-making in the power sector, and educate the stakeholders on likely development pathways in order for them to plan for evolutions in the generation mix. It is a pleasure to be part of the efforts to shaping up the IGCEP into a clear and authoritative blueprint of Pakistan's future electricity generation landscape.

IGCEP 2047 brings us one step closer to the evidence-based planning and would help the Authority in informed decision-making in the power sector. LUMS EI is willing to collaborate with the Authority and other stakeholders to bring IGCEP into a shape that is of highest quality and could deliver optimum costs to the consumers. We would be happy to discuss our comments further with you and participate in related hearings to provide our detailed response.

Sincerely,

Dr. Fiaz Chaudhry, Ph.D., P.Eng.
Director, LUMS Energy Institute
Professor of Practice and Werner-Von Siemens Chair,
Department of Electrical Engineering
Syed Babar Ali School of Science and Engineering
Lahore University of Management Sciences (LUMS)
Sector U, DHA, Lahore, Pakistan
Tel: +92-42-35608312, Cell: +92-321-999-0780
Lei.lums.edu.pk

Annex-I: Comments by LUMS EI on Draft IGCEP 2047

IGCEP 2047 shows marked improvements in contrast to its previous version. Some of which are listed below:

(i) Use of PLEXOS planning package is a useful transition towards accomplishing more robust handling of data, analysis, and optimization. Consequently, NTDC will have more flexibility, transparency, and ability to conduct high-quality analysis and planning;
(ii) The simulations include a Base Case which reflects the business-as-usual trajectory and many scenarios that attempt to assess the impacts of change in various assumption(s). This will be beneficial in considering a variety of options and will discourage *ad-hoc* decision-making. We would advocate for even more alternative scenarios (even if these may not be included in the final IGCEP) to enhance PSP team's understanding and knowledge;
(iii) Instead of using present costs as static, the NTDC team has projected future costs in some aspects using international/local indices and practices. This improves the economic analysis and increases future optimizations of generation mix based on the likelihood of expected trends. Such forecasting techniques are essential to improving the quality of IGCEP.

While many aspects of IGCEP 2047 make it superior to its previous version, we still note some critical gaps and deficiencies that will require addressing. As raised during the hearing with the panel of experts on October 10, 2019 and later through our letter no. LEI/NEPRA/19-1016-01 dated Oct 16, 2019, the Authority is requested to revisit our previous recommendations that have not been followed by NTDC, in addition to the following:

1. Scope:

#	IGCEP 2047 Reference	LUMS EI Comments
1.1	Para 2.4 "… provide a least cost optimal generation expansion plan for development of hydroelectric, thermal, nuclear and renewable energy resources to meet the expected load demand up to the year 2047	The draft IGCEP does not reveal the impact of future plan on the overall generation basket price. Un-discounted and discounted system costs have been estimated but these alone do not demonstrate the significance of the evolving generation mix. Instead, and as had been recommended by LUMS EI previously also, NTDC should have estimated the generation cost per unit, segregated into capacity and energy components, for each financial year. A meaningful contrast can then be made between different scenarios to inform the impact of choices and assumptions.
1.2	Para 2.5	The time horizon considered in the optimization is from FY2019-20 till FY2046-47 (28-years ahead), whereas the regulatory requirement (Grid Code) only stipulated 10-

	"… it has been decided to prepare all the long-term plan up to 2047 to mark the 100th anniversary of Pakistan. IGCEP 2047 has thus been prepared under the initiative Pakistan @100."	years ahead plan only, i.e. till FY2028-29. We feel that IGCEP should have been restricted to this period only as any projections beyond FY2028-29 are likely to be far-fetched owing to uncertainties in future technology and economics. In general, power generation planning organizations in global markets plan for 10-years ahead only. In Pakistan also, it would be prudent to focus time and efforts on the stipulated period of 10 years for greater accuracy in the optimization.
1.3	Para 2.6 "The IGCEP covers the whole country except Karachi..." "… NTDC has undertaken to model the K-Electric system using PLEXOS as an independent system."	IGCEP 2047 is envisioned to be an Integrated System Plan (ISP) at the country level. NTDC states in the document that it intends to model and optimize the K-Electric system as an independent system. IGCEP 2047 merely includes 650 MW fixed export from NTDC system to K-Electric system till year 2022 and then 1,150 MW onwards. We feel that NTDC needs to re-align its scope when optimizing generation mix. We expect the IGCEP exercise to incorporate power and energy flows to the K-Electric system as well as it may be optimal and prudent to increase capacity of tie-lines such that consumers in Karachi can also benefit from the surplus, low-cost generation in the NTDC system and enjoy enhanced reliability. In other words, the interconnection flows should be taken as a variable in the optimization process rather than a constraint. Therefore, the IGCEP should assess whether K-Electric's own generation projects (for e.g. the recent venture of imported RLNG power plant) are really necessary in the wake of surplus, secure, and reliable supply available from the national grid.
1.4	Para 2.7 "The IGCEP is developed as a suggested starting point for the preparation of a determinative Transmission System Expansion Plan as a part of the overall PSP process."	IGCEP 2047 must be complemented by Transmission System Expansion Plan ("**TSEP**"). Transmission holds a key link in supplying electricity and could be an alternative to generation in some cases. Therefore, merely planning for generation would be fruitless and sub-optimal. Moreover, the Grid Code mandates NTDC to identify new generation requirements by capacity, commissioning date, and location. While the former two have been provided in IGCEP 2047, the location of selected candidate plants has not been identified. We feel that siting of these plants is a crucial aspect of generation planning. When conducted in tandem with the TSEP, it is likely to produce a different outcome than envisaged in IGCEP 2047. Thus, an end-to-end cost analysis of electricity supply should be considered for all generation plants.

1.5	Executive Summary "The base case scenario covers targets set out in the draft Alternative and Renewable Energy (ARE) Policy 2019…."	We feel that inclusion of ARE Policy targets in the Base Case is misguided. The policy is currently a draft and has not been ratified by the Council of Common Interests (CCI). It should not be part of the Base Case, rather it should be considered as an alternative scenario where the impact of this additional policy option/constraint is assessed. Consequently, the IGCEP exercise should advocate the level of ARE penetration in the future

2. Demand projections

#	IGCEP 2047 Reference	LUMS EI Comments
2.1	Table 4-1 IGCEP Input Data Currency Log	The cut-off date used as reference for future projections is June 30th 2019. This is understandably in line with the fiscal calendar and regulatory timeframe for development of IGCEP. However, the ongoing COVID-19 pandemic has created an unprecedented impact on the economy. As a result, the electricity demand has suffered a significant blow. It is likely that in the short-term, the demand trajectory will deviate from the current projections in the IGCEP 2047. Therefore, there is a need to revisit the forecasting methodology in order to include the impacts of COVID-19 pandemic on these plans.
2.2	Para 5.2 "A detailed regression analysis involves the review of fundamental quantitative relationships between the electricity demand and the independent variables of the equation like electricity price, sector's GDP, and population of Pakistan, etc."	As was observed in the hearing for previous version, the demand forecast in IGCEP 2047 is based on historical demand regressed on many economic variables, especially the GDP. This has been a contentious approach in the industry. Some had questioned whether it should be based on optimistic outlook of the economy while others argued that it did not reflect the current nature of a slowing economy. Therefore, we feel that NTDC will benefit by holding a debate on its demand forecasts by soliciting inputs from various market participants, government bodies, and independent institutions.
2.3	Para 5.8 "Modelling of Electric Vehicles and Naya Pakistan Housing Scheme"	The IGCEP 2047 base case includes the impact on demand of the Naya Pakistan Housing Scheme (NPHS) and the Electrical Vehicles (EV) policy. Yet, no details have been provided on how this has been accounted for in the forecast to ascertain whether the approach used is rigorous. Similarly, it is not clear whether the impacts of energy efficiency improvements and rooftop PVs have been included in the base case or alternative scenarios.

		These will significantly alter the demand projections and has been the case in most developed countries where actual peak demand has not followed the projections.
2.4	Chapter 5 Long Term Energy and Demand Forecast	NTDC has not considered the option of bringing back commercial and industrial consumers who either have deserted the grid or opted for their own captive power plants to satisfy their electricity demands. Since Pakistan does not have scarcity of supply now and transmission and distribution network reinforcements are also underway, it may be prudent to incentivize these consumers to utilize the more reliable and secure grid electricity that will effectively increase demand and lower the average generation cost. We request the Authority to take lead in this regard by mandating DISCOs to bringing back these captive consumers through attractive pricing schemes or any other suitable mechanism.

3. Costing of plants

#	IGCEP 2047 Reference	LUMS EI Comments
3.1	Para 6.7, clause n	IGCEP 2047 does not adequately establish capital cost basis for candidate power plants. NTDC has used NEPRA determinations of recent projects for each technology, except nuclear, as its references. We feel that this approach is not wise as it is the mandate of NTDC to advise NEPRA regarding costs of candidate technologies. Such practice has not been followed in the past and needs to be corrected henceforth. Accordingly, we strongly encourage NTDC to establish a Technology and Resource Assessment department that explores and identifies the project costs itself. It must consult with different manufacturers and contractors and seek information on the costs that form a fundamental basis in IGCEP. NEPRA should then review and approve as may be appropriate. Moreover, projection of capital costs for wind and solar plants has been done but seemingly ignored for all the other technologies. NTDC should clarify whether this is indeed the case and, and if so, this may have skewed the results and should be revisited.

3.2	Table 6-7 Economic Parameters of Generic Thermal Power Units	Referring to the capital cost used in the IGCEP 2047 for imported coal as $1,583 per kW based on a size of 660 MW of China Power Hub Generation coal-fired project (China HUBCO), no justification has been provided in this regard. First, we fail to understand why China HUBCO has been used as a reference since it is G2G project as part of CPEC and not competitively procured. As future projects are to be installed following an international competitive bidding process, the reference costs should be aligned in the same manner. Moreover, it should be noted that coal-fired plants have all been installed in the past with a two-unit configuration to achieve cost-efficiency. For instance, Jamshoro coal unit-2 has a marked reduction in its EPC cost compared to that of unit-1. Therefore, when the model selects coal-fired power plant in a given year, it should optimize the size by incorporating the corresponding cost-efficiency.
3.3	Table 6-6 Performance Characteristics of Generic Thermal Power Plants	The fixed and variable costs taken for thermal plants again have been based on NEPRA determinations and instead should have been sourced by NTDC itself. Further description and justifications should also be provided. For instance, is the difference between the variable costs of imported coal plant and local coal plant attributable to the cost of mining? While it is admirable that fuel cost have been projected into the future using an international index so as to create a yearly "Merit Order", a justification of using such index should have been included.

4. Retirement of plants

#	IGCEP 2047 Reference	LUMS EI Comments
4.1	Para 6.9 "A significant quantum i.e. 11,511 MW of existing thermal power plants are scheduled to be retired during the planning horizon of the IGCEP. A plant is supposed to be declared	IGCEP 2047 assumes a significant quantum of existing thermal power plants to retire based on their PPAs' expiry. We strongly feel that this approach is not appropriate. Some of these assets will still have further useful lives. NTDC should take lead in approaching the owners of these plants and formulating a strategy for utilizing them as reserve capacity/merchant plants. This could offer significant cost savings by way of deferring new investments. For instance, more than 25,000 MW of RLNG-based OCGT plants are proposed in IGCEP 2047 with little or no energy generation and merely acting as

	as retired upon completing its PPA term."	reserve capacity, mostly to manage the variability and uncertainity in renewables. We consider it to be more prudent if these to-be-retired plants are kept as reserve capacity in the system. The notion that to-be-retired plants are approaching the end of their operating life, and therefore are inefficient in providing energy, need not be a concern since they will only be serving as reserve capacity – even if they are dispatched, for example during peak periods, system balancing at such events rely more on the output of the plant rather than its efficiency. We strongly encourage NTDC to explore this option.

5. Variable Renewables (VRE)

#	IGCEP 2047 Reference	LUMS EI Comments
5.1	Para 6.7 Clause n	NTDC has considered Master Green (50 MW) and Zorlu (100 MW) as reference plants for their costs, based on NEPRA's tariff determinations, for candidate wind and solar plants, respectively. As noted earlier in our comment at 3.1, we advise NTDC to base these reference costs on its own sources and analysis. In fact, the reference should be based on a competitively-sourced price.
5.2	Para 4.6.11 "It is apprised that in this regard, the CAPEX is degraded by almost 3.6% and 1% for solar and wind respectively every year up till 2030"	It is commendable that the capital costs have been projected in the future using a degradation of 3.6% and 1% for solar and wind respectively every year till 2030. We request NTDC to elaborate in the IGCEP report how these figures have been determined? Why projections have not been made beyond 2030?
5.3	Table 4-3 CAPEX Indexation of Solar and Wind Based Technologies	Wind power plants are segregated into three categories based on location: South, Mid-country and North. No details have been provided for the geographical boundaries of each region. What basis NTDC has used for modelling these three regions, given that there have only been wind projects installed in the southern Gharo-Jhimpir corridors? Has a locational study been conducted in this regard? Moreover, a 5% differential in capex is used, from South to North, without providing sufficient detail as to how this has been determined.

5.4	Executive Summary Tables E-3 and E-7 Summary of Nominal Capacity (MW) of Scenarios by 2030 and 2047 Table E-11 Summary of Total Generation Cost Comparison of all Scenarios	We take note of an interesting observation in this version of the IGCEP. In the Base Case, the model optimizes VRE penetration of 30% by capacity till 2030 (pursuant to ARE Policy 2019 target), and then reducing it to 22% till 2047. Whereas, in the No VRE Policy scenario, the model optimizes VRE penetration of 21% by 2030, reducing slightly to 19% by 2047. This clearly shows that in the Base Case, the model chooses VRE as a constraint in the optimization (by satisfying the policy obligation) rather than "opting for VRE in view of its economic viability" as noted in the draft IGCEP. This can also be seen by a reduction of approximately $1.7 billion in total investment NPV cost in the No VRE Policy scenario. Indeed, the targets envisaged in the ARE Policy 2019 are ill-advised based on the current assessment and regulatory framework. Moreover, consistent with para 1.5 above and as noted in the policy itself, IGCEP should recommend the optimal levels of VRE penetration in the future. Opting for increased uptake should be appropriately identified as increasing or decreasing system costs.
5.5	Table 7-8 Annual Energy Generation 2031-2047	We note that all existing wind and solar plants are reported to have energy generation values beyond their PPA expiry and even their assumed economic life. For example, Sapphire Wind (52.8 MW wind farm), commissioned in 2015, should only have energy generation values till 2035 based on its 20-year PPA, consistent with the NTDC assumption of retiring plants on their current PPAs' expiry dates. Yet, the said plant is delivering energy till 2047 (that too at the same levels as before), and even beyond the assumed economic life of 25 years i.e. 2040. This is the case for all other wind and solar plants and clearly distorts the optimization results. NTDC team should clarify accordingly. Moreover, all solar plants have constant capacity factors over their plant life. This suggests that annual performance degradation of a solar plant has not been accounted for in the modelling exercise. If it has been, then no details have been provided as to how this has been included. NTDC team should clarify accordingly.

6. Hydro plants

#	IGCEP 2047 Reference	LUMS EI Comments
6.1	Annexure B, Table B-3 Revised Capital Cost Calculations of Candidate Hydro Power Plants	No justification has been provided for the capital costs of hydro power plants. In many cases, candidate hydro power plants' unit costs are comparable to wind/solar projects, yet they do not get dispatched. No discussion of results have been provided.
6.2	Chapter 7 IGCEP Study Output – Base Case	It should be noted that the draft ARE Policy 2019 does not include hydro plants sized less than 50 MW ("**Small Hydro**") in the portfolio of ARETs. Consequently, the policy targets tend to drive the inclusion of wind and solar and do not account for small hydro, while forcing all hydro plants towards the end of horizon. We feel that this approach is discriminatory to the competitive hydro plants and should be revisited. Moreover, large hydropower projects offer additional socio-economic value of water conservation which is most useful for an agrarian economy. These projects have a life of approximately 80 years and their capital costs, in contrast with other technologies, are predominantly local inputs which are reinvested into the local economy and promotes industrial growth. This should be considered in the IGCEP.

7. Jamshoro CFPP Unit-2 Scenario

#	IGCEP 2047 Reference	LUMS EI Comments
7.1	Table 7-4b Projects Optimized by PLEXOS (7 Scenarios)	In the Base Case, Jamshoro coal-fired power plant (CFPP) unit-2 is assumed to be a committed plant that will be first available in 2024. In the alternative scenario, the said plant is a candidate plant that the model optimizes to be available in 2041. In conjunction with 3.1 above, there appears to be an error in judgement. Again, the costing of imported coal plants assume a capex based on a size of 660 MW (refer Table 6-7 in IGCEP 2047). For Jamshoro coal project, the first 660 MW EPC cost, obtained through a competitive bidding, was priced at around $560 million in 2018, while the second 660 MW EPC cost is $313 million. While the actual cost will be calculated at the

		time of commercial operations, it is argued that these costs have been obtained with the intent of installing both units collectively to achieve cost-efficiency – if only the first unit is procured, then the tariff per kWh unit will increase. IGCEP 2047 has not taken this into account, such that the two scenarios would have different cost structure (that would drive the year when needed) instead of using static reference for a single 660 MW unit.
7.2	Annexure N, Table N-3 Future generation additions	We note that instead of bringing unit 2 online in 2024, a comparable-sized RLNG-based OCGT plant is proposed – only as a reserve capacity, while energy is provided by other imported coal/local coal-based plants. We fail to understand the reasoning/justification behind this approach. The two plants should be compared based on their levelized cost of electricity. Although, the RLNG-based OCGT plant has a lower reference capital cost than that tendered for Jamshoro unit 2, the former has significantly lower O&M cost. Also, the RLNG-based OCGT plant has a capacity factor of less than 1% while the Jamshoro unit 2 experiences higher dispatch. Higher the dispatch, lower the levelized cost per kWh of electricity. Moreover, if unit 2 is not procured, the cost-efficiency achieved for unit 1 will not be obtained – these savings should therefore be added as a cost for the RLNG-based OCGT plant in the alternative scenario. Therefore, we feel that proper analysis needs to be conducted in view of the tendered costs for Jamshoro unit 2.

8. Other elements of IGCEP 2047

#	IGCEP 2047 Reference	LUMS EI Comments
8.1	Chapter 7 and Annexures	Overall, the document lacks sufficient details and descriptions of the model outcomes. Merely stating the results and presenting graphs is unsatisfactory. Increased transparency can be achieved by including discussions, reflecting the thought-process of NTDC in system planning and modelling – NTDC as system planner is in fact best placed to provide this.
8.2	Table 6-1 Generation Planning Criteria	Many assumptions have not been supported by proper reasoning. For instance: i. Why a discount rate of 10% was chosen? Why not 8% or 12%? Did the NTDC conduct any analysis around this 10% discount rate assumption to learn how

		sensitive the IGCEP's outcomes are to this particular assumption? ii. Why a fixed USD/PKR exchange rate has been used? Should this not also be projected in the future consistent with economic growth? iii. A $0.80/kWh cost of unserved energy and $100/MW value of reserve shortage have been used. These two are often difficult to compute and highly debated in global electricity markets. What evidence has been used in this regard? Have stakeholders been consulted in their calculations?
8.3	-	Many assumptions and aspects have not been included in the document. For instance: i. LOLP of each year has not been provided ii. Construction period of each technology has not been provided iii. Other non-conventional generation/demand options have not been considered which may have profound impact e.g. hybrid wind-solar, storage options (especially pumped storage), demand-side management, energy efficiency etc.
8.4	-	A competitive wholesale electricity market ("**CTBCM**") is expected to commence in late 2021. It is envisaged that dispatch in CTBCM will be quite different than that in the present state of affairs. No details in this regard have been provided.

9. General remarks

9.1. IGCEP is more than just an outcome of a system planning tool, it is highly dependent on the input variables and their solid reasoning, conceptual and analytical thinking, and collective discussion for informed decision-making. Therefore, we advise NTDC to engage seasoned relevant professionals and/or firms that may assist in improving the quality of its deliverable.

9.2. It will be prudent if NTDC can engage and consult with local consultants and academic institutions that can bring more innovative ideas and conceptual thinking to the table. Such collaborations often improve the quality of analysis and is a practice in most global markets. In fact, we would encourage NTDC to seek input from foreign system operators (such as AEMO in Australia and IESO in Canada) that have established generation planning models. This will only add value that is crucial in the early stages.

The Registrar
National Electric Power Regulatory Authority,
NEPRA Tower, Ataturk Avenue (East), G-5/1,
Islamabad

Dated: May 21, 2020

My Dear Registrar,

Subject: **Comments on IGCEP 2047 of NTDC**

Reference: **Notice for submitting comments in the matter of IGCEP, dated April 25, 2020**

The Indicative Generation Capacity Expansion Plan is a very fruitful effort made by NTDC based on the PLEXOS software. The undersigned has reviewed the plan as an energy and power system analyst and the following comments are offered as a member of the general public.

1. It is mentioned in the document at page 65, section 6.2.a *"Targets set out in the draft ARE Policy 2019 (20% and 30% of the installed capacity by the year 2025 and 2030, respectively)"*. The ARE Policy 2019 document itself mentions (Page 6), "To provide the least cost power generation while keeping other constraints in mind" as one of the objectives of the policy. It is, therefore, suggested that the base case of IGCEP should consider renewable projects as candidate plants with fair competition with other supply options and not take 20% ARE capacity by 2025 and 30% by 2030 as committed. This action will promote affordable electricity supply to the general public.

2. It is mentioned at the page 65, section 6.2.d *"Hydro optimization during the study horizon"*. This phrase is misleading in the sense, apparently showing that the hydro power projects are optimized as per the least cost expansion plan by the model. However, looking at the scenario description given at the same page 65, description of Scenario-I: **Hydro Optimization Not Horizon Bound – HPP Free**, one comes to know that this is not the case and hydro projects are not optimized in the base case. By comparing the Objective function values in 2047, for the base case and HPP free scenarios, it is evident that base case has higher values by a difference of US$ 4,578 million if undiscounted and US$ 312 million in terms of present worth of costs. It is therefore suggested that hydro power projects may be optimized in the base case. If the projects are fixed like this then there is very little room left for optimization and it is against the true spirit of least cost optimization.

3. I was astonished to note that there is continuous addition of OCGT type plants fueled by RLNG during 2028 to 2043 with capacity of about 25,000 MW but operating at low capacity factors of 13-15% during 2028 – 2032, even lower capacity factors of 6% in 2033 and 1-3%

during 2033-2047. This way a huge investment on installing these plants have gone into vein. However, I found it mentioned in the document (page 95) *"It is evident through the results that there is a wide disparity of thousands of MW between the projected demand and the nominal capacity. It is pertinent to mention here that this gap is due to the heavy induction of thermal generation source i.e. RLNG and other thermal options.having high capacity factors and reserve provisioning characteristics* ***to cope up with the intermittent nature of variable renewable energy.***" Similarly, it is mentioned (pages 96-97) that *"Due to more quantum of VRE being optimized, the reserve requirements also increase, resulting in substantial selection of candidate CCGTs. A total of 26,127 MW candidate solar and 8, 332 MW candidate wind are optimized by the year 2047.* ***In a bid to cater for the intermittent nature of REs and system's reserve requirements, 25,828 MW of candidate OCGTs are selected*** *by the tool; these OCGTs are selected to provide reserve requirements of the system but they are not readily dispatched on normal operation, thus,* ***remain almost at zero annual plant factor****"*. It is suggested that the cost of such additional capacities added to the system to cater for the intermittent nature of REs over several years needs to be estimated and attributed to the RE projects and a revised least cost expansion plan may be prepared accordingly.

4. It is also suggested that marginal cost analysis may be performed to work out the maximum capital costs of the candidate plants which have not been selected and minimum capital costs of the candidate plants that have been selected in the optimal expansion plan. This will help in better understanding the economics of various power generation technologies in our national power system.

5. Once again, the work is very much appreciated and hoped that NTDC will make this exercise a regular feature of its planning team with further improvements in future.

(Muhammad Latif)
Former Chief (Energy), Energy Wing,
Planning, Development and Reforms Division
Postal Address: H 1550, St 39, I-10/2, Islamabad
Mob. 0300-5018195
Email: mlatif2000@gmail.com

MARKHOR GABRAL UTROR HPP (PRIVATE) LIMITED

Ref: GUHP /1/2020/12
21 May 2020

The Registrar,
National Electric Power Regulatory Authority
NEPRA Tower,
Islamabad, Pakistan

For info & nec. PD,
- ADG (Lic)
Copy to:
- SA (Tech)
- SA (T)
- DG (M&E)
- SLA (LLP)
- MF

CC: Chairman
- V.C / M (M&E)
- M (CA) / MCTD
- M (Lic)
1/6/2020

Comments on "Indicative Generation Capacity Expansion Plan 2047" of NTDC
(82MW Gabral Utror HPP, 36MW Bankhwar HPP, 16MW Sakhra (I & II) and 45MW Wari HPP)

Dear Sir,

We are pursuing a 82MW Gabral Utror hydro power project under the terms of a Letter of Intent ("**LOI**") issued by Pakhtunkhwa Energy Development Organization ("**PEDO**"). Markhor Gabral Utror HPP (Private) Limited, a company incorporated under the laws of Pakistan is a Joint Venture project of M/s InfraCo Asia, Singapore and M/s Markhor Energy, Pakistan.

In addition to Gabral Utror HPP (82MW); we are also pursuing Bankhwar HPP (36MW), Sakhra –I HPP (8MW), Sakhra-II HPP (8MW) under the terms of LOIs issued by PEDO and Wari (45MW) HPP for which LOI is awaited.

We are one of the very few hydro power projects currently under development in Pakistan by an international investor having strong presence in various countries.

InfarCo Asia funded by four sovereigns (Governments of UK, Switzerland, Australia and the Netherlands) is keen in developing the hydro power project by following international best practices. In order to maximize the usage of available hydel resource at the Project Site; JV Partners have engaged internationally reputable technical consultants for the development of the feasibility studies. We are glad to inform that so far progress of the development of our projects is on track, and feasibility studies are near completion though we have to put on hold certain on-sites activities due to COVID-19 and lockdown at the project sites in particular and in the country in general.

Power System Planning ("**PSP**") of National Transmission and Despatch Company ("**NTDC**") submitted an "Indicative Generation Capacity Expansion Plan 2047" ("**IGCEP**" or the "**Plan**") to NEPRA in April 2020 whereon NEPRA has solicited comments from the stakeholders on IGCEP.

We have reviewed IGCEP in detail and have observed that all the hydro power projects of private sector have been pushed to Year 2046 onward, which is beyond comprehension and apparently without any solid basis. Ignoring cheap and reliable electricity from hydro power projects has significantly diluted the overall impact of the Plan and resultantly makes the conclusions defective. It is important to note that a number of important aspects are not adequately covered in it, Plan of 'National Transmission and Despatch Company' has almost everything related to the power sector except 'transmission and despatch' related matters.

Please note below our comments on IGCEP for your kind consideration;

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

Dy. No.
Dated

Year	Solar	Wind-Mid	Wind-North	Wind-South	CASA	Coal - Local	RLNG	Year Total
2023	1,500	300	200	1,000	1,000	-	-	4,000
2024	1,500	-	-	-	-	1,988	-	3,488
2025	1,500	-	-	-	-	-	-	1,500
2026	1,500	-	-	-	-	-	-	1,500
2027	-	-	-	-	-	236	-	236
2028	1,500	-	-	-	-	103	2,020	3,623
2029	1,500	-	-	-	-	158	908	2,566
2030	1,500	-	-	-	-	917	3,010	5,427
2031	1,500	-	-	-	-		901	2,401
2032	1,500	-	-	-	-	7	1,204	2,711
2033	1,500	-	-	-	-	3,919		5,419
2034	567	-	-	-	-	3,360	633	4,560
2035	-	-	-	-	-	2,248	2,719	4,967
2036	742	-	-	-	-	2,375	2,831	5,948
2037	1,354	-	-	-	-	2,551	2,058	5,963
2038	669	-	-	-	-	2,963	2,202	5,834
2039	1,124	-	-	-	-	3,206	2,572	6,902
2040	360	-	-	-	-	3,528	2,933	6,821
2041	1,500	-	-	-	-	32	270	1,802
2042	1,500	-	-	-	-	1,237	2,102	4,839
2043	1,500	-	-	-	-	-	-	1,500
2044	1,500	-	-	-	-	1,125	-	2,625
2045	1,500	-	-	-	-	7	-	1,507
2046	-	-	-	-	-	-	-	-
TOTAL	27,316	300	200	1,000	1,000	29,960	26,363	86,139

NOTE: [As per Annexure E, No VER Policy]. *The above table ONLY includes "Generic Candidate" power projects and doesn't include already identified power projects having name and project site.*

From the above Table, without even going into the document; one can assess that the Plan is based on weak assumptions. So much so, Plan is assuming to take additional power from a new power plant in certain years even without considering the efficiencies of the machines and sizes of the turbine. For example; is it even worth it to develop and install a 7MW coal power plant or less than 1200MW RLNG based power plant, when latest model of turbines have bigger size and higher efficiencies. Turbines of thermal power plants come in fixed sizes unlike in case of hydro, where machines are designed on the basis of requirements.

It seems from the above numbers that local coal and RLNG are being considered as peakers and will be operated to take the load when solar/wind is not available. As a practice, no bank will finance and no investor will either invest in a greenfield infrastructure project without first knowing the revenue stream and the security package. In this situation, a generation Plan on the basis of misunderstanding can create more issues and will definitely choke the already troubled power sector.

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

O&M and fuel tariff is indexed; variation in yield curves and cost of transmission line and related losses are considered then there is a probability that hydro power projects might be the least cost generation units.

10. We respect the decision of Ministry of Power GoP to include CASA-1000 project in their medium term forecast but in comparison to huge potential of hydro power plants; importing power of 1000MW from Central Asia will seriously affect the development of local hydro power industry in Pakistan and such ambiguous projects can distract the focused discussion.

11. As a practice, Public Sector hydro power projects start with the funding from annual funds allocation in Public Sector Development Program (PSDP) and thereafter due to various budgetary constraints; the construction gets slowed or stopped and project gets delayed. We have seen in case of Neelum Jhelum Hydro Power Project, where a project of national importance was first remained on papers for over 20 years and thereafter commissioning delayed by at least 5 years. The cost overrun has now put huge financial burden on the state and the objective of developing a cheap and least cost generating facility has completely ruined. Similar instances are being observed in case of Nandipur Thermal, Trimmu RLNG project and Jamshoro Coal Project. Delays and cost over runs are quite normal in case of public sector power projects. Due to limited resources of the country; it is suggested that public sector projects must not start construction before the financial close as is done by the private IPPs, unless there is a project of a national strategic importance (e.g. diamer-bhasha dam). NEPRA has already laid down guidelines for the selection of an EPC Contractor and has also set tariff mechanism process therefore, it is suggested to encourage private sector to take the risk and invest in the power sector especially in the hydro power and transmission line sectors. This would not only be cost effective but will also help brining generation facility online within a given timeframe.

12. During summer months, demand of electricity in the country increases while these are also high water months therefore, it is in Pakistan's benefit to utilize high water months and get cheap electricity from hydro power plants. During high water months, capacity factor even goes to 90% in case of hydro power plants, which is not possible in wind/solar in their high time. All other technologies have unique limitations, be it limited to day time only (solar) or high yield at dawn (wind) or high cost of imported fuel (RLNG) or inefficient and polluted generation (coal). It is also to be noted that arrangement of debt for coal and big public sector hydro power projects would be a huge challenge in coming years. Without securing finances to develop a power project will heavily cost the government.

13. Following aspects have completely been ignored while determining the demand forecast;

    a. CPEC projects have been given priority in the Plan where, we must not forget that CPEC is a live national importance project hence any power project can be added or removed in or from CPEC list of projects any time during the development. Therefore, it is requested not to give special status to CPEC projects so that every project could be evaluated on its own merits.

    b. Economic and Industrial Zones under CPEC or under any other government special schemes have not been considered.

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

Gabral Utror HPP - Comments on NTDC's IGCEP

arooj asghar <arooj.asghar@hotmail.com>

Fri 5/22/2020 8:25 PM

To: registrar@nepra.org.pk <registrar@nepra.org.pk>; office@nepra.org.pk <office@nepra.org.pk>
Cc: fawad.rauf@pedo.pk <fawad.rauf@pedo.pk>; imran.halim@pedo.pk <imran.halim@pedo.pk>; asif.pedo@hotmail.com <asif.pedo@hotmail.com>; rahim.ddpp@pedo.pk <rahim.ddpp@pedo.pk>; safdar.hayat@pedo.pk <safdar.hayat@pedo.pk>; ali@maskatiya-group.com <ali@maskatiya-group.com>; Ali Maskatiya <am@markhorenergy.com>
Bcc: arooj asghar <arooj.asghar@acltd.net>

1 attachments (721 KB)

Gabral Utror HPP Comments on NTDC IGCEP.pdf;

Dear Safeer Sahib,
Registrar, NEPRA,
NEPRA Tower, Islamabad,

We are pursuing a 82MW Gabral Utror hydro power project under the terms of a Letter of Intent ("LOI") issued by Pakhtunkhwa Energy Development Organization ("PEDO"). Markhor Gabral Utror HPP (Private) Limited, a company incorporated under the laws of Pakistan is a Joint Venture project of M/s InfraCo Asia, Singapore and M/s Markhor Energy, Pakistan.

In addition to Gabral Utror HPP (82MW); we are also pursuing Bankhwar HPP (36MW), Sakhra –I HPP (8MW), Sakhra-II HPP (8MW) under the terms of LOIs issued by PEDO and Wari (45MW) HPP for which LOI is awaited.

InfarCo Asia funded by four sovereigns (Governments of UK, Switzerland, Australia and the Netherlands) is keen in developing the hydro power project by following international best practices. In order to maximize the usage of available hydel resource at the Project Site; JV Partners have engaged internationally reputable technical consultants for the development of the feasibility studies. We are glad to inform that so far progress of the development of our projects is on track, and feasibility studies are near completion though we have to put on hold certain on-sites activities due to COVID-19 and lockdown at the project sites in particular and in the country in general.

Power System Planning ("PSP") of National Transmission and Despatch Company ("NTDC") submitted an "Indicative Generation Capacity Expansion Plan 2047" ("IGCEP" or the "Plan") to NEPRA in April 2020 whereon NEPRA has solicited comments from the stakeholders on IGCEP.

Please find attached our comments on IGCEP.

Please do let us know if any clarification is required.

Thanks,

Arooj Asghar
Markhor Gabral Utror HPP
Islamabad

Ref: GUHP /1/2020/12
21 May 2020

The Registrar,
National Electric Power Regulatory Authority
NEPRA Tower,
Islamabad, Pakistan

Comments on "Indicative Generation Capacity Expansion Plan 2047" of NTDC
(82MW Gabral Utror HPP, 36MW Bankhwar HPP, 16MW Sakhra (I & II) and 45MW Wari HPP)

Dear Sir,

We are pursuing a 82MW Gabral Utror hydro power project under the terms of a Letter of Intent ("**LOI**") issued by Pakhtunkhwa Energy Development Organization ("**PEDO**"). Markhor Gabral Utror HPP (Private) Limited, a company incorporated under the laws of Pakistan is a Joint Venture project of M/s InfraCo Asia, Singapore and M/s Markhor Energy, Pakistan.

In addition to Gabral Utror HPP (82MW); we are also pursuing Bankhwar HPP (36MW), Sakhra –I HPP (8MW), Sakhra-II HPP (8MW) under the terms of LOIs issued by PEDO and Wari (45MW) HPP for which LOI is awaited.

We are one of the very few hydro power projects currently under development in Pakistan by an international investor having strong presence in various countries.

InfarCo Asia funded by four sovereigns (Governments of UK, Switzerland, Australia and the Netherlands) is keen in developing the hydro power project by following international best practices. In order to maximize the usage of available hydel resource at the Project Site; JV Partners have engaged internationally reputable technical consultants for the development of the feasibility studies. We are glad to inform that so far progress of the development of our projects is on track, and feasibility studies are near completion though we have to put on hold certain on-sites activities due to COVID-19 and lockdown at the project sites in particular and in the country in general.

Power System Planning ("**PSP**") of National Transmission and Despatch Company ("**NTDC**") submitted an "Indicative Generation Capacity Expansion Plan 2047" ("**IGCEP**" or the "**Plan**") to NEPRA in April 2020 whereon NEPRA has solicited comments from the stakeholders on IGCEP.

We have reviewed IGCEP in detail and have observed that all the hydro power projects of private sector have been pushed to Year 2046 onward, which is beyond comprehension and apparently without any solid basis. Ignoring cheap and reliable electricity from hydro power projects has significantly diluted the overall impact of the Plan and resultantly makes the conclusions defective. It is important to note that a number of important aspects are not adequately covered in it, Plan of 'National Transmission and Despatch Company' has almost everything related to the power sector except 'transmission and despatch' related matters.

Please note below our comments on IGCEP for your kind consideration;

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

1. As per the Foreword of the Plan; NTDC has prepared the IGCEP and once it is approved then on the basis of approved generation Plan; NTDC will prepare a 'Transmission System Expansion Plan'. The success of a long term strategically important plan is highly dependent on the adopted methodology and on the envisaged sequence of events under the plan. Here, the sequence of events is exactly opposite to what it ought to be. Rationally, NTDC should only prepare 'Transmission System Expansion Plan' on the basis of information provided to it by the Ministry of Power of GoP, PPIB, AEDB, and all provincial agencies. NTDC is apparently not supposed to; determine the cost of a generating unit; even determination of demand and supply forecast; and devising a strategy for either utilizing indigenous resources or to reliance on imported fuels. Instead, it should only focus on developing a technical and financial plan on how to evacuate power from a power project and what would be the cost of transmission line thus NEPRA, Ministry of Power of GoP, PPIB, AEDB, and all provincial agencies could take a comprehensive decision of procuring power from any particular project or from a cluster of projects and take a view on how to utilize the available resources resultantly bringing down the cost of electricity.

2. On one side, IGCEP shows the hard work and dedication of PSP team in developing the Plan while on the other, it also shows lack of guidance thus it has distracted from its original objective and the very intent of the Plan. The Plan has apparently trespassed into implementing agencies (i.e. PEDO as approving authority of feasibility studies) and NEPRA as a Regulator in issuing the tariff to a project. It is humbly suggested that let implementing agencies and NEPRA do the math and NTDC should provide its input on evacuation only.

3. While performing simulations, a lot of emphases have been given to various technologies except hydro power from private IPPs while it assumes procuring power from all sources except from hydro power till Year 2046. IGCEP has considered least cost solution (a combination of CAPEX, OPEX and Capacity factors) for input in the software. While doing so; IGCEP has conveniently ignored to add the cost of transmission line and related losses, dispatch requirements, and consumption patterns. As per the Plan; 1500MW, 1500MW and 1000MW have been assumed as commissioned in Year 2023 from solar, wind and CASA-1000 respectively. Without going into the merits and de-merits of solar, wind and CASA-1000, these are just 'Generic Candidate' projects for which even no decision has yet been taken. Considering this 4,000MW of 'Generic Candidate' projects in Year 2023 simply erodes the possibility of utilizing huge hydro potential in KP province of Pakistan. As per the Plan; 27,316MWs will come from 'Generic Candidate' Solar projects from Year 2023 to 2046. Pakistan has a potential of solar/wind projects but that should not be assessed in isolation. Without considering load centers, load requirements and evacuation strategy; the potential of solar/wind is good for nothing. It is encouraging to see that NTDC is emphasizing on induction of renewable power plants in the system but without any legal framework, power policy, and mechanism to initiate (solicited or un-solicited) a project, adding thousands of MWs of 'Generic Candidate' in the system planning study and consequently pushing the real projects such as hydro power does not provide a meaningful analyses.

4. Below table ONLY shows 'Generic Candidate Projects' from different technologies (as given in Annexure E of the Plan) where basis/ location/ any specific information for massive 84,139MWs potential power projects from Year 2023 to 2046 have not been provided.

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

Year	Solar	Wind-Mid	Wind-North	Wind-South	CASA	Coal - Local	RLNG	Year Total
2023	1,500	300	200	1,000	1,000	-	-	4,000
2024	1,500	-	-	-	-	1,988	-	3,488
2025	1,500	-	-	-	-	-	-	1,500
2026	1,500	-	-	-	-	-	-	1,500
2027	-	-	-	-	-	236	-	236
2028	1,500	-	-	-	-	103	2,020	3,623
2029	1,500	-	-	-	-	158	908	2,566
2030	1,500	-	-	-	-	917	3,010	5,427
2031	1,500	-	-	-	-		901	2,401
2032	1,500	-	-	-	-	7	1,204	2,711
2033	1,500	-	-	-	-	3,919		5,419
2034	567	-	-	-	-	3,360	633	4,560
2035	-	-	-	-	-	2,248	2,719	4,967
2036	742	-	-	-	-	2,375	2,831	5,948
2037	1,354	-	-	-	-	2,551	2,058	5,963
2038	669	-	-	-	-	2,963	2,202	5,834
2039	1,124	-	-	-	-	3,206	2,572	6,902
2040	360	-	-	-	-	3,528	2,933	6,821
2041	1,500	-	-	-	-	32	270	1,802
2042	1,500	-	-	-	-	1,237	2,102	4,839
2043	1,500	-	-	-	-	-	-	1,500
2044	1,500	-	-	-	-	1,125	-	2,625
2045	1,500	-	-	-	-	7	-	1,507
2046	-	-	-	-	-	-	-	-
TOTAL	**27,316**	**300**	**200**	**1,000**	**1,000**	**29,960**	**26,363**	**86,139**

NOTE: [As per Annexure E, No VER Policy]. *The above table ONLY includes "Generic Candidate" power projects and doesn't include already identified power projects having name and project site.*

From the above Table, without even going into the document; one can assess that the Plan is based on weak assumptions. So much so, Plan is assuming to take additional power from a new power plant in certain years even without considering the efficiencies of the machines and sizes of the turbine. For example; is it even worth it to develop and install a 7MW coal power plant or less than 1200MW RLNG based power plant, when latest model of turbines have bigger size and higher efficiencies. Turbines of thermal power plants come in fixed sizes unlike in case of hydro, where machines are designed on the basis of requirements.

It seems from the above numbers that local coal and RLNG are being considered as peakers and will be operated to take the load when solar/wind is not available. As a practice, no bank will finance and no investor will either invest in a greenfield infrastructure project without first knowing the revenue stream and the security package. In this situation, a generation Plan on the basis of misunderstanding can create more issues and will definitely choke the already troubled power sector.

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

5. Instead of first determining the electricity requirement of an area, allocation of a resource for meeting the requirement and thereafter determining the best possible option; the whole exercise is going in cycles. There is a very high possibility that once NTDC completes its 'Transmission System Expansion Plan', post approval of IGCEP, a large number of assumed least cost generating facilities would technically become unviable (due to transmission line cost and away from the load centers). Therefore, in this situation, what is the intended purpose of IGCEP. It is therefore, requested the honorable Authority to advise NTDC to focus on relevant aspects of the generation plan only rather than adding irrelevant information and doing analyses for the sake of analyses.

6. No explanation is given in Table E.11 - 'Summary of Total Generation Cost Comparison of all Scenarios'. Probable intention of calculating NPVs of CAPEX and OPEX is to see how much a particular Scenario will cost the system but there are many other factors, which actually determine the total cost of electricity for the system operator. Anyhow, while looking at the NPV numbers alone as given in Table E.11 - 'Summary of Total Generation Cost Comparison of all Scenarios'; it is interesting to note that NPV of CAPEX and OPEX under 'Base Case' is US$ 69.8 whereas NPV of CAPEX and OPEX under 'HPP Free' Scenario is calculated as US$ 69.5 billion. The difference between two NPVs of CAPEX and OPEX is well under the margin of error and can be due to rounding off the numbers. There is hardly any additional CAPEX and OPEX on developing hydro power plants therefore, pushing hydro power plants to the tail end of the generation plan will not serve the country well. We need to be mindful of the fact that; indexation of fuel and fixed O&M have not been considered in the Plan thus eventually cost to the system under 'HPP Free' Scenario would be much higher. Therefore, it is submitted to consider injecting more hydro power projects in the system as early as possible.

7. Pushing all hydro power plants currently under advanced stage of development to Year 2046 onward means NTDC is not even considering private sector's participation in hydro power plants. While looking at the list of PEDO's hydro power plants; total is around 5,500MW, which also includes around 5 hydro power plants totaling 2,000MW. Hydro power project pursued by PEDO are real and are on ground with name, size, site and are with well-known sponsors rather than just a 'Generic Candidate' power projects without any background.

8. In order to illustrate the real issue with the structure and methodology of the Plan; Plan says 1500MW of solar to be injected in the system without assessing the area of these solar projects. What if an Economic Zone in KP province requires electricity and NTDC plans to provide super cheap solar power but the possible solar site is in Rahim Yar Khan area of Punjab (i.e. best solar resource of say 23% annual average capacity factor) or from local coal or RLNG. In this case, how NTDC will be transmitting power to KP Province from Rahim Yar Khan? Will that even be technically and economically viable option to develop a solar project in that area or will Government of Pakistan abandon the economic zone right on the route of CPEC? Therefore, it is requested to do the exercise systematically instead of wasting time and energy of all the stakeholders. Besides this will seriously affect the investment climate of Pakistan and can also hamper foreign direct investment.

9. The overall concept of evaluation on the basis of CAPEX and OPEX of a project is defective. It doesn't provide an apple to apple comparison as per MW cost of a hydro might be higher (and O&M cost mostly in local currency is on the lower side) than any other power plant but if, Fixed

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

O&M and fuel tariff is indexed; variation in yield curves and cost of transmission line and related losses are considered then there is a probability that hydro power projects might be the least cost generation units.

10. We respect the decision of Ministry of Power GoP to include CASA-1000 project in their medium term forecast but in comparison to huge potential of hydro power plants; importing power of 1000MW from Central Asia will seriously affect the development of local hydro power industry in Pakistan and such ambiguous projects can distract the focused discussion.

11. As a practice, Public Sector hydro power projects start with the funding from annual funds allocation in Public Sector Development Program (PSDP) and thereafter due to various budgetary constraints; the construction gets slowed or stopped and project gets delayed. We have seen in case of Neelum Jhelum Hydro Power Project, where a project of national importance was first remained on papers for over 20 years and thereafter commissioning delayed by at least 5 years. The cost overrun has now put huge financial burden on the state and the objective of developing a cheap and least cost generating facility has completely ruined. Similar instances are being observed in case of Nandipur Thermal, Trimmu RLNG project and Jamshoro Coal Project. Delays and cost over runs are quite normal in case of public sector power projects. Due to limited resources of the country; it is suggested that public sector projects must not start construction before the financial close as is done by the private IPPs, unless there is a project of a national strategic importance (e.g. diamer-bhasha dam). NEPRA has already laid down guidelines for the selection of an EPC Contractor and has also set tariff mechanism process therefore, it is suggested to encourage private sector to take the risk and invest in the power sector especially in the hydro power and transmission line sectors. This would not only be cost effective but will also help brining generation facility online within a given timeframe.

12. During summer months, demand of electricity in the country increases while these are also high water months therefore, it is in Pakistan's benefit to utilize high water months and get cheap electricity from hydro power plants. During high water months, capacity factor even goes to 90% in case of hydro power plants, which is not possible in wind/solar in their high time. All other technologies have unique limitations, be it limited to day time only (solar) or high yield at dawn (wind) or high cost of imported fuel (RLNG) or inefficient and polluted generation (coal). It is also to be noted that arrangement of debt for coal and big public sector hydro power projects would be a huge challenge in coming years. Without securing finances to develop a power project will heavily cost the government.

13. Following aspects have completely been ignored while determining the demand forecast;

    a. CPEC projects have been given priority in the Plan where, we must not forget that CPEC is a live national importance project hence any power project can be added or removed in or from CPEC list of projects any time during the development. Therefore, it is requested not to give special status to CPEC projects so that every project could be evaluated on its own merits.

    b. Economic and Industrial Zones under CPEC or under any other government special schemes have not been considered.

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

c. Rural electrification has not been considered which can effectively revive the stressed DISCOs.

Our hydro power projects are at an advanced stage of development and we expect that we would be able to achieve financial close in 2021, if everything goes as per plan. Sponsors have already lined up equity and debt would be arranged from the international lenders in due course. Sponsors of the Project have international presence and are confident to arrange a longer term debt which would bring down the overall tariff. Total construction time of our hydro power projects is estimated to be 3.5 years and COD can be achieved in 2024. In this situation, it is humbly submitted to revise the Plan and preference should be given to such projects for early power evacuation.

Pakistan has huge potential of hydro power and it is in the best interest of the country to utilize this resource. There is no doubt that developing hydro power projects especially small to medium will help Pakistan to bring down the cost of electricity. It is also requested to please add real projects of serious investors in the evacuation plan instead of relying on arbitrary and imaginary projects.

We look forward to working with Ministry of Power GoP, NEPRA, NTDC, CPPA(G), PEDO, PPIB, AEDB and all other stakeholders in bringing our hydro power project online in minimum possible time which will also provide cheap and clean electricity.

Yours Sincerely,

Arooj Asghar
Project Lead

c.c. Director Hydro Power, PEDO, Peshawar, KP Province.

33-C, Hockey Stadium Lane #2, Shamsheer Commercial Area, Phase V, Defence, Karachi. Pakistan

COMMENTS

INDICATIVE GENERATION CAPACITY EXPANSION PLAN (IGCEP-2047)

General:

1. The executive summary indicates that 3 scenarios of long term forecast are prepared for low, normal and high GDP growth of 4.5%, 5.5% and 6.5% respectively by enhancing the peak demand from 27,128 MW to 103,065 MW for fiscal years 2019 to 2047. This forecasted value of demand is at variance to that of negative low demand growth by -1.5% which resulted due to escape of industry owing to expensive electricity tariffs, as indicated in the NEPRA's State of Industry Report. Further, the report is silent about the treatment of selected projects in the event of negative load growth and accumulation of circular debt.

2. Section 2.8 of the executive summary indicates that IGCEP will provide basis for expansion of transmission network whereas, the draft National Electricity Policy 2020 at Section 5.8.4 provides:

> *"All future procurement of electricity will be in accordance with IGCEP and TSEP, pursuant to applicable policy / framework and regulatory stipulations".*

3. Further, Section 5.8.3 of the draft National Electricity Policy 2020 provides:

> *"The regulator, while approving the IGCEP, shall also consider relevant transmission cost for the candidate power plant(s). The criteria for inclusion of transmission cost shall be incorporated in the regulatory framework."*

This provision indicates that the project financial viability will be based upon the project cost and its associated transmission network to the load center. NEPRA / NTDC may ascertain that the project has considered such a provision so that the end consumer cost should be bearable and there should be no escape of consumers from the national network due to enhanced tariff.

4. The IGCEP Report is silent about the proximity of projects to load centre and end consumer tariff which should be basic parameters of such planning.

5. The IGCEP Report indicates its revision and resubmission annually prior to April of every year. In the event of any deviation from the selected and under process projects, what road map is required to be adopted? Such a variation of revised IGCEP will also have a corresponding effect on TSEP.

6. It is apprehended that input data of certain projects provided by the stakeholders is without the conduct of bankable Feasibility Study. NEPRA / NTDC is requested to verify the prices, capacity, plant factor and location of the projects to achieve the implementable least cost project selection.

Hydropower:

7. Table 6.5 of IGCEP 2047 indicates the input data to PLEXIS. This input data regarding PPDB's 28 number projects been compared to that of input data submitted by PPDB on the format provided by NTDC. There seems to be typographical/punching errors in the input to the program in the area of Plant Factor, annual Energy Generated. Further, the COD indicated by PPDB has also been changed. NEPRA / NTDC may be requested to verify the input data as the said deviations have been marked as Annex-A to these comments.

8. PPIB Board's decision during its 125th Meeting held on 29.08.2019 indicates that the following projects given at Annex- B will be declared as committed projects. NEPRA / NTDC are requested to incorporate the said decision appropriately.

9. With regard to 135 MW Taunsa Hydropower Project, it is intimated that the plant factor has been changed from 55% to 40% and Energy Generation from 650 GWh to 468 GWh, thus justification of the project has been dragged from 2024 to 2047 against the provision of NTDC's letter No.GMPSP/CEG&LF/MGPO&LF/463/119-22 dated 06.01.2020 (Annex-C). In which it is stated that 135MW Taunsa Hydropower Project is included in the IGCEP 2018-2040. On the basis of inclusion of Taunsa Hydropower Project in IGCEP, PPDB has initiated the process of International Competitive Bidding under the NEPRA's Regulation CBTR-2017. Under the requirements of CBTR-2017

the pre-qualification of Sponsors has been carried out and RFP has been submitted to NEPRA for its approval. Dragging the COD from 2024 to 2047 with subsequent revisions of IGCEP, the progress made for development of the project will jeopardize. The data used for Taunsa Hydropower should be corrected and its COD date may be revised in reference to IGCEP 2018-40 reports.

10. Further it may also be considered in finalization the IGCEP report for small hydropower projects that as compared to runoff stream hydropower projects which have relatively lower plant factor hydropower plants on perennial canal projects having a higher plant factor due to uniform hydrology throughout the year. Thus the dependability of projects on canal makes them better candidate projects over ones on stream.

STATUS OF HYDROPOWER PROJECTS
IGCEP 2047

ANNEX-A

Sr. #	Name / Site of the Project	Project Capacity (MW)	Ref. Page	Data Provided by PPDB	IGCEP Entered Data by NTDC	Remarks
1	**Taunsa Hydropower Project, Taunsa Barrage, District Muzaffargarh**	**135**	**85**	COD: 2024 PF: 55 % EG: 650 GWh	COD: 2024 PF: 40 % EG: 468 GWh	The Project included in IGCEP-2018-40, with COD date of 2024. In the current version of IGCEP-2047 the correct data for the project is not used in analysis which resulted in shifting of COD from 2024 to 2047.
2	**Lucky HPP**, Marala Barrage**, District Sialkot**	**20**	**85**	COD: 2024 PF: 50 % EG: 87.4 GWh	COD: 2047 PF: 46 % EG: 81 GWh	• As PPIB 125 Board these projects were declared as committed projects. • Further the input/used Information mentioned in NTDC's IGCEP report table 6.5 is not correct. Correction /revision is required to get actual results.
3	**Ravi HPP,** Lower Bari Doab Canal (LBDC), RD. 260+000, District Sahiwal	**4.6**	**84**	COD: 2023 PF: 75 % EG: 27 GWh	COD: 2046 PF: 57 % EG: 23 GWh	
4	**Alka HPP,** Jhang Branch Canal, RD. 0+000 to 69+000, **District Hafizabad**	**1.8**	**82, 110**	COD: 2024 PF: 75 % EG: 12.08 GWh	COD: 2030 / 2045 PF: 70 % EG: 11 GWh	
5	**C.J. HPP,** Chashma Jhelum Link Tail Canal Fall, RD. 316+622, District Khushab	**25**	**84, 106, 139(A)**	COD: 2025 PF: 51.6 % EG: 110 GWh	COD: 2032 / 2043 PF: 36 % EG: 76 GWh	
6	**Gugera HPP,** Upper Gugera Branch Canal, RD 214+000 to RD 220+750, District Nankana	**3.6**	**85, 106, 139(A)**	COD: 2024 PF: 67 % EG: 21.1 GWh	COD: 2047 PF: 32 % EG: 10 GWh	
7	**Mehar HPP,** B.S. Link-I Canal,RD. 106+250, District Kasur	**10.49**	**84, 109**	COD: 2024 PF: 73.23 % EG: 67.29 GWh	COD: 2033 / 2047 PF: 49 % EG: 45 GWh	
8	**Trident HPP, Lower Chenab Canal (LCC), RD. 0+000, District Gujranwala**	**7.55**	**85, 109**	COD: 2024 PF: 67.21 % EG: 43.71 GWh	COD: 2028 / 2047 PF: 39 % EG: 26 GWh	
9	**Mandi Baha-ud-din HPP, L**ower Jhelum Feeder Canal, RD. 8+626, District Mandi Baha-Ud-Din	**3.3**	**85, 108**	COD: 2024 PF: 65 % EG: 18.6 GWh	COD: 2024 / 2047 PF: 31 % EG: 9 GWh	
10	**Khokhra HPP,** Gujrat Branch Canal, RD 0+000 to 2+000, District Gujrat	**2.8**	**81, 111**	COD: 2023 PF: 68 % EG: 17.12 GWh Capcity: 2.8	COD: 2024 PF: 70.21 % EG: 18 GWh Capacity: 3.2 MW	
11	**Rasul HPP,** Rasul Barrage, District Mandi Baha-Ud-Din	**18**	**85, 109**	COD: 2025 PF: 60.15 % EG: 95 GWh	COD: 2025 / 2047 PF: 41 % EG: 64 GWh	

12	**Kasur HPP**,BRBD Link Canal, RD. 509+712, District Kasur	**2.54**	**85, 108**	COD: 2024 PF: 51 % EG: 10.88 GWh	COD: 2025 / 2047 PF: 27 % EG: 6 GWh	
13	**Khanewal HPP, LBDC** RD. 602+000, District Khanewal	**1**	**85, 109**	COD: 2024 PF: 75.34 % EG: 6.6 GWh	COD: 2025 / 2047 PF: 5 % EG: 0.47 GWh	Information mentioned in NTDC's IGCEP is not correct. Need correction to yield to get appropriate results
14	**Murree HPP**	**12**	**85, 109**	COD: 2025 PF: 62.18 % EG: 65.18 GWh	COD: 2026 / 2045 PF: 39 % EG: 41 GWh	
15	**Engro HPP,** D.G. Khan Link-III Canal,RD. 0+000 to RD. 14+000, District DG Khan	**4.63**	**86, 108**	COD: 2025 PF: 51.6 % EG: 20.9 GWh	COD: 2026 / 2045-47 PF: 22 % EG: 9 GWh	
16	**Chichawatni HPP**, RD. 489+000, District Sahiwal	**1.6**	**85, 108**	COD: 2024 PF: 86 % EG: 12.04 GWh	COD: 2025 / 2045-47 PF: 43 % EG: 6 GWh	
17	**Soan HPP**	**25**	**85, 109**	COD: 2030 PF: 51.6 % EG: 113 GWh	COD: 2025 / 2047 PF: 35 % EG: 76 GWh	
18	**UCC Bambawala HPP**	**5**	**85, 108**	COD: 2030 PF: 70 % EG: 30.7 GWh	COD: 2025 / 2046 PF: 37 % EG: 16 GWh	
19	**Okara HPP**	**4.8**	**85, 145**	COD: 2027 PF: 70.6 % EG: 30 GWh	COD: 2024 / 2046 PF: 38 % EG: 16 GWh	
20	**QB Link HPP**	**9.18**	**86, 109**	COD: 2027 PF: 75 % EG: 60 GWh	COD: 2046. 2047 PF: 20 % EG: 16 GWh	
21	**BS Link Tail HPP**	**9**	**85, 108**	COD: 2024 PF: 63 % EG: 49.2 GWh	COD: 2030 / 2047 PF: 37 % EG: 29 GWh	
22	**TP Link HPP**	**9**	**85, 108**	COD: 2030 PF: 49 % EG: 38.4 GWh	COD: 2024 / 2047 PF: 29 % EG: 23 GWh	
23	**Chenawan HPP**	**3**	**85, 108**	COD: 2025 PF: 86 % EG: 22.8 GWh	COD: 2045, 2043, 2047 PF: 38 % EG: 10 GWh	
24	**Sahiwal HPP**	**4.8**	**85, 108**	COD: 2027 PF: 70 % EG: 29.3 GWh	COD: 2050, 2047, 2027 PF: 43 % EG: 18 GWh	
25	**Khanki Barrage HPP**	**14**	**85, 108**	COD: 2030 PF: 32 % EG: 39 GWh	COD: 2050, 2047 PF: 19 % EG: 23 GWh	
26	**Qadirabad barrage HPP**	**23**	**86, 109**	COD: 2033 PF: 27 % EG: 54.58 GWh	COD: 2025 / 2047 PF: 16 % EG: 33 GWh	
27	**Trimmu HPP**	**13**	**85, 109**	COD: 2032 PF: 52 % EG: 59.45 GWh	COD: 2029 / 2047 PF: 33 % EG: 38 GWh	

28	**Punjand HPP**	**15**	**86, 109**	COD: 2032 PF: 44 % EG: 58.43 GWh	COD: 2032 / 2047 PF: 28 % EG: 37 GWh	

Note:
COD: Commercial Operation Date
PF: Plant Factor
EG: Energy Generated

ANNEX-B

Processing of Small Hydropower Projects initiated by the provinces and AJ&K

PPIB letter Ref. No. (101)PPIB-MISC/19/PRJ/O-53805 dated 7th November 2019

Category - II			
1	**Ravi HPP,** Lower Bari Doab Canal, RD. 260+000, District Sahiwal	Trident Power JB (Pvt.) Ltd.,	**4.6**
2	**Lucky HPP**, Marala Barrage, District Sialkot	Olympus Energy (Private) Limited	**20**
3	**Alka HPP,** Jhang Branch Canal, RD. 0+000 to 69+000, District Hafizabad	Alka Power (Private) Limited	**1.8**
CAPACITY (SUB-TOTAL)			**26.4 MW**
Category - III			
4	**Gugera HPP,** Upper Gugera Branch Canal, RD 214+000 to RD 220+750, District Nankana	Gugera Power Company	**3.6**
5	**Lower Chenab Canal (LCC) HPP,** RD. 0 + 000, District Gujranwala	Trident Power GR (Pvt.) Limited	**7.55**
6	**Mandi Baha-ud-din HPP,** Lower Jhelum Feeder Canal, RD. 8+626, District Mandi Baha-Ud-Din	Mandi Baha-ud-din Energy Limited	**3.3**
7	**Khokhra HPP,** Gujrat Branch Canal, RD 0+000 to 2+000, District Gujrat	Blue Star Energy (Pvt.) Limited	**2.8**
8	**Rasul HPP,** Rasul Barrage, District Mandi Baha-Ud-Din	S2 Hydro Ltd (Suraj Cotton Mills Limited)	**18**
9	**Mehar HPP,** B.S. Link-I Canal, RD. 106+250, District Kasur	Associated Technologies (Pvt.) Limited	**10.49**
10	**BRBD Link Canal HPP,** RD. 509+712, District Kasur	Packages Power (Pvt.) Limited	**2.54**
11	**C.J. HPP,** Chashma Jhelum Link Tail Canal Fall, RD. 316+622, District Khushab	C.J. Hydro (Haseeb Khan & Co.)	**25**
CAPACITY (SUB-TOTAL)			**73.28 MW**

-C

NATIONAL TRANSMISSION & DESPATCH COMPANY LTD.

General Manager (Power System Planning), NTDC

No. GMPSP/CEG&LF/MGPO&LF/463/ 119-22

Date: 06.01.2020

Managing Director,
Punjab Power Development Board.

Subject: **JOINT STUDY ON PAKISTAN POWER MARKET**

Ref: PPDB letter No. PPDB/599/2019 Dated: 27/12/2019

With reference to the above referred letter, it is apprised that 135 MW Taunsa Hydropower project is included in the IGCEP 2018-2040.

As per minutes of meeting of Workshop on *"Finalization of the Joint Study on the Power Market in Pakistan' dated 3rd November 2019,* Joint Study on Pakistan Power Market has endorsed the output of IGCEP 2018-2040 which includes 135 MW Taunsa Hydropower Project.
Kindly contact Power Division, Ministry of Energy for obtaining the relevant minutes/report.

This office is available for any further support in this regard.

Engr. Salis Usman
General Manager (Power System Planning)

Cc:
- PS to MD NTDC, WAPDA House, Lahore.
- PS to Secretary, Government of the Punjab, Energy Department, Lahore.
- PS to Managing Director, Punjab Power Development Board.

Seen, noted, 17/01/2020

16/1/20 DAR

Important. Please file SEN

16-01-2020

Dated: May 5, 2020

The Registrar,
National Electric Power Regulatory Authority,
NEPRA Tower, Ataturk Avenue (East), Sector G-5/1,
Islamabad

Dear Sir,

Subject: **Comments in the matter of Indicative Generation Capacity Expansion Plan 2047 (IGCEP)**

Please refer to 'notice for submitting comments in the matter of IGCEP', dated April 25, 2020. As a member of the general public, with some experience of analyzing electricity generation expansion plans, I am offering comments on the IGCEP. My comments are related to the following three aspects, (i) presentation of results in the Executive Summary of IGCEP 2047, (ii) the Thar coal price and indexation factors used, and (iii) selection of electricity demand scenario. These comments are followed by submission of suggestions.

2. The Plan results, as presented in the Executive Summary, provide nominal capacity and generation for the two marker years of 2030 and 2047. This presentation masks some of the important results. A summary of the capacity and generation for the year 2040 is essential for conveying model results and understanding the swing of results from Base Case to other scenarios. Tables A and B, extracted from the report are presented in next paras to compare the Base Case with two scenarios of special interest (HPP Free and No VRE Policy).

3. A Thar coal price of 1.37 $/GJ (Table 6-7) and fuel price indexation factor of 1.0 initially increasing to 1.06 in 2021 and then declining with some variation and stabilizing at 0.69 by 2039 (Table 4-2) have been used as model inputs. Thar Coal Energy Board (TCEB), having representation of Sindh and Federal governments, has the mandate to determine the price of Thar coal. The TCEB has been urging the mining companies of block-1 and 2 to scale up their mining equipment/technology for cost-effective mining. This will not only reduce the fuel cost but will also help in reducing the average generation cost of the system, benefitting all consumers. The value of this one parameter (other things remaining same) is driving the Capacity Expansion Plan towards local coal by substituting expensive hydro and wind projects.

4. The approved Electricity Plan should have hydro projects selected on the basis of least cost. Forcing the model to pick all candidate hydro projects in the planning horizon (2020-2047), negates the objective of integrated least cost planning. Table A, given below, provides a comparison of capacity shift from hydro to coal when the model is free to pick least cost

projects. In the period 2041-47 some 30,750 MW hydro projects are omitted, and mostly substituted by Thar coal. The omitted projects include several hydro projects having generation cost of less than 4.88 cents/kWh (generation cost of wind projects in south). Some of the larger omitted projects include Thakot-II 966 MW (3.49 cent/kWh); Pattan 2,400 MW (4.70 cent/kWh; Lower Spat Gah 496 MW (4.75 cents/kWh). The omitted projects also includes Diamer Bhasha Dam of 4,500 MW having generation cost of 6.36 cents/kWh, with storage capacity of 6.4 MAF.

5. For storage hydro projects, the cost attributed to the power project is 65% of the total project cost with the remaining 35% attributed to water storage (Section 6.10, IGCEP 2014-40, NTDC). This cost split may be reviewed by the Federal Government to make room for the planned storage project, in a transparent manner.

Table A: Comparison of Hydro and Local Coal Capacities in two Cases

(Units: MW)

	Base Case		**HPP Free Case**	
	Hydro	Local Coal	Hydro	Local Coal
Installed capacity 30 June 2019	9,769	0	9,769	0
Capacity addition 2020-2030	10,970	6,055	10,873	6,055
Capacity addition 2031-2040	4,314	23,785	4,314	23,785
Capacity addition 2041-2047	30,785	3,108	0	20,886
Total Installed Capacity:	55,838	32,948	24,956	50,726

Source: Base Case: Tables E3, 7-11; HPP Free Case Table E3 and Annex C-3

6. The approved Electricity Plan should also have solar and wind projects selected on the basis of least cost, rather than arbitrary targets. Table B shows that if arbitrarily set renewable energy policy targets are omitted and capacities are determined on the basis of least cost, then higher solar capacity and lower wind capacity, with overall reduction in Renewable Energy capacity is selected, compared to the Base case.

Table B: Comparison of Local Coal and RE Capacities in two Cases

(Units: MW)

	Base Case		**No VRE Policy**	
	Local Coal	RE	Local Coal	RE
Installed capacity 30 June 2019	0	1,746	0	1,746
Capacity addition 2020-2030	6,055	22,287	7,942	13,937
Capacity addition 2031-2040	23,785	5,831	24,157	9,316
Capacity addition 2041-2047	3,108	8,297	2,401	7,512
Total Installed Capacity:	32,948	38,161	34,500	32,511

[Base Case: Tables E3, 7-11; No VRE Policy Case Table E3 and Annex E-3]

7. As indicated by Table B, some 4,865 MW of wind projects are omitted by 2040, if VRE targets are not forced. This is a case of one renewable against the other. From the operations point of view hydro plants are better than wind. So free optimization of solar and wind projects would allow space for significant additional hydro capacity.

8. The approved Electricity Plan should be based on a realistic power demand scenario, rather than wishes. A lower demand scenario was required, even before the covid-19 pandemic set in. There is need reconsideration, as over building capacity has a very high cost penalty.

9. By making use of the scenarios presented in the IGCEP report, it is suggested that:

(i) **NTDC may be directed to reformulate the Generation Capacity Expansion Plan** by incorporating the following three changes: (i) the Plan should be based on Lower Demand (4.5% GDP growth case), (ii) it should be based on free optimization of hydro power projects, (ii) it should omit VRE policy targets, and determine new VRE targets by free optimization.

(ii) As Electricity Plan will be updated annually, so **in future all large power projects should be approved only if they are part of the integrated least cost expansion plan**. This decision will increase the transparency of economic decision making in the country. However, implementation of this condition will require not only strengthening of expansion planning capability, but also resources for retaining this capability and putting it to good use.

10. The above suggestions are submitted for due consideration of the Authority.

Yours sincerely

5/5/2020 Ahmad Mumtaz.

(Ahmad Mumtaz)
Energy System Analyst
(CNIC number: 61101-4671205-1)

Contacts:
Address: House 51, Street 1, B Block,
PWD Society, Islamabad Highway, Islamabad
Phone (Residence): 051-5170881
Email: amumtaz1952@gmail.com

From: Syed Akhtar Ali
Ex-Member Energy
Planning Commission
0345-2447714

To: Registrar NEPRA
CC MD. NTDC
Comments on on IGCEP-2047

0)Let me first congratulate NTDC and its young team which has produced a fine product which hitherto has been the exclusive domain of the foreign consultants.

1)Three plans have been prepared in addition to additional simulations; Low demand Generation Capacity is 133000 MW; Base Case 164000 MW; High demand 222000 MW for the year 2047.

2) The energy consumption /demand has grown at a rate of 6.51% during the period 1990 and 2001 and at 4.37 % during 2001-2018.Over all long term energy growth has been at 5.22%.If historical demand is projected at a rate of 4%, FY 2030 demand/generation comes out to be 49639 MW. This compares with the low demand scenario projections of a peak demand of 39111 MW by FY 2030, requiring 67964 MW. This is a rate of 7% which should not be so high in low demand case. There is a case for toning down the low demand case to be requiring 49639 MW or slightly more.

3)Base Case Demand as per IGCEP is 43820 for FY 2030 for which a capacity of 76391 MW has been provided. This gives a RoG of 4.2585 % in the period FY 2020-30.For FY 2047, the demand has been projected at 103065 MW for which a capacity of 168425 MW has been provided. The RoG for 2020-47 comes out to be 4.825 %.

4)We will contain our discussion to low demand scenario upto FY-2030,as in this dynamic period, it is rather impossible to forecast technology and economics that far. The demand is stagnant around 120,000 GWh for the last two years. In FY 2019-20, energy demand is expected to be at the same level of 120,000 GWh, instead of 155000 GWh predicted by IGCEP-47 base case. In this low scenario, IGCEP projects expansion of generation capacity at a rate of 7.32% .In the environment that is prevailing and is expected to continue, a slower expansion should be projected. My suggestion is that 4% RoG be taken in this lean period. This would mean a capacity of 49639 MW installed by 2030.Existing Installed capacity is 33534 MW. A total of 16105 MW would be required to be added.4200 MW would be retied and 7200 MW is under construction. It means that only 13105 MW would have to be actually added. All of this should come out of RE, Hydro and Thar Coal. For the next two or three years, excess capacity is to be consumed. In the remaining 7 years of FY-2021-30,13105 MW would have to be implemented; an average of 2000 MW per year. If there is a some shortfall, it can be quickly added by additional 2-3000 MW of solar projects. No more expensive Nuclear in this decade at 4.5 Million USD/MW.A detailed plan on the afore-mentioned specifying locations and capacities should be prepared. It would be solicited

projects or auctioning under CTBCM, hence detailed planning would be required by agencies and rather than the investors .

5.On fuel prices, Thar coal has been taken at USD 1.5/MJ while the actual TCEB determination is of 3.4 USD/GJ. Similarly, RLNG price has been taken at USD 9 per GJ. Perhaps Qatar Gas price has been taken which is up for revision in 2025, a few years ahead. It may be more appropriate to take a conservative Long Term Spot Prices of LNG at 6.00 USD/MMBtu.

Energy/Electricity-GDP Elasticity

The Report authors have not revealed the elasticity data which would have enabled o make some judgement or evaluation of demand model. There are all kinds of estimates of GDP elasticity in papers published in economic journals. Estimates for Pakistan vary from 1.5 to 0.6.The variations are due to data, methodology and other factors. The confusion is not there only in Pakistan. In India, the corresponding estimates have also a similar kind of variations. However, one thing is sure that energy efficiency is improving almost everywhere due to technology changes and the GDP elasticity numbers are going down. For example in Europe, Energy-GDP elasticity has gone down to 0.25 from earlier figures of 1.0 or little less. In some cases ,it is even negative. And for India, it is 0.5.Involvement of Academia would have been mutually rewarding

Conclusion & Recommendations

6.Low demand scenario may be considered for the period FY2020-30 and Base case for 2030-2047.Number crunching and modeling seldom gives accurate plans. These are to be digested and normalized by the experts and decision makers. A strategy meeting of the related agency should be called to finalize a Plan based on the afore-mentioned and the modifications thereof.

7.It would be advisable to develop DISCO –centred plans as well based on broader precincts of IGCEP-47 or even independently. The Bottom-up and Top-down approaches may be reconciled.

8.For Balochistan, special planning is required for its specific need. It is an ideal case for distributed generation. There are 136 Tehsils. Solar-Wind-Battery Storage projects of 1-5 MW may be considered for Balochistan. Irrigation Pumps may be energized out of these projects.

9.Distributed generation should have been more visible than is the case in the IGCEP. It appears to be Grid-centered. At least one Solar project per district should be considered connected at 11 kV. Solar should be given preference as it is available everywhere, as opposed to Wind Power which is not available at all locations.

10.Hydro COGE of around 5 USC in most cases and higher capacity factor of 50-55% have been used. Recent hydro projects have been awarded at considerably higher prices exceeding 7 USc. On realistic prices including Hydro Royalty, possibly, higher share of RE(Solar & Wind) could have been there.

11. In solicited projects or auctioning/bidding, more responsibilities of upfront project definition would lie on PPIB and System Operator. They should be asked to undertake preliminary studies defining

location, technology and capacity. As per CTBCM, responsibility of IGCEP should be shifted to the System Operator. NTDC –IGCEP cell should be transferred to its new place.

12.In order to evaluate the optimality of a Plan, one would like to know the capacity Utilization(System Load Factor) and the unit Cost. Both are missing.The functionality would be there in the software.All data input seems to be there. May be it has already been calculated but has not been included in the Report.I would suggest and request to include the same.

13.I have added formats of two Tables which has helped me greatly in clearly understanding the results.If the author of the report will, they may like to use this format.

13.There is a rich presence of Econometricians in Academia in Pakistan. Academia should be involved in demand modeling for a mutually beneficial cooperation.

Table 13. Comparison of Elasticities for Developing and Industrialized Economies

	Price		Income	
	Short	Long	Short	Long
LDC Estimates				
Oil (wrt Crude Price)	-0.07	-0.15	0.39	0.50
Gasoline	-0.33	-0.61	0.64	0.94
Diesel	-0.41	-0.50	#N/A	-0.10
Natural Gas	-0.23	-1.36	0.11	0.89
Electricity	-0.44	-0.46	0.36	0.59
Electricity-residential	-0.32	-0.49	0.36	0.53
Dahl (2004)				
Oil	-0.11	-0.43	0.47	0.84
Gasoline	-0.13	-0.61	0.25	0.69
Diesel	-0.13	-0.67	0.55	1.13
Natural Gas Industry	-0.03	-1.35	0.12	1.39
Natural Gas Residential	-0.13	-0.56	0.18	0.11
Electricity	-0.14	-0.32	0.37	1.04
Electricity - residential	-0.23	-0.43	0.28	0.60
Dahl (2014)				
Gasoline				
Low Response	-0.20	-0.60	0.30	0.50
High Response	-0.30	-0.90	0.50	1.50

[13] At the crude oil level, this short-run response could be about -0.15 if half of the gasoline price covers refi
and these non-crude costs do not change.

Demand Forecast 2020-2047-ICCEP-47

	Low		Normal		High		Supply
	Energy GWh	Pk.Demand MW	Energy GWh	Pk.Demand MW	Energy GWh	Pk.Demand MW	MW
2019-20	155203	26844	156840	27128	158365	27391	33534
2029-30	212418	39111	237996	43820	264595	48718	76391
2046-47	411379	75744	559765	103065	759041	139756	168426
RoG-2020-30-%/yr	3.1876		4.2585		5.267		
RoG-2030-47-%/yr	3.96		9.6568		9.6568		
RoG-2020-47-%/yr	3.67		4.825		5.976		

Source:NTDC-IGCEP-2047

Electricity Generation Growth

Year	GWh	RoG-%
1990	29078	
2001	58395	6.51
2002	60796	
2018	120785	4.37
		5.22

Source: NTDC System Statistics-2017-18

Summary-Capacity Addition over Plan Period2020-47-MW Base Case

	L.Coal	Hydro	RLNG	Nuclear	I.Coal	R.E.	N.Gas	F.O.	Imported	yearly Tot	Cum.Total
2020	602	9945	6677	1230	3736	1846	3010	-6488	0	33534	33534
Addition-2021-30	5453	10792	4205	3187	1561	22188	-1506	-4013	0	42857	42857
Total-upto 2030	6055	20737	10882	4417	5297	24034	1504	-2475	0	76391	76391
addition-2031-47	26893	35099	19695	-10	0	14127	-1484	-2475	1000	91855	92035
Total-2047	32948	55836	30577	4407	5297	38161	20	0	1000	168246	168426

Source:NTDC-IGCEP-2047

Capacity Addition over Plan Period2020-47-MW

Low Demand	L.Coal	Hydro	RLNG	Nuclear	I.Coal	R.E.	N.Gas	F.O.	Imported	yearly Tot	Cum.Total
2020	602	9945	6677	1230	3736	1846	3010	6488	0	33534	33534
Total-upto 2030	42891	134807	48615	13221	15891	79883	3412	1822	3000	67964	67964
Addition-2021-30	42891	132933	48732	13221	15891	77742	3518	1822	3000	64172	
addition-2031-47	-23716	-78971	-28207	-8814	-10594	-52966	-3412	-1822	-2000	65077	65077
Total-2047	19175	55836	20408	4407	5297	26917	0	0	1000	133041	133041

Source :NTDC IGCEP 2047

COMMENTS ON

Indicative Generation Capacity Expansion Plan

By Asim Javed

TABLE OF CONTENTS

1. INTRODUCTION

Author of this document is a data analyst and freelance management consultant with more than 18 years of experience in power sector of Pakistan. The comments provided in this document are not suggestions by the author and are based on actual analysis of figures presented in the IGCEP report. Author has just used data intelligence tools to analyze the facts presented in the IGCEP and found certain glitches which need attention of policy makers.

Following are the main problems in the IGCEP report, details, references, and examples off which are provided in subsequent sections of this document.

a) Renewable Energy Projects (Wind & Solar) are not retired at the end of their economic life of 25 years. They continue to generate indefinitely as per IGCEP report.

b) Present value of costs related to projects are incorrectly discounted in IGCEP report.

c) Criteria for selection of hydropower projects is inconsistent, where expensive projects are picked, and cheaper projects are abandoned.

d) Generation statistics are full of errors and do not comply with projects capacity and proposed capacity factors.

e) Carbon emission figures are warped to show improvement, however data of IGCEP report itself reveals an average increase of 11% in emissions per year between 2020 & 2047.

f) Minutiae of candidate projects are inaccurate, which give way to selection of wrong projects at inappropriate time.

g) Role of Implementing Agencies is absurd keeping in view the historic performance and financial resources available to these bureaus.

h) Contrary to commercial prudence, projects with costs on declining trend are prioritized for developement and vice versa. The cost of delay in COD of projects is not considered while finalizing the plan.

Author can be reached through following contact details for further clarifications regarding facts provided in this document.

Asim Javed
House No. 7, Street No. 70, G-13/2, Islamabad.
+92 300 8521234; asim.javed@live.com

2. QUESTIONS RELATED TO PROJECT LIFE

As per Section 6.6 (Planning Basis) of the Main Report, certain assumptions for PLEXOs software has been outlined, including Economic Life of the different technology projects.

Parameter	Value
Economic Life of Plant:	
Hydroelectric	50 years
Steam Turbines	30 years
Combined Cycle Plants	30 years
Combustion Turbines	30 years
Wind Power Plants	25 years
Solar Power Plants	25 years
Nuclear Power Plants	70 Years

As per IGCEP report, Economic Life of Solar and Wind Power Projects is assumed 25 years as shown in figure above. At the same time Annexure B-1 contains following projects as existing wind and solar power projects (these projects are supposed to retire at most by year 2044).

Plant Name	Installed Capacity
Act	50
Appolo Solar	100
Artistic_wind	50
Best Green Solar	100
Crest Energy Solar	100
FFC	50
FWEL-I	50
FWEL-II	50
Gul Ahmed	50
Hawa	50
Jhimpir	50
Master	50
Metro_Power	50
Quaid e Azam Solar	100

Plant Name	Installed Capacity
Sachal	50
Sapphire_Wind	30
Three_Gorges_I	50
Three_Gorges_II	50
Three_Gorges_III	50
Tricon_A	50
Tricon_B	50
Tricon_C	50
UEP	99
Yunus	50
Zorlu_Wind	56
Total	**1,485**

Table 1: Existing Wind & Solar Power Projects in Pakistan

Similarly, as per Table 7.5 of the Main report following solar and wind power projects are planned to be developed and commissioned till year 2021 (these projects should retire at most by year 2045).

Plant Name	Installed Capacity
Access Electric Pvt. Ltd.	10
Access Solar Pvt. Ltd.	12
Hydro China Dawood Power Pvt. Limited	50
Master Green Energy Ltd.	50
Shaheen Renewable Energy-1 Pvt. Ltd.	51
Tenga Generasi Limited	50
Tricorm Wind Power Pvt. Ltd	50
Western Energy Pvt. Limited	50
Zephyr Power Pvt. Limited	50
Zorlu Solar Pakistan Pvt. Ltd.	100
Total	**473**

Table 2: Planned Wind & Solar Power Projects in IGCEP

The problem with the output in all scenarios of the report is that these projects (both existing and planned to be commissioned till year 2021) have not been retired at the end of their useful economic life of 25 years.

This way generation from at least 35 power projects having cumulative capacity of more than 1,950 MW has been included erroneously in the IGCEP report. Please explain, why all projects are not retired at their respective end of concession periods and are generating till year 2047?

3. QUESTION RELATED TO PRESENT VALUE CALCULATIONS

Reference: ***Table 7.5 of the Report***

As per Section 4.6.2 of the report a discount rate of 10% is assumed for all calculations. However, as per calculations shown in Table 7.5 of the IGCEP report, it has been found that this assumption does not stand true. Through reverse engineering of reference table, it has been observed that instead of 10% discount rate, ~11.11% discount rate has been used to calculate the present value of project costs.

Table 7.5 of the IGCEP is reproduced here with two additional scenarios. Calculation of PV using discount rate of 11.11% and 10% are shown in separate columns for comparison purposes.

Year	Report Data		Using Discount Rate of 11.11%		Using Discount Rate of 10%	
	Present Worth	Un-Discounted	Discount Factor	PV	Discount Factor	PV
2023	215,029	294,964	0.729	215,029	0.751	221,611
2024	511,136	779,052	0.656	511,136	0.683	532,103
2025	579,057	980,638	0.590	579,057	0.621	608,899
2026	608,447	1,144,901	0.531	608,447	0.564	646,267
2027	642,058	1,342,384	0.478	642,058	0.513	688,855
2028	683,448	1,587,690	0.430	683,448	0.467	740,669
2029	830,902	2,144,703	0.387	830,902	0.424	909,563
2030	940,954	2,698,629	0.349	940,954	0.386	1,040,438
2031	961,650	3,064,429	0.314	961,650	0.350	1,074,064
2032	963,445	3,411,275	0.282	963,445	0.319	1,086,937
2033	1,008,553	3,967,768	0.254	1,008,553	0.290	1,149,321
2034	1,022,063	4,467,687	0.229	1,022,063	0.263	1,176,482
2035	1,012,602	4,918,143	0.206	1,012,602	0.239	1,177,364
2036	1,001,325	5,403,744	0.185	1,001,325	0.218	1,176,012
2037	984,242	5,901,729	0.167	984,242	0.198	1,167,626
2038	969,280	6,457,792	0.150	969,280	0.180	1,161,491
2039	951,916	7,046,785	0.135	951,916	0.164	1,152,206
2040	933,975	7,682,189	0.122	933,975	0.149	1,141,908
2041	928,448	8,485,252	0.109	928,448	0.135	1,146,617
2042	892,657	9,064,611	0.098	892,657	0.123	1,113,551
2043	924,064	10,426,160	0.089	924,064	0.112	1,164,374
2044	947,658	11,880,408	0.080	947,658	0.102	1,206,166
2045	908,189	12,650,666	0.072	908,189	0.092	1,167,606

Year	Report Data		Using Discount Rate of 11.11%		Using Discount Rate of 10%	
	Present Worth	Un-Discounted	Discount Factor	PV	Discount Factor	PV
2046	902,141	13,962,693	0.065	902,141	0.084	1,171,546
2047	892,700	15,351,744	0.058	892,700	0.076	1,170,995
Total	**21,215,939**			**21,215,939**		**24,992,671**

Table 3: Recalculation of Present Value of Project Costs

It is evident from Table 3 above that there is a clear deviation from standard assumptions set for analysis of project portfolio, which may result into misleading output of the software. Please clarify the reason for such deviation.

4. QUESTIONS RELATED TO HYDROPOWER SELECTION CRITERIA

Table 7.4a shows the results of software about "selected for development" projects based on input as shown in table 6.12. Two important scenarios are discussed in this section of report.

In HPP Free Scenario, following projects are selected as per IGCEP Report.

Power Plant	US Cents/KWh	PKR/KWh
Blue Star	4.01	6.28
Dander	3.47	5.43
Dasu_2	2.06	3.23
Dubair Kalay	4.48	7.02
Mahl	3.31	5.18
Nerai-Dubair	3.85	6.03
Rajdhani	3.83	6.01
Riali-III	0.64	1
Thakot-I	3.08	4.83
Thakot-III	3.5	5.49
Maximum Tariff	**4.48**	**7.02**

Table 4: Hydropower Projects Selected under HPP Free Scenario

Please note that maximum tariff of all these selected projects is US Cents 4.48/kWh. However, among various projects, which were not selected by software have generation cost lower than US Cents 4.48/kWh. List of such projects is extracted from report in the following table.

Power Plant	US Cents/KWh	Tariff Advantage (US Cents/KWh)
Bhimbal Katha	3.88	0.60
Chapri Charkhel	4.33	0.15
Dowarian	3.85	0.63
Harigehl- Majeedgala	4.34	0.14

Power Plant	US Cents/KWh	Tariff Advantage (US Cents/KWh)
Sakhra-I	4.27	0.21
Skardu	3.46	1.02
Thakot-II	3.49	0.99
Torkhow	4.40	0.08

Table 5: Hydropower Projects Rejected under HPP Free Scenario

Last column of the Table 5 shows the advantage of generation cost from "Maximum Tariff" of selected projects in previous table.

The question arises, why projects in Table 5 are not selected despite having lower generation costs than those shown in Table 4.

5. QUESTIONS RELATED TO CALCULATION METHODOLOGY

Although there are accumulation errors in almost all generation scenarios, Annexure-C and Annexure-N have considerable discrepancies between year wise generation and totals calculated in the IGCEP report. Following table shows the difference between Reported Total (as reported in IGCEP) and Actual Total (positive figures represent overstatement of generation figures & vice-versa). It is to be noted that Annexure-C totals are mostly incorrect in Phase-1 of the operations while Annexure-N totals are mostly wrong for Phase-2 of the operations.

Year	Annexure-C	Annexure-N
2020	13,370	6
2021	14,390	1
2022	11,449	3
2023	10,229	32
2024	9,853	4
2025	3,069	1
2026	(6,467)	4
2027	(10,281)	3
2028	(10,993)	45
2029	(9,312)	(5)
2030	(11,925)	30
2031	4	(14,018)
2032	3	(14,019)
2033	2	(14,007)
2034	6	(14,007)
2035	(1)	(14,010)
2036	7	(14,006)
2037	6	(13,994)
2038	11	(13,999)

Year	Annexure-C	Annexure-N
2039	4	(13,997)
2040	231	(13,758)
2041	136	(13,857)
2042	5	(13,990)
2043	3	(13,991)
2044	6	(13,974)
2045	8	(13,986)
2046	7	(13,988)
2047	2	(13,981)

Table 6: Calculation Errors in the Generation Statistics of IGCEP

There are similar differences in other annexures of the IGCEP report as well, however I have ignored them based-on the assumption of rounding challenges. Please explain the reasons of difference in generation figures totals.

6. QUESTIONS RELATED TO GENERATION STATISTICS OF PROJECTS

There are substantial calculation errors in annual generation figures presented in various annexures. This research will become needlessly lengthy if author incorporates all such problems in tabular form. However, to demonstrate the type of errors and problem, all projects with names starting from alphabet "A" are listed here. If Authority requires so, author can share the details of all remaining projects as well.

Reference: Access Electric- (Annexure-C)

Reference	Description	Problem
Table C-4, #9	10 MW Solar Project	With mentioned Capacity and PF[1] only ~17 GWh can be produced. How the figure of 83 is calculated. The Problem is only for Phase-1. For Phase-2 correct figure of 17 GWh is considered correctly.
Table C-5, #78	Annual Plant Factor is 19%	
Table C-6, #78	Annual Energy is ~83 GWh	

Reference: Access Solar- (Annexure-C)

Reference	Description	Problem
Table C-4, #10	12 MW Solar Project	With mentioned Capacity and PF only ~19 GWh can be produced. How the figure of 165 is calculated.
Table C-5, #79	Annual Plant Factor is 19%	
Table C-6, #79	Annual Energy is ~165 GWh	

1 Plant Factor/ Capacity Factor

Reference	Description	Problem
		The Problem is only for Phase-1. For Phase-2 correct figure of 17 GWh is considered correctly.

Reference: Act Wind Power- (Annexure-C)

Reference	Description	Problem
Table C-5, #262	Annual Plant Factor is 33%	If PF is same in both phases, why generation is higher in phase-1 than phase-2? Please Clarify.
Table C-6, #262	Annual Energy is ~149 GWh	
Table C-7, #262	Annual Energy is ~87 GWh	

Reference: AES Pakgen- (Main Report & Annexure-C)

Reference	Description	Problem
Table 7.6 Main Report, #307	Annual Plant Factor is 1% for 2 years & then 0% thereafter.	If PF is same in both phases, and for all scenarios, why there is difference in energy generation. Moreover, if PF becomes 0% after two years, how energy of 13GWh has been calculated in base case? Same problem occurs in other annexures of the report for this project. Please clarify.
Table 7.7 Main Report, #307	Annual Energy is 35,17,13 GWh for 3 years respectively & then 0 Gwh thereafter.	
Table C-5, #307	Annual Plant Factor is 1% for 2 years & then 0% thereafter.	
Table C-6, #307	Annual Energy is 9 GWh for only 1 year and 0 GWh thereafter.	

Reference: AGL RFO- (Annexure-C)

Reference	Description	Problem
Table C-5, #321	Annual Plant Factor is 88% for 2 years, then 14% for 3rd year & drops to single digit thereafter.	Generation figures do not reconcile with project Capacity and proposed PF. Similar issues are present in other annexures of the report as well. Please clarify the issue.
Table C-6, #321	Annual Energy is 193 GWh for 1st year and then ~2,200 GWh till end of phase 1.	
Table C-7, #321	Annual Energy is ~65 Gwh	

Reference: Artistic-I Hydropower (Annexure-I)

Reference	Description	Problem
Table I-5, #95	Annual Plant Factor is 52% for year 2047 & 0% before that.	If PF is zero for 2046, how energy is generated? Please Clarify.
Table I-6, #95	Annual Energy for year 2046 is 281 GWh and 168 GWh for 2047.	

Reference: Artistic-II Hydropower (Annexure-I & H)

Reference	Description	Problem
Table I-5, #96	Annual Plant Factor is 42% for year 2047 & 0% before that.	If PF is zero till 2046, how energy is generated in previous years? Please Clarify.
Table I-6, #96	Annual Energy for year 2044 onward is ~190 GWh.	

Reference: Ashkot Hydropower (Annexure-I & H)

Reference	Description	Problem
Table I-5, #97	Annual Plant Factor is 46% for year 2047 & 0% before that.	If PF is zero till 2046, how energy is generated in this year? Please Clarify.
Table I-6, #97	Annual Energy for year 2046 onward is ~1200 GWh.	

Reference: Asrit Kedam Hydropower (Annexures-I, M & N)

Reference	Description	Problem
Table I-5, #98	Annual Plant Factor is 48% for year 2045 & 0% before that.	If PF is zero till 2045, how energy is generated in previous years? Please Clarify.
Table I-6, #98	Annual Energy from year 2039 onward is ~910 GWh.	

Reference: Atlas RFO- (Annexure-C)

Reference	Description	Problem
Table C-5, #322	Annual Plant Factor is 13%, 5% & 2% for first 3 years respectively, and then drops to 0% thereafter.	Generation figures do not reconcile with project Capacity and proposed PF. Similar issues are present in other annexures of the report as well. Please clarify the issue.
Table C-6, #322	Annual Energy is 583 GWh for 1st year and then ~2,200 GWh till end of phase 1.	
Table C-7, #322	Annual Energy is 0 Gwh	

Reference: Azad Pattan HPP (Annexure-C)

Reference	Description	Problem
Table C-5, #100	Annual Plant Factor is 0% till year 2026, 48%, for year 2027 and 53% thereafter.	Generation figures do not reconcile with project Capacity and proposed PF. Project COD is Sep-26, then how energy is being generated two years before COD? Please clarify the issue.
Table C-6, #100	Annual Energy is ~17.5 GWh starting from year 2024 till end of Phase-1.	
Table C-7, #100	Annual Energy is 3,253 Gwh from 2031 till year 2047.	

7. QUESTIONS RELATED TO CARBON EMISSIONS

The Long-Term Climate Risk Index (CRI) placed Pakistan as the 5th most vulnerable country to environmental calamities. The Intergovernmental Panel on Climate Change (IPCC) has already predicted that risks associated with extreme events will continue to increase as the global mean temperature rises. In terms of economic costs at $3.8 million, Pakistan is ranked number three over a 20-year period. What this means is that our economy is constantly at risk from climate devastations and this is not just an environmental challenge but an issue impacting our economy, human health, agriculture, and ecosystem as well.

As per IGCEP, carbon emissions in the country by power generation accounts for 0.406 kg-CO_2/kWh in FY 2019-20 and this indicator reduces to 0.32 kg-CO_2/kWh by FY 2046-47. It is to be noted that total generation during FY 2019-20 was recorded as ~108,205 GWh[2], which means that total emissions of CO_2 were recorded as ~44,000 tons during 2019-20. Also note that total generation is planned as 559,760 GWh in year 2046-47, which means that absolute total emissions in that year would be ~179,000 tons of CO_2.

When coal is burned it releases several airborne toxins and pollutants. They include mercury, lead, sulfur dioxide, nitrogen oxides, particulates, and various other heavy metals. Health impacts can range from asthma and breathing difficulties, to brain damage, heart problems, cancer, neurological disorders, and premature death. Although limits set by the Environmental Protection Agency (EPA) have helped prevent some of these emissions, many plants do not have the necessary pollution controls installed. The future of these protections remains unclear.

This analysis therefore requires us to think out of box and realize that although CO_2 emissions have reduced in per kilowatt-hour terms, in absolute figures, it has increased more than 300% in 28 years or equivalently more than 11% per annum during each year between 2020 & 2047. During analysis of IGCEP it was noted that NTDC recommends more projects on local and imported coal as shown in table below.

Name of Project	Installed Capacity
Generic Candidate Local Coal	28,407
Gwadar	300
Jamshoro CFPP Unit 1	660
Jamshoro CFPP Unit 2	660
Lucky	660

2 Table A-10 & A-11 of Annexure A of the IGCEP

Name of Project	Installed Capacity
Oracle_1	660
Oracle_2	660
Siddiq sons	330
Thal Nova	330
Thar TEL	330
Thar-I (Shanghai Electric) Unit 2	660
Thar-I (Shanghai Electric) Unit 1	660
Grand Total	**34,317**

Table 7: Planned Imported & Local Coal Projects in IGCEP

Keeping in view the above statements, proposed capacity addition of 34,317 MW based on local and imported coal should be reconsidered and be replaced by green energy sources like hydropower projects.

8. QUESTIONS RELATED TO PARTICULARS OF PROJECTS

Reference: Table 6.12 & Table 7.4a.

Table 6.12 of the report shows the salient features of the candidate hydropower projects. However, an in-depth review of these features helped me to identify some figures which does not seem correct based on other publicly available data. For example, see the table below.

Reference	Description of Report Contents	Query
Table 6.12, #4	Plant Factor of Mahl HPP is shown as 66%.	As per NEPRA Tariff Determination[3] the Plant Factor is 52.33%
-do-	Annual Energy of Mahl is 3,720 GWh	As per NEPRA Tariff Determination the Annual Energy is 2,904 GWh
-do-	Tariff of Mahl is shown as PKR. 5.18/KWh	As per NEPRA Tariff Determination the approved Tariff is PKR. 6.69/KWh
Table 6.12, #87	Cost of Athmuqam HPP is taken as $ 2,944/KW	As per Tariff proposal submitted by Project to CPPA, cost is $ 2,776/KW

Table 8: Difference in Characteristics of Projects

Please clarify, why there is difference between different sources of data for same projects?

3 https://nepra.org.pk/tariff/Tariff/CPPAG/Mahal%20Hydropower%20Project/2019/IPT-04%20MPCL%2023-01-2019%201115-17.PDF

9. QUESTIONS RELATED TO ROLE OF IMPLEMENTING AGENCIES

As per base case scenario, approximately 148,074 MW of installed capacity is planned to be developed by multiple implementing agencies. As per data provided in the report, following is the role of each implementing agency.

Agency	Phase-1[4]	Phase-2[5]	Grand Total
AEDB	3.45%		1.19%
AJK	0.05%	0.35%	0.25%
GENCO	2.59%		0.89%
GOP	1.96%		0.68%
PAEC	6.47%		2.23%
PEDO	0.76%	5.43%	3.82%
PPDB		0.41%	0.27%
PPDB/ AEDB	0.39%		0.14%
PPIB	15.75%	1.59%	6.47%
PPIB/AJK	1.41%		0.49%
STDC/ PPIB	2.59%		0.89%
WAPDA	12.20%	28.37%	22.80%
Yet to be Decided	52.39%	63.84%	59.90%
Grand Total	**100.00%**	**100.00%**	**100.00%**

Table 9: Role of Implementing Agencies during both Phases of Panning

It is to be noted that approximately 60% of the planned capacity has not be allotted to any implementing agency for now and will be decided later. Out of remaining 40% capacity, WAPDA has been allotted biggest chunk of development i.e. ~23%. Remaining 17% is supposed to be developed by 11 different implementing agencies.

Out of total planned installed capacity of 148,074, it is proposed that 45,929 MW of capacity will be hydropower projects. WAPDA is allotted 74% of total planned hydropower capacity i.e. 33,765 MW. Even at an average cost of US$ 2.5 million per MW, total cost for development of this capacity require US$ 84.42 billion of investment over 28 years. As per IGCEP plan, approximately US$ 69 billion of total investment is required in Phase-2 of the plan i.e. in 17 years. Please explain is it practicable to fund such a huge amount by a public sector organization?

4 Planning Period between year 2020 and 2030 as defined by IGCEP
5 Planning Period between year 2031 and 2047 as defined by IGCEP

10. ALTERNATIVE VIEW ON PROJECT SCREENING

Projects are selected based on current development costs (updated costs as on December 31, 2020). Many projects are delayed due to comparison based on current costs. However due to delay, impact on cost has not been considered. It may be noted that some projects may entirely become unviable at the time of their proposed COD in IGCEP. It has been assumed in the IGCEP report that cost of solar and wind power projects will keep on decreasing during planning period, however no assumption has been made for other technologies.

For example, hydropower projects delayed till last couple of years (2045 onward) will become too expensive during delay period. Contrary to solar and wind power projects, cost of hydropower development is on increasing trend. It is therefore necessary to reconsider the selection keeping in view the optimal balance among different technologies. What if most the hydropower projects become unviable on proposed commission dates?

As costs of RE projects is decreasing with the passage of time, would not it be more prudent to urgently develop projects whose cost are increasing over time? In this way we can increase the generation capacity and avoid the imported fuel projects like RLNG and Coal. Later when RE is developed, these hydropower projects may prove reliable support to them as well. Tis way we can completely get rid of imported fuel projects in the long run.

11. OTHER OBSERVATIONS

In addition to above statements, following other points are important to be reported to Authority.

a) Names of Plants mentioned in "Capacity Additions" are different than those reported in "Generation Statistics". It is therefore difficult to compare the projects in different tables. Please use the standardized names for all plants in all scenarios and tables.

b) The relevant statistics should be available in editable format so anyone can analyze the data and provide valuable suggestions to improve it.

c) Methodology for updating costs by CPPA for hydropower should be disclosed in the report because it will enable the analysts to review the process and provide comments on it as well.

***** The End *****

Comments on IGCEP of NTDC

Submitted to

National Electric Power Regulatory Authority (NEPRA)

To be considered at the Hearing of Approval

Shahid Hassan Khan and Dr. Waqar Masood Khan
Interveners

Comments on IGCEP Report

Preliminary Observations

The Indicative Generation Capacity Expansion Plan (IGCEP) – 2047 is a commendable effort to meet a key statutory requirement under Section-32 of Regulation of Generation, Transmission and Distribution of Electric Power, Act 1997 (hereinafter called NEPRA Act 1997). The said section provides as follows:

> 32. Investment and power acquisition programmes. — (1) The Authority shall, within eighteen months from the commencement of this Act, prescribe procedures and standards for the Authority's prior approval of the transmission companies' and distribution companies' investment and power acquisition programmes.
> (2) Any procedures prescribed by the Authority under this section shall advance the goal of minimizing regulatory oversight of contracts entered into by the national grid company and distribution companies.
> (3) Any investment programme or power acquisition programme, approved by the Authority under this section shall take into account the national energy plans issued by the Federal Government.
> (4) Upon the Authority's approval of an investment programmes or a power acquisition programme, the Authority shall, subject to such terms and conditions, including rates and charges of electric power, permit the distribution company to enter into long term contracts for power purchases.

Evidently, this provision of the law stipulates prior approval of the investment and acquisition of power programs by the transmission and distribution companies **(sub-secton-1)**. The ostensible goal here is to minimize regulatory oversight of contracts that these companies would be entering into from the producers of power **(sub-section-2)**. It is also provided that the approved program would take into account the national energy plan issued by the Federal Government **(sub-section-3)**. Given an approved program by the authority (subject to specified terms and conditions including rates and charges of electric power, authority shall permit distribution companies to enter into long term contracts of power purchases **(sub-section-4)**. [There is no mention of transmission companies here]

In pursuance of Section-32(1), the Authority has not specified any procedures or standards that would guide the formulation of the program. However, while issuing the NTDC license, Article-16 has specified the requirement of formulating a Grid Code. This Code was issued with the approval of the Authority in 2005. The Grid Code specified the planning exercises as stipulated under Section-32 of the Act. In particular, the Planning Code (PC) gives elaborate guidelines for ensuring an efficient, stable and reliable transmission system. PC-4 then requires as follows:

> Each year, the NTDC shall prepare and deliver to NEPRA a Ten-Year "Indicative Generation Capacity and Expansion Plan (IGCEP)" covering 0-10 Year time frame. NTDC shall provide this IGCEP or NTDC Plan.
> The "Indicative General Capacity Expansion Plan" (NTDC Plan) shall identify new capacity requirements by capacity, location and commissioning date. This capacity expansion plan shall satisfy Loss of Load Probability criteria, load growth forecast, operative reserves requirements, and other capacity planning criteria. The plan shall be subject to review and approval by NEPRA.

Given the IGCEP, NTDC is required to prepare a Transmission System Expansion Plan based on the load forecast for twenty years and then prepare a detailed "Transmission Investment Plan" for information of NEPRA.

Observations

A number of observations are warranted about the regime that is evolved in pursuance of Section-32 and is currently applicable, which are as follows:

1. Admittedly, this is the first ever IGCEP submitted by NTDC for the approval of NTDC. This is a time period when phenomenal changes were occurring in the power sector, having major implications for the NTDC and for its expansion of system as well as investments. Measuring from this yardstick, the IGCEP is at least 20 years behind schedule. A statutory provision of law was violated for such a long time. What are the implications of such violation as far as major decisions taken in the past without the required statutory approval?

2. What are the implications for the sector once an approved IGCEP is in the field? Does it serve as an approved benchmark for the projects and their timelines over the next twenty years? This is an area which, as we would argue, lacks clarity for otherwise the sector would be struck by an uncertain state of play.
3. Assuming the answer to (2) above is in the affirmative, there would be serious issues of competence. Specific projects are approved at competent forums such as concerned boards, ECC and Cabinet, and NEPRA, being a regulatory body would play its statutory role in setting tariffs or other parameters requiring its approval, which has to be complied with.
4. Section-32(3) requires that "any investment plans or acquisition of power plans approved by the Authority under this section would take into consideration any national energy plan issued by the Federal Government". But there is no such plan acknowledged in IGCEP. If one takes the IGCEP as the plan, then the question would arise as to whether the Federal Government *has* approved IGCEP for submission to NEPRA for its approval? We fail to find any such approval mentioned in the IGCEP.
5. On the other hand, under section-32(1), the distribution companies are supposed to provide their own program but that is still missing.
6. There are major issues with respect to the optimality of proposed plan both on account of cost and timing of the projects with the result that the ostensible objectives of the plan would not be fulfilled.

In view of the above observations, it is clear that there are serious issues and concerns for the stakeholders who would be affected in the absence of a clear understanding of the IGCEP, its role in energy sector planning, the competence of the underlying propositions and the nature of approval that would be granted by NEPRA. If the approved plan means, e.g., a certain class of projects would come on line at a specified time on some specified locations, then such an ascertain would not be tenable as numerous projects, their timings and locations are not remotely certain on the horizon as these are mere assumptions and conjectures. By the same token, the Plan has displaced a large number of projects which are actively pursued at various approval forums on a different planning horizon than the one reflected

under the Plan. Such flagrant contradictions will have to be reconciled before the plan is accorded any sanctity in country's energy planning over the next two decades.

Analysis of IGCEP with respect to Its Objectives

1. Policy of Government to Promote Renewables:

The Government at highest level has been declaring its intent to promote and increase the share of renewable energy in generation mix. This is laudable objective in line with global approach. However, IGCEP seems to view only wind, solar and bagasse as renewable energy; it puts them under Variable Renewable Energy (VRE) head and keeps hydro projects of all sizes as a separate category.

By not recognizing hydro projects of as Renewable Energy (RE), hydropower has been displaced and sent to the bottom of the list of projects to be undertaken by 2047. This is a death knell for hydropower, as projects well into their development cycle just cannot wait 27 years! Government should not attack projects already under development under various power polices as this would create havoc and uncertainty.

Look up Google or any technical directory for definition of Renewable Energy. Hydropower, irrespective of size, is considered as Renewable Energy. In fact, hydropower is the original RE source and must be categorized as renewable. The following relevant news article related to categorization of hydropower as renewables in USA and India are relevant for immediate reference:

https://oilprice.com/Latest-Energy-News/World-News/Renewables-Overtake-Coal-In-US-In-Electricity-Generation.html (5th May 2020)

https://cleantechnica.com/2020/05/04/india-proposes-mandatory-procurement-of-hydro-electricity/ (4th May 2020)

2. Least Cost Generation:

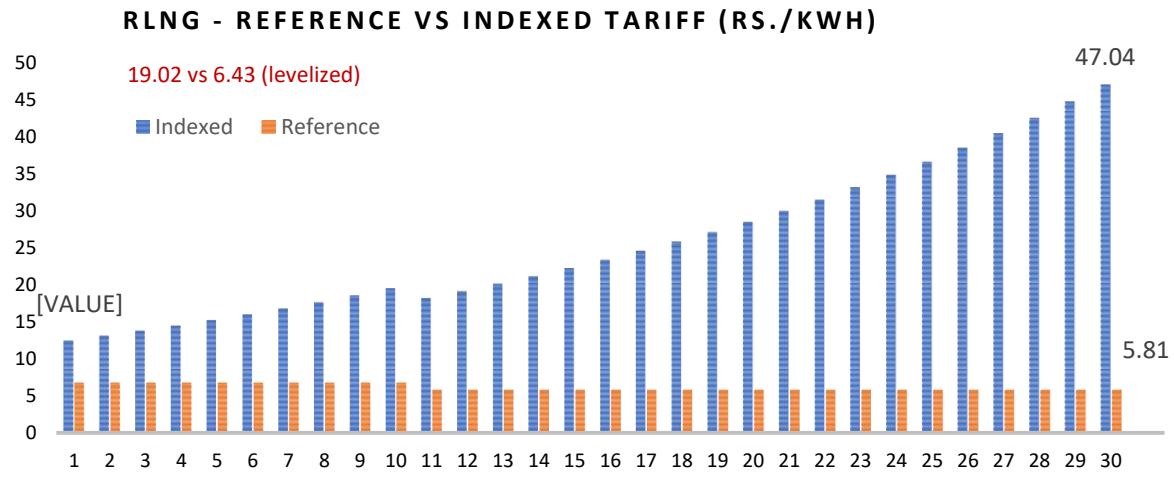
The IGECP states *"least cost generation planning is one of the most important elements of overall integrated plan of electricity sector"*. Once again, a laudable objective; but are we evaluating tariff in realistic manner?

Economic life of hydropower project, as stated in IGCEP, is assumed to be fifty (50) years, however, it is still not clear what costs are provided by the implementing agencies or whether the resultant tariffs have been adjusted for longer economic life as in most of the cases the costs and tariffs are computed for concession terms of twenty-five (25) to thirty (30) years, whereas generally all around the world hydropower civil structures have economic lives of around hundred (100) years and electro-mechanical equipment could be upgraded/dated at the intervals of thirty-fifty (30-50) years with minimal capital expenditure to make it good for another term.

3. Effect of Indexing Pak-rupee depreciation in Tariff Determination

More importantly, has IGECP software been modelled to consider PKR devaluation indexation assumptions against USD, as allowed in most tariffs based on imported fuels or prices against international parity prices, for the study horizon?

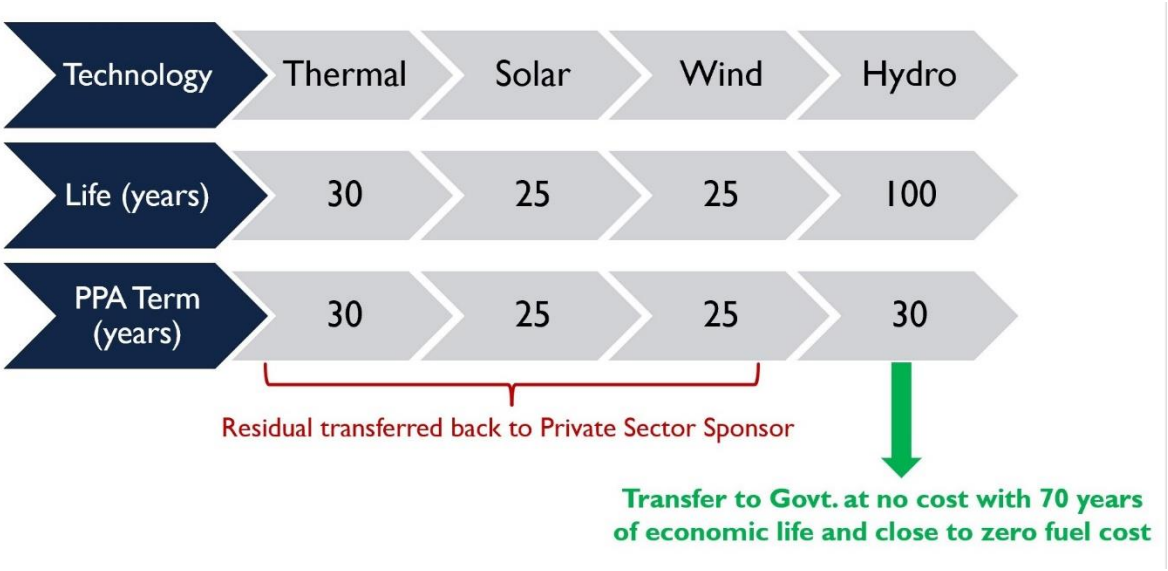
We are of the considered view that when tariff determinations are viewed without indexation they provide a highly misleading picture. The 25-30 years tariff table assumes no devaluation of PKR against USD, zero inflation etc. When the same tariff is indexed, on the basis of indexation allowed in tariff determination, based on last 30-50 years indices, we get a more realistic perspective. As an example, see a typical tariff determination plotted in graph below:



The un-indexed tariff in year one is Rs.6.76 per Kwh and in the year 30 it is Rs.5.81 per Kwh, having levelized tariff of Rs.6.43 per Kwh. However, when this determination is indexed the levelized tariff is Rs.19.02 per Kwh and year 30 tariff is Rs.47.04 per Kwh. This is based on conservative assumption of devaluation of 5%. The actual devaluation over past 30 years is 8.7%. If this is applied, we are looking at last year tariff of around Rs.127 per Kwh.

4. Planning Cycle of Projects

Another element which must be taken into consideration is lifecycle or useful economic life of specific generating technologies. It is important to consider productive economic life during planning and projects approval processes.



Thermal, wind and solar, all have economic lives of 25-30 years and corresponding PPA terms and are developed under BOO regime, while hydro projects have minimum life of almost 100 years and are processed under BOOT model; at the end of the 30 year PPA term, project is transferred to Government at no cost. The Government thus acquires an asset at no cost with almost 70 year of remaining economic life having negligible variable cost of generation.

Indigenous Technologies (Levelized/Indexed Rs. per KWh)

Source: Respective NEPRA Tariff (reference) Determinations, duly indexed for FX 5%, Pak-CPI 4.5% and US-CPI 1.5%

IGECP software must factor PKR/USD devaluation over PPA term and 100 years hydro life in order to arrive at realistic tariff comparison.

5. Excessive Allocation for VREs (36,253 MW):

A total of 25% (36,253 MW) of the new capacity addition has been planned from "Variable Renewable Energy" (VREs), constituting wind and solar. Out of this **20,332 MW** of solar and wind projects are **planned between 2023 and 2030**. *This is a highly aggressive target especially in view of the fact that these projects are included en-block without having any identification of sites, sponsors, feasibility studies or financing*.

It appears that an implicit strategy is being followed to ensure that neither solar/wind nor hydropower will fill the capacity gap up to 2030, leaving an opportunity for fast response thermal to meet the gap dragging Pakistan back into the old imported fuel thermal syndrome, as has been witnessed time and again in the past.

6. VREs and Expensive Open Cycle Gas Turbines (25,828)

While the generation cost of VREs are low and have been continuously decreasing but there effective cost in the guise of base-power has made VREs uneconomical. Since wind and solar do not provide constant power, the intermittency has been balanced in IGECP report by introducing 25,828 MW of highly expensive open cycle gas turbine (OCGT) plants based on imported LNG. IGCEP report itself states at various places as follows:

> *"In a bid to cater for the intermittent nature of REs and system's reserve requirements, 25, 828 MW of candidate OCGTs are selected by the tool; these OCGTs are selected to provide reserve requirements of the system but*

they are not readily despatched on normal operation, thus, remain almost at zero annual plant factor".

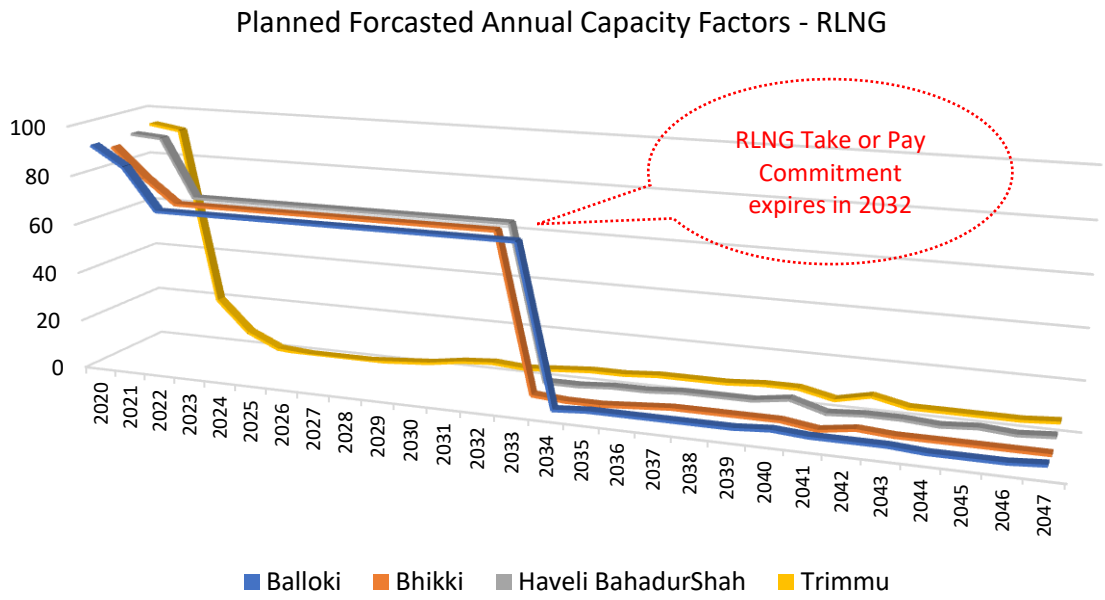
It is not a smart idea to invest huge foreign exchange in new capacity which shall stand underutilized as stated in the IGCEP.

The proposal of NTDC to use thermal Open Cycle plants for stability is most untenable. *When hydropower can provide services including frequency control, grid balancing, water storage, quick start and peaking; why not use hydro plants for stabilization*.

Why not use valuable indigenous resource hydropower projects that have approved sites, available finances, and strong sponsors? Pushing back those hydro projects for decades amounts to effectively killing the most important indigenous resource of the Country that would negate the stated objectives of IGCEP.

Another thing which can be done is to use the existing installed capacity of RLNG plants which will hardly be dispatched after Must Run condition expires in 2032? Table at Para 7.3 of IGCEP itself shows that after the year 2032 (i.e. when take-or-pay commitment for RLNG under Qatar deal expires) Bhikki, Baloki and Haveli BahadurShah annual planned (forecasted) capacity factors drop to 5%, while Trimmun capacity factor as planned and forecasted depicts that this plant was never required in the system as its capacity factor shown dropped to 1% from its forth year of operations and remain between 5%-8% for the majority part of its useful life.

Table at para 7.3 is reflected in form of graph below

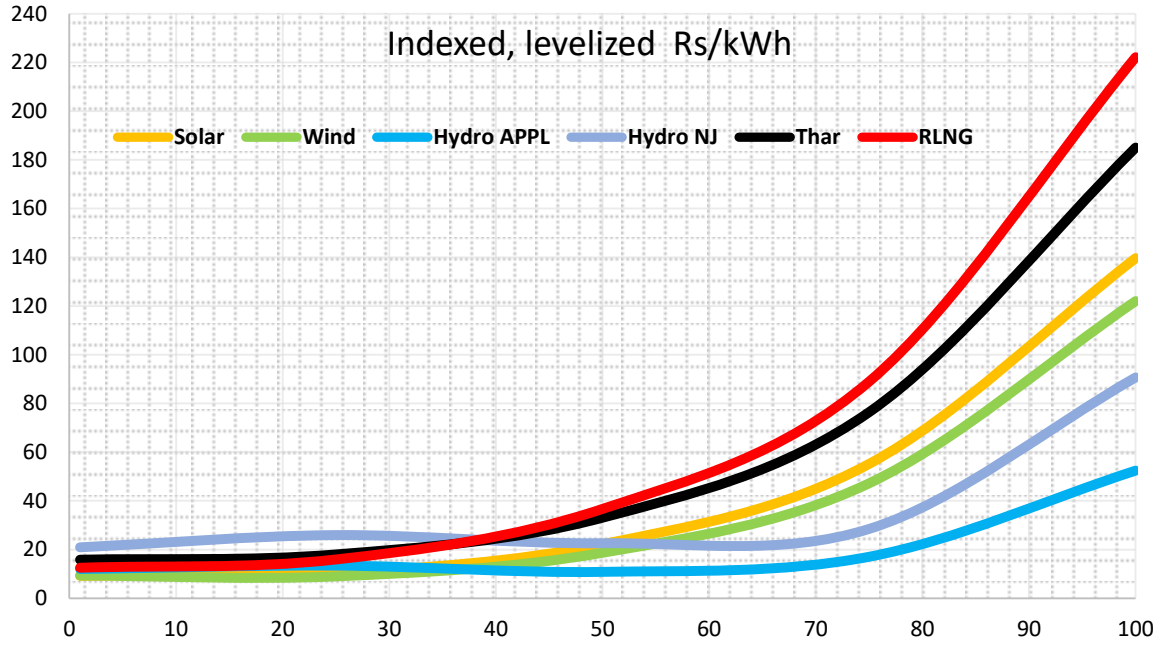


Will we ever be able to learn from the past mistakes? We have constructed these plants by investing billions of dollars and hardly using them. The electricity from these plants is so expensive that they are getting reasonable dispatch until 2032 ONLY because of "MUST Run" clause in PPA.

7. Heavy Reliance on Local Coal:

The world is moving away from Coal while we are planning as much as 33,000 MW of new generation capacity on local coal! Yes, we have local coal resources and we can utilize for our needs, but we should plan it to the extent that our future generations should not repent on our decisions. The following recent news article is relevant and interesting to note: https://reneweconomy.com.au/sweden-exits-coal-two-years-ahead-of-schedule-austria-closes-last-coal-plant-37319/ (dated 24 April 2020)

If least cost tariff is one of the main criteria of IGECP then the tariff should be properly indexed. The tariff determination as given by the Authority for Engro Power-Gen Thar project when indexed shows that it is the most expensive indigenous fuel option.



We should optimize our hydropower resources to the extent and as early as possible, any shortfall should be met through indigenous coal. While in IGCEP, it is the other way around. Most of the hydropower capacity under development and implementation (to be up and running in next 4-6 years) has been delayed for implementation till after 2040 or later while the entire decade of 2031-40 has been dedicated essentially to coal power projects.

8. Need to Allow for the Delays in Public Sector Hydropower Projects:

Work on Tarbela 5th extension, Dasu and Mohmand Dam has started, however it is yet to be seen if these projects can achieve commercial operations at the contracted timelines or become another example of mismanagement like Neelum Jhelum which reached COD after 5 years of delay (?).

Around 5,500MW under committed projects by year 2025 of such hydropower would require dedication by the governmental authorities (including timely availability of funds) to achieve the target. It has been seen in the past that with the change in political governments the priorities and decision making take a major shift without realizing the financial impact on the national exchequer.

9. Project costing and equalization, sanctity of data-set used:

Although it is stated in the assumptions, that the costs have been indexed till Dec-2019, however glaring differences can be observed. As an example, Rajdhani (132 MW) has been shown to plan COD in 2029, a project which has been stalled/cancelled and not yet advertised by the implementing agencies, cost of which must have been taken from the outdated decades old feasibility study which has no match to the projects having feasibility studies on the table (approved or in process) for example Mahl (639 MW planned for 2030), Athmuqam (452 MW planned for 2047) and Ashkot (300 MW planned for 2047). There is a need to rationalize data-set used for the purposes of analysis; equalization should be done for various stages of projects especially for hydropower which shall give different results than projected.

10. Why retain expensive old thermal plants:

In the demand supply analysis carried out in IGCEP, all old RFO plants are retained until their economic life equivalent to the respective PPA terms. This is a grave mistake. If we lock in our existing capacity, then we are locking ourselves into very expensive generation mix and leave no opening for entry of cheaper options to optimise the generation mix and lower the price of power.

Some may say abandoning thermal plants would cause huge upfront capacity payments (CPs). This is a misplaced concern. The average capacity cost of old plants range between Rs.2.0 - 3.5 per KWh. If we can get electricity at Rs.7-10 from renewable sources, and add the CPs of these closed plants, we are still better.

Retaining the existing highly toxic thermal portfolio of old 21,387 MW thermal plants is suicidal. The Energy Purchase Price (including variable cost) of most of the old thermal plants is between Rs.12 – 36 per KWh. We are better off by just paying the Capacity Charges and not despatching plants whose fuel and variable

O&M costs are more than Rs.20 per KWh. The Authority must direct NTDC to factor this important aspect in the IGECP.

11. Has mind been applied for the assumptions fed-in the software:

The software WASP/PLEXOS used by NTDC uses certain assumption and inputs and based on these inputs the software runs them through an optimization algorithm and produces a report. There is a general assumption built into this exercise that whichever project has been selected for any year, all activities to make such project implementable would be in place. Such prior activities would include financing, legal structuring, contracting, creating supply chain for fuel, obtaining regulatory approvals etc. The report/document thus generated by the software must be put through a "reality" check. This is where the team at NTDC has to apply its mind before signing off and taking it as final document.

One wonders if the authors of IGECP have taken into account the following:

1. A realistic assumption about availability of funding available for projects it has listed to be financed from national budget. Besides 5,533 MW of hydro (public) projects for which funding is "committed", an additional massive portfolio of 29,981 MW are planned to be undertaken as Public sector projects. At best of times the Budget can't spare financing of such large scale which will become more scares in future.
2. Is it realistic to assume that infrastructures needed for execution of coal and OCGT's projects will be in place – such as coal mines, RLNG contracts?
3. The IGECP report proposes almost 26,000 MW of plants which will remain idle most of the time as not only the dispatch of such plants highly uncertain but will have plant factor ranging between 1 to maximum of 20% . Will any investor put up a plant which is expected to be so low?
4. Has the report taken into consideration the time it will take for regulatory approvals? The process is time consuming and it will become even slower paced after the manner in which bureaucrats are being hauled by NAB and other agencies.

12. Post Corona world:

Post Corona world will be more inward looking. Each country's investment will be directed towards its own country. The Chief Global strategist of Morgan Stanley Investment in article published in NY times of May 5th 2020 writes that deglobulisation of finance is looking for inward investments : “investors once entranced by the prospect of making fortunes in emerging markets have been scaling back .... more than $90 billion pulled out of emerging stock markets”.

13. Issues with the Software:

The software is not aware of such ground realities. It is proposing that those investors who have started work on various projects under govt’s policies to wait for minimum of 20 years. This will not only kill the projects under development but will send highly negative signal to new investors. Will any investor in their right mind invest in Pakistan when they see such inconsistency in its policies? They will apprehend that their investment may face the same ordeal as in the past.

14. Submissions and Prayers:

- Hydropower is the original renewable energy source and should be categorized as Renewable Energy. RE must be redefined as wind, solar, bagasse & hydropower (all sizes).
- Rather than create conflict between wind, solar, bagasse and large hydro there is a need to re-categorize large hydro as a renewable. This re-categorization would ensure that one renewable energy resource is not developed at the cost of another.
- Revised targets should be developed allowing maximum push for each technology, minimizing risk of missing targets, if one category slips.
- IGCEP’s wrong classification of hydropower as an expensive generation option on the basis of construction cost alone, without considering lifecycle cost and duly indexed fuel cost of thermal based on assumptions provided in NEPRA tariff determinations, needs to be corrected to work out the real cost

of power. IGCEP's classification of hydropower as an expensive generation option only on basis of construction cost, without considering lifecycle cost and fuel cost of thermal, must be corrected

- Large hydropower requires massive resources, investment and more than 10 year development period. Development works should not be interrupted as it not only increases project costs but send highly negative signal to investors. Hydropower projects, with feasibilities studies, identified sites, land and qualified investors, being implemented by Federal bodies, Provincial governments or private investors should not be delayed or held back and COD dates as given in first draft of IGECP 2040 be restored.

NEELUM GREEN ENERGY (Pvt.) Ltd.

May 12, 2020

To:

Chairman
NEPRA
Islamabad

Dy No. 3117
Date: 15-05-2020

Subject: **Comments submitted regarding IGCEP 2047**

Dear Sir

In light of NEPRA's request to submit comments with reference to the recently uploaded IGCEP (Indicative Generation Capacity Expansion Plan) report 2047 by NTDC, we as stakeholder would like to highlight following very important facts for your consideration:

First I would like to brief you in short about ourselves, our project and the milestones which have been achieved so far.

I represent a company named Neelum Green Energy Pvt. Ltd and have a project named Luat Hydropower project which is located in Luat, Neelum Valley AJK and has the capacity of producing 49MW. The PPC (Private Power Cell AJK) back in October 2015 advertised this project in national and international newspapers seeking private sector investors to bid for it. Due to the fact of being overseas Pakistani myself and always driven by the passion to do something good and long lasting for myhome country, I was convinced that an investment in the power sector would definitely proof to be a worth it as it would ensure transfer of funds from abroad to Pakistan as well as encourage many other Pakistanis abroad to seek investment back in Pakistan as well.

Since having participated in the bidding process and being awarded the project, our company has achieved a number of milestones which include:

1. Environmental NOC issued by EPA, AJK
2. Grid interconnection study which has been approved by NTDC
3. Finalisation of EPC contractor after carrying out ICB by the company
4. Arrangements for financing of the project
5. Land acquisition through local government via implementation of sector 4.
6. Performance guarantee for $245,000 submitted with PPC

I would herby like to draw your attention towards the fact that not a single above mentioned milestone was delayed from our end which means that various measures including (transferring funds from abroad) were assured in order to ensure the financing of all costs occurred until date which are in excess of PKR 220 million.

Now we would like to draw your attention towards the reasons why I/we believe that Hydropower is the way forward for Pakistan and not fossil fuel or coal plants.

Office # 7, MB City Mall Plaza, I-8 Markaz, Islamabad, Ph: 051-4861790, e-mail: info.nge@gmail.com

a. Various international surveys have proven the fact that Hydropower is the most efficient way to generate electricity. Modern hydro turbines can convert as much as 90% of the available energy into electricity whereas fossil fuel plants are only 50% efficient.
b. Another advantage which comes with hydropower projects is the fact that it's energy is renewable
c. Hydropower projects do not pollute compared to all other forms of producing electricity.
d. Hydro electricity is the most reliable form of electricity available
e. Other benefits include flexible energy generation and storage
f. Reducing dependency on fossil fuels as fuel prices are expected to rise sharp in near future
g. Benefits for local community include flood protection and water supply for domestic and commercial use
h. Employment opportunities for locals

Keeping above mentioned facts in mind, we fail to understand how NTDC in its IGCEP report has not given hydro power projects the importance it should have been given. Many countries have accepted the fact that hydropower is the only renewable source of energy that can replace fossil fuel electricity production while satisfying growing energy needs. The case study of China's energy paradigm is best proof of how nations have been emphasizing on the need of establishing hydro power units. Still the report submitted by NTDC seems to suggest otherwise. **Another very important factor why countries such as China have shifted towards hydroelectricity is the fact of having the capacity of satisfying the need of energy with energy sources within its borders**!

With respect to hydropower projects included in the early years by IGCEP, we would like to draw your attention towards the fact that all projects are public sector projects that are to be planned and implemented by WAPDA. **History has proven the fact that projects conducted by WAPDA have been implemented at a much higher cost then initially estimated**. Also have we yet to see any single project planned and implemented by WAPDA which has been on time; meaning anticipating various inflows of electricity into the national grid are all of very speculative nature.

Also would I like to draw your attention towards a specific project named Balkani HPP having a capacity of 8MW. In a letter issued by PPIB back on 7th November 2019 the mentioned project was listed in category IV for which it was stated "that projects in category IV are at initial stages and shall be processed for issuance for TLOS as per revised/approved IGCEP by NEPRA using new software procured by NTDC". In comparison, our project named LUAT having a capacity of 49MW was listed in category V for which the PPIB letter stated "category V projects shall be processed as per IGCEP approved by NEPRA". **We fail to understand how a project which, a couple of months ago, was at a much earlier stage then ours (as admitted by PPIB)has now been given the priority and been listed in IGCEP as a project to be concluded by 2025?**No obvious reason seems to justify the preference that project received compared to ours.

I would like to conclude my statement by asking all stakeholders the following questions:

- Was it a crime as overseas Pakistani to seek investment back in Pakistan; especially in a project which assured us completion within a certain time frame?
- After being awarded a LOS by the PPC in accordance with rules in place, how can NTDC now delay our project by another 26 years when it already has been delayed?
- Who will compensate me for the money and time which has so far been invested in this project?
- How does NTDC justify the feasibility of any hydro power project which will be allowed to operate after 31 years since obtaining the LOS?
- What message will this case study convey to other overseas Pakistani who like myself were looking at options of investing in their home nation as well?

In conclusion I would therefore urge you again to look into the IGCEP conducted by NTDC on urgent basis and kindly assure necessary steps are taken to have it revised in order for us to complete our project at the earliest possible and play my part in assuring cheaper and more environment friendly energy is produced in the interest of the public and State of Pakistan.

Best regards,

Mohsin Bilal Khan
CEO
Neelum Green Energy Pvt Ltd

PAKISTAN ATOMIC ENERGY COMMISSION
P. O. Box No. 1114
ISLAMABAD

MUHAMMAD SALEEM ULLAH
Director
Applied Systems Analysis Division

Phone: 051-9321331
Fax: 051-9321283
Cell: 0301-5555761
E-mail: asaditc@paec.gov.pk

No. ASAD-4(10)/2020/259 Dated: 05-06-2020

Subject:- **Indicative Generation Capacity Expansion Plan 2047 (IGCEP) submitted by National Transmission and Despatch Company Limited.**

Ref: No. NEPRA/ADG(Lic)/LAT-01/11451-501, dated: 28 April 2020

Pakistan Atomic Energy Commission has reviewed the subject plan and is pleased to submit following comments:

i. The model used for IGECP has not taken any candidate nuclear power plant in the plan (page 102-103) probably due to least cost, technical and other constraints. NTDC is requested to include M-1/M-2 as committed NPPs that are at the planning stage. NTDC has already included C-5 as committed NPP.

ii. Nuclear Steam PP on Uranium as new generation option has been assumed as single unit of 2,290 MW capacity. There should be an option of unit size 1145 MW in the modeling software (page 80, page 86).

iii. C1-C4 have annual capacity factor of 79% while for state-of-the-art K-2/ K-3, C-5 and future candidate NPPs, capacity factor of 78% has been assumed which may be taken as 85% (page 316).

iv. The electricity demand in scenarios with EV/NPHS and without EV/NPHS (normal demand scenario) have only difference in 2019-20 while demand is the same afterward (pages xxiv, xxv). Both the scenarios should have different demand in medium to long-term perspective.

v. The fuel prices for future years have been escalated as per index of the Energy Information Authority (EIA) Annual Energy Outlook 2019 (except for Thar coal where regulated mining price index was applied to reduce by 31% by 2047). This makes a strong case for the inclusion of local coal based capacity to serve the base load of the system. However, keeping in view global warming issues, it may be difficult to install large capacities on Thar coal fired power plants. It is proposed to include one more scenario with constrained coal capacity.

With best regards

Yours sincerely,

(Muhammad Saleem Ullah)

REGISTRAR

Mr. Hafeez Ullah Khan,
Deputy Registrar, NEPRA
NEPRA Tower, Attaturk Avenue (East), G-5/1,
Islamabad.

Copy to: Engr. Salis Usman, GM (Power System Planning), NTDC

COMMENTS ON IGCEP 2047

BY

PAKHTUNKHWA ENERGY DEVELOPMENT ORGANIZATION (PEDO)

1. Preamble/background

1.1 After the first issuance of IGCEP Plan 2018-2040 by NTDC in Feb: 2019, Energy & Power Deptt: and PEDO management conducted number of meetings with the NTDC management in Lahore, Islamabad and Peshawar for including PEDO projects in the IGCEP. PEDO provided complete Data as per the prescribed formats, which was duly acknowledged in the meeting with NTDC officials held at the office of PEDO in Nov: 2019.

1.2 The IGCEP forecasts additional system capacity of **127,760 MW** (candidate projects) by 2047 out of which **KPK share of hydropower** is only **5,652 MWs**. Whereas, PEDO had proposed share of 8,562 MWs constituting 6.71% of the planned generation capacity (See Annex "A).

1.3 Total system addition proposed by **IGECP during 2020 – 2030,** the period which is most relevant to us, is **30,685 MW, out of which ONLY 171 MW (0.56%) has been selected by IGECP as share of KPK**.

1.4 Certain major discrepancies have been observed in the IGCEP 2047. Surprisingly, the on-going projects of PEDO are wrongly classified, whereby, PEDO's public sector projects are being treated as private sector projects and except few, most of them are planned to be setup after 2040.

1.5 Some projects of PEDO are referred to as WAPDA and PPIB projects which clearly show that NTDC has used the previous information per the old report disregarding all understandings/decisions taken during our joint meetings. Public sector projects have been termed 'private sector projects' which need to be corrected and placed in public sector list of committed projects. The COD mentioned by PEDO for its planned projects, as communicated to NTDC should have been taken into account.

1.6 The private projects for which Feasibility Studies have been completed, sponsors identified, are mostly G-to-G projects are not included as Committed projects. All these projects are shown as candidate projects beyond 2045.

1.7 IGCEP 2047 completely ignores current status of the KPK projects under development on which PEDO has spent millions of dollars on feasibility studies etc., (approximately USD 33 million till date; (Annexure "B") and have identified the sponsors and are in various stages of development in terms of issuance of LOI/LOS, but have been pushed back after 2045 without any rationale. This seriously negates the efforts of PEDO over the last many years and will have

serious negative consequences in terms of PEDO's credibility before the sponsors in particular large sized government owned companies of China who have been working along with PEDO to develop large hydropower projects on a G-to-G basis and efforts are being made on both sides of the governments for inclusion of such projects as part of CPEC.

1.8 While the IGCEP does not discuss the detailed reasons for such late selection or non-selection of hydropower projects, it only refers to supposedly higher capital costs of the hydropower projects as the main reason for their non-selection.

1.9 IGCEP plans to retain all old RFO plants until end of their economic life / PPA term without giving due consideration of their unaffordable tariffs which is one of the major reasons for circular debt as well. Moreover, this approach shall not allow exploitation of other cheaper options to optimize the generation mix and lower generation cost. Following are some very important points to be considered:

(a) Data from Senate Report on Circular Debt shows that average Capacity Payment cost of old RFO plants range between Rs.2.0 - 3.5/Kwh. The Energy Purchase Price, as reflected in Merit Order list published each month by NTDC, shows that 73 thermal plants have Energy Cost of between Rs.18 to Rs 33/Kwh.

(b) Retaining the existing highly toxic thermal portfolio of old 21,387 MW thermal plants is suicidal. It is more expedient and viable to pay the Capacity Charges and not dispatch these plants whose fuel & variable O&M cost is more than Rs. 18/kWh and instead induct cheaper renewable energy.

The gov't itself is thinking of retiring expensive RFO plants earlier than time indicated in IGECP. The Authority must direct NTDC to factor this important aspect about system capacity in IGECP report.

1.10 We have reviewed the IGCEP 2047 and are of the considered view that the report does not take into account certain fundamental aspects, including policy, technical and economics, of hydropower projects. This has led to the model to erroneously propose wide scale non-selection of viable and cost-effective hydropower. The following sections provide detailed comments.

2. Section 1 Hydropower's Superior Technical and Economic Parameters

2.1 Hydropower is a highly efficient, reliable and long lasting source of power generation. The economic life of a hydropower project can be more than 100 years, which none of the other technologies can match.

2.2 Hydropower projects are efficient means of providing ancillary services to the grid including frequency support, black startup, voltage support and reactive power support.

2.3 In view of quick start and rapid ramping rates, hydropower projects can alleviate any intermittency issues created by Variable Renewable Energy (VRE) power generation sources.

2.4 Given the long life of a hydropower projects, their life cycle costs are significantly lower than other technologies.

2.5 Hydropower projects have higher economic value for the country due to significant material and manpower sourcing from the national economy for its civil works and support to local economies (which are normally under-developed areas).

2.6 IGCEP's model has failed to capture the underlying technical and economic value of hydropower and uses only financial numbers with distortions. Hence the model fails identify hydropower projects as lower cost addition to the grid.

2.7 The IGCEP model used 50 years as useful life of a hydropower project. It should be 100 years.

2.8 Since private hydropower projects are BOOT project, they are transferred to provincial governments after 30 years. Consequently, any dollar indexation of foreign O&M or equity returns cease after 30 years. The model should, therefore, not use any dollar indexed values after 30 years to capture the annualized costs of hydropower project.

2.9 Hydro projects are transferred to gov't after 30 year PPA term at no cost; they still have minimum of 70 year remaining life economic life with almost zero fuel cost – this aspect must be considered while determining the least cost tariff.

2.10 The notion of 'least cost option' should be evaluated keeping in view both the Capex as well as the operational costs over the life of the projects, and after factoring applicable PKR/USD devaluation indexation on a yearly basis.

2.11 *The annualized costs over 100 years of life and no dollar indexation after 30 years, makes hydropower costs lower than other technologies. While determining the least cost generation the projects of coal, OCGT, solar and wind the tariff must be indexed on annual basis to factor dollar/PKR depreciation and evaluated on life cycle basis. Once such criterion is adopted, hydropower turns out to be the least cost generation option.*

3. Section – 2 - Implementation of IGCEP on Ground

3.1 **Reality check needed**: PLEXOS, the software used by NTDC, uses certain inputs and runs them through an optimization algorithm and brings out an output. There is a general assumption built into this exercise that whichever project would be selected for any year, all activities to make such project implementable would be in place. Such prior activities would include financing, legal structuring, contracting, creating supply chain for fuel, obtaining regulatory approvals etc.

*In view thereof, it becomes imperative that the output generated by the software must go through a **"sanity"** or **"reality" check**, which should answer the following questions (not exhaustive):*

(a) Would such financing, in quantum and technology linked, be available in such years? e.g., international lenders are now reluctant to fund coal and thermal projects due to environmental hazards. Can gov't budget afford financing of 29,533 MW of hydro projects?

(b) Would the supply chain be in a position in a particular year to support the operation of a project e.g. readiness of coal mines for local coal projects or RLNG contracts etc.?

(c) Is the specific plant factor being proposed for a project feasible given the investment involved and the returns expected by the investors or the public sector? Or alternatively would there be any investor to put up plant whose plant factor is supposed to low while he might be competing in the market?

(d) Does the principle of "Least Cost" generation of the proposed plan, which has OCGT's operating at very low plant factors, inclusion of mining cost & price of Thar coal indexed in US dollars, lead to lowest energy cost?

3.2 Based on our detailed analysis given below, the answers to the above questions are in negative.

Specific observations / comments are noteworthy:

3.2.1 ***Massive induction of OCGTs – VREs come at very high cost***

The plan proposes huge induction of **25,828 MWs** through Open Cycle Gas Turbines (OCGTs) to mitigate the effects of the intermittency of a large share of Variable Renewal Energy (VRE) proposed by the model. The plant factor shown by the model for such technology falls below 20% and keeps on decreasing until its reach 1% around 2047. This plan seems extremely unlikely to be implemented for the following reasons:

(i) It is highly unlikely that the investors would put on billions of dollars for an investment whose returns are highly uncertain and whose energy generation is low.

(ii) IGCEP proposes RLNG as fuel for such Open Cycle Gas Turbines. The maintenance of fuel supply chain becomes very expensive for such projects whose dispatch is uncertain and low.

(iii) The operational costs and the plant factor has been completely ignored which makes these projects completely unviable as the proposed OGTCs have extremely low plant factor for which there is no committed dispatch. The costing used by IGCEP for these plants do not reflect the actual cost of such energy projects.

3.2.2 Heavy reliance on coal – 32,967 MWs

IGCEP proposes large development of local coal projects. It is commendable to switch to local sources but it is also necessary to take into consideration of availability and ancillary requirements. Three aspects have perhaps been over looked while including such a large MWs of Thar coal power plants:

(i) If least cost tariff is one of the main criteria of IGECP than the tariff should be properly indexed after taking into account all the operational costs. As for instance, the tariff determination recently given by NEPRA for Engro Powergen Thar project when indexed is the most expensive indigenous fuel option as **Thar coal price is linked with USD dollar**. All the advantages of Thar coal being indigenous coal are lost when the coal price has to be paid in US dollar terms.

(ii) The cost of mining (which is part of the project costs) also needs to be factored while determining the Thar coal electricity tariff.

(iii) The availability of water required for cooling turbines and huge ash disposal arrangements are other major challenges which appear to be have been completely ignored.

3.2.3 Highly ambitious/unrealistic VRE targets – 36,253MWs

25% (36,253 MW) of the new capacity addition has been planned from Variable Renewable Energy (VREs), constituting wind and solar. Out of the above aggregate 20,332 MW of solar and wind projects planned between 2023 and 2030. The proposed projects are basically ghost projects with no site, sponsor, feasibility or financing. In last ten years only 400 MW of solar and approximately [1000MWs] wind power plants. Now GOP plans to set up 2500MWs of solar and wind each year. This is extremely unrealistic target.

3.2.4 *Adhoc/arbitrary block provisions*

There is systematic inclusion/exclusion of one technology over another. No new hydro capacity is visualized from 2031 till 2040.

Projects with no site identifications/feasibility studies and sponsors are planned and given priority over KPK hydropower projects which are ready for implementation with their feasibility studies completed. The investors and Government of KP ready to approach international and local lenders for financing. A prudent approach would be to bring such projects into the time frame of 2020-30 so that the uncertainty over implementation of the projects is reduced and risks of supply-demand gap are mitigated.

4. Section – 3 - Policy Input into IGCEP

4.1 IGCEP's wrong classification of hydropower as an expensive generation option on the basis of construction cost alone, without considering lifecycle cost and duly indexed fuel cost of thermal based on assumptions provided in NEPRA tariff determinations, needs to be corrected to work out the real cost of power.

4.2 While the Draft RE Policy does not deal with hydropower, NEPRA must take into account the renewable nature of hydropower in its evaluation of IGCEP.

4.3 IGCEP takes the targets of VREs given in the draft Renewable Energy Policy (the Draft RE Policy) as sacrosanct. It does not afford such treatment to the targets and approvals given to the hydropower projects under federal and provincial power policies.

4.4 As per the constitutional arrangements, whereby, the federal and provincial power policies have been introduced and the projects are being developed thereunder, NTDC is required to align its plan so as to ensure that there are no violations and or the objectives set out in the said policies are negated.

4.5 The projects initiated by PEDO under G-to-G basis and planned to be part of CPEC, for which initial discussions/presentations have already been made, must be considered for development/commissioning up to 2030.

4.6 Under relevant federal and provincial power policies, private investors have invested substantial time and money on completion of Feasibility Studies for various hydropower projects. Similarly the Government of KP has also invested large sums on feasibility studies. IGCEP has ignored the status of such projects and have binned them mostly into a time slot post 2040. This treatment of approved hydropower projects is against the policy aspirations and targets. IGCEP should be meant for future projects that need to be brought in and not to second guess existing commitments of the investors and the provincial governments under relevant policies.

4.7 It is recommended that hydropower targets set by federal and provincial governments, either explicitly or implicitly through issuance of relevant Letters of Intent (LOI) must be made binding for inclusion in the IGCEP as per their proposed regulatory timelines.

4.8 The hydropower projects, private or public, which have completed feasibility studies must be given the status of "committed" projects in the IGCEP, instead of being candidate projects, and the IGCEP should be updated accordingly.

4.9 Projects, with feasibilities, sites, land and investors, being implemented by Federal bodies, Provincial governments or private investors should not be delayed / held back.

4.10 **The 6,873 MW projects being developed by PEDO (KPK) should be made part of the IGECP plan to be developed by 2033. The list of the projects showing the expected CODs is attached as a table at** Annex "C"

ANNEX "A"

	Total System Addition (candidate projects) Proposed by IGCEP	Planned Hydro Capacity Proposed by GOKP	Percentage of Hydro Proposed by GOKP	GOKP Hydro Selected by IGCEP	Percentage of GOKP Hydro Selected by IGCEP
	A	B	B/A	C	C/A
	MW	MW		MW	
2020-30	30,685	5,652	18.42%	171	0.56%
2031-47	97,075	2,910	3.00%	5481	5.65%
TOTAL	**127,760**	**8,562**	**6.70%**	**5,652**	**4.42%**

Remarks

1 Data for Column C has been taken from Table 7-5 of the IGCEP Report

2 During 2020-30, the hydropower capacity proposed by GOKP can be easily accommodated since IGCEP has proposed large addition of Open Cycle Gas Turbine (4.868 MW) that is highly unlikely to be realized. Similarly, a substantial portion of 12,000 MW of Solar Power Projects may not happen.

3 During 2031-47, the projects proposed by GOKP can easily be incorporated by reducing the share of Open Cycle Gas Turbines (20,960 MW)

Annex "B"

Funds spent by PEDO on Feasibility Studies

Sr. No.	Name of Project	Potential (MW)	Location/District	Cost of FS (Mill: PKR)	Cost of FS (Mill: US$)
1	Gahrit-Swir Lasht HPP	377	Chitral	291.72	3.01
2	Toren More Kari	350	Chitral	492.61	5.08
3	Jamshill More Lasht	260			
4	Laspur Miragram	230	Chitral	408.13	4.21
5	Shigo Kach HPP	102	Dir	283.98	2.93
6	Barikot Patrak HPP	47			
7	Patrak Shringal HPP	22			
8	Nandihar HPP	12.3	Shangala	90.10	0.93
9	Ghor Band HPP	20.8	Batagram		
10	Naran HPP	188	Mansehra	338.66	3.49
11	Batakundi	105			
12	Arkari Gol HPP	99	Chitral	213.40	2.20
13	Istaro-Booni HPP	72	Chitral	172.00	1.77
14	Mujigram Shaghore HPP	64	Chitral	146.73	1.51
15	Balakot HPP	300	Mansehra	259.22	2.67
16	Kari Mashkor HPP	495	Chitral	290.00	2.99
17	Gabral Kalam HPP	88	Swat	204.00	2.10
	Total:	**2832**		**3,190.54**	**32.89**

Note:

1 USD = PKR 97

Conversion rate is taken as of 2012 when contracts of FS were awarded.

Annex "C"

List of KPK Hydro projects with Yearwise CODs

	2028	MW
1	Balakot HPP	300
2	Gabral Kalam HPP	88
3	Kalam Asrit HPP	212
4	Naran HPP	188
5	Sharmai HPP	150
6	Batakundi HPP	96
7	Artistic-I HPP	63
8	Shalfalam HPP	60
9	Bankhwar HPP	36
		1193

	2029	MW
1	Dander HPP	56
2	Dubair Kalay HPP	66
3	Nerai-Dubair HPP	46
4	Kalkot Barikot Patrak HPP	47
5	Patrak Sheringal HPP	22
6	Chapri Charkhel HPP	10.56
7	Asrit Kedam HPP	215
8	Shigo Kas HPP	102
9	Gabral Utror HPP	89
10	Chowkel Khwar HPP	60
11	Artistic-II HPP	55
12	Nila Da Katha HPP	34
13	Trappi HPP	32
14	Tangar HPP	26
15	Dhadar HPP	18
16	Mahandri HPP	10
17	Daral Khwar-II	9.5
18	Balkani HPP	7.75
19	Madian HPP	157
		1062.81

	2030	MW
1	Lower Spatgah	496
2	Jamshill-Toren More-Kari HPP	610
3	Laspur-Murigram HPP	231
4	Shushgai Zhendoli HPP	138
5	Shogo Sin HPP	137
6	Arkari Gol HPP	99
7	Mastuj HPP	48
8	Barum Gol HPP	39
		1798

	2031	MW
1	Kari Mashkur HPP	446
2	Ghorband HPP	20.6
3	Gwaldai HPP	20.4
4	Nandihar HPP	12.3
5	Nandihar-II HPP	10.97
6	Serai Sin HPP	6.8
7	Jabri Bedar HPP	3.6
8	Lower Palas HPP	665
9	Sarral-Dhartian	9.2
		1194.87

	2032	MW
1	Middle Palas HPP	398
2	Upper Palas HPP	157
3	Istaro-Booni HPP	72
4	Torkhow HPP	70
5	Khal (Javed-V) HPP	65
6	Mujigram-Shagore HPP	64
7	Gahrit-Swir Lasht HPP	377
		1203

	2033	MW
1	Balakot-2 (Javed II) HPP	100
2	Garhi Habibullah (Javed-III) HPP	100
3	Pashot HPP	60
4	Chota Jabba HPP	51
5	Mahodand (Javed-IV) HPP	45
6	Wari HPP	43
7	Sakhra-II HPP	8.5
8	Sakhra-I HPP	8
9	Bhimbal Katha HPP	7.86
		423.36

No. PPDB/MD/ 195 /2020

PUNJAB POWER DEVELOPMENT BOARD

ENERGY DEPARTMENT

Irrigation Secretariat,
Old Anarkali, Lahore
(Ph: 042-99213879 Fax: 042-99213885)

Date: 11 / 05 / 2020

The Registrar,
National Electric Power Regulatory Authority (NEPRA),
NEPRA Tower, Attaturk Avenue, G-5/1,
Islamabad

Subject: **INDICATIVE GENERATION CAPACITY EXPANSION PLAN (IGCEP) 2047 SUBMITTED BY NATIONAL TRANSMISSION AND DISPATCH COMPANY LIMITED (NTDCL)**

This is with reference to your office letter No. NEPRA/ADG(Lic)/LAT-01/11451-501 dated April 28, 2020 seeking comments on the subject cited IGCEP 2047 submitted by NTDCL.

2. In this regard, the comments have been prepared and are submitted for consideration please.

Regards,

MANAGING DIRECTOR
PUNJAB POWER DEVELOPMENT BOARD

Encl: As Above

REGISTRAR
Dy. No. 6837
Dated: 14-05-20

Dir			
Dy. Dir	I	II	III
AD	I	II	III
TA	E/S	O/A-I	A/A-II

C.C:

1. PSO to the Chairman PPDB Board / Additional Chief Secretary, Government of the Punjab, Energy Department, Lahore
2. PS to the Secretary, Government of the Punjab, Energy Department, Lahore

COMMENTS

INDICATIVE GENERATION CAPACITY EXPANSION PLAN (IGCEP-2047)

General:

1. The executive summary indicates that 3 scenarios of long-term forecast are prepared for low, normal and high GDP growth of 4.5%, 5.5% and 6.5% respectively by enhancing the peak demand from 27,128 MW to 103,065 MW for fiscal years 2019 to 2047. This forecasted value of demand is at variance to that of declined actual demand during the FY 2018-19 mainly due to flight of industrial load from the network which needs to be considered, as indicated in NTDC's IGCEP 2018-19 Case Study report.

2. The forecasts assume almost 5% annual increase in electricity consumption. Pakistan's sustainable GDP growth according to ADB / World Bank is forecasted below 3.8% and also indicated related to services head, which are not as energy intensive as industry, which may be considered.

3. An important aspect for addition of Captive Power Plants (CPP) / Net Metering by residential, commercial, agriculture and industrial consumers including Solar PV Panels, DG Sets, Solar Tube wells etc are not accounted for in this report and this will surely have an impact on short term, medium term and the long run planning as envisaged in this report.

4. Section 2.8 of the executive summary indicates that IGCEP will provide basis for expansion of transmission network whereas, the draft National Electricity Policy 2020 at Section 5.8.4 provides:

> *"All future procurement of electricity will be in accordance with IGCEP and TSEP, pursuant to applicable policy / framework and regulatory stipulations".*

Further, Section 5.8.3 of the draft National Electricity Policy 2020 provides:

> *"The regulator, while approving the IGCEP, shall also consider relevant transmission cost for the candidate power plant(s). The criteria for inclusion of transmission cost shall be incorporated in the regulatory framework."*

This provision indicates that the project financial viability will be based upon the project cost and its associated transmission network to the load center. NEPRA / NTDC may ascertain that the project has considered such a provision so that the end consumer affordability should be considered (if already not undertaken) and there should be no escape of consumers from the national network due to enhanced tariff.

5. The IGCEP Report (the "Report") is silent about the proximity of projects to load centre and end consumer tariff which should be basic parameters of such planning.

6. The Report indicates its revision and resubmission annually by April of every year. In the event of any deviation from the selected and under process projects, what road map is required to be adopted? Such a variation of revised IGCEP will also have a corresponding effect on TSEP.

7. It is apprehended that input data of certain projects (thermal & hydro) provided by the stakeholders is without the conduct of bankable Feasibility Study. NEPRA may verify the prices,

capacity, plant factor and location of the projects to achieve the implementable least cost project selection.

Hydropower:

8. Table 6.5 of IGCEP 2047 indicates the input data to "PLEXOS". This input data regarding Punjab Power Development Board/GoPb (PPDB's) 28 number projects been compared to that of input data submitted by PPDB on the format provided by NTDC. There seems to be **typographical/punching errors** or mistake in the input to the program in the area of Plant Factor, annual Energy Generated. Further, the COD provided to NTDC by PPDB has also been changed. NEPRA / NTDC may be requested to verify the input data as the said deviations have been marked as Annex-A to these comments.

9. PPIB Board's decision during its 125th Meeting held on 29.08.2019 indicates that the projects given at Annex-B will be declared as committed projects. These committed projects as decided by the PPIB Board may be corrected accordingly.

10. 135 MW Taunsa Hydropower Project is an advance stage project of GoPb. It is worth mentioning that 135 MW Taunsa Hydropower Project is a solicited project, surprisingly in this report the plant factor has been **changed** from **55% to 40%** and Energy Generation from **650 GWh to 468 GWh**, thus justification of the project has been dragged from 2024 to 2047 against the provision of NTDC's letter No.GMPSP/CEG&LF/MGPO&LF/463/119-22 dated 06.01.2020 (Annex-C). In which it is stated that 135MW Taunsa Hydropower Project is included in the IGCEP 2018-2040. On the basis of inclusion of Taunsa Hydropower Project in IGCEP, PPDB has already initiated the process of International Competitive Bidding under the NEPRA's Regulation CBTR-2017. Under the requirements of CBTR-2017 the pre-qualification of Sponsors has been carried out and RFP has been submitted to NEPRA for its approval. Dragging the COD from 2024 to 2047 with subsequent revisions of IGCEP, the progress made for development of the project will jeopardize. The data used for Taunsa Hydropower should be corrected and its COD date may be revised in reference to IGCEP 2018-40 report duly considering the WASP result for its inclusion with COD of 2024.

11. Further it may also be considered in the Report that runoff stream hydropower projects have relatively lower plant factor as compared to plants on perennial canals having a higher plant factor due to uniform hydrology throughout the year. Thus the dependability of projects on canal makes them better candidate projects over ones on stream.

THERMAL PROJECTIONS:

12. The expansion plan is outright fixated with adding local coal power projects into the system, i.e. will comprise about 40% of energy mix by 2047 in different scenarios. It is observed that enhanced share coal projects is based on assumptions as LOIs (no feasibilities carried out) are not yet issued by any facilitated agency and hence are not practically envisioned. The manual inputs provided by PPDB for the facilitated coal based projects having aggregate capacity of 2,640 MW (Annex-D) are overlooked and it seems as there may be certain assumptions / conditions given as inputs to the utilized software PLEXOS by NTDC, this needs to be considered particularly how a least cost expansion plan has been developed using the PLEXOS software without actual inputs and without completion of feasibility studies.

13. Carbon emissions from the power sector expected to triple by 2047 as during the same period, the share of coal power increases from 21% in 2019-2020 to 37% in 2047, even reaching a

maximum 49% in 2040. In terms of CO2 emissions, the plan achieves a reduction of emissions per kWh produced from 0.406 kg-CO2/kWh to 0.3 kg-CO2/kWh. This all requires clarification backed by realized data.

Waste to Power Projects based on Municipal Solid Waste:

14. At page 124, Section 6.14 "Other Generation Options", it has been mentioned that Technologies such as municipal solid waste, geo-thermal and tidal energy are not currently mature enough in Pakistan to be considered as candidates and there is no validated data available by the relevant authorities.

15. According to World Bank report 2016 per capita waste generation of Pakistan is 0.43 kg, alone Lahore producing municipal solid waste 7000 tons per day. Similarly in other big cities of Punjab waste is being dumped in open becoming environmental threat for nearby residents. Keeping in view this environment benefit of waste disposal through waste to energy power plant GoPb initiated 1st Waste to energy power project inviting EOI publically. After following rigorous /transparent process LOI was issued by PPDB to a winning company Chinese consortium for the development of 40 MW Waste to Power project at Lakhodair landfill site, Lahore based on 2,000 tons/day of Municipal Solid Waste (MSW) by Lahore Waste Management Company (LWMC). On January 15, 2018, NEPRA determined Upfront Generation Tariff for MSW based power projects of US Cents 10.007/kWh which was later modified to US Cents 9.8257/kWh on July 10, 2018. The project company, after the approval of FS by POE of PPDB, accepted the Upfront Tariff of US Cents 9.8257/kWh which was awarded by NEPRA on July 20, 2018. Generation License for 40 MW Waste to Power project was also granted by NEPRA on August 9, 2018. The Tariff Gazette Notification remained pending at Ministry of Energy, Power Division (MoP) till to date.

16. In the meanwhile, country wide RE projects were suspended due to expiry of RE Policy 2006. On April 4, 2019, CCOE decision allowed few advance stage RE projects under RE Policy 2006 including 40 MW Waste to Power project. The project was initially misplaced at Category-III of CCOE decision, however, later during 49th AEDB Board meeting and verification by MoP the project was included in Category-II.

17. It is important to mention that dumping of solid waste is creating an alarming situation due to environmental pollution and hazards in Metropolitan cities like Lahore, Fasialabad, Rawalpindi, Multan Gujranwala etc. Methane gas emission, 21 times more potent than CO2, is causing air pollution and can cause multiple diseases. Leachate from solid waste is damaging water table and drinking water. Waste to Power projects provide safe & scientific disposal of waste and globally considered as clean environment projects. It is therefore requested that the 40 MW Waste to Power project slot may be included in IGCEP report. Further, based on better waste collection system and project readiness in other populous cities of Punjab, approximate 150 MW Waste to Power potential exists in Punjab. Further, the success of 1st WtE power project can replicate in other major cities of Punjab and Pakistan.

<u>Biomass Power Projects</u>

18. The sugarcane residue bagasse based power projects, committed and candidate both, have been indicated in IGECP report. However, keeping in consideration that Pakistan is an agriculture country with Punjab province is more enriched in agriculture, biomass based projects of crop residues other than bagasse such as maize stalk, corn cob, rice straw, rice husk, wheat straw, cotton stalks etc. have not been considered and available for future projects.

19. World Bank, biomass Atlas report 2016 shows promising power potential of around 5,000 MW based on local indigenous biomass resource. Similar potential of biomass was previously identified by German International Cooperation (GIZ) report in 2012 'Development of Market based approach for Utilization of Biomass in Industrial Power Generation'. These indigenous based biomass resources have already been used in industry for power generation and heating applications. Prime example is Bulleh Shah Packaging Plant near Kasur, established in 2015, is a biomass based power plant having installed capacity of around 41 MW for its captive use. The plant is operating on multiple crop residues such as wheat straw, maize stalks, cane trash, mustard straw, oat straw, cotton sticks etc. The biomass collection centers and supply chain mechanism of biomass already exists in Punjab.

20. Further, in order to promote and utilize indigenous biomass resource for power generation, NEPRA also determined biomass upfront generation tariff on December 15, 2017 at US Cents 8.2816/kWh.

21. In addition, local biomass renewable resource can also be mixed with local coal for power generation projects. Such Co-firing technology has already been successful and operational globally and may be matured/commercially viable in coming years in Pakistan.

In view of above, it is requested that future window for biomass power projects may be considered and included.

Solar & Wind Power Projects:

22. It is now evident that indigenous resources of solar & wind energy are much cheaper and competitive in global market including Pakistan. The IGCEP report based on multiple scenarios indicates promising addition of SPP in committed and candidate future projects. The IGCEP report says share of solar & wind may increase to 23% in overall energy mix till 2030. Beyond 2030, share of solar and wind plants decreases due to the increase in number of new local coal-based plants having greater capacity factors. Further, report says by the end of 2047, renewable accounts for 15% of the overall energy mix.

23. It is important to consider the hybrid option scenarios (solar & wind) to increase the capacity utilization factor for future candidate projects in particular location.

24. In VRE study, conducting by World Bank, solar plants have been proposed in Punjab with capacity allocation of around 1200 MW till 2023, 12010 MW till 2025 and 1200 MW till 2030. The block allocation for solar power projects in VRE study with expansion transmission plan may also be look upon in IGCEP keeping in consideration Punjab has more load centers and less transmission constraints when it comes to power evacuation.

25. GoPb has marked / allocated 10,000 acres of land in Cholistan, QA Solar Park, Bahawalpur for development of solar power plants in this area. Out of 10,000 acres, only 5,000 acres of land is currently available for 1000 MW power evacuation. It is requested that grid expansion/reinforcement at QA Solar Park may also be assessed for more SPPs in future years.

26. The 1000 MW wind power potential has been identified in Punjab at Rojhan area with the support of Danish firm VESTAS. It is requested that block allocation for wind power projects in this area may also be consider with solar hybrid option.

Solar Thermal / Concentrated Solar Power (CSP)

27. Solar thermal technologies especially CSPs are now becoming more viable for power generation and heat storage options. Results from latest International Renewable Energy Agency (IRENA) report shows the project CAPEX for CSP is reduced to 3 Million USD/MW from 2010 to 2018. Pakistan (Punjab province) lies in a region where Direct Normal Irradiance (DNI) is quite high and suitable for CSP based power generation. Further, it has been evident that CSP limitations can also be easily controlled with use of biomass as hybrid option resource. It is therefore requested future slots for CSP may please be considered and included in IGCEP.

ANNEX-A

STATUS OF HYDROPOWER PROJECTS
IGCEP 2047

Sr. #	Name / Site of the Project	Project Capacity (MW)	Ref. Page	Data Provided by PPDB	IGCEP Entered Data by NTDC	Remarks
1	**Taunsa Hydropower Project, Taunsa Barrage, District Muzaffargarh**	**135**	**85**	COD: 2024 PF: 55 % EG: 650 GWh	COD: 2024 PF: 40 % EG: 468 GWh	The Project included in IGCEP-2018-40, with COD date of 2024. In the current version of IGCEP-2047 the correct data for the project is not used in analysis which resulted in shifting of COD from 2024 to 2047.
2	**Lucky HPP**, Marala Barrage, **District Sialkot**	**20**	**85**	COD: 2024 PF: 50 % EG: 87.4 GWh	COD: 2047 PF: 46 % EG: 81 GWh	• As PPIB 125 Board these projects were declared as committed projects. • Further the input/used Information mentioned in NTDC's IGCEP report table 6.5 is not correct. Correction /revision is required to get actual results.
3	**Ravi HPP,** Lower Bari Doab Canal (LBDC), RD. 260+000, District Sahiwal	**4.6**	**84**	COD: 2023 PF: 75 % EG: 27 GWh	COD: 2046 PF: 57 % EG: 23 GWh	
4	**Alka HPP,** Jhang Branch Canal, RD. 0+000 to 69+000, **District Hafizabad**	**1.8**	**82, 110**	COD: 2024 PF: 75 % EG: 12.08 GWh	COD: 2030 / 2045 PF: 70 % EG: 11 GWh	
5	**C.J. HPP,** Chashma Jhelum Link Tail Canal Fall, RD. 316+622, District Khushab	**25**	**84, 106, 139(A)**	COD: 2025 PF: 51.6 % EG: 110 GWh	COD: 2032 / 2043 PF: 36 % EG: 76 GWh	
6	**Gugera HPP,** Upper Gugera Branch Canal, RD 214+000 to RD 220+750, District Nankana	**3.6**	**85, 106, 139(A)**	COD: 2024 PF: 67 % EG: 21.1 GWh	COD: 2047 PF: 32 % EG: 10 GWh	
7	**Mehar HPP,** B.S. Link-I Canal,RD. 106+250, District Kasur	**10.49**	**84, 109**	COD: 2024 PF: 73.23 % EG: 67.29 GWh	COD: 2033 / 2047 PF: 49 % EG: 45 GWh	
8	**Trident HPP, Lower Chenab Canal (LCC), RD. 0+000, District Gujranwala**	**7.55**	**85, 109**	COD: 2024 PF: 67.21 % EG: 43.71 GWh	COD: 2028 / 2047 PF: 39 % EG: 26 GWh	
9	**Mandi Baha-ud-din HPP, Lower** Jhelum Feeder Canal, RD. 8+626, District Mandi Baha-Ud-Din	**3.3**	**85, 108**	COD: 2024 PF: 65 % EG: 18.6 GWh	COD: 2024 / 2047 PF: 31 % EG: 9 GWh	
10	**Khokhra HPP,** Gujrat Branch Canal, RD 0+000 to 2+000, District Gujrat	**2.8**	**81, 111**	COD: 2023 PF: 68 % EG: 17.12 GWh Capcity: 2.8	COD: 2024 PF: 70.21 % EG: 18 GWh Capacity: 3.2 MW	

11	**Rasul HPP,** Rasul Barrage, District Mandi Baha-Ud-Din	**18**	**85, 109**	COD: 2025 PF: 60.15 % EG: 95 GWh	COD: 2025 / 2047 PF: 41 % EG: 64 GWh	
12	**Kasur HPP,**BRBD Link Canal, RD. 509+712, District Kasur	**2.54**	**85, 108**	COD: 2024 PF: 51 % EG: 10.88 GWh	COD: 2025 / 2047 PF: 27 % EG: 6 GWh	
13	**Khanewal HPP, LBDC** RD. 602+000, District Khanewal	**1**	**85, 109**	COD: 2024 PF: 75.34 % EG: 6.6 GWh	COD: 2025 / 2047 PF: 5 % EG: 0.47 GWh	Information mentioned in NTDC's IGCEP is not correct. Need correction to yield to get appropriate results
14	**Murree HPP**	**12**	**85, 109**	COD: 2025 PF: 62.18 % EG: 65.18 GWh	COD: 2026 / 2045 PF: 39 % EG: 41 GWh	
15	**Engro HPP,** D.G. Khan Link-III Canal,RD. 0+000 to RD. 14+000, District DG Khan	**4.63**	**86, 108**	COD: 2025 PF: 51.6 % EG: 20.9 GWh	COD: 2026 / 2045-47 PF: 22 % EG: 9 GWh	
16	**Chichawatni HPP,** RD. 489+000, District Sahiwal	**1.6**	**85, 108**	COD: 2024 PF: 86 % EG: 12.04 GWh	COD: 2025 / 2045-47 PF: 43 % EG: 6 GWh	
17	**Soan HPP**	**25**	**85, 109**	COD: 2030 PF: 51.6 % EG: 113 GWh	COD: 2025 / 2047 PF: 35 % EG: 76 GWh	
18	**UCC Bambawala HPP**	**5**	**85, 108**	COD: 2030 PF: 70 % EG: 30.7 GWh	COD: 2025 / 2046 PF: 37 % EG: 16 GWh	
19	**Okara HPP**	**4.8**	**85, 145**	COD: 2027 PF: 70.6 % EG: 30 GWh	COD: 2024 / 2046 PF: 38 % EG: 16 GWh	
20	**QB Link HPP**	**9.18**	**86, 109**	COD: 2027 PF: 75 % EG: 60 GWh	COD: 2046. 2047 PF: 20 % EG: 16 GWh	
21	**BS Link Tail HPP**	**9**	**85, 108**	COD: 2024 PF: 63 % EG: 49.2 GWh	COD: 2030 / 2047 PF: 37 % EG: 29 GWh	
22	**TP Link HPP**	**9**	**85, 108**	COD: 2030 PF: 49 % EG: 38.4 GWh	COD: 2024 / 2047 PF: 29 % EG: 23 GWh	

23	**Chenawan HPP**	**3**	**85, 108**	COD: 2025 PF: 86 % EG: 22.8 GWh	COD: 2045, 2043, 2047 PF: 38 % EG: 10 GWh	
24	**Sahiwal HPP**	**4.8**	**85, 108**	COD: 2027 PF: 70 % EG: 29.3 GWh	COD: 2050, 2047, 2027 PF: 43 % EG: 18 GWh	
25	**Khanki Barrage HPP**	**14**	**85, 108**	COD: 2030 PF: 32 % EG: 39 GWh	COD: 2050, 2047 PF: 19 % EG: 23 GWh	
26	**Qadirabad barrage HPP**	**23**	**86, 109**	COD: 2033 PF: 27 % EG: 54.58 GWh	COD: 2025 / 2047 PF: 16 % EG: 33 GWh	
27	**Trimmu HPP**	**13**	**85, 109**	COD: 2032 PF: 52 % EG: 59.45 GWh	COD: 2029 / 2047 PF: 33 % EG: 38 GWh	
28	**Punjand HPP**	**15**	**86, 109**	COD: 2032 PF: 44 % EG: 58.43 GWh	COD: 2032 / 2047 PF: 28 % EG: 37 GWh	

Note:
COD: Commercial Operation Date
PF: Plant Factor
EG: Energy Generated

ANNEX-B

Processing of Small Hydropower Projects initiated by the provinces and AJ&K

PPIB letter Ref. No. (101)PPIB-MISC/19/PRJ/O-53805 dated 7th November 2019

Category - II			
1	**Ravi HPP,** Lower Bari Doab Canal, RD. 260+000, District Sahiwal	Trident Power JB (Pvt.) Ltd.,	**4.6**
2	**Lucky HPP**, Marala Barrage, District Sialkot	Olympus Energy (Private) Limited	**20**
3	**Alka HPP,** Jhang Branch Canal, RD. 0+000 to 69+000, District Hafizabad	Alka Power (Private) Limited	**1.8**
CAPACITY (SUB-TOTAL)			**26.4 MW**
Category - III			
4	**Gugera HPP,** Upper Gugera Branch Canal, RD 214+000 to RD 220+750, District Nankana	Gugera Power Company	**3.6**
5	**Lower Chenab Canal (LCC) HPP,** RD. 0 + 000, District Gujranwala	Trident Power GR (Pvt.) Limited	**7.55**
6	**Mandi Baha-ud-din HPP,** Lower Jhelum Feeder Canal, RD. 8+626, District Mandi Baha-Ud-Din	Mandi Baha-ud-din Energy Limited	**3.3**
7	**Khokhra HPP,** Gujrat Branch Canal, RD 0+000 to 2+000, District Gujrat	Blue Star Energy (Pvt.) Limited	**2.8**
8	**Rasul HPP,** Rasul Barrage, District Mandi Baha-Ud-Din	S2 Hydro Ltd (Suraj Cotton Mills Limited)	**18**
9	**Mehar HPP,** B.S. Link-I Canal, RD. 106+250, District Kasur	Associated Technologies (Pvt.) Limited	**10.49**
10	**BRBD Link Canal HPP,** RD. 509+712, District Kasur	Packages Power (Pvt.) Limited	**2.54**
11	**C.J. HPP,** Chashma Jhelum Link Tail Canal Fall, RD. 316+622, District Khushab	C.J. Hydro (Haseeb Khan & Co.)	**25**
CAPACITY (SUB-TOTAL)			**73.28 MW**

ANNEX-C

NATIONAL TRANSMISSION & DESPATCH COMPANY LTD.

General Manager (Power System Planning),
NTDC

No. GMPSP/CEG&LF/MGPO&LF/463/ 119-22   Date: 06.01.2020

Managing Director,
Punjab Power Development Board.

Subject: **JOINT STUDY ON PAKISTAN POWER MARKET**

Ref: PPDB letter No. PPDB/599/2019 Dated: 27/12/2019

With reference to the above referred letter, it is apprised that 135 MW Taunsa Hydropower project is included in the IGCEP 2018-2040.

As per minutes of meeting of Workshop on *"Finalization of the Joint Study on the Power Market in Pakistan' dated 3rd November 2019,* Joint Study on Pakistan Power Market has endorsed the output of IGCEP 2018-2040 which includes 135 MW Taunsa Hydropower Project.
Kindly contact Power Division, Ministry of Energy for obtaining the relevant minutes/report.

This office is available for any further support in this regard.

Engr. Salis Usman
General Manager (Power System Planning)

Cc:

- PS to MD NTDC, WAPDA House, Lahore.
- PS to Secretary, Government of the Punjab, Energy Department, Lahore.
- PS to Managing Director, Punjab Power Development Board.

Sem, n.b.a.l, 17/01/2020

16/1/20 DHR

Important. Please file SEN

16-01-2020

4th Floor PIA Tower, Egerton Road, Lahore Phone: +92 42 99202013, Fax: +92 42 36307758 gm.psp@ntdc.com.pk

ANNEX-D

LIST OF COAL BASED POWER PROJECTS SHARED WITH NTDC FOR INCLUSION IN IGCEP 2047

LOI (2,640 MW) issued to following projects:

i. Kot Adu Power Company Limited (KAPCO) –1 x 660 MW (FDI Target – 0.9 Billion USD - LOI issued in May 08, 2015)

ii. Nishat Energy Limited (NEL) – 1 x 660 MW (FDI Target – 0.9 Billion USD - LOI issued in October 2014)

iii. Huaneng Shandong Power Generation Co Ltd (HSPG) – 2 x 660 MW (FDI Target- 1.85 Billion USD - LOI issued in September 23, 2016)

Sr. No.	Company	Project Size	Location	Status
1.	Kot Addu Power Company Ltd	1x660 MW	Muzaffargarh	• Data on prescribed format shared with NTDC for inclusion in IGCEP-2047 • Due diligence on national power policy & fuel mix is in progress by GoP • GoPb & LOI holder companies are considering use of Thar Coal for these projects
2.	Nishat Energy Ltd	1x660 MW	Rahim Yar Khan	
3.	Huaneng Shandong Power Generation Co. Ltd.	2x660	Rahim Yar Khan	
Total Capacity		**2640 MW**		

BEFORE THE NATIONAL ELECTRIC POWER REGULATORY AUTHORITY

COMMENTS ON
THE INDICATIVE GENERATION CAPACITY EXPANSION PLAN 2047 (IGCEP)

DATED: 23 May 2020

FILED BY:

RMA &CO.
RAJA MOHAMMED AKRAM & CO.
ADVOCATES AND LEGAL CONSULTANTS

33 – C Main Gulberg, Lahore
Tel: 92 42 3575 0208
Fax: +92 42 3575 0175
Email: info@rmaco.com.pk
URL: http://www.rmaco.com.pk

By Email and Courier

Registrar
National Electric Power Regulatory Authority (NEPRA)
NEPRA Tower
Attaturk Avenue
Sector G - 5/1, Islamabad.

Subject: **Comments on the Indicative Generation Capacity Expansion Plan 2047 (the "IGCEP 2047")**

Dear Sir,

1. We refer to the IGCEP 2047 (or the "**Plan**") prepared by the National Transmission and Despatch Company (**"NTDC**") available on the National Electric Power Regulatory Authority's ("**NEPRA**" or the "**Authority**") website. The NTDC's Plan is prepared in compliance with the Grid Code and is subject to review and approval by the Authority. In response to NEPRA's notice for comments by stakeholders on the IGCEP 2047, Raja Mohammed Akram & Co **("RMA & Co")** hereby submits these comments with the learned Authority.

Brief Introduction

2. RMA & Co is amongst the premier law firms in Pakistan. We have played a significant role in highlighting environmental issues and the urgent threat of climate change at various forums including through filing public interest litigation petitions. In this regard, RMA & Co has been at the vanguard in advocating state policies that are in conformity with environmental laws and rules and encourage carbon neutral development pathways, including adopting mitigation measures through the promotion of renewable energy. We routinely represent clients from the power sector. These comments have been drafted based on input and feedback from various stakeholders in the renewable energy sector, as well as environmental and climate activists.

3. In summary, we submit that the IGCEP 2047 in its existing form does not fully consider the imminent threat of climate change and sobering research reports that point to Pakistan being the fifth-most adversely impacted country due to climate change. The IGCEP 2047 appears to have been drafted without taking into account the responsibility of the State of Pakistan and its agencies to provide a clean, healthy environment and a climate capable of sustaining human life to the citizens of Pakistan as guaranteed under the Constitution of Pakistan, 1973. Moreover, the IGCEP 2047 does not give due regard to Pakistan's international commitments under the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement 2015 (the "**Paris Agreement**").

IGCEP 2047

4. Pursuant to the provisions of the Grid Code, the NTDC is mandated to prepare and deliver IGCEP to NEPRA for its review and approval. The IGCEP aims to devise a minimum cost strategy for long range expansion of power generation, transmission and distribution systems to supply the load forecast demands within the technical, economic and political constraints. The purpose of the plan is to inform investment decisions in the development of different types of power plants. The IGCEP purportedly claims to account for Government's policies, latest generation technologies and relevant regulatory obligations.

Generation Mix: Current and Proposed

5. The IGCEP 2047 sets out a comprehensive view of the projected electricity demand and the existing generation system. The IGCEP 2047 focuses on the development of the least cost expansion plan to meet the anticipated load demand up to 2047. The IGCEP 2047 divides the decisions for investment pertaining to the development of different types of power plants into two periods from 2020 – 2030 and 2031 – 2047. As per the IGCEP 2047, the contribution in energy production in GWh by various technologies as base case scenarios is as follows for each respective year:

IGCEP Generation Mix for 2020 (GWh)		
Thermal Plants		**65%**
	Natural Gas	14%
	Local Coal	3%
	Imported Coal	18%
	Residual Furnace Oil (RFO)	4%
	Re-gasified Liquid Gas based technologies (RLNG)	26%
Nuclear Plants		**5%**
Hydro Electric Plants		**26%**
Renewable Resources Plants		**4%**
	Solar	1%
	Wind	2%
	Bagasse	1%

6. We draw the Authority's attention to the optimal generation mix for 2030 and 2047 as proposed by the IGCEP 2047 as base case scenarios. The optimal generation mix for 2030 is tabulated below:

IGCEP Generation Mix for 2030		
Thermal Plants		**25%**
	Natural Gas	0%
	Local Coal	13%
	Imported Coal	3%
	RFO	0%
	RLNG	9%
Nuclear Plants		**13%**
Hydro Electric Plants		**37%**
Renewable Resources Plants		**25%**
	Solar	9%
	Wind	14%
	Bagasse	2%

7. Similarly, the optimal generation mix plan for 2047 as per the IGCEP 2047 is as follows:

IGCEP Generation Mix for 2047		
Thermal Plants		**37%**
	Natural Gas	0%
	Local Coal	36%
	Imported Coal	1%
	RFO	0%
	RLNG	0%
Nuclear Plants		**5%**
Hydro Electric Plants		**43%**
Renewable Resources Plants		**15%**
	Solar	8%
	Wind	6%
	Bagasse	1%

8. **Renewable resources only account for 25% of the optimal generation mix for 2030 and the contribution of renewable sources drops to a strikingly low level of 15% for 2047.** It is clear from the above tables (paras 6 and 7) that whilst the IGCEP 2047 purports to consider various factors such as governmental policies and the Draft ARE Policy 2019 in the development of the generation expansion plan, the Plan fails to reflect

the State's energy and climate change policies, the legal precedents established by the higher courts of Pakistan and the obligations of the State of Pakistan under the Constitution and international treaties, such as the Paris Agreement.

9. The Plan acknowledges that the Government of Pakistan "envisages to aggressively include 20% and 30% renewable energy generation by capacity by the year 2025 and 2030." However, according to the Plan, the realization of this target is impossible as the present grid infrastructure is incapable of dealing with intermittent sources of energy.

10. At Section 4.6.5, the Plan states:

> *However, these two energy resources (wind and solar) due to their intermittency cannot be considered as a firm capacity, at all points in time or all around the clock; therefore, appropriate amount of backup generation is also required to provide for reserve requirements of the system.*

11. In Section 4.6.6, it states:

> *The complexity associated with integrating intermittent sources of electricity stems from the fact that the power grid was basically designed around the concept of large, controllable electric generators. Today, the grid operator uses a planning process to ensure power plants generate the required amount of electricity at the right time to ensure continuous and reliable supply for meeting the electricity demand. The balance between electricity supply and demand must be maintained at all times.* ***Renewables intermittency is challenging since they disrupt the conventional methods for planning the economic despatch of the electric grid.*** *Their power fluctuates over multiple time horizons, forcing the system operator to adjust its day-ahead, hour-ahead, and real-time operating procedures.*

12. The above extracts illustrate the reluctance on the part of NTDC in the adoption of renewable technologies. Given that the most recent tariff determinations for renewable technologies issued by NEPRA are much lower than fossil-fuel based technologies, we do not see any reason why NTDC should not be able to overcome the challenge posed by the supposed intermittency of renewables. We further highlight that the Plan appears to have been drafted without taking into consideration the policy directives in the Draft Alternative and Renewable Policy 2019 (the "**Draft ARE Policy 2019**") that emphasize the need to upgrade the grid infrastructure (as discussed in para 20 below).

13. We hope that in its review of the IGCEP 2047, the learned Authority's judgment

is not clouded by an out-dated view of renewables, but takes into account verifiable present-day data and evidence of developers and utilities successfully setting up and operating firm, despatchable renewable power plants with battery storage in various countries. We urge the Authority to build on past lessons regarding the steep decline in renewable prices in the last five years and base its determination on the definitive studies published by various international energy research agencies. The research forecasts that round-the-clock generation from renewables through using alternative sources will be commercially feasible within the next decade.

14. The Plan highlights the achievement of switching from imported fuel to local indigenous coal while disregarding the negative effects of coal based power plants on the climate and air pollution levels in Pakistan. On page xxvii, the IGCEP 2047 states that in the year 2047, "there is minimal reliance on the imported fuel with RFO having no contribution at all. Imported coal is contributing just 1% in the total energy requirements." Further, as identified by the Plan, **the increase in the share of coal-based plants in the energy mix for 2047 is at the cost of a reduction in the share of solar and wind plants.**

Pakistan: 5th most Vulnerable Country to Climate Change

15. As the Authority is aware climate change poses an imminent threat to the world and particularly Pakistan. Pakistan ranks fifth among the countries that are most vulnerable to the effects of climate change. Reduction in emissions through cutting down on the combustion of fossil fuels and switching to alternative sources is a crucial solution to address climate change. Based on the GHG Inventory of Pakistan (2014-15), energy and agriculture sectors account for 90% of the total emissions, with the energy sector representing 47% of the GHG emissions.

Pakistan's Commitment under the Paris Agreement

16. Pakistan has ratified the Paris Agreement. The Paris Agreement is a legally binding framework for a coordinated effort to limit the impact and urgent threat of climate change by keeping global temperature rise below 2 degrees Celsius above pre-industrial levels. Article 2.1 of the Paris Agreement requires the state parties to increase the ability to "foster climate resilience and low greenhouse gas emissions development."

17. Further, the Paris Agreement obligates each party to introduce mitigation measures. Pursuant to Article 3 read with Article 4 of the Paris Agreement, all state parties are required to prepare, communicate and maintain successive "nationally determined contributions" (NDCs) that they intend to achieve which should reflect each party's **highest possible ambition**. Countries are required to submit their first NDCs in

2023. Prior to NDCs, countries are required to submit their Intended Nationally Determined Contributions (INDCs). An INDC indicates a country's contribution towards the achievement of the universal target set in the Paris Agreement. Pakistan submitted its INDC statement on 6 November 2016. The INDC statement indicates that energy and agriculture will continue to predominate in GHG emissions.

18. It may please the Authority to note that Pakistan's INDC statement has committed to reducing 20% of the country's projected GHG emissions by 2030. Further, Pakistan's INDC statement identifies as ***High Priority,*** *the adoption of mitigation measures in the energy sector through the development of solar, wind and hydroelectricity.*

Draft Alternative and Renewable Policy 2019

19. The Government of Pakistan in the Draft ARE Policy 2019 sets out that Pakistan intends to have 30% of its generation capacity as renewable resources. The Draft ARE Policy 2019 underlines the need to upgrade the transmission infrastructure to meet this target. It states that the upgradation shall be taken in parallel and where necessary as a prerequisite.

NEPRA's Role: IGCEP in violation of International Obligations and National Policies

20. As set out in the Preamble of the Transmission and Distribution of Electric Power Act, 1997 (the "**NEPRA Act**"), the NEPRA Act aims to provide "*special provisions for the development of renewable electricity markets in accordance with* ***the international commitments of Pakistan as well as the responsibility of Pakistan to support and encourage measures to effectively mitigate adverse climate change***." Pursuant to Section 7 of the NEPRA Act, the Authority is exclusively responsible for regulating the provision of electric power services. Therefore, NEPRA's mandate includes regulation of NTDC to ensure that the IGCEP 2047 submitted by NTDC reflects Pakistan's international commitments and is in line with the State's responsibility to adopt mitigation measures to reduce climate change.

21. We request that the Authority review and revise the IGCEP 2047 based on the following reasons:

a. The IGCEP 2047 does not propose meaningful adoption of mitigation measures against the urgent threat of climate change and does not promote Pakistan to move to a carbon-neutral economy. As mentioned, the energy sector represents 47% of the total GHG emissions in the country. Despite the clear evidence of the severe impact of fossil fuel combustion on climate, IGCEP 2047 gives undue importance to the use of

fossil fuels like coal for energy generation. The switch to local coal instead of imported coal comes at the cost of reduced share of renewable energy resources in the generation mix. The share of coal in the generation mix increases **from 14% in 2019 to an astounding figure of 36% in 2047.** The Plan will undoubtedly contribute to a significant rise in GHG emissions and the worsening of climate change impacts.

b. The IGCEP 2047 does not reflect the "highest possible ambition" in terms of the reduction in the use of fossil fuels that can be undertaken in Pakistan in light of our national circumstances. Any plan or proposal approved by the learned Authority must comply with the commitments made by the State of Pakistan pursuant to the Paris Agreement to reduce GHG emissions and encourage and foster the development of renewable energy sources. As mentioned in para 18 above, Pakistan committed to a 20% reduction in its projected GHG emissions by 2030. Similarly, Pakistan, in its INDC statement, identified the development of solar, wind and hydropower as a high priority mitigation measure. However, as is evident from the tables above, the IGCEP 2047 fails to prioritize the development of renewable energy resources which account for only 25% of the generation mix in 2030 and drop to a mere 15% in 2047 as base case scenarios.

c. Similarly, the IGCEP 2047 is not in line with the Draft ARE Policy 2019 i.e., Government of Pakistan's intention to have 30% of its generation capacity as renewable resources in 2030. As explained in para 9 above, the IGCEP 2047 disregards the Draft ARE Policy 2019's recommendations for upgradation of the transmission infrastructure to achieve the target of 30% by 2030.

d. Further, IGCEP 2047 deflects the responsibility towards reduction in GHG emissions by comparing Pakistan's contributions with other countries. It is pointed out that the Paris Agreement requires countries to take measures based on the principle of "*common but differentiated responsibilities in light of different national circumstances.*" The Paris Agreement represents an unequivocal acknowledgement by all state parties that each party must cut down its GHG emissions as ambitiously as possible. The percentage of global GHG emissions that are contributed by a particular state party is irrelevant—each state party is part of the problem and therefore **each state party must implement its highest possible emissions reduction target to comply with the Paris Agreement.**

Conclusion

22. In light of the aforesaid, we respectfully request the Authority to consider our comments in its review and revision of the IGCEP 2047 and to ultimately approve a generation capacity expansion plan that takes into account environmental issues and the threat of the catastrophic impact of climate change on Pakistan. Such a plan should also be in compliance of the constitutional guarantee of a clean and healthy environment to the citizens of Pakistan and Pakistan's commitments under the Paris Agreement.

23. We would be happy to assist the Authority in case of any questions or queries.

Yours sincerely,

RMA & Co.

RAJA MOHAMMED AKRAM & CO

Aneesa Agha
Partner
Advocate High Court
Barrister at Law

E: *aneesa.agha@rmaco.com.pk*

Mariam Noor
Associate
Advocate

E: *mariam.noor@rmaco.com.pk*

Legal Consultants

Main Office: Suit No. 1, 3rd Floor, Ghazi Plaza, 2 Mozang Road, Lahore.
Regional Office: [Islamabad] 19-B, Saeed Plaza, Blue Area, Islamabad.
E-Mail: syed.ghazenfur@gmail.com
Contact Number: 092 - 308-6124105

21st of May, 2020

Registrar NEPRA
NEPRA Tower, Attaturk Avenue (East),
Sector G-5/1, Islamabad.

Subject: Comments on the Indicative Generation Capacity Expansion Plan (IGCEP) 2047.

Dear Sir,

1. The following comments are being submitted by SA Legal Consultants with reference to Notice for submitting Comments in the matter of Indicative Generation Capacity Expansion Plan, 2047 ('**IGCEP**') invited by your respected Office through advertisement.

2. SA Legal Consultants is a group of public spirited lawyers, who specialize in different fields but collectively work towards causes having social impact. The undersigned counsels engaged with SA Legal Consultants, affected as citizens of Pakistan by IGCEP 2047, propose following comments, for a socially inclusive, environmentally green energy policy which will hopefully achieve sustainable development:

A. IGNORANCE OF PROBLEM OF OVER-CAPACITY AND WATEFUL ECONNOMIC RENT PAID AS CAPACITY PAYMENTS.

3. Power capacity and power generation figures under the Base and Low Demand scenarios in the IGCEP demonstrate that Pakistan will lock in significant power overcapacity if it follows this plan.

Figure 1: Power Capacity and Generation by 2030, Base Case IGCEP 2047

REGISTRAR
Dy. No. 746
Dated 02-06-20

For info & n.c pl.
ADG (Lic)
Copy to:
- SA(Tech)
- SA(T)
- DG(M&E)
- SLA(LCP)
- M/E

2/6/2020

cc: Chairman
- V.C/M(M&E)
- M(T)
- M(CA)
- M(L)

SA Legal Consultants

Main Office: Suit No. 1, 3rd Floor, Ghazi Plaza, 2 Mozang Road, Lahore.
Regional Office: [Islamabad] 19-B, Saeed Plaza, Blue Area, Islamabad.
E-Mail: syed.ghazenfur@gmail.com
Contact Number: 092 - 308-6124105

Figure 2: Power Capacity and Generation by 2030, Low Demand Case IGCEP 2047

	Low Demand Case Capacity 2030 (MW)	Low Demand Case Generation 2030 (GWh)	Low Demand Case Utilisation
Imported coal	5,297	5,149	11.1%
Domestic coal	3,934	15,568	45.2%
LNG	7,238	20,683	32.6%
Gas	1,484	404	3.1%
Nuclear	4,407	30,248	78.4%
Bagasse	913	3,967	49.6%
Solar	12,793	21,120	18.8%
Hydro	20,622	85,994	47.6%
Imports	1,000	1,969	22.5%
Wind	7,799	25,873	37.9%
Oil	2,475	25	0.1%
Total	67,962	211,000	35.4%
Renewable %	32%	24%	

Source: IGCEP 2047, calculations

B. FINANCIAL PARAMETERS BIASED BY PROBLEMATIC SELF-REPORTING OF POWER PLANT COST DATA REPORTED BY PROJECT EXECUTING ENTITIES.

4. The Financial Parameters used in the study, as explained in Section 4.4, have been obtained from 'concerned project executing entities' and 'the latest tariff determination available on the NEPRA website'[1]. The Financial Parameters are biased by the self-reporting of Power Plant Cost Data by project executing entities, which have historically been accepted by NEPRA without any objection. The Committee for Power Sector Audit, Circular Debt Resolution and Future Roadmap in its 'Report on the Power Sector' ('**RPS**') recently calculated an excess payments of Rs. 291.04 billion over the tariff control period of 30 years by just one coal fired power plant i.e. Huaneng Shandong Ruyi (Pakistan) Energy (Private) Limited located at Qadirabad, District Sahiwal.[2] The entire costing model adopted is biased by self-reporting of costs constitution tariff claims by project executing entities to NEPRA.

[1] P. 25 of IGCEP.
[2] P. 217 of RPS

SA Legal Consultants

Main Office: Suit No. 1, 3rd Floor, Ghazi Plaza, 2 Mozang Road, Lahore.
Regional Office: [Islamabad] 19-B, Saeed Plaza, Blue Area, Islamabad.
E-Mail: syed.ghazenfur@gmail.com
Contact Number: 092 - 308-6124105

for their absence from study has not been provided. Further, in estimating costs IGCEP has not factored in carbon tax on fossil fuels (including coal), which has been allowed by applicable environment laws and National Climate Change Policy issued by the Ministry of Climate Change.

8. As discussed above, IGCEP gives primacy to 'green power' but also projects that "[b]eyond 2030, share of solar and wind plants decreases due to the increase in the number of new local coal based plants having greater capacity factors"[5]. No environmental impact of such a greater share of CFFP in the energy mix has been studied; furthermore, neither the data inputs nor the methodology for calculating carbon emissions from such a radical change in energy mix has not been released.

F. ERRONEOUS RELIANCE ON HOURLY LOAD CURVE AS EXISTING ON 30-06-2019 TO DETERMINE 'ANTICIPATED LOAD DEMAND UP TO THE YEAR 2047'.

9. IGCEP has used the hourly load curve as existing on 30-06-2019 to determine 'anticipated load demand up to the year 2047'. However, the growth in GDP in Pakistan caused by COVID-19 and the resultant fall in future energy demand has not been factored in by IGCEP while calculating Demand Forecast Numbers[6], which raises question over the effectiveness of future forecasting of demand. Even the projected scenario of Low Demand[7], sounds at best optimistic due to the unforseen COVID-19 situation.

G. LACK OF ATTENTION PAID TO RENEWABLE ENERGY AS COST EFFECTIVE AND MORE RELIABLE SOURCE OF INDIGENOUS ENERGY MIX.

---

[5] P. xxvii of IGCEP
[6] P. 59 of IGCEP
[7] P. 56 of IGCEP

SA Legal Consultants

Main Office: Suit No. 1, 3rd Floor, Ghazi Plaza, 2 Mozang Road, Lahore.
Regional Office: [Islamabad] 19-B, Saeed Plaza, Blue Area, Islamabad.
E-Mail: syed.ghazenfur@gmail.com
Contact Number: 092 - 308-6124105

12. From 2030 to 2047 the IGCEP 2047 envisages a significant turn away from renewable energy and towards even more domestic coal-fired power and hydro. Under the Base scenario, by 2047 the IGCEP foresees the power generation mix as 36% domestic coal, 42% hydro and only 15% renewable energy. The long term plan appears to be to meet the 2030 renewable energy target and then start reducing renewables' share of the power mix despite the fact that renewable energy will be by far the cheapest source of power generation in the 2030s. The rationale for the IGCEP's focus on domestic coal and hydro in the long term is presumably a need for increased energy security and the reduction of fossil fuel imports which are a significant economic burden. The IGCEP fails to acknowledge that wind and solar power are better from an energy security standpoint than both domestic coal and hydro. Furthermore, not only do wind and solar avoid the need for fossil fuel imports, they do not have any fuel cost at all. The IGCEP appears to fail to take this into account.

13. The undersigned request your respected Office to be allowed participation in public hearings to further evince the above provided comments.

Regards,

Asad Farood Professor of Law at LUMS	**Syed Zain ud Din Moulvi** Advocate High Court (Lahore)	**Muhammad Zuabir** Advocate High Court (Sindh)
Syed M. Ghazenfur Advocate High Court (Lahore)	**Warda Khalid** Advocate High Court (Islamabad)	**Mian Waseem Mehmood** Advocate High Court, (Lahore)

Saani Power
-PRIVATE LIMITED

21/5/22

REGISTRAR
Dy. No: 7283
Dated: 21-05-20

To,

Chairman,
National Electric Power Regulatory Authority (NEPRA),
NEPRA Tower, G - 5, Islamabad.

Dated: 16th of May, 2020
Ref: SPPL/NEPRA/ 001/2019

Subject: **Comments on Draft Indicative Generation Capacity Expansion Plan (IGCEP – 2047)**

Honorable Chairman,

This is with reference to NEPAR's notice vide No. PID (1)5860/19. We the Saani Power (Pvt) Limited are in the category of small hydropower project developer would like to draw your kind attention towards the report recently outlined and submitted on IGCEP 2020-2047 by NTDCL for various categories of hydropower projects in Pakistan and AJ&K. We humbly request the following:

CHAIRMAN
Dy No. 3177
Date: 19-05-2022
Registrar

1. LOI was issued to us in 28-02-2013 by AJ&K PPC in accordance with the GoP Power Policies 2002 – 2015, envisaging to develop the project. A time line was given to complete the feasibility studies and reports in order to get approvals/NOCs from the relevant departments.

2. The detailed feasibility studies and reports were prepared by engaging consultant of international repute and were submitted well in time to the line departments for processing and approvals. The approvals for FSR, Environmental Impact Assessment Report, and Grid Interconnection Study were granted. Based on theses approvals Power Absorption and Power Evacuation Certificates were also issued by the relevant DISCO.

3. As a consequence of approvals and detailed feasibility studies, we submitted our tariff petition dated 18-08-2015 to CPPA (G) to forward it to NEPRA for tariff approval which was returned with the remarks that tariff approval is conditioned to the inclusion of Project in IGCEP-2047.

4. As the IGCEP-2047 has taken more than three years to get finalized and we kept waiting with no option to move forward nor were in a position to fall back as we have already spent millions of rupees on the project and had engaged foreign firms and investors who were willing to work and invest in our project, now are losing their interest due to blocked prospects and are likely to slip away which may result in utter embarrassment and serious setback to our project.

5. The draft in its final shape which has been submitted by NTDC in your good office and also has been uploaded on NEPRA's website we have come to know that our project COD has been pushed to 2045, whereas, our COD as per time line and WASP data was June 2024.

For information & n/a pl.
- ADG (Tic
- DDC (M&E)
- DDC (Tech)

21/5/22

cc: chairman
- VC/M (M&E) - M (Tic)
- MCF, - MCA.

1

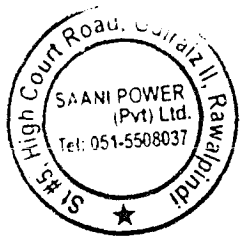
SAANI POWER (Pvt) Ltd. Tel: 051-5508037 — 5, High Court Road, Gulraiz II, Rawalpindi

6. Now above in view, we (M/s Saani Power (Pvt) Limited), the IPP of hydropower project who has put in years of time and efforts and have spent millions of rupees on the basis of LOI issued by PPC-AJ&K in Feb 2013 and had conducted intensive studies, detailed feasibility reports and surveys in fulfillment of project obligations are badly stuck up with no way to move forward. The blocking of the prospects would not only deprive M/s Saani Power (Pvt) Ltd but also the people of the area from many direct/ indirect benefits and employment opportunities.

7. Requested to please that M/s Saani Power (Pvt) limited be provided an opportunity to be part of early phase of IGCEP (2020-2030) scheduled between 2024 to 2026 to safeguard our investment of millions of rupees otherwise it will be disastrous for us and the project as well.

Best regards,

Sincerely,



Sardar Fahad Yaqoob
Director

Copy to:

1. Nadeem Babar, Special Assistant to the Prime Minister (SAPM), PM Secretariat, Islamabad.
2. Secretary, Electricity / PDO, PDO Complex, Muzaffarabad, AJ &K.
3. Director General, Private Power Cell, PDO Complex, Muzaffarabad AJ&K.
4. Chief Executive Officer, CPPA-G, Islamabad.
5. Chief Engineer (P&E), IESCO, Street 40, G-7/4, Islamabad.
6. Managing Director, PPIB, GOP.
7. The General Manager, Power System Planning, NTDC, PIA Tower, Egerton Road Lahore.
8. Master file

7-A/K, Main Boulevard, Gulberg-II,
Lahore (Pakistan).
UAN: +92 42 111-000-100 Fax: +92 42 35758783, 35713753

Sapphire **Sapphire Hydro Limited**

The Registrar
National Electric Power Regulatory Authority
Islamabad, Pakistan.

Dated: 21st May, 2020
REF: SHL/LHR/0073

SUBJECT: **COMMENTS ON IGCEP 2020-47**

Dear Sir,

We write to your good selves in response to the advertisement dated 25th April, 2020, soliciting public comments on draft "Indicative Generation Capacity Expansion Plan". In the capacity of a stakeholder in energy sector, we hereby submit our recommendations for Policy Level considerations (Annexure – 1) and an overview of shortcomings in IGCEP 2020-47 (Annexure – 2).

We believe the above, when considered in whole, would not only facilitate in developing a true and fair future outlook of the energy sector along with clarity on current challenges being faced but also ease achievement of the objectives of this policy document of least cost generation with preference of indigenization of fuel in the long run.

IGCEP 2020-47 is a public policy matter and critical for the developments / progress in Pakistan's energy sector. We appreciate NEPRA's initiative of extensive consultations on first draft of IGCEP 2019-40 and facilitating a public dialogue to ascertain participation and noting of all stakeholders' concerns in a transparent manner so that this policy paper duly accounts for the wider national interest. Further the projects from all federal and provincial agencies should be evaluated on same merit and costing basis in order to achieve the overall objective of least cost generation for future.

Thanking you in anticipation.

Yours truly,

Authorized Signatory
Sapphire Group of Companies

ANNEXURE 1 – POLICY LEVEL CONSIDERATIONS

WIND / SOLAR PROJECTS

- Wind and Solar projects should also compete within themselves on tariff quite like other generation options, while currently both are being accommodated without assessing comparative tariffs. Solar, being the cheapest, shouldn't be suppressed to accommodate Wind.
- VRE Projects are evaluated based on their generation tariff. However due to their intermittent nature, following additional requirements contribute significantly to their overall cost to the system and hence their overall cost should be modelled likewise:
    - Spinning reserve requirements (Stand by thermal capacity cost should be calculated at the actual plant factor rather than notional factors of 60% or 90%)
    - Requires Grid Reinforcements
    - Constraints due to Geographical distribution / Transmission losses

HYBRID

- Solar / Wind Hybrid projects is not a widely practiced model due to intermittent nature of both power sources. More practical models include Thermal / VRE and Storage / VRE hybrids that can provide more sustained power augmentation
- Solar / Wind Hybrid projects would average out at a plant factor of around 28~32%, which doesn't meet the overall objective of plant factor optimization or reduction of intermittency

BAGASSE PROJECTS

654MW Bagasse projects are taken as committed and recently LOS were issued despite significant over capacity in the system. We suggest following should be considered:

- Bagasse projects should not be allowed must run status and they should compete on merit order
- Bagasse availability for this new 654MW capacity should be ensured. Too much cogeneration capacity is already disrupting agricultural supply chains by creating incessant demand for Bagasse reducing sugar to a by-product attracting further Government subsidies for export. The impact of cogeneration plants on Food and Agri supply chains should be studied before allowing additional Bagasse based power generation.
- Coal augmentation shouldn't be allowed, especially when 40% efficiency plants are not fully utilized. This would also help reduce energy import bill of the country.
- IGCEP assumes 55% availability and also considers 654MW projects as committed, which actually is not the case. These project never had the LOS until earlier this month, save meeting the other two conditions of Financial Close and Construction Start.

THAR COAL

- IGCEP proposes local coal capacity of 6GW by 2030 and 33GW by 2047 and recommends a study to analyze the constraints on mining, water availability and most importantly environmental challenges (p37 Section 8.6). This should have been the other way around, whereas Local Coal projects should have been added into IGCEP only once this study has been completed.

- Mining should be scaled quickly and Imported Coal plants already operational should be converted partially or fully on local coal at first priority. IGCEP currently doesn't simulate any such shift.

JAMSHORO COAL

- Jamshoro II 660 MW shouldn't be allowed being on imported Coal and even on Local Coal. We have significant thermal power surplus in the system and VRE projects should be prioritized over new thermal projects until addition of new thermal power becomes necessary due to VRE intermittency. It also doesn't meet criteria of Committed Project.

OTHER CONSIDERATIONS

- New thermal plant addition to K-Electric system should be discouraged. Rather, NTDC should increase its export of generation to K-Electric through its already surplus capacity.

- IGCEP hasn't modeled availability of Local gas / well head for plants on different variants of local gas. Reserve depletion and alternate operation plans for these plants should be part of IGCEP simulation.

- As mandatory for Private projects, Public Sector projects should get all required consents such as interconnection, NEPRA tariff, CPPA offtake consent before committing public funds. They should not be allowed cost overruns from their original submitted cost except for NEPRA allowed cost openers

ANNEXURE 2 IGCEP SHORTCOMINGS

1.	**HYDEL PROJECT SCREENING ISSUES** • All upcoming Hydel projects including projects with LOI and Tariff have been categorized as Candidate projects, while Category I & II solar/wind/bagasse Projects have been listed as committed projects • Hydel capacity addition has been considered pre-dominantly through inclusion of public sector hydel projects. • Candidate projects have varying challenges apart from their costs and these challenges should be kept in mind while putting forward their candidacy. e.g. many projects suffer grid constraints, very large projects may have financing issues, some projects do not have active sponsor, public sector agencies may have constraints on simultaneous development of projects	Hydro Projects with similar development status should also be assigned "Committed" status Public Sector projects should also be dealt on merit with Private projects. Projects, despite being in CPEC or GTG but with little progress, should be reviewed as "Committed" Candidate projects should be additionally categorized based on these: • Availability of Sponsors / Lenders • Project award and development status • Distance from Grid • Development workload of the Sponsor agency
2.	**ISSUES WITH LEAST COST CRITERIA** New Projects are being added on Annualized Construction Cost, which creates a number of issues: • Optimizing based on Cumulative CAPEX prioritizes projects with lower CAPEX. Examples being, Hydel projects being parked end of the horizon (Pg. 133) and RLNG projects in Open Cycle being prioritized over Combined Cycle projects. • CAPEX investment is a faulty criterion as it disregards the plant factor e.g. $2million/MW Hydel project with 70% plant factor will not be selected over US$1.2million/MW wind project with a plant factor half of it.	Rather than annual incremental CAPEX, all new projects should be screened based on their full PPP (EPP+CPP) tariff as per NEPRA methodology adjusted for their expected plant factor

3.	**PROJECT COSTS AND OTHER ASSUMPTIONS** Project costs and timelines needs to be verified for the following issues: • Data provided by Sponsors have been used as it is but not verified independently. • Many projects have very old feasibilities and hence unrealistic cost numbers that needs to be indexed to current date. • Most of the Public Sector projects start on very unrealistic PC-1 numbers and later on the Project cost significantly increases. Some recent projects have seen as much as 400%increase in project costs	Project Cost numbers needs to be verified and indexed by NEPRA. Sponsors committing to the Project between 2020-2030 period should not be allowed to increase their IGCEP cost numbers once reported in IGCEP. Public Sector project cost and tariff should also be locked by NEPRA before start of construction like IPP projects and only allowed openers should be trued up at COD
4.	**SOLAR/WIND (VRE)** • Capping solar projects arbitrarily at 1500MW each year creates window for rather expensive wind and thermal options against the spirit of least cost generation criteria. • 3.6% p.a. reduction in CAPEX has been assumed for Solar till 2030 (Pg. 31). Overall 36% reduction in Solar Project CAPEX seems quite aggressive despite considering technological advancements and economies of scale. • All RE plants (in Category I & II) of CCOE's decision considered as committed (6.7 (g)). However, these do not meet the criteria for committed project as per IGCEP 2047 • North and Mid Country Wind projects are being accommodated by capping Solar and South Wind Projects	Solar being the cheapest should not be capped at 1500MW each year and should be allowed to get maximum capacity on merit This assumption should be rationalized, 1-2% may be a rational estimate Developed Hydro Projects should be assigned "Committed" status They should qualify purely on least cost criteria rather than keeping cheaper options

5.	**SUPPRESSED "LOAD FORECAST"** • Linear model is assumed for demand projection (Pg. 91) based on historic figures. In 2017-18 after generation constraint removal, generation spiked by 13 TWh (Chart 3-4). Once transmission and distribution constraints are removed, we expect a similar adjustment will be required to reflect the true demand. • Pakistan is significantly under-served in terms of Per Capita Energy Consumption. Substantial demand is being catered through off grid generation (Section 3.1) that needs to be brought online. • 381,910 applications (majority by domestic followed by commercial) are pending for connection to grid (Pg.18). This is latent demand not accounted for	A one-time adjustment in demand forecast is needed to account for (i) grid constraint removal (ii)latent demand and (iii) win back of captive producers
6.	**CAPACITY RETIREMENT** • Plants with no capacity utilization have been kept active • Only Thermal Projects with PPA expiring in the time horizon (2020-2047) are considered in retirement schedule	Plants with no capacity utilization e.g. old GENCOs may be evaluated for early retirement VRE and other projects with expiries before 2047 should also be included in retirement schedule
7.	**OPEN CYCLE GAS TURBINE CAPACITY** OCGT capacity of 4,868 MW (PAGE 26) on RLNG has been proposed for reserve capacity with less than 10% Load Factor. This selection is resulting from a number of erroneous assumptions: • Same fuel cost for both Open and Combined cycle are assumed (Table 6-7), which is effectively the fuel cost for highest efficiency (62%) plants. • Capital Cost assumptions for both OCGT and CCGT needs to be rechecked. Recently concluded CCGT transactions do not support these numbers	OCGT Fuel cost should be adjusted for their actual efficiency and open cycle configuration, it should be way below 40% Capital Cost based on complete project with IDC should be used here

8.	**TARIFF ISSUES** • Fuel Cost Component (FCC) and Variable O&M should have been taken from NEPRA determination rather than Merit Order. Merit Order numbers are many times less than actual tariff due to lag in indexation true up	Merit order numbers should be adjusted as per applicable NEPRA indexation numbers
	• Tariff for operational projects are based on their actual COD true up, whereas Non-True up tariffs are being used for candidate projects. For instance, this allows installation of upcoming RLNG projects while keeping the already installed projects redundant	True up tariffs should be used for new project screening
9.	**MISC / TYPOS** • Projects Hydro China, Zephyr and Tenaga giving electricity to KE (Page 27) but still included in Upcoming Private Sector Committed Projects (Table 6-4)	Should be removed from NTDC network numbers
	• Mari CCGT and Hatim CCGT not in Candidate list of projects but still considered in "Future Capacity Addition"	Table to be updated
	• For Local Coal, SSRL information was used as reference cost 6.7 (n) (i). However, there are other expensive projects too which should be considered at their respective cost for fair representation	Should be reverified
	• Gwadar projects' is not connected with NTDC Grid.	Should not be added to NTDC system capacity
	• Combined Cycle minimum load is assumed at 50%.	Should be 25%
	• For 660MW Coal Projects, Net Capacity of 625MW is assumed	Should be as per NEPRA determinations

Saifco

Saifco Hydropower Ltd.,
Delivering a Bright Future

Saifco Group

Ref: SHPL/IGCEP/Report/1-5/2020

Date: May 22,2020

Registrar
NEPRA,
NEPRA Tower, Attaturk Avenue (East),
Sector G-5/1, Islamabad.

Subject: **COMMENTS IN THE MATTER OF INDICATIVE GENERATION CAPACITY EXPANSION PLAN 2047 (IGCEP). SUMMARY OF KEY DISCREPANCIES / INCONSISTENCIES**

Reference: Saifco Hydro Power Ltd (SHPL)/Shigo Kas Hydropower Project.

Respected Sir,

Refer to above mentioned subject, the comments of SHPL are enclosed for kind consideration.

REGISTRAR
Dy. No. 7435
Date: 01-06-20

Kind Regards.

Yours Sincerely,

Dr. Asif Qayyum Qureshi, Ph.D.,
Chief Executive Officer

Encl: As above

For info & nec pl
- ADG (Lic)
Copy to:
- SA (Tech)
- SA (T)
- DG (M&E)
- SLA (LLP)
- MF

cc: Chairman
- VC/M (M&E)
- M (T)
- M (CA)
- M (Lic)

1/6/2020

Islamabad Office:
Plot # 12, I-8 Markaz Islamabad.
+92 (51) 4862412 + 92 (51) 4862413
asifqayyum58@gmail.com, saifcohydropower@gmail.com

Peshawar Office:
Silk Executive Apartments, Deans Complex, Block 'C',
Ground Floor, Main University Road, Peshawar, KPK
+92 (91) 5612333, +92 (91) 5612444 www.saifcogroup.

IGCEP 2047

SAIFCO HYDRO POWER LTD., (SHPL)

COMMENTS IN THE MATTER OF INDICATIVE GENERATION CAPACITY EXPANSION PLAN 2047 (IGCEP).

SUMMARY OF KEY DISCREPANCIES / INCONSISTENCIES

Saifco
Saifco Hydropower Ltd.,
Delivering a Bright Future

中国国机重工集团有限公司
China SINOMACH Heavy Industry Corporation

Saifco Group

SUMMARY OF SHIGO KAS HYDRO POWER PROJECT 102 MW

- The provincial government through the Pakhtunkhwa Energy Development Organization (PEDO) decided to offer solicited sites to different investors as independent power producers (IPPS) on build-own-operate-transfer (BOOT) basis through international competitive bidding/competitive bidding (ICB/CB) as stipulated in the Khyber Pakhtunkhwa Hydropower Policy 2016.
- PEDO carried out ICB/CB and declared the joint venture of Saifco Group and China Sinomach-HI as the successful bidder for the development of 102MW Shigo Kas Hydropower Project.
- The authority has observed that the proposed project, for which tariff and generation licence is being sought, is based on renewable energy source and does not cause pollution as in the case of conventional hydro power plants.
- NEPRA, in its determination, noted that sustainable and affordable energy was a key prerequisite for socioeconomic development of any country. In fact, the economic growth of any country was directly linked with the availability of safe, secure, reliable and cheaper supply of energy/electricity.
- The authority noted "The existing energy mix of the country is heavily skewed towards thermal power plants, mainly operating on imported fossil fuel. The continuous import of fossil fuel not only creates pressure on the precious foreign exchange reserves of the country but is also an environmental concern,". Therefore, in order to achieve sustainable development, it was imperative that indigenous renewable energy resources were given priority for electric power generation and their development encouraged. concluded

Saifco
Saifco Hydropower Ltd.,
Delivering a Bright Future

中国国机重工集团有限公司
China SINOMACH Heavy Industry Corporation

Saifco Group

IGCEP ISSUES

Sr #	Issues	Recommendations
1.	**INDICATIVE GENERATION CAPACITY EXPANSION PLAN (IGCEP) 2047** It is a high time to abandon the old approach and replace it with a new flexible and adaptable approach to running this critical sector of the economy. The utility of the past that relied primarily on large and central-station power generating facilities intertie through extensive and complex transmission and distribution grids to serve demand located far away from generation sites is now giving way to a new utility of the future concept that strives to serve demand right at the spot through a blend of options including energy conservation, demand-side management, and distributed sources of power generation. thorough revamping of the power sector's legal and regulatory frameworks, institutional structure, physical systems and business	Agreed We need to replace the old plant of higher energy cost and need to replace with new projects Need of time for Pakistan to move on path of sustainable energy approach. Responsibility of Ministry of Power along with NTDC

Saifco Hydropower Ltd., Delivering a Bright Future

中国国机重工集团有限公司 China SINOMACH Heavy Industry Corporation

Saifco Group

IGCEP ISSUES

Sr #	Issues	Recommendations
2.	Pakistan is at a crossroads at the moment and in fact faces a defining moment in its history. Ample evidence already exists to suggest that the former approach to managing the power sector entities and their affairs is not proving successful," it said. "A continuation of business-as-usual approach in the power sector will be akin to inviting trouble not only for this particular sector but for the nation on the whole.	A continuation of business-as-usual approach in the power sector will be akin to inviting trouble not only for this particular sector but for the nation on the whole.
3.	**Alternative and renewable energy Policy 2019 and other Energy Policies** Alternative and renewable energy generation targets assessed and established by the Alternate Energy Development Board in consultation with distribution companies in various parts of the country, including both on-grid and off-grid should be included in the future editions of the IGCEP to give these promising new technologies their due share.	IGCEP 2047 document has given much more emphasis to New Alternative and renewable energy policy 2019 with out any substantial consideration to other National Energy Polices. Hydro power required its due share as per technology perspectives

Saifco Hydropower Ltd., Delivering a Bright Future

中国国机重工集团有限公司 China SINOMACH Heavy Industry Corporation

Saifco Group

IGCEP ISSUES		
Sr #	Issues	Recommendations
4.	Power generation policies should be regularly reviewed and updated to align the policy instruments with the latest trends in generation technologies and other factors that can influence both the demand and supply side of the electricity business	The concern ministry fail to regularly reviewed and updated to align the policy instruments with the latest trends in generation technologies and other factors that can influence both the demand and supply side of the electricity business.
5.	Planning process should be more comprehensive, both in scope and depth. Instead of yearly updating, IGCEP should be revised every five years," . "It will reduce unpredictability and will also minimize risks for the potential investors." .	We recommends that Planning process should be more comprehensive, both in scope and depth. IGCEP should be revised every year with quality and correct data. It will reduce unpredictability and will also minimize risks for the potential investors.

IGCEP ISSUES		
Sr #	Issues	Recommendations
6.	**Access to Project Quality Data and its Authenticity** In this report access to data and quality data must be facilitated and further improved. A central data repository may be formed to facilitate planners and policymakers, having specific data privileges and to ensure access to quality data, for data modeling and decision making.	IGCEP 2047 is written based on wrong data provided to NTDC by concern Provincial department such as PEDO. The data provided as per given format was not incorporated in the report. Without utilizing the correct data the software used can not produced the exact result. Quality data must be facilitated and further improved. A central data repository may be formed to facilitate planners and policymakers, having specific data privileges and to ensure access to quality data, for data modeling and decision making.

IGCEP ISSUES		
Sr #	Issues	Recommendations
7.	In a similar vein, project execution entities should enhance and accelerate their response, with respect to provision of project data to NTDC, for updating of the IGCEP, in a precise and timely manner," it added. "Keeping in view the latest technological changes and latest advancements in the power supply and delivery business, customized trainings should be provided, especially for the power system planners, system operators, and disco (distribution company) staff.	Project execution entities have always in responded in accelerate and prompt reply, with respect to provision of project data to NTDC, for updating of the IGCEP, in a precise and timely manner,. However the delay might be due to executing department. In this respect (provision of data) customized trainings should be provided, which is Highly recommended

IGCEP ISSUES		
Sr #	Issues	Recommendations
8.	**HYDEL PROJECT SCREENING ISSUES** • All upcoming Hydel projects including projects with LOI and Tariff have been categorized as Candidate projects, while Category I & II solar/wind/bagasse Projects have been listed as committed projects . • Hydel capacity addition has been considered pre-dominantly through inclusion of public sector hydel projects. • Candidate projects have varying challenges apart from their costs and these challenges should be kept in mind while putting forward their candidacy. e.g. many projects suffer grid constraints, very large projects may have financing issues, some projects do not have active sponsor, public sector agencies may have constraints on simultaneous development of projects	Hydro Projects with similar development status should also be assigned "Committed" status Public Sector projects should also be dealt on merit with Private projects. Projects, despite being in CPEC or GTG but with little progress, shouldn't be considered as "Committed" Candidate projects should be additionally categorized based on these: • Availability of Sponsors / Lenders • Project award and development status • Distance from Grid • Development phasing by the Sponsor agency

IGCEP ISSUES		
Sr #	Issues	Recommendations
9.	**ISSUES WITH LEAST COST CRITERIA** New Projects are being added on Annualized Construction Cost, which creates a number of issues: • Optimizing based on Cumulative CAPEX prioritizes projects with lower CAPEX. Examples being, Hydel projects being parked end of the horizon (Pg. 133) and RLNG projects in Open Cycle being prioritized over Combined Cycle projects. • CAPEX investment is a faulty criteria as it disregards the plant factor e.g. $2million/MW Hydel project with 70% plant factor will not be selected over US$1.2million/MW wind project with a plant factor half of it.	New projects should be screened based on their tariff as per NEPRA methodology and not annual incremental CAPEX

Saifco Hydropower Ltd., Delivering a Bright Future

中国国机重工集团有限公司 China SINOMACH Heavy Industry Corporation

Saifco Group

IGCEP ISSUES		
Sr #	Issues	Recommendations

10.	**PROJECT COSTS AND OTHER ASSUMPTIONS**
	• Project costs and timelines needs to be verified for the following issues:
	  • Data provided by Sponsors have been used as it is but not verified independently
	  • Many projects have very old feasibilities and hence unrealistic cost numbers that needs to be indexed to current date.
	• Most of the Public Sector projects start on very unrealistic PC-1 numbers and later on the Project cost significantly increases. Some recent projects have seen as much as 400%increase in project costs.
		Project Cost numbers needs to be verified and indexed by NEPRA. Sponsors looking to increase their project cost numbers subsequently have to surrender their allocated IGCEP slot to next candidate project.
		
		Public Sector project cost and tariff should also be locked by NEPRA at the start of construction like IPP projects and only allowed openers should be trued up at COD

Saifco Hydropower Ltd., Delivering a Bright Future

中国国机重工集团有限公司 China SINOMACH Heavy Industry Corporation

Saifco Group

IGCEP ISSUES		
Sr #	Issues	Recommendations
11.	**SOLAR/WIND (VRE)** • Capping solar projects arbitrarily at 1500MW each year creates window for rather expensive wind and thermal options against the spirit of least cost generation criteria. • 3.6% p.a. reduction in CAPEX has been assumed for Solar till 2030 (Pg. 31). Overall 36% reduction in Solar Project CAPEX seems quite aggressive despite considering technological advancements and economies of scale. • All RE plants (in Category I & II) of CCOE's decision considered as committed (6.7 (g)). However, these do not meet the criteria for committed project as per IGCEP 2047 • North and Mid Country Wind projects are being accommodated by capping Solar and South Wind Projects	Solar being the cheapest should not be capped at 1500MW each year This assumption should be rationalized Developed Hydro Projects should be assigned "Committed" status They should qualify purely on least cost criteria

IGCEP ISSUES		
Sr #	Issues	Recommendations
12.	**SUPPRESSED "LOAD FORECAST"** • Linear model is assumed for demand projection (Pg. 91) based on historic figures. In 2017-18 after generation constraint removal, generation increased by 13 TWh generation demand was added (Chart 3-4). Another one-time adjustment is due to reflect true demand without grid constraints. • Pakistan is significantly under-served in terms of Per Capita Energy Consumption . Substantial demand is being catered through off grid generation (Section 3.1) that needs to be brought online. • 381,910 applications (majority by domestic followed by commercial) are pending for connection to grid (Pg.18). This is latent demand not accounted for.	A one time adjustment in demand forecast is needed to account for (i) grid constraint removal (ii)latent demand and (iii) win back of captive producers

IGCEP ISSUES		
Sr#	Issues	Recommendations
13.	**CAPACITY RETIREMENT** • Plants with no capacity utilization have been kept active. • Only Thermal Projects with PPA expiring in the time horizon (2020-2047) are considered in retirement schedule	Plants with no capacity utilization e.g. old GENCOs may be evaluated for early retirement VRE and other projects with expiries before 2047 should also be included

14.	**OPEN CYCLE GAS TURBINE CAPACITY**
	• OCGT capacity of **4,868 MW** (PAGE 26) on RLNG has been proposed for reserve capacity with less than 10% Load Factor. This selection is resulting from a number of erroneous assumptions:
	  • Same fuel cost for both Open and Combined cycle are assumed (Table 6-7), which is effectively the fuel cost for highest efficiency (62%) plants. 400MW turbines do not have this high efficiency even in combined cycle mode
	  • Capital Cost assumptions for both OCGT and CCGT needs to be rechecked. Recently concluded CCGT transactions do not support these numbers.
		OCGT Fuel cost should be adjusted for efficiency and open cycle configuration, it should be way below 40%
		
		Capital Cost based on complete project with IDC should be used here.

IGCEP ISSUES		
Sr #	Issues	Recommendations
15.	**TARIFF ISSUES** • Fuel Cost Component (FCC) and Variable O&M should have been taken from NEPRA determination rather than Merit Order. Merit Order numbers are many times less than actual tariff due to lag in indexation true up • Tariff for operational projects are based on their actual COD true up, whereas Non-True up tariffs are being used for candidate projects. For instance, this allows installation of upcoming RLNG projects while keeping the already installed projects redundant	Merit order numbers should be adjusted as per applicable NEPRA indexation numbers True up tariffs should be used for new project screening.
16.	**MISC / TYPOS** • Projects Hydro China, Zephyr and Tenaga giving electricity to KE (Page 27) but still included in Upcoming Private Sector Committed Projects (Table 6-4) • Mari CCGT and Hatim CCGT not in Candidate list of projects but still considered in "Future Capacity Addition"	Should be removed from NTDC network numbers Table to be updated Should be reverified

IGCEP ISSUES		
Sr #	Issues	Recommendations
17.	For Local Coal, SSRL information was used as reference cost 6.7 (n) (i). However, there are other expensive projects too which should be considered for fair representation	
18.	**NEPRA role with respect IGCEP** NEPRA also disfavors centralized control of power distribution companies and generation companies, saying this is one of the main reasons for substandard performance and accumulation of circular debt. "The real dilemma of the sector is that due to continued centralized control at every level the discos tend to seek shield against any measure, which leads to competition and opening of the sector,"	NEPRA in its latest industry's overview report 2019. "It is to be understood by the relevant agencies managing and in control of discos that new concepts of electricity supply and delivery are being introduced at a fast pace." Keeping in view the investment in the Energy sector and above mentioned issues the NEPRA can play its pivotal role for not accepting the report with out so many ambiguities and incorrect data used in the soft ware.

SJS (PRIVATE) LIMITED

Subsidiary Of Siddiqsons Limited

27th Floor, Ocean Tower, G-3, Block-9, Scheme#5, Main Clifton Road, Karachi, Pakistan Phone: + 92 21 35166571-5

Dated: 01 June 2020

The **Registrar**,
National Electric Power Regulatory Authority (**NEPRA**)
NEPRA Tower, Attaturk Avenue (East), G-5/1,
Islamabad.

Subject: **COMMENTS IN THE MATTER OF INDICATIVE GENERATION CAPACITY EXPANSION PLAN (2047)**

Dear Sir,

We are writing with reference to the Indicative Generation Capacity Expansion Plan 2047 (**"IGCEP"**) issued by the National Transmission and Despatch Company ("**NTDC**") and NEPRA's notice 25 dated April 2020 for submission of comments on IGCEP (the **"NEPRA Notice"**).

The Jagran-III Hydropower Project ("**Jagran-III**") is a 35 MW hydropower project located in Azad Jammu & Kashmir ("**AJK**"), being developed by SJS (Private) Limited who are holders of a valid Letter of Intent ("**LOI**") issued by the AJK Private Power Cell ("**AJK PPC**"). Jagran-III is at an advanced stage of development and is scheduled to achieve Commercial Operations Date in the Year 2024-25 provided the submitted tariff is approved by Dec 2020.

We have made some observations in the IGCEP that would place the development of all hydropower projects in Pakistan in serious jeopardy due to the recommendation of NTDC to delay their commissioning beyond 2045. In fact, such projects have been pushed to the end of the time-frame covered by the IGCEP, i.e. to 2045-2047. We are of the opinion that, in doing so, the Government of Pakistan ("**GOP**") has dealt a major blow to the investment environment of the country, which is already at a minimum level. Moreover, such measures do not bode well for any prospect of attracting future investments in the power sector, particularly with respect to hydro power projects.

In light of the NEPRA Notice, we have reviewed the IGCEP in detail and hereby submit the following comments on the IGCEP, which we hope will be duly considered by NEPRA before it issues its approval thereof:

1. IGCEP has prioritised 'committed' projects over 'candidate' projects. The criteria for committed projects involves fulfillment of any one of the following pre-requisites:

   i. projects already under construction;
   ii. achieved financial close;
   iii. projects of strategic importance i.e. China-Pakistan Economic Corridor (CPEC) project;
   iv. G2G projects.

As is evident from the above, the IGCEP has conveniently overlooked projects that are at advanced stages of development, particularly those projects for which considerable resources and investment have already been utilised by the respective sponsors/investors. In this vein, the IGCEP has failed to consider other pre-requisites such as projects that have been issued LOIs, and Letters of Support ("**LOS**") under which feasibility studies have been conducted and approved and projects for which financial closing has not been achieved but Power Purchase Agreements have been executed.

For example, in the case of Jagran-III, the project has achieved the following milestones:

- Environmental Studies have been conducted and approved;
- Grid Interconnection Studies have been conducted and approved;
- Power evacuation certificate has been issued by NTDC;
- Engineering, Procurement and Construction Contract has been finalised;
- Geotechnical and Topographic studies have been conducted;
- Engaged renowned German consultants for designing of plant;
- Land acquisition notification under Section 4 of the Land Acquisition Act has been notified by the relevant government department;
- Private Power Cell of Government of AJK to the PPIB has issued consent for processing of Tripartite LOS.
- EPC stage tariff submitted to CPPA for onward submission to NEPRA in Dec 2017
- EPC tariff submitted directly to NEPRA in Oct 2018

Keeping in view the advance stage of development of Jagran-III, to push the development of the Project to 2045 threatens the commercial viability of the project as well as of those projects that are at similar stage of development.

2. We note that RLNG based projects, for which neither LOIs have been issued nor any feasibility study has been conducted, have been considered to provide base power for intermittencies of solar and wind power projects. Such a proposition is not only ill-conceived and baseless, but ultimately of questionable prudency as RLNG is an expensive source of fuel. Instead, hydro power projects being developed by private sector should be given priority for their development on a fast-track basis on account of their ability to provide cheap electricity to the national grid.

3. Under this facile categorization of committed and candidate projects, projects being developed under the umbrella of CPEC have been prioritised, while other hydropower projects which are in similar stages of development have been pushed back. We deem it important to highlight that the designation of projects under CPEC should not be considered a closed matter. GOP should consider adding and removing projects in the list based on commercial viability, potential benefit of each project to the power sector, among other factors to be carefully analysed.

4. While projects at an advanced stage of development have been delayed, projects such as 132 MW Rajdhani, which have yet to be initiated, have been given priority. This shows complete ignorance on part of the authors of the IGCEP to carefully consider each and every aspect when prioritizing projects, which should be based on merit rather than baseless assumptions.

5. It is imperative to point out that the IGCEP has proposed delaying the development of hydropower projects to 2045. In doing so, the IGCEP has failed to take into account the enormous potential of hydropower generation in Pakistan which we have failed to fully utilise. Even more so, hydropower projects are a source of cheap electricity for the national grid that will help lower the overall basket price, which the IGCEP has failed to factor in.

6. Further, it appears that many hydropower projects have been delayed without taking into confidence the respective provincial and AJK entities. Following the 18th Amendment, the provinces have been afforded autonomy to conceive and develop projects of their own accord. The IGCEP has failed to give due consideration to the constitutional rights of provinces which may have serious ramifications on provincial commitments vis-a-vis government-to-government arrangements.

7. Given the current energy demand-supply scenario in the country, it is a well-recognised fact that the overall demand of electricity during summer season is much higher than during the winter season. In this regard, while water flow during winter season is lower, hydro-based electricity generation is at its minimum, however, during summer season hydropower projects can produce maximum electricity to meet the higher demand of consumers. Therefore, it is important to note that hydropower projects not only cater to this demand-supply shortfall, but also provide a better economic and cost-effective solution.

8. The IGCEP has taken the overall operating lifespan of hydropower plants to be 50 years, which appears to be in stark contrast to the ground reality. In practicality, when compared to other technologies, hydropower offers the longest working life. In fact, the operating lifespan of hydropower projects can be extended to 100 years with some rehabilitation.

9. Hydropower projects are unique compared to other power supply options such as thermal. Hydropower projects are always custom-designed site-specific projects. Hydropower require substantial capital investment, but they offer extremely low operating costs and long operating lifespans. The result is extremely competitive production costs for electricity. Such factors have not been taken into account by the IGCEP and, as a result, hydropower projects have been delayed without an all-inclusive analysis of the associated cost and benefits.

10. The IGCEP aims to further prioritise public sector projects over private sector hydropower projects, while remaining oblivious to the various inefficiencies and obstacles associated with public sector projects in developing key projects within the given time-frame and forecasted costs. Moreover, the financial and budgetary constraints on the government cannot be disregarded, which seriously hamper the development of the projects. This is evident from the Neelum-Jhelum Project, regarded of national importance, which suffered 5 years of delay before becoming operational at a cost of USD 5 billion as opposed to the initially projected USD 1.2 Billion. Such delays and exceeding project costs are a common sight in the public sector, which has been completely ignored in the IGCEP.

11. It is surprising to note that the hydropower projects have not been categorised under renewable energy projects. Where solar and wind projects have been prioritised as cheap and environmentally friendly source of power, hydropower projects have been relegated to a secondary status despite being having all the inherent characteristics. It is strongly recommended that, given the various complexities of each technology, due consideration should be given to hydropower as a renewable energy source to improve the overall energy mix of the country.

12. On one hand, where projects under CPEC have been considered of strategic importance, it is baffling to note that the Diamer-Bhasha dam has not been prioritised for construction. In fact, in addition to being a cheap source of electricity, Diamer-Bhasha is vital for water storage in the wake of a deepening water scarcity crisis in Pakistan. As such, failure to take into account such essential factors when assigning priority to projects shows lack of in-depth, merit-based analyses of each project, which was ought to be carried out.

To conclude, while it is commendable that the NTDC is willing to employ new planning tools like "PLEXOS", the IGCEP shows NTDC's inexperience with the results of these planning tools. We strongly feel that the various government departments ought to have provided more input on the assumptions and recommendations of PLEXOS. Like any other planning tool, PLEXOS has its own shortcomings, which cannot be overlooked and its use and reliance required more guidance for crucial planning recommendations.

Sincerely,

Abdul Rahim
Director
SJS Pvt Ltd

CC:

- Secretary Energy, Islamabad
- Managing Director, PPIB, Islamabad
- Director General, AJK PPC, Muzaffarabad
- GM Planning NTDC, Lahore

siddiqsons HYDRO LIMITED
27th Floor, Ocean Tower, G-3, Block-9, Scheme#5, Main Clifton Road,
Karachi, Pakistan Phone: + 92 21 35166571-5

Dated: 01 June 2020

The **Registrar**,
National Electric Power Regulatory Authority (**NEPRA**)
NEPRA Tower, Attaturk Avenue (East), G-5/1,
Islamabad.

Subject: **COMMENTS IN THE MATTER OF INDICATIVE GENERATION CAPACITY EXPANSION PLAN (2047)**

Dear Sir,

We are writing with reference to the Indicative Generation Capacity Expansion Plan 2047 (**"IGCEP"**) issued by the National Transmission and Despatch Company ("**NTDC**") and NEPRA's notice 25 dated April 2020 for submission of comments on IGCEP (the **"NEPRA Notice"**).

The Daral Khwar-II Hydropower Project ("**DK-II HPP**") is a 9.5 MW hydropower project located in Khyber Pakhtunkhwa ("**KPK**"), being developed by Siddiqsons Hydro Limited who are holders of a valid Letter of Intent ("**LOI**") issued by the Pakhtunkhwa Energy Development Organization ("**PEDO**"). DK-II HPP is at an advanced stage of feasibility approval and is scheduled to achieve Commercial Operations Date in the Year 2025.

We have made some observations in the IGCEP that would place the development of all hydropower projects in Pakistan in serious jeopardy due to the recommendation of NTDC to delay their commissioning beyond 2045. In fact, such projects have been pushed to the end of the time-frame covered by the IGCEP, i.e. to 2045-2047. We are of the opinion that, in doing so, the Government of Pakistan ("**GOP**") has dealt a major blow to the investment environment of the country, which is already at a minimum level. Moreover, such measures do not bode well for any prospect of attracting future investments in the power sector, particularly with respect to hydro power projects.

In light of the NEPRA Notice, we have reviewed the IGCEP in detail and hereby submit the following comments on the IGCEP, which we hope will be duly considered by NEPRA before it issues its approval thereof:

1. IGCEP has prioritised 'committed' projects over 'candidate' projects. The criteria for committed projects involves fulfillment of any one of the following pre-requisites:

   i. projects already under construction;
   ii. achieved financial close;
   iii. projects of strategic importance i.e. China-Pakistan Economic Corridor (CPEC) project;
   iv. G2G projects.

As is evident from the above, the IGCEP has conveniently overlooked projects that are at advanced stages of development, particularly those projects for which considerable resources and investment have already been utilised by the respective sponsors/investors. In this vein, the IGCEP has failed to consider other pre-requisites such as projects that have been issued LOIs, and Letters of Support ("**LOS**") under which feasibility studies have been conducted and approved and projects for which financial closing has not been achieved but Power Purchase Agreements have been executed.

For example, in the case of Daral Khwar-II HPP, the project has achieved the following milestones:

- LOI issued by PEDO in Oct 2017
- Feasibility completed and submitted to PEDO for approval
- Environmental Studies have been conducted and submitted to PEDO for approval;
- Preliminary Grid Interconnection Studies have been conducted;
- Geotechnical and Topographic studies have been conducted;

Keeping in view the development of DK-II HPP, to push the development of the Project to 2045 threatens the commercial viability of the project as well as of those projects that are at similar stage of development.

2. We note that RLNG based projects, for which neither LOIs have been issued nor any feasibility study has been conducted, have been considered to provide base power for intermittencies of solar and wind power projects. Such a proposition is not only ill-conceived and baseless, but ultimately of questionable prudency as RLNG is an expensive source of fuel. Instead, hydro power projects being developed by private sector should be given priority for their development on a fast-track basis on account of their ability to provide cheap electricity to the national grid.

3. Under this facile categorization of committed and candidate projects, projects being developed under the umbrella of CPEC have been prioritised, while other hydropower projects which are in similar stages of development have been pushed back. We deem it important to highlight that the designation of projects under CPEC should not be considered a closed matter. GOP should consider adding and removing projects in the list based on commercial viability, potential benefit of each project to the power sector, among other factors to be carefully analysed.

4. While projects at an advanced stage of development have been delayed, projects such as 132 MW Rajdhani, which have yet to be initiated, have been given priority. This shows complete ignorance on part of the authors of the IGCEP to carefully consider each and every aspect when prioritizing projects, which should be based on merit rather than baseless assumptions.

5. It is imperative to point out that the IGCEP has proposed delaying the development of hydropower projects to 2045. In doing so, the IGCEP has failed to take into account the enormous potential of hydropower generation in Pakistan which we have failed to fully utilise. Even more so, hydropower projects are a source of cheap electricity for the national grid that will help lower the overall basket price, which the IGCEP has failed to factor in.

6. Further, it appears that many hydropower projects have been delayed without taking into confidence the respective provincial and AJK entities. Following the 18th Amendment, the provinces have been afforded autonomy to conceive and develop projects of their own accord. The IGCEP has failed to give due consideration to the constitutional rights of provinces which may have serious ramifications on provincial commitments vis-a-vis government-to-government arrangements.

7. Given the current energy demand-supply scenario in the country, it is a well-recognised fact that the overall demand of electricity during summer season is much higher than during the winter season. In this regard, while water flow during winter season is lower, hydro-based electricity generation is at its minimum, however, during summer season hydropower projects can produce maximum electricity to meet the higher demand of consumers. Therefore, it is important to note that hydropower projects not only cater to this demand-supply shortfall, but also provide a better economic and cost-effective solution.

8. The IGCEP has taken the overall operating lifespan of hydropower plants to be 50 years, which appears to be in stark contrast to the ground reality. In practicality, when compared to other technologies, hydropower offers the longest working life. In fact, the operating lifespan of hydropower projects can be extended to 100 years with some rehabilitation.

9. Hydropower projects are unique compared to other power supply options such as thermal. Hydropower projects are always custom-designed site-specific projects. Hydropower require substantial capital investment, but they offer extremely low operating costs and long operating lifespans. The result is extremely competitive production costs for electricity. Such factors have not been taken into account by the IGCEP and, as a result, hydropower projects have been delayed without an all-inclusive analysis of the associated cost and benefits.

10. The IGCEP aims to further prioritise public sector projects over private sector hydropower projects, while remaining oblivious to the various inefficiencies and obstacles associated with public sector projects in developing key projects within the given time-frame and forecasted costs. Moreover, the financial and budgetary constraints on the government cannot be disregarded, which seriously hamper the development of the projects. This is evident from the Neelum-Jhelum Project, regarded of national importance, which suffered 5 years of delay before becoming operational at a cost of USD 5 billion as opposed to the initially projected USD 1.2 Billion. Such delays and exceeding project costs are a common sight in the public sector, which has been completely ignored in the IGCEP.

11. It is surprising to note that the hydropower projects have not been categorised under renewable energy projects. Where solar and wind projects have been prioritised as cheap and environmentally friendly source of power, hydropower projects have been relegated to a secondary status despite being having all the inherent characteristics. It is strongly recommended that, given the various complexities of each technology, due consideration should be given to hydropower as a renewable energy source to improve the overall energy mix of the country.

12. On one hand, where projects under CPEC have been considered of strategic importance, it is baffling to note that the Diamer-Bhasha dam has not been prioritised for construction. In fact, in addition to being a cheap source of electricity, Diamer-Bhasha is vital for water storage in the wake of a deepening water scarcity crisis in Pakistan. As such, failure to take into account such essential factors when assigning priority to projects shows lack of in-depth, merit-based analyses of each project, which was ought to be carried out.

To conclude, while it is commendable that the NTDC is willing to employ new planning tools like "PLEXOS", the IGCEP shows NTDC's inexperience with the results of these planning tools. We strongly feel that the various government departments ought to have provided more input on the assumptions and recommendations of PLEXOS. Like any other planning tool, PLEXOS has its own shortcomings, which cannot be overlooked and its use and reliance required more guidance for crucial planning recommendations.

Sincerely,

Abdul Rahim
Director
Siddiqsons Hydro Limited

CC:

- Secretary Energy, Islamabad
- Managing Director, PPIB, Islamabad
- GM Planning, NTDC, Lahore
- Chief Executive (Private Power), PEDO, Peshawar

siddiqsons SHALFALAM HYDRO LIMITED
27th Floor, Ocean Tower, G-3, Block-9, Scheme#5, Main Clifton Road,
Karachi, Pakistan Phone: + 92 21 35166571-5

Dated: 01 June 2020

The **Registrar,**
National Electric Power Regulatory Authority (**NEPRA**)
NEPRA Tower, Attaturk Avenue (East), G-5/1,
Islamabad.

Subject: **COMMENTS IN THE MATTER OF INDICATIVE GENERATION CAPACITY EXPANSION PLAN (2047)**

Dear Sir,

We are writing with reference to the Indicative Generation Capacity Expansion Plan 2047 (**"IGCEP"**) issued by the National Transmission and Despatch Company (**"NTDC"**) and NEPRA's notice 25 dated April 2020 for submission of comments on IGCEP (the **"NEPRA Notice"**).

The Shalfalam Hydropower Project (**"Shalfalam HPP"**) is a 60 MW hydropower project located in Khyber Pakhtunkhwa (**"KPK"**), being developed by Siddiqsons Limited who are holders of a valid Letter of Intent (**"LOI"**) issued by the Pakhtunkhwa Energy Development Organization (**"PEDO"**). Shalfalam HPP is at an advanced stage of feasibility approval and is scheduled to achieve Commercial Operations Date in 2025.

We have made some observations in the IGCEP that would place the development of all hydropower projects in Pakistan in serious jeopardy due to the recommendation of NTDC to delay their commissioning beyond 2045. In fact, such projects have been pushed to the end of the time-frame covered by the IGCEP, i.e. to 2045-2047. We are of the opinion that, in doing so, the Government of Pakistan (**"GOP"**) has dealt a major blow to the investment environment of the country, which is already at a minimum level. Moreover, such measures do not bode well for any prospect of attracting future investments in the power sector, particularly with respect to hydro power projects.

In light of the NEPRA Notice, we have reviewed the IGCEP in detail and hereby submit the following comments on the IGCEP, which we hope will be duly considered by NEPRA before it issues its approval thereof:

1. IGCEP has prioritised 'committed' projects over 'candidate' projects. The criteria for committed projects involves fulfillment of any one of the following pre-requisites:

   i. projects already under construction;
   ii. achieved financial close;
   iii. projects of strategic importance i.e. China-Pakistan Economic Corridor (CPEC) project;
   iv. G2G projects.

As is evident from the above, the IGCEP has conveniently overlooked projects that are at advanced stages of development, particularly those projects for which considerable resources and investment have already been utilised by the respective sponsors/investors. In this vein, the IGCEP has failed to consider other pre-requisites such as projects that have been issued LOIs, and Letters of Support ("**LOS**") under which feasibility studies have been conducted and approved and projects for which financial closing has not been achieved but Power Purchase Agreements have been executed.

For example, in the case of Shalfalam HPP, the project has achieved the following milestones:

- LOI issued by PEDO in May 2018
- Feasibility completed and submitted to PEDO for approval
- Environmental Studies have been conducted and submitted to PEDO for approval;
- Preliminary Grid Interconnection Studies have been conducted;
- Geotechnical and Topographic studies have been conducted;

Keeping in view the development of Shalfalam HPP, to push the development of the Project to 2045 threatens the commercial viability of the project as well as of those projects that are at similar stage of development.

2. We note that RLNG based projects, for which neither LOIs have been issued nor any feasibility study has been conducted, have been considered to provide base power for intermittencies of solar and wind power projects. Such a proposition is not only ill-conceived and baseless, but ultimately of questionable prudency as RLNG is an expensive source of fuel. Instead, hydro power projects being developed by private sector should be given priority for their development on a fast-track basis on account of their ability to provide cheap electricity to the national grid.

3. Under this facile categorization of committed and candidate projects, projects being developed under the umbrella of CPEC have been prioritised, while other hydropower projects which are in similar stages of development have been pushed back. We deem it important to highlight that the designation of projects under CPEC should not be considered a closed matter. GOP should consider adding and removing projects in the list based on commercial viability, potential benefit of each project to the power sector, among other factors to be carefully analysed.

4. While projects at an advanced stage of development have been delayed, projects such as 132 MW Rajdhani, which have yet to be initiated, have been given priority. This shows complete ignorance on part of the authors of the IGCEP to carefully consider each and every aspect when prioritizing projects, which should be based on merit rather than baseless assumptions.

5. It is imperative to point out that the IGCEP has proposed delaying the development of hydropower projects to 2045. In doing so, the IGCEP has failed to take into account the enormous potential of hydropower generation in Pakistan which we have failed to fully utilise. Even more so, hydropower projects are a source of cheap electricity for the national grid that will help lower the overall basket price, which the IGCEP has failed to factor in.

6. Further, it appears that many hydropower projects have been delayed without taking into confidence the respective provincial and AJK entities. Following the 18th Amendment, the provinces have been afforded autonomy to conceive and develop projects of their own accord. The IGCEP has failed to give due consideration to the constitutional rights of provinces which may have serious ramifications on provincial commitments vis-a-vis government-to-government arrangements.

7. Given the current energy demand-supply scenario in the country, it is a well-recognised fact that the overall demand of electricity during summer season is much higher than during the winter season. In this regard, while water flow during winter season is lower, hydro-based electricity generation is at its minimum, however, during summer season hydropower projects can produce maximum electricity to meet the higher demand of consumers. Therefore, it is important to note that hydropower projects not only cater to this demand-supply shortfall, but also provide a better economic and cost-effective solution.

8. The IGCEP has taken the overall operating lifespan of hydropower plants to be 50 years, which appears to be in stark contrast to the ground reality. In practicality, when compared to other technologies, hydropower offers the longest working life. In fact, the operating lifespan of hydropower projects can be extended to 100 years with some rehabilitation.

9. Hydropower projects are unique compared to other power supply options such as thermal. Hydropower projects are always custom-designed site-specific projects. Hydropower require substantial capital investment, but they offer extremely low operating costs and long operating lifespans. The result is extremely competitive production costs for electricity. Such factors have not been taken into account by the IGCEP and, as a result, hydropower projects have been delayed without an all-inclusive analysis of the associated cost and benefits.

10. The IGCEP aims to further prioritise public sector projects over private sector hydropower projects, while remaining oblivious to the various inefficiencies and obstacles associated with public sector projects in developing key projects within the given time-frame and forecasted costs. Moreover, the financial and budgetary constraints on the government cannot be disregarded, which seriously hamper the development of the projects. This is evident from the Neelum-Jhelum Project, regarded of national importance, which suffered 5 years of delay before becoming operational at a cost of USD 5 billion as opposed to the initially projected USD 1.2 Billion. Such delays and exceeding project costs are a common sight in the public sector, which has been completely ignored in the IGCEP.

11. It is surprising to note that the hydropower projects have not been categorised under renewable energy projects. Where solar and wind projects have been prioritised as cheap and environmentally friendly source of power, hydropower projects have been relegated to a secondary status despite being having all the inherent characteristics. It is strongly recommended that, given the various complexities of each technology, due consideration should be given to hydropower as a renewable energy source to improve the overall energy mix of the country.

12. On one hand, where projects under CPEC have been considered of strategic importance, it is baffling to note that the Diamer-Bhasha dam has not been prioritised for construction. In fact, in addition to being a cheap source of electricity, Diamer-Bhasha is vital for water storage in the wake of a deepening water scarcity crisis in Pakistan. As such, failure to take into account such essential factors when assigning priority to projects shows lack of in-depth, merit-based analyses of each project, which was ought to be carried out.

To conclude, while it is commendable that the NTDC is willing to employ new planning tools like "PLEXOS", the IGCEP shows NTDC's inexperience with the results of these planning tools. We strongly feel that the various government departments ought to have provided more input on the assumptions and recommendations of PLEXOS. Like any other planning tool, PLEXOS has its own shortcomings, which cannot be overlooked and its use and reliance required more guidance for crucial planning recommendations.

Sincerely

Abdur Rahim
Director
Siddiqsons Hydro Shalfalam Limited

CC:

- Secretary Energy, Islamabad
- Managing Director, PPIB, Islamabad
- GM Planning, NTDC, Lahore
- Chief Executive (Private Power), PEDO, Peshawar

21st of May, 2020

Registrar NEPRA
NEPRA Tower, Attaturk Avenue (East),
Sector G-5/1, Islamabad.

Subject: Comments on the Indicative Generation Capacity Expansion Plan (IGCEP) 2047.

Dear Sir,

1. The following comments are being filed on behalf of Pakistan Fisher Folk Forum ('**PFF**') through its Chairperson Mr. M. Ali Shah, who has been authorized in this behalf. PFF as an organization strives for rights of the peasants and indigenous people or Thar affected by the mega development projects. The instant Comments reflect the grievances of the indigenous people of Sindh regarding the proposed expanded coal projects in Thar.

2. PFF has noted with concern that in IGCEP 2047 the role of domestic coal in the energy mix of Pakistan rises to constitute 37% of Generation Mix (GWh). This study has not taken into consideration the devastating impact of coal power projects on the indigenous people of Thar, communities of whom have been dislocated due to the project. Neither adequate compensation nor any relocation has been provided to the affected people.

3. The coal projects adversely impact the larger ecology of the region, including its environment, which have only been addressed in the report in a passing manner. IGCEP has not addressed the highly polluting effect of coal on the ambient air of Thar, which is causing high levels of respiratory distress problems. The levels of particle matter, mercury and nitrogen dioxide pollution is Thar is among the highest in the province as a direct corollary of the existing coal projects.

4. A total of nine power plants with a total capacity of 3.7 gigawatts are proposed in Thar, which would constitute one of the largest air pollutant, mercury and carbon dioxide (CO2) emissions hotspots in South Asia. The coal power plants would emit an estimated 1400 kilograms of mercury per year, of which one-fifth would be deposited into land ecosystems in the region. Most of the deposition took place onto cropland, increasing the

For info & nec pl.
- ADG(LTO)
Copy to
- SA(Tech)
- SA(T)
- DG(M&E)
- SLA(LLD)
- [illegible]

28/5/20
cc: Chairman
- V.C/m(m&E)
- m(T)
- m(CA)
- m(Lic)

REGISTRAR
Dy. No. 2378
Dated 28-5-20

mercury concentrations in crops and grazing areas of animals, which are the principal source of income for the indigenous people.

5. The study while calculating the lowest cost and efficient solution has neglected the globally accepted principles of inter-generational equity and sustainable development. An example of it is its neglect over the impact of increased coal sourced power over the aquifers and ground water table of Thar. Thar being a desert has limited water resources, which if used at a higher rate than by which it is filled, would cause desertification and mass drought in the region. The coal mining and power plants would create a water shortage as these activities would destroy underground aquifers. For the next few years, the coal mining in Thar would require 4,000 billion gallons of water and for generation of 10 Gegawatt power 8,500 billion gallons of water would be consumed. This would create an acute shortage of water in the Thar desert.

6. Apart from the unsustainable use of water by coal fired plants, the discharge of used water has already wreaked havoc upon the local water sources. The massive increase in future coal powered energy would amplify the magnitude of pollution caused by waste water affluence of coal fired plants.

7. The world is shifting to renewable solutions to cope up with energy crisis but our inclination is more on environmentally hazardous energy sources rather than energy efficient sources. Therefore the PFF also advocates that Pakistan should consider the environmental, social and economic side-effects of fossil fuels and lay stress on renewable sources of energy.

Regards,

For and on behalf of
Pakistan Fisher Folks Forum

Uzghor Hydro Power Company (Pvt.) Ltd

UHPCO

Ref No: UHPCO/NEPRA/TUHPP/2020/015 Dated: May 12, 2020

The Registrar
National Electric Power Regulatory Authority (NEPRA)
NEPRA Tower Attaturk Avenue (East)
Sector G-5/1,
Islamabad.

SUBJECT: COMMENTS ON INDICATIVE GENERATION CAPACITY EXPANSION PLAN "IGCEP 2047"

Dear Sir,

NTDC in compliance to NERPA's approved Grid Code clause PC-4 (Forecasts and Generation Expansion Plan) and PC-4.1 (Generation Capacity Additions) has prepared long-term "Least Cost Generation Plan" or Indicative Generation Capacity Expansion Plan (hereinafter referred to as the "**IGCEP**" or the "**Report**") for review and approval of NEPRA (the "**Regulator**" or the "**Authority**"). NEPRA *vide* their website has invited the stakeholders for submitting comments in the matter of IGCEP. We, being one of stakeholder are pleased to submit our comments for Authority's kind consideration:

A. GENERAL COMMENTS:

1. In accordance with clause PC-4 of the Grid Code, NTDC is obligated to prepare and deliver to NEPRA a ten year plan, however in this instance case the planning horizon has been expanded & extended to 2047 – an additional 17 years to correspond to the Initiative Pakistan @ 100 launched by Government of Pakistan to mark the 100th anniversary of Pakistan. We believe that such planning cannot be accurately done for an extremely long-term horizon especially when it is based on ever-changing wide range of assumptions, such as volatility of fuel prices for thermal plants either produced indigenously (e.g. thar coal) or imported (e.g. furnace oil, RLNG etc.).

2. Refer to page-16 of 237 of the Report, where it is mentioned that "the energy requirements in the system increased by a meager margin of 0.17% during FY2018-19, Peak Demand actually turned out 4% lower than that of in FY 2017-18. Contrary to this behavior of load recession in the previous year, Annual Demand Growth of 4% to 6.1% has been assumed in the future years. It is proposed that there could be a comprehensive five (5) to seven (7) years Medium Term Plan instead of this Twenty-Seven (27) Years Plan for generation capacity expansion. A developing country like Pakistan wherein power generation policies are solely dependent on fragile political and non-political governments can neither afford nor sustain such a long-term plan. Hardly any five years plan is completed in its true spirit. This Medium-Term Plan would be reviewed, revised and fine-tuned annually on regular basis in order to make it real-time and to keep the balance of power system. Accordingly, Capacity Procurement would be initiated as per future load demand forecast of Medium-Term Plan. Market Operator would do this job with the approval of NEPRA. IGCEP would not be used for capacity procurement (refer to Figure 2-1 page-6 of 237 and Disclaimer).

Head Office: 59-E, Street – 7, Sector: I-10/3, Islamabad. Tel: (+92-51) 4446873-74 - 4436004
Fax: (+92-51) 4431774, Email: uhpco58@gmail.com,

3. Pakistan's electricity generation mix relies on fossil fuels including RLNG, imported / domestic coal, natural gas (NG) and furnace oil; more than 60% of energy mix is formed of fossil fuels. Thermal Power has three components – capital costs; O&M and fuel component. All three components vary with time, but fuel prices are most unpredictable as RFO prices changes up to 3000% since 1994; it is impossible to be able to forecast fuel prices and thus fix fuel cost component in a regulated power generation tariff. Therefore, no realistic Least Cost Generation Plan could be developed solely based on cost. Since the prices of fossil fuels (domestic / imported) are linked to the international prices of these fuels; hence, fuel price uncertainty shall be the major determinants for a long-term generation expansion plan and it may be noted that all thermal based power generation inheritably possess such fuel price uncertainty (up to 90%); in other words if the price of fuel goes up the end tariff goes up. The below mention table highlights change in fuel price from the plant commissioning to present (all the data is extracted from NEPRA website) and **is a proven fact that the fuel prices of thermal based power plants have historically gone up, therefore alternative source of energy generation may be opted in the national interest.**

No.	Category	Company Name	Capacity	Year : Fuel Price	Year : Fuel Price
1	Imported Coal	Huaneng Shandong Ruyi (Pakistan) Energy (Private) Limited.	2x660MW	2015 : 4.291 Rs/kWh	2020: 8.180 Rs//kWh ~200% increase
2	Local Coal	Engro Powergen Thar Pvt. Ltd.	2x330MW	2015: 4.124 Rs./kWh	2020: 7.958 Rs/kWh ~200% increase
3	RLNG	National Power Parks Management Co. (Pvt) Ltd.	1223.06MW	2016 : 8.032 Rs/kWh	2020: 9.535 Rs/kWh
4	Furnace Oil	Attock Gen Ltd.	156.13MW	2006: 4.362 Rs/kWh	2020: 11.14 Rs/kWh

4. PKR has devalued @ 7.45pc per annum during the past 20 years. On this basis, the fuel cost of $3.64bn today would be about $7bn per annum in next 10 years, $10bn in next 15 years and $14bn in coming 20 years. In line with this, the LNG fuel cost, which is at present Rs9.53 per unit (kWh), would rise to Rs34 per unit (fuel only) in 20 years. The cost of coal alone, which is presently Rs7.95 per unit would rise to Rs27 per unit (fuel only) in 20 years, meanwhile the generation cost of hydropower (variable) of Rs. 0.62 would only rise to Rs. 1.01 in 20 years. Therefore, fuel price escalation in future is unpredictable, uncertain and can be a basis of any Least Cost Generation Plan. Other factors also needed to be accounted for future planning such as health/environment cost in case of thermal power plants, impact of hydel's on local economy & tourism etc.

5. The country meets two-thirds of its energy requirement from fuel oil and natural gas. Majority of energy generation from thermal power plants is based on imported fuels such as coal, oil & LNG. Unfortunately, we have three imported coal power plants now with a

combined capacity of 3960 MW and a fourth one that has yet to be installed, taking the total to more than 4000 MW. More than $1.5 billion of foreign exchange is spent annually in coal imports and is slated to increase. Similarly, we spent billions of dollars in importing RLNG and furnace oil for the purpose of energy generation from these fuels; that is why the country needs a lot of foreign exchange for the import of petroleum products including crude and refined oil, liquefied natural gas (LNG), liquefied petroleum gas (LPG), etc. **It may also be noted that the scarcity of foreign exchange is a perennial problem, which will not be going away within a year or two. Currently, Pakistan's economy is growing at a slow pace. GDP growth, according to government's own estimates, tanked to 3.3% in FY19 from 5.5% in FY18. Therefore, future planning for energy generation / energy mix must keep in mind the detrimental effects of depleting foreign reserves on country's economy & balance of payments.**

6. **Fuel Price Indexation**; Indexation for Variable Price Index of Thar Coal Fuel has been assumed from 1.00 in 2019 to 0.69 during 2039 to 2047 (9 years). It is added that excavation of local coal shall require a lot of machinery & equipment, labor cost and fuel, whose prices shall increase with the passage of time instead of decreasing. There shall be impact of different currencies on Pak Rupee in future years. How the price of Thar Coal shall decrease in future years up to 2047? The basis of such decline is not given or explained in the Report.

7. Table 6-7 (page 87/237) of IGCEP provided the economic parameters considered for the thermal candidate plants. The Capital Cost of 660MW Coal Power Plant based on Thar Coal is mentioned as $1,310/kW. However, NEPRA has determined the reference capital cost including IDC of $ 1,637/kW for 660 MW coal power plant and ref. levelized tariff of 9.21 USc/kWh. The Authority in Jan, 2018 has determined tariff of 7.33 USc/kWh for M/s Siddiqsons 330 MW **Mine Mouth** Thar Coal based power project. The Authority during the same period has determined **(i)** 5.79 USc/kWh for 640 MW Mahl hydro power Project in Jan, 2019 and **(ii)** 6.68 USc/kWh for 8 MW Kathai-II HPP in Nov, 2018. This is evidence that if one likes to compare the cost, hydel is much cheaper solution than thermal plant, although in this tariff escalation of fuel price is not factored in.

8. The Report discuss generation plan but ignore any plan for transmission & distribution. The IGCEP shall be linked to the transmission & distribution plan and the drafts of all these plans may be shared conjointly for the better understanding of power expansion plans and for avoidance of our prevailing practices; where several projects are kept on abeyance by the federal government/MOE due to a usual reason that further studies are required / in process before the issuance of necessary approvals required by sponsors.

9. The report has proposed that for going forward the base load shall be of RLNG & Local Coal and by 2047 shall be 30,577MW and 32,948MW respectively; which is extremely hypothetical and over ambitious due to following:

——→ **a.** RLNG shall remain an imported fuel and will be a financial burdened in term of foreign currency exposure. In the recent past powerful lobbies backed the construction of thousands of megawatts of public-sector power plants based on imported fuels.

These plants are developed with massive policy breaches and out-of-turn privileges. The fact remains that the country now faces a power surplus after induction of highly expensive RLNG generation with mandatory 60% must run plant load factor. These RLNG plants are now actively considered by the govt. for privatization along with proposals to offer additional concessions to the prospective buyers.

b. Thar Coal has its own technical mechanics for utilization such as an ample water supply is required which is not available (LBOD line is still not started, Engro is relying on ground water) and alternative line of Makhi Farsh has 200 cusec of water out of which 50 cusec is already allocated to 1660MW power plants (M/s Shanghai and M/s Siddiqsons). Further, the Report has not considered the cost of mine extraction, as the existing block-II mine has 3 phases to cater 6 projects only with 2310MW and block-I has only one project; whereas other blocks of Thar are still untapped by any other company. Therefore, mine extraction is a long-term process and future generation planning cannot be left on the mercy of mine extraction only.

c. NTDC in their Report stated that "*the cost of mining is expected to be reducing with every new initiative. However, there are certain issues such as availability of sufficient water, estimation of optimal amount of mining, etc. are required to be studied. It is suggested that the relevant project execution entity i.e. PPIB should undertake such studies in addition to studies by NTDC with respect to power evacuation and transmission of power to the load centers*". (Section 8.6; Page 237/236). It is evident from the above NTDC's statement that there is absence of authenticated/independent study confirming the effects of setting up further power plants in Thar and that whether the Thar area has enough water resources that are needed to produce 30% of Pakistan electricity including its cost?

d. As per the 2016 Paris accord on climate change, by 2038 all the brown coal (lignite coal) plants shall be closed out to curb the climatic issues caused by coal. Considering this, if pressure comes on Pakistan and the coal plants are forced to close so a huge amount of capacity shall be paid to these projects just like currently RFO is being handled and an inquiry is going against it.

e. The Report stated that the impact of carbon emissions due to addition of power generation in future is considered. Carbon emissions in the country by power generation accounts for 0.406 kg-CO_2/kWh in FY 2019-20 and this indicator reduces to 0.32 kg-CO_2/kWh by FY 2046-47 which is even less than average of OECD countries. The value of the carbon emission indicator for Pakistan as per IGCEP 2047 is smaller than world average (.52) and non-OECD countries (.60) (page xxvii / 3rd Para). In other words, IGCEP claims that by increasing the Coal share from current 3% to ~30% in year 2047 will decrease from current rate of .406 kg-CO_2/kWh to 0.32 kg-CO_2/kWh by FY 2046-47. The aforesaid findings of the Report may need to be verified & confirmed though an expert in the relevant field.

f. In the Report it is stated that Combined Cycle Power Plants on RLNG and Gas would be used as base load plants, whereas their annual utilization is given in the range of 1% to 5% beyond the year 2030. In this situation, whether there is justification for

proposing new power plants, how CAPEX of new or these plants could be recovered and what shall be the impact on overall generation cost? The generation costs per kWh of these low capacity factors have not been discussed in the report and the same are required to be analyzed technically & financially. This has adverse effect on circular debt. The existing Coal, RLNG and even hydel's can be utilized as base load power plants in the future.

g. It is a well-known fact that there are numerous environmental & health related adverse effects of coal power plants on the residents of that area. This is the major reason that majority of countries such as China, U.S.A and all European countries are now dismantling their coal power plants and their focus is now shifted on setting up renewable based power plants such as hydro, wind & solar. According to www.hydropower.org/statusreport China alone in 2019 has added more than 8,500 MW of electricity generation from hydropower.

h. The Report has not considered or included the health & environmental cost relating to coal-based power plants before allowing the setting-up of more than 29,000 MW of new power plants based on Coal under long-term PPAs. The massive environmental & health related adverse effects have led the developed countries in dismantling coal power plants. **Therefore, a holistic approach is needed before considering huge addition of coal-based power generation as envisage in IGCEP because health of the general public shall be the utmost priority of the government/Regulator as compare to economic viability of power generation from coal.**

B. COMMENTS ON HYDRO POWER & RENEWABLES:

10. The report envisages a target of 30 percent renewables (wind, solar and biomass) by 2030 even though this is not achievable in the next 10 years, because 78pc of the projects are not based on feasibility studies or site confirmations. The candidate projects include schemes of 37,160 MW (60pc) wind, solar and coal-based IPPs which are "expected" plans without any sponsors, locations or financing. It may be noted that high penetration of RE power plants in the system shall require additional measures for system stability, which may increase the cost of energy generation.

11. Although, the Report aggressively discussed advantages of Wind/Solar (Table 4.3 / Page 31) and Thar Coal but however miserably failed to discuss advantages of hydro power plants. Instead the Report highlighted that hydropower plants are rather expensive. This discrimination shows the intention that how thermal base power projects are encouraged precisely, further the Report has failed to recognize the fact Hydropower is one of the most efficient sources of energy and as of now power generated from Mangla & Tarbela are the cheapest among all. Besides that, the hydropower projects are the only assets that are transferable to the government from IPPs after the completion of the concession period for a nominal cost of one rupee.

12. It is to be noted that Nature has gifted huge hydel source to Pakistan and increasing demand of power in summer and increase in hydel potential during the same period are propionate. CASA 1000 project is also an attempt transfer hydel power from Central

Asian countries to Pakistan. The Report failed to take the advantage and simply down grade hydel's on purported high cost of generation.

13. In addition, hydropower stations have a very long service life, which can be extended further with minimum refurbishment works. Life of run of river hydro power project(s) is usually more than 70 years i.e. a small ROR hydro power project at Renala Kurd is operating since 1925 and producing electricity without any major overhauls. Therefore, hydropower is considered as the best long-term option for power generation (lowest levelized tariff in long-term). The life of power plants on other technologies cannot be stretched beyond 30 years; a brief comparison of tariff & operational life of power plants on different technologies is presented below:

No.	Technology	Levelized Tariff (1-30 Years)	Levelized Tariff (1-50 Years)	Levelized Tariff (1-70 Years)
→ 1	Hydro Power Plant	Rs. 8.50/kWh	Rs. 4.62/kWh	Rs. 3.84/kWh
2	Coal Power Plant	Rs. 11.5/kWh	-	-
3	RLNG Power Plant	Rs. 12.6/kWh		-
4	Wind Power Plant	Rs. 6.4/kWh	-	-
5	Solar Power Plant	Rs. 6.1/kWh	-	-

14. Despite initial costs and long gestation periods, hydropower plants have almost no fuel cost and have operational lives of over a century. THERE IS NO FUEL PRICE ESCALATION IN HYDRO POWER PROJECT UNLIKE THERMAL POWER PLANTS. New hydropower plants generate electricity at Rs. 5-10 per unit compared to thermal power plants' Rs15-25 per unit. All other power-generating technologies have up to 30 years of project life and need up to four times expensive plant replacements/rehabilitation in foreign exchange.

No.	Technology	Tariff (1-10 Years)	Tariff (10-30 Years)	Tariff (30-50 Years)
→ 1	Hydro Power Plant	Rs. 10/kWh	Rs. 4.5/kWh	Rs.2.0/kWh
2	Coal Power Plant	Rs. 15/kWh	Rs. 12/kWh	-
3	RLNG Power Plant	Rs. 13/kWh	Rs.11/kWh	-
4	RFO Power Plant	Rs.18/kWh	Rs. 15/kWh	-
5	Wind	Rs.7.5/kWh	Rs.3.1/kWh	-
6	Solar	Rs.7.6/kWh	Rs. 3.3/kWh	-

15. NTDC in their Report has not considered or compared the impact of power generation technologies on our local economy. One of the major benefits of preferring hydro power projects over other renewables and thermal power projects is that more than 65% - 70% of capital cost relating to hydro power is spent within the country, in contrary there is no more 10-15% of local component in capital cost of solar, wind & thermal projects. This means that developing hydel's is beneficial for local economy in terms of boosting economy i.e. direct/indirect employment generation, as well as leading to growth in cement & steel sector and development of far flung/mountainous areas which *inter alia* boost tourism related activities. Other technologies-based power plants lead to outflow of

dollars from the country for the imports of plant & machinery which is comprised of 80-90% of capital cost. NTDC is requested to consider the aforesaid direct/indirect benefits of hydro power plants while drafting IGCEP.

No.	Technology	Local Component (%)	Foreign Component (%)
1	Hydro Power Plant	70% - 75%	25-30%
2	Coal Power Plant	20%-25%	75 – 80%
3	RLNG Power Plant	20%	80%
4	RFO Power Plant	15%	75%
5	Wind	10% - 15%	85-90%
6	Solar	10% - 15%	85-90%

16. Wind and solar are intermittent technologies reliant solely on weather. They can at best supplement but not replace hydropower, which, amongst others, can provide a range of valuable services, including frequency control, grid balancing, water storage, quick start and peaking services not inherent in wind and solar generation.

17. In the Report, hydropower projects with approved sites & feasibility studies, available finances, approved tariffs and strong sponsors are being pushed back & refused, thus effectively killing them in favor of renewables (mainly wind, solar) that have no sponsors, sites, financing, planning or grid evacuation studies.

18. The Report envisages scheme of 22,772 MW (37pc) public sector hydropower projects but we as a nation are familiar with delays and cost and time overruns caused due to paucity of funds and financial resources. Interestingly, IGCEP has not considered hydropower projects above 50 MW as renewable projects. Majority (90%) of hydel projects for which realistic data is available through their approved feasibility studies and under valid LOIs were ignored on one pretext or the other and considered in IGCEP as Candidate Projects for implementation in year 2047. IGCEP has failed to allocate any preference, priority or weight towards milestone achieved by Sponsors of these private hydel power projects who basically invested in their projects upon the invitation of the government. It is to be noted that every hydel power plant requires at least 10 to 12 years from conceiving the idea to develop project up to COD unlike other technologies where only 2.5 to 3 years are required. Therefore, it makes no sense to abandon privately funded hydropower projects developed without any government investment and having a fixed approved tariff with the cost of delays and overruns borne by the private sponsor. On the other hand public sector power projects are inclined to cost escalation under PC-I & revised PC-I, and so on and on.

19. The Authority may note that after the re-classification of hydro power (irrespective of size) as a renewable energy, the Indian government is planning an amendment to the Electricity Act calling for the implementation of hydro power purchase obligation (HPO), which requires electricity retailers to mandatory purchase electricity from hydro power projects. The experts have welcomed this move, claiming that an increased share of hydro power in the grid would help grid operators manage the intermittent nature of solar & wind power.

20. It is apparent from the Report that due to some unknown reasons NTDC has expedited the WAPDA sponsored projects and discouraged private sector hydel projects by considering them at the end of the period i.e. 2047. Report is silent on parameters for selection of few hydropower projects in early years most of which are planned to be implemented by WAPDA:

No.	Name of the Project	Implementing Agency	Capacity (MW)	Commissioning Year
1	Keyal Khwar	WAPDA	128	2025
2	Mohmand	WAPDA	800	2025
3	Dasu-1	WAPDA	2160	2025
4	Harpo	WAPDA	35	2026
5	Thakot-III	WAPDA	1686	2029
6	Thakot-I	WAPDA	2154	2031
7	Dasu-2	WAPDA	2160	2032
8	Lower Palas	WAPDA	666	2041
9	Patan	WAPDA	2400	2041
10	Thakot-II	WAPDA	966	2041
11	Tangus	WAPDA	2200	2042
	Total WAPDA Addition (MW) – (2025-2042)		**15,355**	

It may be noted that majority of WAPDA planned mega projects are situated on Indus river with very close proximity to each other, such as Dasu & Thakot power projects. The arrangement of funds for these mega projects, construction methodology, provision of alternative route for Karakorum highway, current status of land acquisition and competitive bidding are needed to be verified from WAPDA. It is evident from the WAPDA's executed projects that due to delays in construction time, variation orders and very lethal bureaucratic process the Project's IDC rise as high as the Project cost itself.

21. The Capital Cost including IDC of WAPDA sponsored projects as mentioned in the Report (Table B 3; Page 43/1067) such as Thakot ($1200/kW, Dasu-2 $1059/kW) needs to be verified, as it is mostly observed that the project cost, tariff & time period of WAPDA implemented projects are normally higher than as of IPP's. This fact is highlighted in below mention table:

No.	Project Name	Executing Agency	Initial Planned Cost	Current Cost	Contract Awarded	Completion
1	Neelum Jhelum HPP (969 MW)	WAPDA	Rs. 80 Billion	Rs. 500.34 Billion	2008	2018
2	Golen Gol HPP (108 MW)	WAPDA	Rs. 16 Billion	Rs. 30 Billion	2011	2018
3	Dasu-1 HPP 1-Land Acquisition 2- Project Cost	WAPDA	Rs. 19 Billion Rs. 486 Bil.	Rs. 37 Bil. Rs. 511 Bil	2017	ongoing
4	Bhasha Dam 1-Land Acquisition 2-Pay& Allowances	WAPDA	Rs. 60 Billion Rs. 721 Mil.	Rs.175 Bil. Rs. 5.7 Bil.	2008 2008	ongoing

22. The Authority is requested to confirm from relevant entities the current status of WAPDA sponsored projects such as Thakot, Dasu-2, Lower Palas as well as their economical / financial parameters. For example the project financing is not secured by WAPDA for Thakot & Lower Palas HPPs and land acquisition process as well as EPC tendering has not been initiated, however NTDC has considered these projects for earlier commissioning as compare to the projects of IPPs whose feasibility studies are approved and are mostly waiting for issuance of LOS to start the acquisition of Project land. In addition, as per WAPDA website, WAPDA & PEDO has yet to decide that who will develop/implement Lower Palas Power Project.

23. It is a well-known fact that most of public sector projects do not follow rigorous checking mechanism implemented by NEPRA during feasibility and EPC stage tariff determination of IPPs. Public sector implemented projects skips feasibility & EPC stage tariff mechanisms and seek COD stage tariff from NEPRA only. At COD stage the Regulator has minimum options to scrutinize the project cost; hence the end consumers are forced to pay more for electricity due to these public sector projects.

24. The Table 6.12 of the IGCEP (Page 81/237) has shown the Annualized Cost of Energy; however, the assumptions of these costs needs to be reviewed such as the Plant Factor of Mahl HPP is mentioned as 66% but in actual it is 52%. Similarly, the plant factors of WAPDA sponsored projects as well as FO&M ($/kW/Yr) and Annualized Cost of Energy needs to re-checked / verified; so that a realistic planning & cost analysis could be done.

25. The Report has proposed the inclusion of Thar Coal in massive scale from 2024 onwards (29,621 MW of new addition from Thar Coal (Page 212/237)) and **no hydro power project is considered for continuous seven (7) years from year 2033 to 2040.**

26. The Report has failed to recognize the fact that it is the government initiative who have approved power policy(s), invited / selected the private investors to develop a power project under a given timeframe and policy by offering various incentives & concessions. These IPPs after receiving permission from the government in the shape of LOI or LOS invest in developing the project by hiring consultants to conduct project feasibility related studies with an aim to complete the study and get it approved from government nominated Panel of Experts ("POE") within the time as allocated in the LOI. Each phase / milestone mentioned under LOI or LOS is strictly monitored by the Implementing Agency/POE; and in case of default by Sponsors of any milestone, the performance guarantee is encased by the Implementing Agency. Similarly, the Sponsors of the Project have legitimate expectations from Implementing Agency that the provisions of the Power Policy(s) and terms and conditions of the LOI shall be complied with and that the Project shall be implemented and developed in accordance with such terms and conditions. Contrary to this, WAPDA's projects are neither under any policy nor under any time frame and there is no monitoring either by PPIB, CPPA or NEPRA etc.

27. It may be noted that most of thermal, solar, wind power projects could be implemented within a short span of time (8 months – 2 years); therefore, long term planning for installation/procurement of power from such technologies is not critical. On the other hand a typical hydropower plant requires a period of at least 10 to 12 years from inception

to completion; therefore hydro power projects are best suited for long term planning such as IGCEP and the developers who have been already issued LOI/LOS shall be allowed to carry on the implementation of their projects in accordance with timelines approved by POE in the Project's feasibility study and shall be given the status of committed projects.

Turtonas-Uzghor Hydro Power Project

28. We, the Sponsors of 82.25 MW Turtonas-Uzghor Hydro Power Project (the "**Project**") to be located at Golen Gol, Chitral, KPK (just upstream of 108MW WAPDA's Golen Gol HPP) were selected by PPIB, MOE after International Competitive Bidding (ICB) to develop the Project under 2015 Power Generation Policy on BOOT basis. The Project was approved by PPIB's board headed by the Federal Minister of Energy for development under IPP mode. The PPIB's board comprise of members that *inter alia* include the federal secretaries of Ministry of Energy, Finance & Planning Commission.

a. Letter of Intent (LOI) was issued by PPIB to the Sponsors in March, 2017 after submission of Performance Guarantee of USD 58,000/. The Sponsors (M/s Sinohydro Corporation Limited & M/s Sachal Engineering Works Pvt. Ltd.) after the issuance of LOI had hired the services of renowned international & local consultants (M/s Fichtner GmBh, Germany & M/s T.E.A.M Consultants Pakistan) to carry out the detail feasibility study of the Project.

b. In order to evaluate the performance of the Sponsors and to make sure that feasibility study of the Project is completed in accordance to best international standards, PPIB formulated a team of Panel of Experts (POE) in order to review and approve the feasibility study at every step i.e. site selection, plant optimization, project cost etc. The POE members *inter alia* included the followings:

No.	POE Members	Organization
1	a. Managing Director (Chairman, POE) b. Director (Hydel) c. Director (Finance & Policy) d. Director (Legal)	PPIB
2	Chief Technical Officer (CTO)	CPPA-G
3	**Manager, Transmission Planning**	**NTDCL**
4	Director (Planning) HPO	WAPDA
5	Chief Planning Officer	Energy & Power Development, KPK
6	Assistant Engineering Advisor (Power)	Ministry of Energy (Power Division)
7	Representative of EPA	EPA, KPK
8	PPIB General Consultant	M/s Associated Consulting Engineers
9	Engr. Azhar Masood Panni	Electro-Mechanical Expert
10	Mr. Arshad Fayaz	Geology & Geotechnical Expert
11	Engr. Dr. Sajjad Haider	Associate Professor, NICE-NUST

c. The Project feasibility study was successfully conducted within the timeframe allocated by PPIB in LOI and the Sponsors approached NEPRA for tariff & generation license immediately after the approval of the feasibility study by POE in May, 2019.

d. In the approved feasibility study the POE including (NTDC & CPPA-G) unanimously agreed that the Project shall be commissioned in 2026. In order to further support the Project for the issuance of Generation License & Tariff, NTDC issued letters to PPIB that the Sponsors are not required to carry out interconnection study, as NTDC with the assistance of PEDO shall carry out the integrated power evacuation study for upcoming projects in Chitral Corridor.

e. However, for unknown & flimsy reasons NTDC in IGCEP has considered the Project as a Candidate Project for Commissioning in 2047 (21 years from originally planned). The sudden shift in NTDC decision from Project commissioning in 2026 (as agreed by NTDC during the approval of Project F/S) to commissioning in 2047 is mind boggling for the sponsors of the Project. IGCEP totally ignored the major milestones achieved by the Project Company so far while preparing their plan. **The Authority is requested to direct NTDC to re-consider the Project commissioning timelines mentioned in IGCEP; so that the Project could achieve the commissioning as agreed by POE in the approved feasibility study.**

f. It is earnestly observed that inclusion of power projects in IGCEP are majorly dependent on NTDC's current and future plans of laying transmission lines, irrespective of the project's feasibility. This is evident from the fact that almost all of prospective hydropower plants located in Chitral/Swat district's where NTDC has no plan to invest in transmission lines are intentionally delayed till year 2047; in spite of the fact that these power projects are being developed under valid permissions from the provincial & federal governmental entities. **The Authority is requested to direct NTDC for immediate inclusion of a transmission line in their plan for the purpose of power evacuation from upcoming hydropower projects located in Chitral/Swat districts (major potential of hydropower in these districts); hence enabling the projects to achieve COD in accordance with timelines mentioned in LOI/LOS, in the first phase the existing 132 kV D/C Golen Gol transmission line could easily be converted to 220 kV D/C line.**

UHPCO

PRAYER

In view of the foregoing, it is respectfully prayed:

i. That the Report may kindly be revised/revisited keeping in consideration of our above-mentioned comments;

ii. That the Least Cost does not mean the initial cost only rather it is the total cost during the total life of the Project. Price escalation may also be factored. Further, significant milestones achieved by hydel projects should also be considered in the Report.

iii. That we are afraid that in case hydel projects are deferred up to 2046/2047 then hardly any Sponsors would move forward to invest in Pakistan in such uncertain circumstances and weak political system.

iv. That the Project Sponsors shall be allowed to develop and implement the Project i.e. (Turtonas-Uzghor Hydro Power Project) in accordance with the existing terms and conditions of the GOP's 2015 Power Generation Policy (the "Power Policy") and timelines mentioned in Letter of Intent issued by PPIB;

v. That the Project Sponsors has relied upon the terms and conditions, incentives and concessions provided in the Power Policy and commitments made in the Letter of Intent issued under the aforesaid Policy and millions worth of investment have already been incurred. Therefore any proposed changes in the Project commissioning / timelines approved by POE in feasibility study will cause an irreparable loss and damage to the Sponsors;

vi. That the history may not be allowed to repeat; like in 1990s where the government intentionally blocked private investments in hydropower sector that were implemented under 1995 Hydel Policy. The decision had resulted in huge losses to private sponsors as well as to our country;

vii. That the POE approved upfront tariff of 4.7 cents/kWh for implementation of Kohala HPP in 1996. A renowned American company (M/s Synergics hydro Asia) was selected by WAPDA/GoP after international advertisement and MoU was signed between PM Pakistan and Sponsors in Washington D.C, USA. The Sponsors hired the services of well-known international consultant "M/s Norconsult" to conduct feasibility study and spent more than six million

UHPCO

dollars to complete the study. However, the-then government reneged on its announced upfront tariff of 4.7 cents per unit for hydropower plants and instead asked investors to accept 2.5 cents per unit tariff or quit. As a result, ex-Sponsors of Kohala HPP quit after spending millions of dollars in conducting feasibility study. Had the WAPDA allowed the then developers to proceed, Kohala could have been operational since 2006. It is ironic that then Sponsors were not reimbursed a single penny for their feasibility study and later WAPDA claimed more than 560 million rupees from national kitty for minor improvements of M/s Norconsult conducted feasibility study. The upgraded version of study has now been sold to the new developer of the Project. It is unfortunate, that the aforesaid decision by then government has led to delays in developing HPPs and resulted in influx of expensive thermal based power plants; the nation is still suffering from the results of such hasty and *mala fide* decisions. The Authority is requested to ascertain that the same episode may not be repeated and take all necessary action to safeguard the investments of sponsors who have invested in their Project after soliciting permissions from the relevant governmental entities. The Authority has a mandate to ensure that the interests of the investor and the consumers are duly protected through judicious decisions based on transparent commercial principles;

viii. That the Authority may suggest Ministry of Finance & State Bank for the launch of Green Energy Credit Line for hydro power projects above 50MW at consumer-friendly interest rates. Such credit line offer will result in (i) rise of activities in construction sector (as more than 65% of hydropower EPC cost is related to local civil works) (ii) the favorable interest rate will help in reducing the tariff (iii) debt repayment will be carried out locally therefore no outflow of foreign exchange.

Sincerely Yours,

(Syed M. Hussain Gardezi)
Director (Development)

COMMENTS ON IGCEP

NOTE:

The comments on the IGCEP are being submitted by **USAID's Sustainable Energy for Pakistan (SEP) Project**. SEP is working to reduce the constraints Pakistan's energy sector is facing throughout the energy value chain, enable private sector investment in Renewable Energy (RE) projects, reform policies, and enhance grid reliability for the transmission and distribution sectors—all of which advance SEP's goals. SEP activities span all segments of the clean energy domain, including generation, transmission, distribution, commercialization, and sector governance and regulation. The Project's objectives are to help Pakistan:

- Create a creditworthy business environment that attracts private sector investors in a fair, competitive, and transparent energy market that is accessible to all stakeholders.
- Support the development of investment opportunities and expand the capacity within the Government of Pakistan (GoP) to bring projects to financial close.
- Transform the transmission system operator (NTDC) into an entity capable of managing and expanding the national grid while ensuring reliable, efficient, and stable transmission and dispatch services.
- Support the market operator and regulator (CPPA-G and NEPRA, respectively) in transitioning to an open wholesale market.
- Contribute to performance improvements at electricity distribution companies.
- Overcome barriers to RE investment through suitable policy, regulatory, or legislative amendments and procurement measures.

In this vein, there are multiple Teams undertaking various activities to implement SEP's objectives. The comments below represent views primarily from two distinct teams and are presented separately so that the essence of their comments and the continuity of thought of each team is preserved without disruption. These teams are:

1. Transactions Team: The comments are written by the team working closely with Alternative Energy Development Board under the guidance of the Ministry of Energy (Power Division) and the private developers in supporting the financial closing of renewable energy transactions in Category 1 and 2 as well as the design and implementation of the competitive procurement framework for projects in Category 3.
2. Integrated Energy Planning (IEP) Team: The comments are written by the team working closely with the Ministry of Planning, Development and Reforms on developing the Integrated Energy Plan, EV policy and the Prime Ministers Naya Housing Scheme. In addition, the team has very good knowledge of the economics of the fuels consumed in all sectors of the economy, including the critical oil, gas and power sectors.

Comments from other teams (transmission and policy) have been incorporated within the body of these comments to avoid redundancy.

DEFINITION OF LEVELS A AND B

Level A- Critical Comments/Corrections That Merit Immediate Action:

Comments/changes that are critical and need to be incorporated in the refined version of IGCEP of April 2020 which we propose be released, preferably by July 31, 2020 based on a June 30, 2020 data cut-off point. This is because several key input values (e.g., prices of oil, RLNG and coal; GDP growth rate, baseline power consumption for 2019-20,…) have changed materially post COVID-19. These changes, if incorporated, will provide more realistic and accurate projections for all stakeholders to work with till the release of IGCEP 2021. In the interim, the existing report can be used.

Level B- Comments/Corrections That Need to be Incorporated In The Next Version Of IGCEP (April 2021):

Level B represents changes which will require a lot of detailed background research, analysis and verification, including the recommended internal and external audits, for inclusion in the April 2021 version of IGCEP. Level B will include correction and verification of certain inputs which may have been inputted in error or may have changed with the passage of time or circumstances. These 'fact check' based corrections should be incorporated in the next annual version of IGCEP due April 15, 2021 to increase the credibility and accuracy of the projections.

2. COMMENTS FROM SEP TRANSACTIONS TEAM

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
1.	Section 2.1, Generation Planning- A Subset of Power System Planning, page 6 of 237	It is stated in the text that, 'In an ideal scenario, the Integrated Energy Plan (IEP), a mandate of the Ministry of Planning, Development & Reforms (MoPDR) is meant to provide the fuel mix targets for all sectors of the economy including the power sector…'	• The 2020 version of IGCEP does not have the benefit of IEP input. We hope that MoPDR will be able to provide the IEP by December 31, 2020 so that the fuel mix targets as well as other relevant information can be incorporated into IGCEP 2021. This will enable the submission of a more optimized least-cost generation plan. The comments and thoughts of the IEP Team are included in the next section.	**B**
2.	Section 2.6, Scope and Planning Horizon, page 9	The KE system is not integrated into IGCEP 2020. However, NTDC stated that it has been modelled separately using PLEXOS.	• The KE system should be integrated in IGCEP 2021. There are tremendous benefits in economics, reliability, sustainability and national unity. An IGCEP without KE is a sub-optimal document from a national perspective.	**B**
3.	Section 2.7, Nature of the IGCEP, page 9.	IGCEP 2020 does not take into consideration incremental Transmission Costs (TC) of each proposed generating location.	• The omission of TC results in a sub-optimal solution. We strongly recommend that IGCEP 2021 take TC into account. This can be based on the Transmission System Expansion Plan which will follow IGCEP 2020. A simple adder/subtractor in paisas/kWh for the top ten nodal points of Pakistan would be a good start. NTDC can design and add a more refined transmission cost module based on the locational value of power later.	**B**
4.	Section 4.6.10. Fuel Prices Indexation, page 29.	The indexation is based on data from EIA's Annual Energy Outlook, (Outlook) 2019. Since Outlook 2020 was released on January 29, 2020, it was unable to meet the December 31, 2019 deadline set by NTDC for data input.	• We recommend that IGCEP 2021, to be released by NTDC by April 15, 2021 should be based on the Outlook for 2021which will be released in January,2021. This is because accuracy and freshness of data are key to the development of a robust least-cost generation plan.	**B**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
5.	Section 4.6.10. Fuel Prices Indexation, pages 29-30.	The base fuel prices have been taken from the merit order provided by CPPA-G of December 2019 which are pre-Covid. There have been material price changes in fuel commodity prices since then.	• It is strongly recommended that a revised IGCEP 2020 be run in late July,2020 on merit order prices for June 2020 as the base fuel prices. This will enable the capture of the dramatic changes (reductions) in oil and LNG prices with knock-on effects on other fuel prices which must be captured in the results for informed decision making. This will provide a much needed 'post-Covid' reality check to the inputs and accuracy of the results will be enhanced.	**A**
6.	Section 4.6.10. Fuel Prices Indexation, Table 4-2 Fuel Price Indexation Factors, pages 29-30.	The natural gas (NG) variable price index in Table 4-2 increases from 1.00 in 2019 to 1.49 in 2047. On the other hand, the regulated Thar coal index, declines from 1.00 to 0.69 by 2047. In addition, the NG index is linked to the US $ whereas the Thar index is most likely in Pak rupees (PKR). However, no inflation or devaluation adjustment for PKR appears to have been made over a 28-year period. This raises questions like, • Is this methodology to calculate future Thar coal prices correct; and, • What is the assurance that the Thar Coal and Energy Board (TCEB) will have the financial solvency to sell coal at 69% of its 2019 price without any inflation or devaluation adjustments 28 years from now! The current data input approach, as understood by us, dramatically reduces the variable cost of Thar coal over time vs other domestic (hydro, wind and solar) and imported fuel choices and may be the cause for the heavy concentration of local coal plants in the generation mix. Are the multipliers in Table 4-2 in nominal or in real terms (inflation-adjusted)?	• Please review all input variables and algebraic calculations and make sure that they are inputted correctly. Please also ensure that appropriate adjustments for inflation, indexation and devaluation, where applicable, have been made. Otherwise, it will cause a distortion in the generation mix, which may already be happening. It seems counter-intuitive to see an inordinate number of large Thar coal unit entering 'optimized' scenarios across the board, raising the average system price but operating at low capacity factors in the last half of their contract term. We need to have a very clear understanding how future Thar coal prices for each existing, under construction and under development plants based on local coal are priced and inputted. • **Our intuitions may be wrong, but as a matter of prudency we propose a comprehensive, thorough and robust internal and external audit of all the input numbers, formulas, adjustments and calculations throughout the IGCEP 2020 document. This document will be setting the future direction of the scale and mix of the required energy generation for a nation of 220 million people. An audit is a small price to pay in terms of time and money to assure that the input values and related algebra are free from human and mechanical error.** • The corrected numbers should be shared and reviewed with stakeholders and inputted into the revised IGCEP 2020 to be released no later than July 31, 2020. • A long-term solution to Thar lignite pricing may be to index it to the C. & F. Karachi prices of sub-bituminous coal from the primary source countries for Pakistan (Indonesia, South Africa and Australia) which will free it from adjustments by regulators and tracking inflation and devaluation numbers.	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
			The index will be calculated in US $ but the payment will be made in equivalent Pak rupees at the then exchange rate. This may have to wait about 3 to 5 years for the Thar coal industry to mature, scale-up and allow accumulation of data on costs and correlations with imported coal prices.	
7.	Section 4.6.11. Renewable Energy Technology Capex Indexation, pages 30-32, Table 4-3.	The cost reduction indexation assumptions end in 2030. What is assumed thereafter till 2047?	• Please provide your assumptions and its rationale for the period 2031 to 2047.	**A**
8.	Section 4.7. IGCEP Data Input Format, pages 33-51	There could be errors, human or otherwise, in calculations, inputting and transcribing the voluminous information in the Data Input Format that (presumably) was collected from 328 separate generators.	• As stated in comment 6 above, it is strongly recommended that the input data be reviewed and verified both internally (first) and externally (second). The internal review should be conducted by qualified technical, commercial and fuel specialists who were, preferably, not part of the original team. The external team should be similarly composed and conducted by a major Pakistani accounting firm.	**A**
9.	Section 5.3.1 Demand Forecast, page 56, Scenarios: a, b and c.	The GDP growth scenarios, when compared to Pakistan's recent performance are on the aggressive side. Future growth will also be constrained by Pakistan's fragile fiscal situation, continuing impact of the drastic devaluation, stricter compliance requirements by the domestic taxation regime and post-Covid factors. In addition, the baseline numbers for 2019-20 for GDP, peak demand (MW) and energy consumption (kWh) are likely to be negative over 2018-19 so the starting base will also be lower than assumed. This will have follow-on effects for peak demand and energy consumption, at least in the near term (1-5 years).	• It is recommended that NTDC try to get a consensus forecast on GDP growth from MoPDR, SBP and PIDE. If that process fails, then it is better to use the forecast from the IMF, World Bank and ADB. • Please note that Pakistan is highly resource constrained and using a high growth rate which is not achieved, results in sub-optimal deployment of its resources. In addition, the IGCEP is an annual feature and will be fine-tuned every year in response to changing external circumstances. Hence prudence requires that Pakistan begins its IGCEP journey with conservative growth inputs since it will have an opportunity to adjust to new information on an annual basis.	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
10.	Section 5.3.2. Other Demand Forecast Scenarios: b, c and d, page 56	The GOP Discos are implementing various levels of load-shedding on feeders whose customers have a poor record of paying their bills. This is now called Load Management (LM) and is a decision based on political economy.	• The practice of LM is within the rights of each ruling government. However, the government in power must ensure that the payment for the 'lost revenue' resulting from ordering Discos to provide power to low revenue generating feeders is reimbursed to them in full and in a timely manner. The record, however, of each ruling government is to promise to pay, but in reality, they never pay in full and pay late. The result is a growing and unmanageable Circular Debt. • Since this is a matter of political economy affecting the most vulnerable sections of society, we will not comment further, except to suggest that whatever decision is made on this issue, it is with the explicit approval of the ruling government and at least the Ministries of Energy and Finance. Preferably, it should be a clearly stated line item in the annual budget. • As a datapoint for reflection, based on IGCEP 2020, the PV cost (read subsidy) of including LM is US $5.0 billion or PKR 775 B., which is more than the projected Annual Development Budget of Pakistan for 2020-21.	**B**
11.	Section 5.3. Other Demand Forecast in Scenario e, page 57	What are the assumptions of the hours and the quantity of MWH consumed for the charging of the EV batteries in both commercial and residential sectors? Is it uniform over 24 hours or does it follow some behavioral pattern?	• Pakistan's grid shows low capacity factors because of the (presumed) 'Duck Curve' shape of its 24-hour peak load profile unlike the more conventional, 'head and shoulders' profile. In order to reduce the extremes between peaks and valleys of the load, activities that can be conducted at night or are deferrable into the night (induced by a discounted night tariff) should be considered. Moving the entire charging operation of EV batteries into the night can be one such candidate for a win-win solution. • The advantage would be higher capacity factors for generators leading to avoided capex investments by 'flattening' steep and narrow load peaks and lower tariffs for EV battery charging consumers. Please provide this information since there could be some cost-saving opportunities which can be explored.	**B**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
12.	Section 5.6. Demand Forecast Numbers, page 59	There is a sharp drop in the increase between the forecast numbers for both capacity (MW) and energy (GWh) between 2039-40 and 2040-41 when compared to the numbers for preceding and subsequent years, there must be a reason for it or is it an error?	• Please clarify the rationale for the drop and correct it if it is an error.	
13.	Section 5.7. Hourly Peak Demand Forecast page 61	We note that you have detailed data and projections of hourly peak demand from FY 2019-20 to FY 2046-47.	• Please provide on a single page, graphs of the highest peak demand day(MW) and the lowest demand day(MW) over a 24-hour period for the year 2018-19. The graph will allow us to do some qualitative thinking on options to meet the load in a least cost way. These qualitative thoughts will help define required sensitivity tests using PLEXOS to further refine the Base Case.	
14.	Section 6. 2 and 6.3, Defining the Base Case and Other Scenarios, pages 65 and 66.	Section 6.2 a. Impact of ARE 2019 Policy Targets of 20% & 30% in 2025 & 2030. The purpose of this exercise is to generate a least-cost generating plan by allowing PLEXOS to design the generation mix based on defensible economic criteria. Granted, a limited number of national strategic constraints are understandable. However, hard wiring the system by inputting pre-determined capacity targets and timing for Renewable Energy, as done in the Base Case represents constrained optimization. The ARE 2019 targets were not based on any rigorous analytical and documented process and were, at best, an 'aspirational' goal disguised as Policy. PLEXOS should now be used to design and propose informed and documented policy targets which can be defended as part of a least-cost generation plan.	• In order to explore and determine the least cost generation plan and initiate a robust discussion on the subject, we are proposing the 'SEP Base Case V.1' with the following assumptions as the second step in the **evolution** of an optimal solution. The NTDC Base Case was the first step: **SEP Base Case V.1** 1. Start with the Existing NTDC Base Case 2020. 2. Add the elements of Scenario-I (6.3a), Hydro Optimization Not Horizon Bound ('HPP Free'). 3. Add the elements of Scenario-III (6.3c), No VRE Policy Targets ('Target Free'). 4. Add the elements of Scenario-II (6.3b revised), a **post-Covid** IMF Projected GDP rate ('IMF GDP growth rate'). 5. Please use the fuel cost and the variable O&M costs obtained from the Merit Order for June 2020 to fully reflect post-Covid prices. (Reference 6.7.m in the Assumption Set). 6. Please replace the indices in Table 4-2 from EIA Outlook of 2019 with indices from Outlook 2020 to update the analysis. 7. Please update the go/no-go status of all Category I and 2 projects and revise their COD dates.	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
		Section 6.2 d. Hydro Optimization. Same as above. Forcing selection of hydro projects within a specified period (horizon) is also constrained optimization at best (unless a project is contracted, irreversibly committed, under construction, G2G…). Even then, it should be analyzed if a lower system cost can be achieved by reversing sub-optimal decisions if detected at an early stage. Every sub-optimal decision increases the average system price and forecloses future optimal choices. No wonder, PLEXOS is forced to back-load mega-hydro projects in the last 7 years to meet the 2047 horizon limit. This is not optimization. Section 6.2 b. GDP Growth Rate. The rates proposed by MOPDR ('Planning') are very ambitious. It would be better if a post-Covid consensus rate between Planning, PIDE and SBP could be developed. Otherwise, we suggest that the most current post-Covid IMF forecast be used in the Revised Base Case with a +/- 1% band.	8. Please consider taking into account the cost of 'externalities' that each of the new fossil fuel (oil, gas, RLNG, imported coal and Thar lignite) plants impose on the environment from their emissions by adding it to their generation costs. 9. Please sequence the integration of very large generation plants by staggering their COD on a unit basis. For example, the Diamer-Basha hydro-electric plant with a total capacity of 4500 MW and consisting of 12 units of 375 MW is currently scheduled to come on-line in 2043. If it was structured as 6 packages of 2 units each, it is possible that the Optimizer would find it economic to select some of the units earlier than 2043, most likely at a lower average system cost. Our suggestion is that all multi-unit plants, regardless of fuel, above a threshold total capacity, should be evaluated for a staggered entry into the system. This matter has also been addressed in Comment # 19. • We have focused our critique on the basic structural changes we would like to see in the Base Case which we believe will lower system PV Costs, optimize all the fuels and technologies relevant to the supply mix and provide a more accurate representation of the current situation. • There are several other refinements, scenarios and sensitivity tests which we can propose later. However, that would be more appropriate after initiating discussions with NTDC, NEPRA, AEDB and applicable stakeholders and agree on a disciplined process based on continuous interaction to improve IGCEP 2020 and its subsequent versions. SEP is willing to play its role in this exercise.	
15.	Section 6.7. Assumption Set, pages 68-70.	Section 6.7 g. All RE plants in Category I and II are considered committed plants. Why? For example, we are aware that some projects are unlikely to move forward or delayed. Incorrect information distorts the optimization process with negative long-term effects.	• On the issue mentioned under 6.7.g, as an example, SEP is aware of at-least two projects (one Solar and one Wind) in Categories I and II which are unlikely to move forward and projects with COD dates materially different than those reported in IGCEP 2020. Please note that the status of projects changes over time. Hence the importance of verifying all COD dates for the next iteration and dropping all projects that are unlikely to move forward in Tables 6-3 and 6-4. This will result in a more accurate least cost plan.	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
		Section 6.7 h. Candidate Wind and Solar Power 'blocks' of 1500 MW each from the year 2022-23 onwards have been 'force fitted' into the system. Why? Section 6.7 k. Candidate Bagasse blocks of 250 MW from the year 2022-23 onwards have been 'force fitted' into the system. Why?	• On the issue mentioned in 6.7 h. and k., we have already made the point earlier that we should allow the process to optimize and select the technology (fuel), capacity (MW) and timing in an unconstrained manner to create the least cost generation portfolio. Forcing pre-determined technology, capacity and timing without a defensible reason defeats the very goal of least-cost optimization.	
16.	Section 6.9. Retirement of existing power plants, pages 70.	An IPP is retired at the end of its PPA term and a public sector plant is retired as per its Economic Life provided in Table 6-1. A one size fits all approach is not defensible since it ignores the global data points in the generation sector that the quality of maintenance and management makes a difference.	• PLEXOS can be used to identify and retire inefficient and higher system cost plants based on their economic performance rather than using administrative criteria like plant age and contract life. This could lead to a lowering of average system cost. • For example, in the Base Case (and all other cases) a large number of new OCGT plants on RLNG (imported) are entering the system to balance the intermittency of RE. However, it is possible that a government owned retiring plant or most likely a private sector IPP ending its contract term may still be cheaper than a new OCGT plant for peaking purposes. A new OCGT will require a capacity payment (30-year PPA) in addition to fuel cost. The older plants may have a slightly higher variable fuel cost but with no capacity payment (except for O & M and a competitive profit margin) may be a lower cost option which will be free from contractual bondage of 30 years. PLEXOS has the capability to test a variety of similar options and give an optimized solution. In fact, a competitive procurement program can be designed among retiring RFO plants to upgrade their plants to specified performance targets (heat rate, MW availability, reliability) through asset life extension programs and enter a bid process for 3 to 5-year 'peaking PPAs' with capacity and variable cost payments. These auctions can be held on a periodic basis based on the gaps in the peaking requirement, displacing on an economic basis, (a part of) the huge OCGT capacity additions proposed in the Base Case.	**B**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
17.	Section 6. 11. New Generation Options, page 80.	The candidate generation technologies do not include options like waste to energy (WTE), Concentrating Solar Power (CSP) and utility scale Energy Storage Technologies (EST) to the mix of supply options.	• Please develop the capex, opex, technical and financial data sheets (economics) for WTE, CSP and utility scale EST generation and add to the available mix of generation options beginning with IGCEP 2021. Doing so will increase the choices for new generation available to PLEXOS that could be added, if viable, to lower average system costs. By a process of annual testing of every available option, IGCEP will optimize the supply mix in response to changing GDP growth, demand and supply changes, and changes in relative capex, opex, technical performance and fuel prices. • Storage is a relatively new technology (but is not generation) and can be utilized primarily for accumulating power during system valleys for release during system peaks. This will result in avoidance or deferral of required investment in more expensive peak load generation, e.g. OCGT projects with very low capacity factors thereby reducing the average system cost.	**B**
18.	Section 6.13. New Thermal Options, page 87.	We had no intention of commenting on potential unintended errors since we believe an internal audit by NTDC and an external audit by a major domestic accounting firm are the appropriate vehicles to do it. However, since some cases are of an extreme nature, we decided to point them out. In Table 6-7, The fuel price in $ per Giga Joule for imported and domestic Thar coal is given as 3.65 and 1.37 respectively. This makes the domestic price a mere 38% of the price of the imported coal on a Btu basis. This divergence is further amplified by the potential lapses in adjustment (inflation, devaluation, indexation) for future prices as pointed out in comment 6.	• We need a thorough discussion on how the future price of Thar coal is to be calculated for generators considering all the necessary adjustments (inflation, devaluation and indexation) with supporting documentation. It is extremely important to understand and clarify this because the Optimizer seems to select local Thar Coal in the generation mix in very high proportions. • We do not believe that PLEXOS has any favorites but incorrect inputs by error could be the cause of this potential problem. That is why we strongly recommend two levels of audits for input numbers as recommended earlier in comment 6.	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
19.	Section 7.2. Future Demand and Capacity Additions (Base Case), pages 94-149	Projects of very large capacity are assumed to come on-line on a single COD. For example, the 4500 MW Diamer-Basha (DB) is scheduled for COD in 2043 (page 144). It is a stretch to think that there is construction capability, consumer demand, transmission capacity and financing capability for the entire 4500 MW of hydro capacity to come on-line with the flick of a switch in one year.	• It is recommended that very large projects be structured, constructed and financed and entered into PLEXOS on a staggered basis. DB with 4500 MW is 12 units X 375 MW. For discussion purposes, if it is offered as 6 separate packages, it is likely that a portion of the generation capacity would have been optimized by PLEXOS for an earlier COD date, contributed to a lower system cost and displaced a portion of the near 0% capacity factor OCGT generators based on imported RLNG. As a start, all projects based on any fuel above a total size of say 500 MW, with multiple units should also be evaluated on a staggered basis to test if it results in lower average system costs and a more diversified fuel/technology base. Smaller unit sizes with multiple fuels and different operating characteristics give greater flexibility to the Optimizer to pick and choose the lowest cost supply source. • In addition, this approach will also enable the entry of hydro into the system on a more uniform basis. Currently, 30,785 MW or 55% of the total hydro capacity installed by 2047 is projected to come on-line in the last 7 years from 2040-41 to 2046-47 of the 28 year horizon of the study. More disturbingly, there are no capacity additions of hydro in the preceding 8 years (2032-33 to 2040-41)! Table 7-11, page 211. This is what happens when a system is forced to optimize 'selected' projects within a specified horizon.	**A**
20.	Sections 7.3 and 7.4 Annual Capacity Factors. Pages 149-206.	The Annual Capacity Factors (ACF) for local coal show a great divergence from project to project and is a cause for serious concern. All the 8 local coal projects (numbered 7 to 14, page 151/237) are in the same location (mine mouth), provided coal from the same or adjacent mines and operated by the same public (GoSindh) and private partnership. and presumably receives lignite at the same 'regulated' rate per ton.	• Hence, we are perplexed to see projects 7, 8, 12, 13 and 14 suffer a decline in Annual Capacity Factors (ACF) to under 50% after high dispatch years in the beginning while projects 9, 10 and 11 are being dispatched at over 80% ACF over the lives of their term. Are the variable fuel & O & M costs so different for each project, that they are so out of line in the merit order? Is the GoS selling lignite at different prices to different projects from the same source? Please review this matter, clarify and correct it if it was an input error or explain the rationale for this uneven dispatch. • Please confirm that projects which have a CF of zero throughout the period of the analysis in the Base Case or any other case are not included as part of the generation plan in the applicable scenario. Or are they included by virtue of being spinning reserves or for some other reason?	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
			• Please review the generation (GWh) numbers in Table 7-8 on page 189/237 for project #9, NEW local coal. A mere visual scan tells us that they are out of line by a factor of 10 to 20 or they have compressed multiple projects into one line! Compressing mega projects in one line is a not advisable since each project has a different COD and different capacity factors over time which is useful information. Please review and correct it if it is an error and unbundle it into separate projects or explain the basis of the high generation numbers if it is correct.	
21.	Section 7.6. Indigenization of Energy Mix, Page 210.	An Indigenization Ratio over time has been provided in Chart 7-5 which is helpful. The purpose of a least cost generation plan is to provide an optimized generation plan leading to lower average system costs (ASC) of kWh over time.	• Please superimpose the ASC/kWh for the Base and other cases in real and nominal Pak Rupees over the horizon period on chart 7-5 so one can visually measure progress being made towards lowering the ASC over time.	**A**
22.	Section 7.8. Salient Features of the IGCEP, pages 211-212.	Table 7-11on page 212, does not show any Imported Coal or Nuclear generating capacity after 2024 and 2026, respectively.	• Please confirm that PLEXOS was not 'constrained' to consider Imported Coal or Nuclear generation in the Base or any other cases. In other words, they were dropped out because they could not qualify to be part of the economic least-cost solution.	**A**

3. COMMENTS FROM SEP IEP TEAM

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
1.	Section 4.6.10: Fuel Price Indexation (page 29)	In economic optimization, fuel supply costs should be used rather than retail fuel prices which include duties/taxes. Retail prices reflect the financial cost to the end-user, not the true economic cost to the country, and are subject to discretionary variations in the government's taxation policies from time to time. Correct fuel cost assumptions (i.e., real economic value) are critical to the optimization of generation capacity between thermal and non-thermal options (e.g., gas vs. RE) and between various thermal options (e.g., CCGCT on gas vs. ST on coal). Such supply cost assessments for fossil fuels should be developed in coordination with the Petroleum Division, MoE (for gas, RLNG, oil, imported coal) and other relevant bodies, such as Thar Coal and Energy Board (for Thar lignite).	• Long-term fuel supply costs should be projected based on market factors, freight and other supply chain costs and consistent with the basis used for other generation sources (e.g., hydel, solar, wind, nuclear, etc.). • Instead, fuel prices for the power sector in the IGCEP have been assumed based on the merit order of Dec. 2019 and then escalated based on EIA-specified fuel price indexing. o Fuel price assumptions are based on a simplistic approach. What is the source and rationale of such a methodology? o Are these constant dollar or nominal price indices? o In Table 4-2, what is the difference between Fuel Oil and HFO? One index is going down, the other is going up. • NTDC should confirm with the Petroleum Division about sources and cost assumptions for marginal gas supplies to the power sector taking into consideration long-term projections of domestic production, imports and non-power gas demand, i.e., whether the marginal gas should be based on imports or a combination of imports and local gas (economic price). It is to be noted that LNG import cost is linked to Brent crude oil plus tolling and T&D costs, while the cost of domestic gas is based on petroleum concessions agreements (prices paid to producers) as per applicable petroleum policies plus T&D costs. • Similarly, the Petroleum Division should provide long-term supply costs for: o Imported coal linked to international FOB prices for sub-bituminous coal (Australia, Indonesia, S. Africa) plus marine freight, port costs and inland freight/losses. o Local Thar coal (lignite) as per the mechanism advised by Thar Coal and Energy Board (TCEB) for power generation.	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
			• A single WACOG-based economic gas price (for local and imported gas) for power generation, the stated intent of the GoP, will affect the least-cost generation mix presented in the IGCEP. Such an option should be explored as an additional IGCEP scenario to assess its impact on the overall cost of electricity supplies as it is likely to optimize utilization of gas-based generation capacity.	
2.	Section 5.2: Forecasting Methodology (page 55)	Independent variables in the demand forecasting regression model do not directly relate to the dependent variable	• At the very beginning of the report [Section 2.6: Scope and Planning (page 9)], it is mentioned that the IGCEP covers the entire country except Karachi. • It can be assumed that the regression model regresses NTDC-served demand (and not for the entire country) with total country-level sector-wise GDP. The projection of NTDC-related electricity demand areas is also based on projection of country-level GDP. o Can GDP be adjusted to exclude KE served areas, as the Karachi metropolitan region represents a major demographic/industrial zone in the overall country-level GDP and electricity market? Alternatively, NTDC could project country-level demand growth (including KE region's) and then adjust for KE-supplied electricity.	**A**
3.	Section 5.3.1: Demand Forecast Scenarios (page 56)	It may be necessary to revisit GDP growth rates	• GDP growth scenarios assumed in the IGCEP are too narrowly banded around the 5.5% medium growth case. A more useful spread could be, for instance, 3.5% (low), 5% (medium) and 6.5% (high). Inputs from the Planning Commission and the Ministry of Finance may be sought to define realistic GDP growth scenarios.	**B**
4.	Section 5: Energy and Demand Forecast (pages 55-59)	The IGCEP estimates historical electricity demand by presumably factoring in past 'load shedding' (page 56). Estimation of 'unserved' demand based on 'load shed' demand is not clearly described and is likely erroneous.	• While the quantum of 'load shedding' included in historical electricity demand has not been explicitly provided, there are two issues here: o 'Load shed' demand is defined by PEPCO as the last recorded load on a feeder prior to the year marking the onset of systemic load shedding. This pegs the unmet demand figure to a (often much) earlier period, when connections and consumption on the feeder were lower, and does not account for subsequent increase in demand due to economic growth, population increase and other factors. On a system-wide basis, therefore this method can grossly under-estimate 'load shed demand'.	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
			○ Even if the above estimation is corrected, by definition 'load shed' demand is not the same as 'unserved' demand, which should be added to estimate true total electricity demand. Unserved demand includes consumers who cannot access the grid (due to absence of or delays in connections, remoteness, etc.), and therefore do not engage/invest in electricity-consuming activities/appliances. Even grid-connected consumers resort to electricity-saving practices/alternatives and DSM during periods of chronic load shedding, suppressing their normal demand behaviour. • Based on the above, NTDC's methodology for using legacy 'suppressed' demand figures would tend to underestimate true electricity demand required to achieve and sustain the economic growth numbers used in future demand forecasts, and therefore needs to be rectified.	
5.	Section 5: Energy and Demand Forecast (pages 55-59)	The IGCEP derives the GDP-based elasticity of demand for electricity from historical data. This method does not fully account for expected increase in per capita electricity consumption as incomes rise, due to aspirational factors, behavioral/lifestyle changes and other considerations.	• Empirical international data have established that developing societies with per capita consumption below 4,000 kWh/year experience steep increases in electricity demand as national incomes rise incrementally, which then tends to flatten out significantly once that threshold is exceeded. For instance, India with only a 25% higher real GDP per capita compared to Pakistan in FY19 had 65% higher per capita electricity use (1,181 kWh/year v 712 kWh/year, the latter incorrectly stated as 529 kWh/year on page 14). In other words, income elasticity of electricity demand does not remain constant with rising GDP, but increases at higher incomes. ○ For instance, based on the IGCEP's own figures (Chart 5-1, page 59), for the normal case of 5.5% annual GDP growth, Pakistan's per capita consumption will only increase to about 855 kWh/year by FY2026-27 for a corresponding 25% GDP/capita increase over FY2019-20, which would be only 72% of India's current consumption levels. ○ There are many international studies correlating GDP v electricity demand data using global country data spread over several years from which a strong empirical relationship between the two parameters can be derived, calibrated for Pakistan's experience, and used to augment NTDC's own historical (underserved) demand data. This will lead to a more accurate estimation of future demand growth on which the entire IGCEP rests. • As a matter of policy, it should be the GoP's aim to facilitate increased per capita consumption of electricity (to the 4,000 kWh/year 'developed' society threshold) in order to help raise incomes, productivity and other socioeconomic benefits	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
			(corresponding to an HDI level close to 0.9, compared to 0.56 in 2018), increase the electrification of the economy thereby reducing its energy intensity, and displace traditional inefficient fuel use (e.g., firewood, dung, kerosene, etc.) that is deleterious to human health and the environment. o According to the IGCEP's own projected normal case (5.5% GDP growth, 1.8% assumed population growth rate), per capita electricity consumption would reach only 1,570 kWh/year, or less than half of this target, by 2047. This should clearly not be an acceptable goal for Pakistan@100.	
6.	Section 5.4: LF&GP-PSP Database (page 57)	Base year for calculating GDP has been revised by the government?	• GDP base year is quoted as 2005-06. As per web sources, in Dec. 2019, the government rebased GDP calculations to 2011-12 to better reflect the changing socioeconomic environment of the country. o GDP data may be adjusted to 2011-12 base year as this will impact demand projections.	**A**
7.	Section 5.4: LF&GP-PSP Database (page 57) Section 6.6: Planning Basis (page 67)	Cost of unserved energy is assumed as $0.80/kWh, the source for which has not been specified.	• It is mentioned that in a bid to consider the effect of load management practices in the country, the electricity consumption data include an estimate of unserved energy to reflect total demand. o The estimation and impact of unserved energy on generation optimization is not clear. o The source for the assumed cost of unserved energy ($0.80/kWh) should be provided and may need to be adjusted to reflect current conditions in Pakistan.	**A**
8.	Section 5.5: Preparation of Demand Forecast (pages 58-59)	The IGCEP refers to the NTDC grid only, but grid parameters and territorial coverage has not been properly defined. It is also not clear how GDP projections and related power demand parameters for the entire country have been used to forecast demand growth on the NTDC grid without factoring out non-NTDC service regions	• Pakistan's power grid and supply consists of the following mutually exclusive regions: o NTDC grid (also exporting bulk electricity to the K-Electric and AJK grids) o K-Electric grid o Makran regional grid (also importing bulk electricity from Iran) o Mini grid and Off-grid generators (diesel/HPPs in KP, Balochistan, GB and AJK, some SPP/CPPs) o It would be useful for the IGCEP to define the territorial and relative generation capacity in each of the above grids, as well as to use this to properly separate out historical and future electricity demand growth in the NTDC region.	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
		which may have inherently different characteristics (e.g., demographics, economic activity, etc.).	• The Karachi metropolitan region is the largest industrial/commercial zone of the country and accounts for about 25% of national GDP. Its demand and future growth parameters have been subsumed incorrectly as part of total demand in estimating growth for the separate NTDC grid region. • Similarly, the Makran grid is expected to grow substantially on account of CPEC-related activities, starting with a 300 MW CPFF in 2022. This growth in demand has likewise been subsumed in the national growth projections used and thus assimilated erroneously into NTDC grid demand forecasts. • With the expected development of Gwadar as a major industrial/exporting economic zone, its integration into the national electricity grid will become inevitable in the not too distant future. However, despite the extended time horizon of the IGCEP (2019-2047), no provision has been made for implementing transmission interties between the Makran and NTDC grids. Furthermore, the ample solar energy resources of western Balochistan might merit a dedicated HVDC line for evacuation to national demand centers on its own (as recommended in the World Bank RE Locational Study, 2019). Such integration of Balochistan demand/supply in the NTDC grid needs to be considered and factored in at appropriate future years in the IGCEP.	
9.	Section 5.5: Preparation of Demand Forecast (pages 59-61)	In the 2019 IGCEP report, as in the earlier version, a regression-based computation forecasts total annual electricity demand in Pakistan. A system load factor is then projected for future years and this is used to determine peak demand projection on the grid for each year. It is not clear is how the load factor itself is projected. It is likely a manual projection based on external factors or targets, but the details are not provided in the report.	• It is notable is that in the current IGCEP report, the load factor is projected to decrease from 66% (in 2018-19) to 62% in 2029-30 and thereafter (based on Table 5-2, page 61), whereas in the 2018 IGCEP report it was projected to increase from 61% (in 2016-17) to 65% in 2025-26 and thereafter. It is also not clear what led to this change in load factor projection and why. o If, for instance, this is due to the mandatory inclusion of RE capacity targets by 2030 and associated backup thermal generation, then it would seem to indicate that the RE targets, when taken with their associated backup generation requirements, may not present an optimum solution for the 2020-2030 timeframe (see also discussion under Item 12).	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
10.	Section 5.6: Demand Forecast Numbers (page 61)	In Chart 5-1 (page 61), there appears to be an anomalous flattening of the peak demand forecast in 2040-2041 in all three cases illustrated. Using the regression formula given on page 59 should result in a smooth growth curve instead. The reason for the kink in the curves is not apparent or explained.	• The flattening of the curve between 2040-41 should be elaborated on or rectified, as the temporary change of gradient decreases projected peak demand in subsequent years.	**A**
11.	Section 5.8: Modelling of Electric Vehicles and Naya Pakistan Housing Scheme (NPHS) (page 62)	EV load assumptions (vehicle and transportation service demand projections, energy requirements, market penetration, etc.) have not been provided. NPHS load assumptions (development timelines, housing unit types, household energy consumption, gas vs. electricity use) have not been specified. Additional demand (GWh) and marginal generation (new MW) to meet EV and NPHS loads needs to be specified separately, taking into account planned available idle generation capacity (e.g., unutilized reserve capacity).	• The Executive Summary (ES) states that the load forecast also includes the impact of electric vehicles pursuant to targets set by GoP of 30% of new vehicles by 2030 (this text is not mentioned in the main body of the report). • EV targets in the draft EV policy range between 30-50% of new vehicle sales. EV load projections require detailed modeling. Earlier EV load estimates shared by NTDC with SEP were found to be understated on account of low vehicle number and mileage assumptions. o SEP/DOE have conducted extensive EV load modeling at the request of the Planning Commission and the PM's Task Force on Energy Reforms. Corresponding preliminary daily EV load profiles were provided to NTDC in Jan. 2020; it is not clear if these have been considered in the IGCEP runs. o SEP/DOE have finalized more refined base, target and reference case EV market penetration assessments based on levelized cost projections and developed corresponding hourly/daily EV electricity loads up to 2030 which can be requested from the Planning Commission for use in the IGCEP model to more accurately represent the impact of EVs. This would be consistent with the integrated energy planning process recommended in the IGCEP (Section 2, page 6) and includes an assessment of the associated fuel-side impacts as well. o Long-term assumptions for EV loads after 2030 are difficult to assess at this stage, but could also be derived from further SEP/DOE analysis which can extend to 2050.	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
			○ A proper inclusion of the SEP/DOE EV load profiles would require separate PLEXOS runs by NTDC with and without EV loads for computation of the net marginal generation and fuel displacement requirements. • Based on the IGCEP scenario results presented, it can be deduced from the difference between forecasts with EV and NHPS loads (Annex M-6, page 933/Chart M-3, page 973) and those without (Annex L-6, page 847/Chart L-3, page 887), that the total EV+NHPS load by 2030 calculated by NTDC is 14.0 TWh. ○ This compares with SEP/DOE's EV-only load requirements ranging from 6.7-11.3 TWh (low/high cases with NEVP incentives) and 9.9 TWh assuming the EV targets given in the NEVP being met. Assuming that NTDC has used NEVP and NPHS policy-defined targets for its total EV+NHPS load estimates, SEP's target case EV loads (corresponding to 7.2 million EVs by 2030) alone account for 71% of this, leaving only 29% for the 5 million housing units under NHPS. As a residential housing unit would consume much more energy on average than an EV topping up daily under typical use, NTDC's total EV+NPHS estimates appear to be significantly underestimated and should be revised using more detailed SEP/DOE EV projections. ○ It is presumed that NTDC has calculated total EV+NHPS loads for the entire country, and does not exclude the K-Electric region. If yes, this would not represent the actual load on the NTDC system, which would be lower; if not, the method for excluding Karachi region EV and NHPS loads need clarification. In either case, the load calculations would need to be revised to account for more reliable EV and NPHS load estimates (as mentioned in the previous bullet).	
12.	Section 7.2: Future Demand and Capacity Additions (Base Case) (pages 94-97)	There is a very large difference between nominal capacity and peak demand on account of reserve generation capacity assumed for an increased share of variable renewable energy (VRE) amounting to 24 GW in 2030 and 65 GW by 2047. This reserve capacity has been allocated to OCGTs (RLNG) dispatched at zero plant factor.	• Adding significant reserve thermal capacity to back up VRE would negate the cost advantage of lower RE energy tariffs when the full cost of VRE integration (including idling backup capacity and underutilized transmission lines) is taken into account. ○ The additional PLEXOS scenario optimizing VRE capacity without the ARE Policy target constraint of 25% and 30% RE capacity in the generation mix by 2025 and 2030, respectively is given in Annexure E but its outcome is not discussed (see Item 17). It shows a reduction in wind capacity from 10,327 MW in the base case with ARE targets to 3,495 MW (66% decrease) without the targets, and a corresponding reduction in solar PV capacity from 12,793 MW to 11,276 MW (12% decrease) by 2030 (Table E-3, page xxviii). Total investment required for the No VRE Policy case is $68.1 billion compared to $69.8 billion in the Base	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
		This represents a huge sunk investment in additional thermal generation reserve capacity and would add appreciably to the corresponding capacity payment liability due to the OCGTs. Furthermore, provision of RLNG to these plants would entail additional fuel supply commitment costs. These factors, in turn, would raise the effective net cost of the increased VRE capacity assumed in the generation mix. A comparison of final pool purchase price, with and without ARE Policy targets, would be useful to highlight the additional costs of sub-optimized RE deployment targets, which could then be suitably revised.	Case, a decrease of $1.7 billion (Table E-11, page xxxiv). This seems to indicate that the ARE targets for 2030 are not economically optimized and need further review and revision. In the No VRE Policy Case compared to the Base Case, RLNG and local coal capacity increases. It is not clear if this is net of the reduced operational thermal reserves required to backstop lower VRE capacity. o Between 2030 and 2047, wind capacity remains unchanged at 10,327 MW in both the Base and No VRE Policy Cases, indicating that once the mandated ARE targets have been met, wind is no longer economically viable. Solar PV capacity by 2047 increases from 26,921 MW in the Base Case to 28,103 MW in the No VRE Policy Case (Table E-7, page xxx), although it is not clear why solar PV additions between 2030-2047 are higher under No VRE Policy as both cases are equally unconstrained for RE deployment during this period and even though solar PV is over-represented in 2030 in the Base Case (12,793 MW) compared to the No VRE policy case (11,276 MW). • There are several methods for decreasing the additional reserve requirement to backstop VRE (and, hence, reducing the overall cost of RE integration), including: o Geographically dispersed VRE generation to compensate for localized wind/solar fluctuations (e.g., through renewable energy zone (REZ) planning) o Using existing/planned reservoir-based hydel generators as spinning reserves for VRE output compensation o Deploying utility-scale battery storage solutions to smoothen out diurnal VRE fluctuations o Employing hybrid wind/solar IPPs and/or mini grids to reduce VRE feed-in variations, and improve plant/transmission line utilization factors o Improved wind/solar forecasting for improved week-, day- and hour-ahead dispatch planning of VREs and optimization of back up generation requirements. • The IGCEP takes RE share as given (as per the 2019 ARE Policy targets) up to 2030 in all cases (other than in No VRE Policy), and then optimizes RE plant additions on a case-by-case basis. However, it is not clear if this subsequent optimization factors in either the cost-benefit of externalities for all technologies, including the cost of additional backup generation capacity to support VRE supplies. These assumptions affect the determination of a true least-cost generation mix.	

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
			○ The difference in the net power generation pool price of electricity for both cases (including the capacity costs for VRE reserve generation) should also be included in the optimization (if not already done) to see if the ARE targets are economically viable in terms of the overall generation mix (and not only on a plant-wise basis). A comparison of the average power pool purchase price between all scenarios would be very useful in this regard (see also Items 16). ○ Based on the above, the ARE Policy targets would need to be reviewed and revised, if necessary, to make them more economically viable. Factoring in externalities, such as emissions reduction, fuel import savings, dispersed generation, etc., could also be considered for strengthening the case for VRE deployment further.	
13.	Section 7.2: Future Demand and Capacity Additions (Base Case) (page 96)	Chart 7-4 (page 96) does not show any nuclear capacity additions beyond 2025 (i.e., after commissioning of C-5).	• PAEC's longer term perspective nuclear generation plan should be taken into account which includes further reactor additions after the commissioning of C-5 (e.g., at Multan) under G2G arrangements. The cumulative nuclear generation capacity by 2047 shown in the IGCEP is 4,407 MW (Table 7-11, page 212), while the GoP had earlier indicated a target of 8,800 MW by 2030. This ambitious target will almost certainly be missed in that year, but further additions are likely by 2047.	**A**
14.	Section 7.2: Future Demand and Capacity Additions (Base Case) (page 97)	Basis for selection of predominantly hydropower plants (HPPs) in last three years (2020-2047) is not clear, nor realistic. In the HPP-free case (Table 7-4a, pages 110-121), it appears that no major HPP is selected. Hydropower is generally considered to be an inexpensive supply option. The observations above seem to indicate that the high upfront cost of HPPs is preventing selection by PLEXOS, and levelized lifetime	• It is mentioned that significant numbers of candidate HPPs are being optimized by PLEXOS in the last three years of the planning horizon due to the fact that hydro selection/optimization is horizon-bound. ○ How does annualized (levelized) cost of power (Rs/kWh) for HPPs compare with other options? ○ Does the discount rate play a role to defer high CAPEX (and high levelized cost) investments to lower the NPV? ○ Committed HPPs (public and private) are included in the IGCEP up to 2027. Additional candidate HPPs could displace candidate coal and RLNG plants during the period 2025-2043 if their levelized costs are properly considered. This would not only result in a more feasible staggered construction timeline but would also result in a more sustainable long-term generation mix (longer plant life, lower emissions, reduced RLNG import dependence).	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
		cost of power production is being discounted in the optimization process.		
15.	Section 8: The Way Forward (page 233)	In Section 2 (page 6), the IGCEP report emphasizes the need for an integrated energy planning (IEP) process at the Planning Commission to provide overall least-cost energy mix guidelines for the preparation of future IGCEP versions.	• This recommendation needs to be highlighted explicitly in Section 8, which states the need for more coordinated strategic planning using robust analytical tools and data sources (page 235), but does not explicitly mention IEP or the Energy Planning and Resource Centre (EPRC) being set up at the Planning Commission for this purpose. o This section should recommend improvements to be implemented under IEP as well as by NTDC for enhanced coordination and information sharing amongst relevant stakeholder agencies, especially the Planning Commission, Ministry of Energy (Power and Petroleum Divisions) and various power and fuel sector agencies/utilities, in consolidating respective inputs, plans and data to allow better cross-sectoral understanding of operational and strategic needs and objectives.	**A**
16.	General	Although the primary objective of the IGCEP is to compare the relative economic merit of the different scenarios analyzed in terms of least-cost generation options, the IGCEP does not provide a comparison of the final power pool purchase price resulting for each of the milestone years considered. This would provide a quick and convenient means for estimating the cost impact of the various scenario assumptions used and help with appropriate decision-making and planning (see also Item 12).	• The cost information provided in Annexures C to N should include aggregate average power pool purchase price (Rs/kWh), which can be plotted along with the generation mix shown in the main report in Section 7.8 (pages 213-218).	**A**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
17.	General	The IGCEP considers a number of additional scenarios in addition to the Base Case, the results of which are presented as tables in annexures to the main document. The purpose of these additional runs is to evaluate the impact of different base assumptions and draw appropriate conclusions. However, the main IGCEP report does not contain such a comparative discussion, apart from a few summary tables in the Executive Summary.	• It is proposed that each section describing the results of the Base Case (e.g., demand and supply balance, capacity additions, generation mix, capacity factors, fuels used, etc.) also include a section summarizing the corresponding results for each of the scenarios and highlighting key differences and outcomes. This will help in better understanding of the implications of various planning options to relevant GoP stakeholders. • For ease of readability, the base and alternative scenario discussion in the main text should only contain key summary tables and charts, and all multi-page detailed tables (e.g., pages 98-148) should be moved to the annexures as reference information.	
18.	General	Continued assumption of fuel oil (FO)-based generation in the long term should be addressed and verified with Petroleum Division.	• Owing to ongoing refinery upgrades and decrease in demand, FO production and consumption is declining globally. There are already severe restrictions in wt% sulfur specification for in-land consumption and use as ship bunkers. Accordingly, FO may not be a viable fuel option for long-term generation planning. • NTDC should confirm the long-term availability and specifications (viscosity, wt% sulfur) of FO and its cost which can be assumed at par with export netback price if FO continues to be produced by local refineries in the long run.	**A**
19.	General	The IGCEP recognizes distributed generation (DG) as an important consideration in the future but does not include DG capacity as a potential source for meeting future demand, thereby possibly overestimating grid-supplied electricity requirements.	• Projections for residential, commercial and industrial rooftop solar PV should be included in demand forecast scenarios. These can be based on extrapolating recent net metered installations, continued declining solar PV price trends and expected improved regulatory and service industry practices aimed at promoting and facilitating net metered installations in the country.	**B**

Item	Reference	Issue	Comments, Concerns & Potential Mitigation/Solution	Level
20.	General	An important objective under SEP's integrated energy planning (IEP) capacity building are improved data management practices, including the provision of all publicly available energy sector and related information in easily accessible electronic, machine-readable formats. In this regard, disseminating the IGCEP in PDF format alone is neither adequate nor efficient, as it necessitates extra time and effort to extract or transcribe information, therefore making it less usable and more error prone.	• Data-intensive publications, such as the IGCEP, in particular, need to adopt international best practice of making all tables, data annexures and charts available via online links embedded in the main document. o There are over 1,000 pages of data tables included in the IGCEP report that could be much more conveniently shared as Excel or .csv files, or through an online table viewer. The report itself could focus more on summary tables and point to the raw data that is hosted online.	**B**

MASTER

MASTER HYDRO (PRIVATE) LIMITED

Lahore Office: 82 – C-1, Gulberg III, Lahore.
Tel: +92-42-35752620-22, +92-42-35758524-26
UAN: +92-42-111-666-555, Fax: +92-42-35751905

June 19, 2020

MHPL/NEPRA/GEN/001-20

The Registrar
National Electric Power Regulatory Authority
Ataturk Avenue,
Islamabad,
Pakistan

SUBJECT: COMMENTS ON IGCEP 2020-47

Dear Sir,

We write with reference to the advertisement dated April 25, 2020, soliciting public comments on draft "Indicative Generation Capacity Expansion Plan". In the capacity of a stakeholder in the energy sector, we hereby submit our recommendations (attached herewith as Appendix A) regarding the assumptions and rationale thereof in the *IGCEP 2020-47*.

We believe that our insight would not only facilitate in developing a true and fair future outlook of the energy sector, along with clarity on current challenges being faced but also ease achievement of the objectives of this policy document of least cost generation with preference of indigenization of fuel in the long run. IGCEP 2020-47 is a public policy matter and critical for the developments / progress in Pakistan's energy sector.

We appreciate NEPRA's initiative of extensive consultations on the first draft of *IGCEP 2019-40* and thereby facilitating a public dialogue to encourage participation and noting of all stakeholders' concerns in a transparent manner, in order to ensure that this policy paper duly accounts for the wider national interest.

Thanking you in anticipation.

Yours truly,

Rumman Arshad Dar
Chief Executive Officer

NEPRA
Licensing Department
Diary No. 2044
Date 23-06-2020

REGISTRAR
Dy. No. 2227
Date 22-6-20

Appendix A: Discrepancies in IGCEP Assumptions

No.	Assumption	Suggestions
	HYDEL PROJECT SCREENING ISSUES	
1.	All upcoming Private Hydel projects including those with LOI, Tariff or those projects awarded through the competitive bidding process have been categorized as *Candidate* projects	Hydro Power Projects with development status similar to Category I & II Solar / Wind / Bagasse Projects (as per CCOE decision dated April 04, 2019) should also be assigned *Committed* status, in addition to the Projects that are being developed under a competitive bidding regime. Scrapping / delaying projects awarded under a competitive bidding regime would result in a significant loss to investor confidence at a time when the market is being primed for a competitive regime. It is highlighted that the Arkari GoI Hydro Power Project was one of the first Hydro Power projects in Pakistan to be awarded to Master Group of Industries (affiliated with the Author of these comments) under a competitive bidding regime, which was actively marketed by the KPK Government. The Project was awarded based on a levelized tariff of USc 7.9175/kWh and a Project Cost US$ 2.20 million/MW that is amongst the lowest cost generation options available amongst all technologies in Pakistan today. The Sponsor has diligently continued to develop the Project despite delays on part of the relevant Public entities and has invested up to PKR 83 Million to date. Planned induction of the project in Year 2047 – without any meaningful rationale - makes not only the project unfeasible, but casts a serious cloud of uncertainty on the intentions and workability of the government agencies that would undertake competitive bidding in the future.
	Hydel capacity addition has been considered pre-dominantly through inclusion of public sector hydel projects only.	Public Sector projects should be evaluated on the same basis as Private Sector projects despite being designated as CPEC and G2G projects. Their status as committed should be reviewed as there has been limited progress in their development.

	Other factors to consider for the Candidate Hydel projects apart from their costs include grid constraints, financing issues, inactive Sponsor public sector constraints on simultaneous development of projects. Data Performa for Hydro Power projects does not include the plant factor for these projects whereas the same has been input in the ICGEP 47. Can you please specify from where these plant factors have been taken because in certain cases these are inaccurate. E.g. for Arkari Gol the capacity factor is 43.6% (as specified in tariff determination by NEPRA) whereas it is stated as 33% in ICGEP.	Candidate projects should be additionally categorized based on the following, and Projects awarded under a Competitive Bidding process wherein significant project milestones have been completed should be brought forward: • Availability of Sponsors / Lenders • Project Award and Development Status • Development Workload of the Sponsor agency Plant factor for Hydro Power Projects need to be verified again for accuracy. Furthermore, Plant factor cannot be accurately ascertained until a considerable level of studies have been conducted on the project.
2.	**ISSUES WITH LEAST COST CRITERIA** Annualized Construction Cost is used as criteria for determining which technology and project is to be inducted at a particular time frame from the available supply options to meet the Demand Forecast. This creates a number of issues: • Optimizing based on Cumulative CAPEX prioritizes projects with lower CAPEX leading to Hydel projects being selected at the end of the horizon and RLNG projects in Open Cycle being prioritized over Combined Cycle projects. • The above criteria also ignores the plant factor leading to projects with low plant factor being preferred over high plant factor projects due to lower CAPEX.	Least cost generation criteria should be based on the full PPP (EPP+CPP) tariff as per NEPRA methodology and expected plant factor over the life of the project. Annualized Construction Cost is an extremely trivial metric to ascertain competitiveness of technology.

3.	**PROJECT COSTS AND OTHER ASSUMPTIONS** Project costs and timelines need to be verified for the following issues: • Data provided by Sponsors have been used as is but not verified independently. • Most of the Public Sector projects start on very unrealistic PC-1 numbers with the Project costs increasing significantly in the latter stage of the projects. • In section 3.1 (Pg. 14) it is stated that in developing nations, increased sale of electricity causes growth in GDP. In contrast the multiple regression model is based on the assumption that growth in GDP is an independent variable which has an effect on the electricity energy sale. These two statements contradict each other.	Project cost numbers need to be verified and indexed by NEPRA. Public Sector projects cost and tariff should be locked by NEPRA at the start of construction period as is the case with IPPs with true-up allowed at COD based on the indexation allowed. It needs to be clarified if there is interdependence between the GDP growth and Electricity sale or this is a typo.
4.	**SOLAR / WIND (VRE)** Wind resource of the country is not being utilized over the projection period e.g. in high demand scenario only 10,830MW is expected to be generated from wind. 3.6% p.a. reduction in CAPEX of solar is till 2030 seems quite aggressive despite considering the technological advancement and economies of scale. Category III have not been considered in the Candidate projects at all despite these expected to be developed under competitive bidding regime and having lower cost than the current set of projects.	It is highlighted that a Solar/Wind Hybrid model can reduce the intermittent nature of the Renewable Projects. In particular, energy output from the Wind Power Projects in the Jhimpir cluster may be augmented during the day time (low wind speeds) with higher production from Solar. Therefore, Solar/Wind Hybrid model should be considered so that the overall capacity factors of the projects are increased resulting in optimal use of resources. 1% to 2% is a more rational estimate based on industry projection. Category III projects should also be considered in the Candidate projects in line with the CCoE decision for which Competitive Bidding would take place.

5.	**SUPPRESSED "LOAD FORECAST"** Historically, GDP has not grown in the same fashion as projected in growth projections. A more robust approach towards growth estimates will help in driving a more reliable demand estimate. Linear model is assumed for demand projection (Pg. 91) based on historic figures. In 2017-18 after generation constraints removal, generation spiked by 13 TWh (Chart 3-4). Once transmissions and distribution constraints are removed, we expect a similar adjustment will be required to reflect the true demand. Pakistan is significantly underserved in terms of Per Capita Energy Consumption. Substantial demand is being catered through off grid generation (section 3.1) that needs to be brought online. 381,910 applications are pending for connection to gird (Pg. 18). This is latent demand not accounted for.	The GDP growth forecast should be based on a robust model rather than linear projection which assumes a constant growth rate. A one-time adjustment in demand forecast is needed to account for (i) grid constraints removal (ii) latent demand and (iii) win back of captive producers. - Should be accounted for.
6.	**CAPACITY RETIREMENT** Plants with no capacity utilization have been kept active. Only Thermal projects with PPA expiring in the time horizon (2020-2047) are considered in retirement schedule.	Plants with no capacity utilization e.g. old GENCOs may be evaluated for early retirement. VRE and other projects that expire before 2047 should also be included in retirement schedule.
7.	**GAS/RLNG Plants** OCGT capacity of 4,868 MW (pg. 26) on RLNG has been proposed for reserve capacity with less than 10% Load Factor. This selection is resulting from number of erroneous assumptions: • Same fuel cost for both Open and Combined cycle are assumed (Table 6-7), which is effectively the fuel cost for highest efficiency (62%) plants.	OCGT Fuel cost should be adjusted for their actual efficiency and for open cycle configuration the actual efficiency should be below 40%.

	• Capital Cost assumptions for both OCGT and CCGT needs to be rechecked. Recently concluded CCGT transactions do not support these numbers.	Capital cost based on complete project with IDC should be used here.
	• The aggressive focus on indigenous coal-based generation will lead towards more consumption of water and externalities (e.g. health issues, environmental issues, and etc.)	These external costs should also be captured in the model
	• For any simulation where RLNG plants are curtailed, the potential impact on gas infrastructure has not be considered.	A study needs to be conducted for the potential cost of these impacts with these costs incorporated in the IGCEP 2047.
	• Similarly, the Plan does not consider whether sustainable gas is available for generation purposes (Instance: in high demand seasons with shortage of local gas, RLNG has been routed to domestic consumers.)	A study to determine the availability of sustainable gas needs to be conducted to ensure that there is sufficient fuel for not only the current Plants but also for future generation purposes and this should be incorporated in the plan.
	• Since the economic slowdown oil and RLNG have become cheap, a simulation to be incorporated in high demand or boom to calculate the impact of higher oil prices/LNG prices on the national exchequer and the resultant tariff.	-
8.	**TARIFF ISSUES** Fuel Cost components (FCC) and Variable O&M taken from Merit Order are inaccurate as they lag in indexation true up. Tariff for operational projects is based on their actual COD true up whereas non-true up tariffs are being used for candidate projects. For instance, this allows installation of upcoming RLNG projects while keeping the already installed projects redundant.	A more precise measure is to determine the identified components on basis of applicable NEPRA indexation numbers. True-up tariffs should be used for new projects screening.
9.	**MISC/TYPOS** Projects Hydro China, Zephyr and Tenaga giving electricity to KE (Pg. 27) but still included in Upcoming Private Sector Committed Projects (Table 6-4)	Should be removed from NTDC network numbers

	For local Coal, SSRL information was used as reference cost as stated in section 6.7 (n) (i) however, there are other expensive projects too which should be considered at their respective cost for fair representation	Should be verified
	Gwadar projects not connected with NTDC grid	Should be added to NTDC system capacity
	For 660MW Coal projects, Net Capacity of 625MW is assumed	Should be as per NEPRA determinations
	It would seem that the IGCEP hasn't modeled availability of Local gas / well head for plants on different variants of local gas. Reserve depletion and alternate operation plans for these plants should be part of IGCEP simulation.	Should be make part of IGCEP simulation if not already
	Projection for grid up gradation & expansion should be in line with the projections for generation in order to avoid T&D losses or outage losses.	The Generation addition plan should also collaborate with the Transmission and Distribution lines addition plan so as to provide evacuation to new Power Plants.

Comments on the Indicative Generation Capacity Expansion Plan (IGCEP) 2047

Date: May 22nd, 2020

From: Vestas

Vestas is thankful to NEPRA for the opportunity to provide comments on the Indicative Generation Capacity Expansion Plan 2047. This document contains some general and some section-specific comments, and few big picture learnings about renewable expansion in both developing countries and established wind markets that Vestas has acquired through several decades of global operation.

I. General Comments and Observations on Indicative Generation Capacity Expansion Plan 2047

Vestas congratulates the NTDC team on the preparation of this long-term plan. We appreciate the efforts invested by NTDC on its establishment and are grateful for the stakeholder consultation. It is worth noting that NTDC accommodated different scenarios of demand forecasts and factors various possible options and came up with the detailed forecast. Vestas endorses the recommendation of NTDC of revising this plan on 5-year basis as it will help the industry to have a clear visibility of the volume to be procured, build up the confidence of stakeholders and minimize the risk of uncertainty.

Pakistan has abundant renewable energy resources that can be utilized for power generation and end-use sectors. Irena' Renewable Readiness Assessment Report has identified an economic and technical viable potential of various renewable energy sources, from hydropower over wind and solar to biomass based on industrial and agricultural residues. The projected capacity additions across all the IGCEP 2047 scenarios tap into only a fraction of this potential, preventing thus Pakistan from benefitting of a cleaner mix of more affordable, reliable electricity.

Vestas beliefs that Pakistan can accommodate substantially higher shares of renewable energy, by integrating the guidance from the International Energy Agency (IEA) and Irena with regards to the system integration of renewables. The barriers to higher shares of notably variable renewable energy (VRE), such as wind and solar PV, that are addressed in the IGCEP 2047 can be overcome by following international best-practice. There is indeed an established and consistently increasing body of knowledge on the successful management of modern power systems transitions towards cleaner sources of energy.

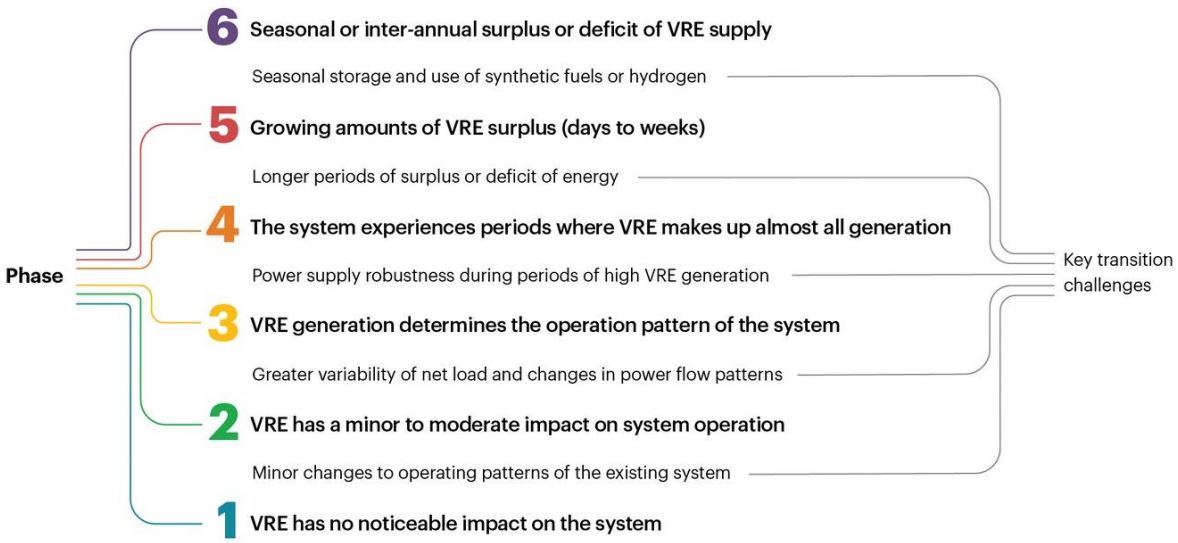
The ease of increasing VRE generation in a power system depends on the flexibility of the power system. Power system flexibility refers to the capability of a power system to maintain continuous service in the face of rapid and large swings in supply or demand, whatever the cause. Flexibility has always been an important requirement for power systems due to the need to plan for unexpected contingencies such as plant and transmission outages. However, system flexibility is becoming increasingly important when the share of VRE generation increases and needs to be addressed in all time domains from real-time operations to long-term system planning.

In this regard, it is of crucial importance to plan for the future energy mix and the increase of power system flexibility together. System flexibility requirements do however not increase abruptly, but gradually, providing policy makers and regulators with ample time to react.

The IEA categorizes the integration of VRE into six different phases, which can be used to priorities different measures to support system flexibility, identify relevant challenges and implement appropriate measures to support the system integration of VRE.

Phase 1 captures very early stages where VRE deployment (often no more than a few percent of annual energy demand) has no immediate impact on power system operation. Phase 2 flexibility issues emerge but the system is able to cope with them through minor operational modifications. Phases 3 through 6 respectively indicate greater influence of VRE in determining system operations; starting from the need for additional investments in flexibility; structural surpluses of VRE generation leading to curtailment; and structural imbalances in energy supply at seasonal and inter-year periods requiring sector coupling.

Key characteristics and challenges in the different phases of system integration

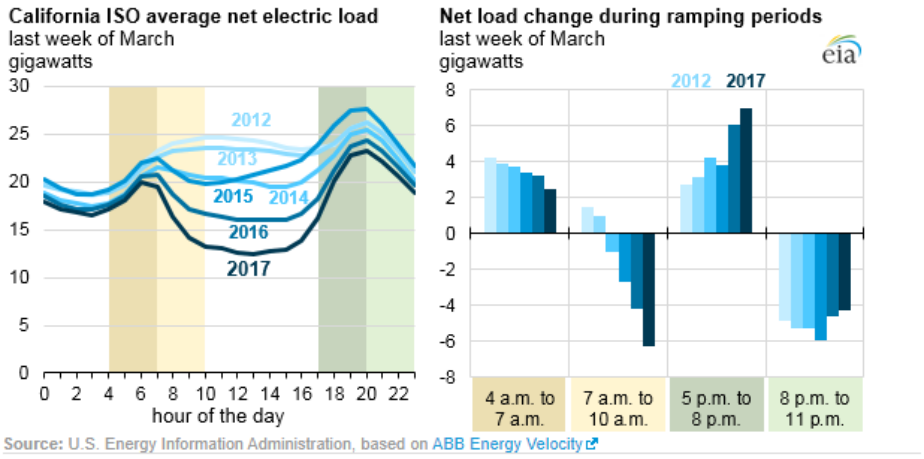


Source: IEA, https://www.iea.org/reports/introduction-to-system-integration-of-renewables

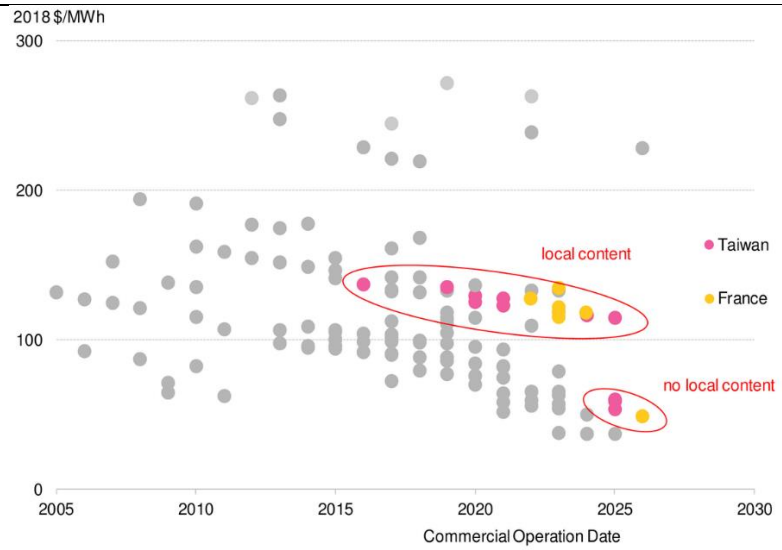
Currently, phase 4 is the highest phase that has been achieved, but only by a small number of countries or regions like Denmark, Ireland and South Australia. With a renewable energy share of 3.86%, Pakistan belongs to majority of countries that are in early transition phases, providing ample time to prepare for reaching higher shares.

Good advice, addressing also reservations with regards intermittency, forecasting and back-up requirements, can be found in IEA's summary report "System Integration of Renewables, An update of Best Practice", available here: https://webstore.iea.org/search?q=system+integration+of

II. Specific Comments on Indicative Generation Capacity Expansion Plan 2047

No	Comment	Reference Section (Page no)
1.	**Tables from E3 to E10:** Capacity additions of wind and solar PV **[Vestas]** All IGCEP 2047 scenarios – with regards to capacity additions from 2030 to 2047 - forecast no wind energy additions, but rather ambitious additions of solar PV. But as the availability of wind and sun is generally complementary, with solar reaching peak production during the day and wind in the evening hours (and more sun during summer and more wind during winter). Thus, deploying both technologies in the right mix can reduce variability (from minutes to months) and impacts on the grid. Experience from California also shows increased ramping requirements with increasing solar capacity that could be eased by having more wind in the energy mix (together with other flexible resources, such as storage and demand side management):  Source: U.S. Energy Information Administration, California wholesale electricity prices are higher at the beginning and end of the day, 07/2017, https://www.eia.gov/todayinenergy/detail.php?id=32172 To enable Pakistan planning for the optimal energy mix, we recommend assessing the complementarity of wind and solar and plan for a more balanced energy mix. As Pakistan plans to attract local manufacturing, it is furthermore advisable to plan for stable and sufficiently high yearly capacity additions to provide business case certainty.	xxviii-xxii

2.	**Tables from E3 to E10:** Capacity additions of local coal (lignite) **[Vestas]** All IGCEP scenarios– with regards to capacity additions from 2030 to 2047 – forecast significant additions of local coal. As Pakistan has ratified the Paris Agreement in 2016, planning for significant amount of fossil fuel-based capacity additions puts Pakistan at risk of not being able to contribute to achieving the agreed objectives. Many countries have already introduced or plan to introduce ambitious plans to phase-out fossil fuel-based power plants. And as financial investors have started furthermore to avoid financing of fossil fuel-based plants and related infrastructure, private sector financing of the planned capacity additions might be challenging.	xxviii-xxii
3.	**Local Manufacturing:** The document states- **"**indigenization of RE technologies through local manufacturing is also suggested to lower the basket price and thus providing a relief to the end consumer as well as saving precious foreign exchange while maximizing the nature's endowment bestowed upon Pakistan**"** **[Vestas]** International experience shows that local content requirements actually increase the levelized cost of electricity (LCOE) instead of lowering it. Bloomberg New Energy Finance's (BNEF) analysis of the LCOE of offshore wind in France and Taiwan with local content requirements and after removing local content requirements illustrates this point very well:	xxiv

	 *Source: BloombergNEF. Note: Levelized price, takes into account tariff price and length, inflation, a merchant tail assumption and a 25-year project lifetime. Grey dots represent other offshore markets.* Source: BNEF Shorts, French Offshore Wind Prices Plunge on Local Content U-Turn, 10/2019 It is furthermore important to highlight that local value creation goes beyond local manufacturing. Expanding renewables entails job creation along the complete value chain – and many of these jobs are local in nature: project development, sales activities, construction, transport, commissioning and operations and maintenance, and not to forget indirect jobs that e.g. result from grid infrastructure expansion. With regards to service and maintenance it is worthwhile to highlight that these jobs are long-lasting as spanning over the operational project lifetime and very often located in rural areas in proximity to wind and solar plants.	
2.	**Intermittency Nature of Wind:** The document states- **"**Optimal quantum of renewable energy in the national energy mix owing to various factors such as i) intermittent nature of renewable energy; ii) lack of a robust electricity grid; iii) extreme local temperature in the wind corridor; v) Harmonic distortion due to the presence of inverters in the generation mechanism of solar power plants and the newer technology wind power plants; and v) lack of reliable weather forecast effecting efficient dispatch**"** **"**GoP envisages to aggressively include 20% and 30% renewable energy generation by capacity by the year 2025 and 2030, respectively. However, these two energy resources due to their intermittency cannot be considered as a firm capacity, at all points in time or all around the clock; therefore, appropriate amount of backup generation is also required to provide for reserve requirements of the system.**"** **"**the total nominal capacity in the system stand at 126,136 MW and 168,246 MW against a peak load projected as 77,110 MW and 103,065 MW, respectively. It is pertinent to	1 of 237 26 of 237 95 of 237

	mention here that this gap is due to the heavy induction of thermal generation source i.e. RLNG and other thermal options having high capacity factors and reserve provisioning characteristics to cope up with the intermittent nature of variable renewable energy**"** **"**A total of 26,127MW candidate solar and 8,332 MW candidate wind are optimized by the year 2047. In a bid to cater for the intermittent nature of REs and system's reserve requirements, 25, 828 MW of candidate OCGTs are selected by the tool;**"** **[Vestas]** The concern with regards to the "intermittency" of wind and solar is common in countries with low shares of VRE. In the 1990s, German utilities ran an advertorial stating that "Renewable energies such as sun, hydro or wind cannot cover more than 4% of our electricity consumption – even in the long run." Year-to-date, Germany' wind and solar share in 2020 elevates to 44.7% with Germany being one of the countries having the most stable electricity supply. And in 2003, the Western Danish system operator ELTRA (now part of nationwide system operator energinet) stated "…We said that the electricity system could not function if wind power increased above 500 MW. Now we are handling almost five times as much…" [Since 2003, wind energy expanded significantly and 2019 saw the first day where wind energy covered more than 100% of demand each hour of the day – without any issues with regards to system stability]. Considering one single wind or solar plant, it is intuitive to think abrupt changes in wind speed might require thermal units to adapt their output very rapidly, in order to accommodate changing VRE output. Similarly, passing clouds can very rapidly change insolation and thus the output of the solar PV panels over which they pass. But this intuition misses important factors. Power demand itself shows random, short-term fluctuations; in consequence all power systems around the world already have a mechanism to deal with this variability. At low penetration shares, the fluctuations in the output of wind and solar will tend to be "lost in the noise" of demand fluctuations. And as more VRE plants are added to the system, a second effect comes into play. The short-term fluctuations in output of different VRE plants, located in different locations in a power system, tend to cancel out. This means that remaining variability is less pronounced and large changes tend to happen on the hourly timescale rather than seconds. With increasing shares, wind and solar variability raises the importance of power system flexibility—the ability of the system to deal with higher levels of variability in the supply/demand balance of electricity. In this regard it is important to remember that power systems are not dimensioned to back up any one particular group of power plants. It is the system's ability as a whole to meet demand that is important. There are several ways to provide this flexibility that the system ensures reliable and affordable electricity supply: grid infrastructure, demand side response, electricity	97 of 237

	storage, and increased flexibility of conventional generation (including hydropower). Renewables themselves can also participate in providing flexibility. There is ample guidance available in increasing the flexibility of power systems along with increasing the shares of VRE in a cost-efficient manner: IEA, System Integration of Renewables, An update on Best Practice, 2018 (available here: https://webstore.iea.org/search?q=system+integration+of) IEA, Next Generation Wind and Solar Power (Full Report), From Cost to Value, 2016 (available here: https://webstore.iea.org/next-generation-wind-and-solar-power-full-report IRENA/REN21/IEA, Renewable Energy Policies in a Time of Transition, 2018 (available here: https://webstore.iea.org/renewable-energy-policies-in-a-time-of-transition) Irena, Solutions to integrate high shares of variable renewable energy , 2019 (available here: https://www.irena.org/publications/2019/Jun/Solutions-to-integrate-high-shares-of-variable-renewable-energy) Irena, Power system flexibility for the energy transition, 2018 (available here: https://www.irena.org/publications/2018/Nov/Power-system-flexibility-for-the-energy-transition)	
5.	**Forecasting Techniques:** The document states- **"**Forecast of wind availability and hence its corresponding generation has not matured enough to estimate the generation for long duration**"** **[Vestas]** While it is true that wind speeds and directions as well as solar irradiation can only be predicted fairly accurately up to a few days in advance and not several years ahead, it is important to highlight that the same is valid with regards to commodity prices (such as coal, gas, oil or even carbon prices) and electricity demand. The impact on power demand of the ongoing COVID-19 crisis illustrates above statement: most countries have seen power prices and prices for oil, gas and coal plummeting to levels that nobody could have forecasted a year ago. While analysis of historic wind and solar data is indeed helpful for longer term energy planning and the identification of the most optimal sites to be deployed, system operations rely not on longer-term forecasts but on short-term forecasts. The later have improved greatly over the past year and are today and increase in precision the closer to delivery time they are made.	27 of 237

6.	**Average Degradation:** The document states- **"**The CAPEX is degraded by almost 3.6% and 1% for solar and wind respectively every year up till 2030 in line with various international practices**"** **[Vestas]** Wind and solar both present consistent declines in CAPEX with increasing installations and technology innovation. It is important to not solely concentrate on expected CAPEX reductions, but on the LCOE, as the decrease of the latter is not only due to decreasing costs (CAPEX, OPEX, financing) but also to increasing annual energy production. The LCOE corresponds to the average cost of an investor developing and operating a power plant per unit of electricity output, expressed in a monetary unit per kilowatt hour (kWh) or megawatt hour (MWh). It is calculated by dividing the sum of all plant-level costs (capital expenditures, finance, fuel, operations and maintenance, etc.) by the amount of power the plant will produce – levelized over the economic lifetime of the plant. When forecast future cost reductions, the horizon shall correspond to the forecasting horizon (here 2047) as it is not realistic to assume that cost reductions will stop in 2030. On global level, LCOE of onshore wind decreased by 60% since 2009 and sits at 44 USD/MWh today (source: BNEF, BNEF, H1 2020 LCOE Update, 05/2020), by 2030, BNEF expects the LCOE to range from 13 to 63 USD/MWh (the expected range is heavily influenced by factors like financing costs, terms & conditions, debt tenure, credit rating of the country, local market conditions, size of the market, size of the project and yearly volume to be procured. As these factors vary from country to country, this explains the wide range of the LCOE forecast. So, it's important to realize the fact that future LCOE reduction is subject to the situation with respect to aforementioned factors	31 of 237
7	**Grid Support:** The document states- "**Upcoming Wind Power Projects** In order to utilize huge renewable resources potential of Pakistan in a sustainable manner, the wind power projects supported by appropriate energy storage should be able to provide the following grid support: a. Base load operation for certain number of hours b. Support in frequency control and regulation c. Reserve power even when the renewable resource is not available d. Support in maintaining the reactive power balance" **[Vestas]** The hybridization of power plants, not only through co-locating wind and storage, but also wind and solar and/or storage can offer multiple advantages (as summarized below),	234 of 237

	but it is important to highlight, that state-of-art renewable energy sources can contribute to system stability when installed stand-alone: - With highly accurate short-term energy production forecasts, wind can contribute to accurate production planning - Wind turbines can provide asymmetric frequency control - Wind turbines can contribute to maintaining reactive power balance By adding co-located solar and/or storage to wind power plants, additional advantages can be achieved: - Increasing the annual energy production and capacity factor compared to a wind- or solar-only installation - Lower development, capital and operational expenditures compared to separate projects - Further easing of compliance with grid requirements (e.g. active control, frequency control and fast frequency control) - Eased fulfilment of power production requirements (e.g. scheduled power dispatch (e.g. load following power production), firming / forecast error reduction (commitment to produce power (MWh) per month / quarter within a certain range), flattened power generation profile over day / season / year) - Opening up new revenue streams if corresponding markets do exist (e.g. participation in ancillary services markets (e.g. power gradient reduction (smoothening); participate in frequency markets (e.g. provision of frequency control)	

ADG (Licensing)

PRIVATE POWER & INFRASTRUCTURE BOARD
MINISTRY OF ENERGY (POWER DIVISION)
GOVERNMENT OF PAKISTAN

No. 1(101) PPIB-IGCEP-2047/20/PRJ/O- 54574 — 22nd June 2020

IGCEP Committee

The Chairman
National Electric Power Regulatory Authority (NEPRA)
NEPRA Tower
Attaturk Avenue (East)
G-5/1, Islamabad
Pakistan

Subject: **PPIB'S COMMENTS ON INDICATIVE GENERATION CAPACITY EXPANSION PLAN 2047 (IGCEP)**

Reference is made to the notice for submitting the comments of the stakeholders, interested/affected parties/persons and the general public in the matter of Indicative Generation Capacity Expansion Plan 2047 (IGCEP) uploaded at NEPRA website dated 25th April 2020.

2. In this regard, being a stakeholder, PPIB has reviewed the IGCEP and views/comments of PPIB are enclosed herewith at **Annex-I** for your consideration before providing the approval of the Authority.

With regards,

Registrar

(**Shah Jahan Mirza**)
Managing Director

CHAIRMAN
Dy No. 3570
Date: 23-06-2020

Encl: (as above)

CC:

The Secretary, Ministry of Energy (Power Division), GOP.

ANNEX-I

PPIB'S COMMENTS ON INDICATIVE GENERATION EXPANSION PLAN 2047 (IGCEP)

PPIB's comments on the IGCEP 2047 submitted by NTDC are as follows:

1) NTDC plans to prepare and deliver IGCEP on yearly basis; whereas, the Power projects initiated for development through private Sector are mainly on medium to long-term basis and requires a fix timeframe for CODs. Hence during annual revision of IGCEP this aspect needs to be taken care, as such projects may not be able to be adjusted to a new timeline of COD, every year.

2) 27 years (2020 to 2047) horizon of IGCEP is too long.

3) CODs of 720 MW Karot HPP and 884 MW Suki Kinari HPP (both under construction/committed category project) have been mentioned in IGCEP as 2022 and 2023 instead of 2021 and 2022 receptively given in signed PPA it may have legal consequences.

4) A large number of Candidate RLNG projects in year 2028 onwards have been listed; however imported fuel based power projects are banned by GOP. Therefore all such imported fuel based projects be converted into candidate Local Coal and/or hydropower projects.

5) Thar/Local Coal based Power Projects are being developed through Chinese financing, as International Multilateral Financing Agencies are reluctant to finance these base load power projects. Therefore, this limited available opportunity of financing of coal based power projects needs to be prioritized for which sufficient block allocation in IGCEP is required.

6) Projects having committed availability of transmission lines should be given due weightage/ preference for inclusion in IGCEP (for instance Mahl HPP whose proposed power evacuation transmission line will be completed in 2022 as per Suki Kinari HPP timeline, whereas in IGCEP its COD is envisaged in 2030 thus leaving the T/L investment redundant for many years due to under capacity operation of the T/L). This aspect merits due attention comparatively both in time-wise and cost-wise competing scenarios.

7) A Generic Candidate Local Coal project of 1514 MW capacity by unknown agency has been considered to be commissioned by 2024. It is difficult to understand that how it is possible that a coal project envisaged to be developed within 4 years in absence of fuel (coal), power evacuation arrangements and other necessary infrastructure. Above all gestation period for a coal project starting from scratch is around 6 years. There appears to be no rationale for including this project in IGCEP.

8) The COD of 1320 MW Oracle Power Project, being a CPEC Priority Project is in year 2027 and 2030 in two phases of 660 MW each. Hence, the project may be re-considered, while keeping in view the latest demand-supply situation and other parameters.

9) 8 MW Kathi-II HPP in AJK (candidate project eategory) has been issued LOS by PPIB however, its COD in IGCEP has been taken as 2044 while 7 MW Riali-II HPP in AJK to whom LOS was also issued almost at same period of time, having similar capacity and tariff (Feasibility stage), lies in committed project category and has been taken to be commissioned in 2021 in IGCEP 2047. This huge difference in COD time frame from now in both the projects will frustrate the project sponsors, will vanish early completion hope of project, and will negatively impact the prospects of attracting investments in future specially in small hydropower.

10) Cost reduction aspect due to "economy of scale" for Thar coal based projects should be prioritized while considering candidature system of project selection as these projects would not only produee cheaper electricity but reduce overall fuel import bill of the Country as well as one step towards self-reliance and sustainable development.

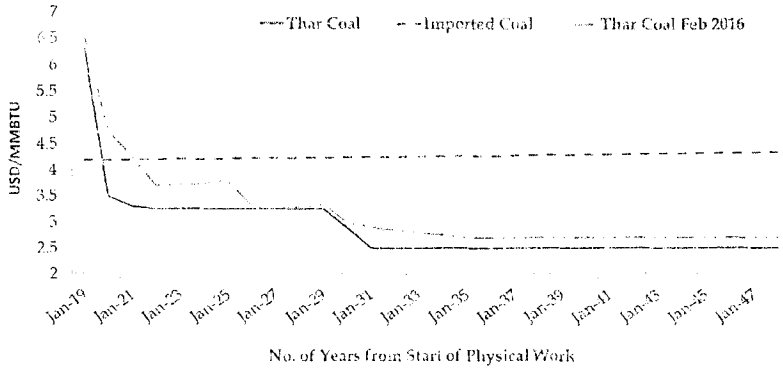
11) A comprehensive mechanism needs to be devised by NEPRA for imported eoal based power projects to utilize local/indigenous coal, which shall reduce the overall cost of electricity produced by coal power projects and shall also save precious foreign currency reserves.

12) In "Retirement Schedule" possibilities of renewing PPAs of power plants based on Low BTU gas like Uch-1, and/or setting up new power plants based on low BTU gas may be given importance.

13) For Thar Coal SSRL tariff has been considered for evaluation of Thar Coal based new projects while NEPRA gave another Upfront Tariff for Thar Coal power projects on **27th July 2017,** which is lower than SSRL's tariff. Revised upfront tariff for PLEXO evaluations should be considered.

14) Furthermore, after coalmine expansion in 2nd and 3rd phases at Thar block-II by SECMC, the price of electricity shall significantly reduce. Therefore, the price of 40USD/Tonne of local coal should be considered as the benchmark price, while considering local coal price.

15) Price of Rs. per unit (kWh) of electricity for each of the years 2020-2047 with base year of 2020 prices may be calculated with an estimated planning basis. Pursuant to the information provided by SECMC(in the table below), the cost of coal in USD/Tonnes would reduce significantly after coalmine expansion from 3.8 MTPA to 30 MTPA, thereby reducing the cost of electricity generated from local coal, significantly. Therefore, these factors need to be considered while eonsidering the candidate local coal power projects and their impaet on the overall priee of electricity.



16) After completion of first Phase of Thar Block-II, wherein Engro was completed, with a higher Fuel Cost Component (FCC). The FCC will be ultimately reduced to 1.6 cents/kWh after the COD of already planned / committed projects of Lucky and Siddiqsons, upon completion of Phase 3 of Block-II. Therefore, it is suggested that Fuel Cost Component based on the Coal tariff for Phase 3 of Block-II should be considered for input in the software.

17) Despatch for some recently commissioned imported coal projects drop drastically from 2024 onwards. These projects were installed recently and will remain underutilized in order to comply with contractual obligations of 66% despatch for RLNG plants. In order to create a balance imported coal power projects should also be given a reasonable despatch in excess of 50%.

18) All Power Projects, which have been issued LOSs, should be included in the definition of "Committed Projects" as it is essential to maintain the confidence of investors and lenders who are committed to invest in Pakistan Power Sector. Whereas, the hydropower projects which have been issued LOIs should get appropriate weightage while establishing the maturity of the candidate projects.

19) 1410 MW Tarbela 5th Extension mainly would either be operative for a couple of months in a year only or it will replace old units of Tarbela HPP so its energy should accordingly be considered to avoid any duplication.

20) COD of 4500 MW Diamer-Basha HPP is mentioned in year 2045, needs to be checked if it is correct or not.

21) Some provincial initiated projects though relatively matured ones are placed towards the back end in the IGCEP timelines. Almost all private sector hydel projects (which are at relatively matured stage) that the sophisticated software PLEXOS has placed them beyond year 2040, assumptions are required to be rechecked. For wind and solar a block allocation (without identification of any sponsors and site) has been included in the IGCEP. This aspect needs re-consideration.

22) The following project (sr. No. 1 to 3) of WAPDA are at initial stage and do not have any commitment for financing as yet but these have been shown in IGCEP with relatively early CODs (year 2029 to 2032) as compared with matured projects for which financing has already been lined-up like 452 MW Athmuqam HPP, 300 MW Ashkot HPP, 48 MW Luat, 35 MW Jagran-III etc., 8 MW KHATAI-II HPP etc. Moreover, these projects are in same corridor and only access is available through Kara-Kuram Highway (KKH) so practically these projects of about 6000 MW capacity will not be possible to be constructed almost in same time frame and if 4500 MW Diamer-Basha HPP is also considered with these projects instead of year 2045, the situation will further worsen. Besides, arrangement of financing (to the tune of USD 12 to USD 18 billion in addition to already committed projects of about 4500 MW at sr. No. 4 to 7 below) in public sector in a narrow time span may not be possible. Therefore, instead of these relatively none mature projects, mature projects may be considered.

	WAPDA PROJETCS (PLANNED)					
	NAME	**FUEL**	**Capacity (MW)**	**AGENCY**	**TYPE**	**COD**
1	Thakot-III	Hydro	1,686	WAPDA	Candidate	2029
2	Thakot-I	Hydro	2,154	WAPDA	Candidate	2031
3	Dasu_2	Hydro	2,160	WAPDA	Candidate	2032
		Total=	**6000**	**MW**		
	WAPDA PROJETCS (UNDER CONSTRUCTION)					
	NAME	**FUEL**	**Capacity (MW)**	**AGENCY**	**TYPE**	**COD**
4	Tarbela 5th Ext.	Hydro	1410	WAPDA	Committed	2023
5	Dasu-I	Hydro	2160	WAPDA	Committed	2025
6	Kyal Khwar	Hydro	128	WAPDA	Committed	2024
7	Mohmand Dam	Hydro	800	WAPDA	Committed	2025
		Total=	**4498**	**MW**		

23) It is observed that the project cost and timelines proposed by the project handling institutes have been included by NTDC in the IGCEP as it is without any independent evaluation. Therefore, an independent evaluation of the proposed timelines of projects needs to be carried out vis-à-vis current status and availability of financing for such projects before inclusion in IGCEP. For instance the WAPDA's public sector hydropower projects always have time overruns manifolds from the initial determined timeline.

24) Moreover, the public sector power project used to experience significant variation towards increases in capital cost than initially set forth through PC-1s than those of private sector projects.

25) An apple-to-apple comparison of the cost of projects on various fuels is missing while establishing the "candidature" of the projects in the IGCEP.

26) Loss of Load Probability (LOLP) of 1% (i.e. LOLE value of 3.65 days/year) has been adopted. A realistic approach may be to analyse the historical data to work out pragmatic number of LOLP instead a percentage.

27) For "Long Term Forecast" electricity demand for current year (YT) and electricity demand for previous year (YT-1) are taken as Sales (GWh) during the said years. Since, these figures represent amount of electricity supplied to utility companies hence may not represent the actual demand.

28) It appears that in the IGCEP RE is taken mainly on face value of tariff and its intermittency is ignored. In the IGCEP it is mentioned that the RE plants have limitations like Optimal quantum of renewable energy in the national energy mix owing to various factors such as i) intermittent nature of renewable energy; ii) lack of a robust electricity grid; iii) extreme local temperature in the wind corridor; iv) Harmonic distortion due to the presence of inverters in the generation mechanism of solar power plants and the newer technology wind power plants; and v) lack of reliable weather forecast effecting efficient despatch. Solar and Wind resources due to their intermittency cannot be considered as a firm capacity, at all points in time or all around the clock; therefore, appropriate amount of backup generation is also required to provide for reserve requirements of the system. Despite such limitations associated with RE plants keeping a very high share 10,327 MW of Wind and 12,793 MW of Solar in the base case scenario up to 2030 & further increasing it beyond 2030 through yearly block allocations may require re-evaluation when all-end reliable, continuous and system-stable hydropower resource with committed investments is available for entry into the national system earlier than as envisaged time-wise in IGCEP.

29) While using the CAPEX of solar, wind and hydropower projects, the effect of useful life of hydropower projects (which may be well beyond 60-70 years) versus 20-25 years life span of wind and solar is ignored in the IGCEP.

30) Solar and wind power projects should compete mutually as well like other fuels. If solar is the cheapest then why solar is supressed by accommodating wind power.

31) Worldwide, hydropower projects (at least small HPPs) are considered as part of RE-Projects but this aspect is totally ignored while deciding the quantity of RE projects in IGCEP.

32) Comprehensive mechanism may be chalked out to determine allied infrastructure such as road and rail network, water, transmission lines and improvement in distribution network and project financing for future generation capacity expansion, so that infrastructure may be developed in parallel.

33) It is also highlighted that from 2025 till 2045, almost 60% of power generation shall be from hydro, solar and wind. These projects shall have high capacity cost as compared to base load thermal power projects. These factors also need to be considered.

May 19, 2020

For m/o & r.c pl.

cc:
- SA (Tech) — Chairman
- SA (T) — r.c/m (M&E) 28/5/20
- DG (M&E) — m (T)
- ADG (Lic) — m (CA)
- SLA (LLP) — m (Lic)

cc:
m/o

Registrar
NEPRA
NEPRA Ataturk Avenue (East)
Sector G-5/1 Islamabad
Tel: 051-9206500 / fax 051-9210215

RE: **Comments in the Matter of IGCEP**

Dear Sir/Madam,

We are writing with reference to your request for comments from relevant stakeholders regarding review and approval by NEPRA of the Indicative Generation Capacity Expansion Plan 2047 (IGCEP).

Indeed, the IGCEP is a very good initiative, albeit requiring guidance and direction from regulatory bodies like NEPRA. For instance, it suffers from a major flaw in so far as it does not distinguish between unsolicited hydel projects, and hydel projects which have been specifically solicited by the Government. Solicited Projects should clearly be given distinction and priority in the Generation Plan. This has been currently overlooked which creates negative impression about credibility of government institutions in the energy sector.

We were awarded the Nila Da Katha small hydro project via a competitive tender process. The Nila Da Katha Project was specifically solicited in 2017 by the K-P Government, under an approved Power Policy and in collaboration with the PPIB/GOP. Please see the attached Expression of Interest.

We have spent crores in completing the feasibility study for this project, and other expenditures, including starting competitive bidding process for EPC Contracts. All these costs were undertaken based on the solicitation by the Government for this Project.

Therefore, while we are fulfilling our end of the bargain, the Government including NEPRA should also give priority as rightly due to solicited projects like Nila Da Katha in the Generation Plan.

Regards,

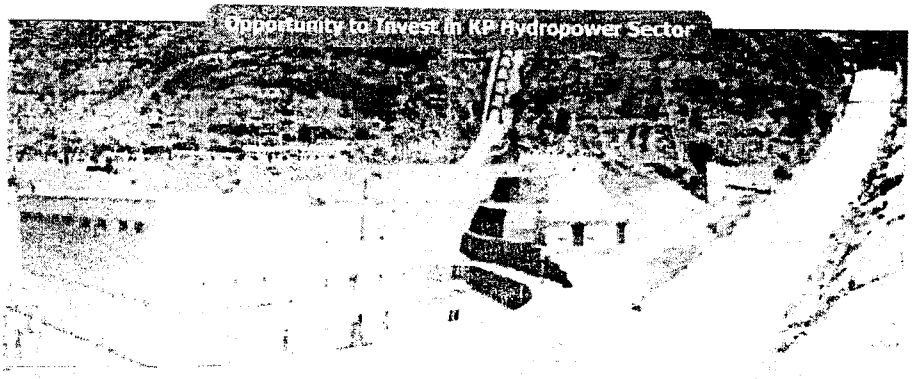
Habib R. Khan
Chairman

REGISTRAR
Dy. No. 1172
Dated: 28-5-20

SinoPak Power (pvt.) Ltd.
46-H Gulberg III, Lahore, Pakistan. +92-(0)300-8452177, +92- (0) 302-8117830
E-mail: hrk118@hotmail.com

Government of Khyber Pakhtunkhwa
Energy & Power Department
Pakhtunkhwa Energy Development
Organization (PEDO)

EXPRESSION OF INTEREST



The Government of Khyber Pakhtunkhwa (GoKP) has been consistently encouraging the participation of private investor in the power generation sector of Khyber Pakhtunkhwa. Pakhtunkhwa Energy Development Organization (PEDO), a one window facilitator on behalf of GoKP.

Applications are invited from interested private sector entrepreneurs, having [illegible] sector and strong financial capability, for development of below [illegible] Hydro Power Projects as Semi-Raw Sites in Khyber Pakhtunkhwa.

Sr. No.	Name of Projects	District	Potential (MW)
[illegible]	[illegible]	Chitral	16.17
[illegible]	[illegible]	Chitral	24.93
[illegible]	[illegible] Kalk Kathi	Mansehra	7.43
[illegible]	[illegible]	Mansehra	2.47
[illegible]	[illegible] Kotla	Mansehra	7.86
[illegible]	[illegible]	Swat	17.14
[illegible]	[illegible]	Swat	12.00
TOTAL			87 MW

[illegible] Package under a Pre-Feasibility is available in collaboration with PPIB/GoP.

The projects shall be implemented under the new KP Hydro Power Policy 2016, which inter alia provides attractive set of incentives to the private sector for investing in Hydro Power Generation Projects in Khyber Pakhtunkhwa. The details of the Projects, Policy and Guidelines are available at PEDO's website: www.pedo.pk

Proposals can be submitted for projects by interested party (ies) after completing pre-requisites of registration and purchasing of Expression of Interest (EOI) Document of the projects. Parties will be selected based on the terms, conditions and the evaluation criteria set forth in the respective EOI Documents.

EOI documents can be obtained from PEDO office upon payment of US $ 100 for [illegible] and US $ 1,500 for EOI Documents fee. Payments will also be accepted in [illegible] Pakistan Rupees through demand draft/pay order drawn in favor of General Manager(Hydel) Pakhtunkhwa Energy Development Organization, Peshawar.

ADG(LC)

PAKISTAN WATER & POWER DEVELOPMENT AUTHORITY

701 Wapda House
Shahrah-e-Quaid-e-Azam Lahore
PAKISTAN
Off : +92 42 99202222-3
Res : +92 42 99202066
Fax : +92 42 99202505
Email : chairman@wapda.gov.pk

No, C/MP/2020/317
29. 5. 20

CHAIRMAN WAPDA

Chairman
National Electric Power Regulatory Authority,
NEPRA Tower, Attaturk Avenue (East), G-5/1,
Islamabad.

Subject: <u>Indicative Generation Capacity Expansion Plan- IGCEP 2047</u>

I take the opportunity to apprise that WAPDA mandate is development of water and hydropower resources in an efficient manner and the department is working hard to harness water and hydropower resources in the country.

NTDC has submitted IGCEP 2047 report to NEPRA for review and approval as per requirement of Nepra Act carrying information's about all projects in implementation as well as planning along with capacities and projected commissioning dates.

It is pertinent to mention here that WAPDA is actively working on three hydropower projects of Dasu, Mohmand and Diamer Basha which are expected to start electricity generation between the year 2024 – 2028. These projects being of great importance will prove to be the real game changer and deemed necessary for sustainable economic growth of the country.

Registrar

Civil Contract for Diamer Basha Mega project has already been awarded with expected completion date of 2028 and the project will generate 4500 MW Power with annual energy of 18097 GWh but the IGCEP 2047 indicated the commissioning of Project during 2043 being an issue of serious concern and raise questions on the authenticity of IGCEP report. The staking sequence and commissioning dates of some future WAPDA Projects like Thakot I and III also require to be adjusted to depict the true scenario.

The planning and implementation of Power Evacuation from all these projects need to be finalized on war footing basis specially for the projects located in the tough terrain of Northern Areas hardly accessible and having limited flexibility in the narrow transmission corridor.

CHAIRMAN
Dy No. 3740
Date: 01-07-2020

WAPDA proposes a meeting to be arranged by NEPRA being regulating body with NTDC to thoroughly discuss the IGCEP 2047 for proper adjustments of commissioning dates of projects and arrangement for power evacuation plans from active WAPDA Projects.

Muzammil

Lt Gen Muzammil Hussain (Retd)

Copy to:

- Managing Director NTDCL, 414 WAPDA House Lahore.

Central Power Purchasing Agency Guarantee Limited

A Company of Government of Pakistan

CPPA-G/2020/CEO/7959-61 Date ; July 2nd, 2020

The Registrar
National Electric Power Regulatory Authority
NEPRA Tower, Attaturk Avenue
G-5/1, Islamabad.

SUBJECT: Indicative Generation Capacity Expansion Plan (IGCEP) 2047

This is with reference to your letter No. NEPRA/ADG(Lic)/LAT -01115164 5169 dated June 19, 2020 on the subject matter.

Accordingly, the following is placed for the due consideration and reference:

1. Under light of the prevailing Legal and Regulatory framework, the indicative Generation Capacity Expansion Plan (IGCEP) of NTDC is the regulatory tool that yields optimal utilization of available resources and ascertainment of new capacity requirements, keeping in view the parameters, inter-alia, Load growth forecasts, Loss of Load Probability (LoLP), Reserve requirements, resource profiling etc. ultimately leading to induction of all future generation on least cost basis, which implies that this process & tool itself is of paramount importance for ascertainment of least cost of electricity to meet the regulated consumer demand;

2. It is pertinent to mention here that NEPRA in its letter no. NEPRA/DG(M&E)/LAT-01/24698-99 dated November 19, 2019 has also noted the following:

".....It was highlighted that the prior decisions of now "committed projects" amount to more than 17 GW till 2025, which are more than adequate to meet the forecasted' demand till-2025. This is also supported by the considerably lower levels or LOLP than the criteria in the IGCEP....."

This is further elevated by the impact of COVID-19 on the overall demand growth coupled with influx of the distributed generation, which in-turn calls for the re-evaluation of the prospects of the future utility scale procurement through a mechanized process already captured in the legal and regulatory framework. This is among the rudimentary pre-requisites to mitigate the menace of circular Debt, Liquidity issues, Stranded Capacities & Costs and eventually yielding an investor friendly environment of the power sector while meeting the overall desired objectives. All these variables, if not being taken care-of, will tend to swell up the electricity tariffs for end consumers of country.

In the light of afore going, it is submitted that entire process of future procurement i.e. issuance of LOI's, LOS's, Generation Licenses, Tariff determinations and eventual execution of contracts needs

to be aligned with the approved IGCEP (instead of executing on case-to-case basis), so to attain affordable, reliable and sustainable supply for the end consumers.

(CHIEF EXECUTIVE OFFICER)
CPPA G

Copy to:

i) Secretary, Ministry of Energy (Power Division);
ii) Managing Director, NTDCL;

Mr. Hafeez Ullah Khan,
Deputy Registrar,
National Electric Power Regulatory Authority (NEPRA),
NEPRA Tower, Attaturk Avenue (East),
G-5/1,
Islamabad.

Ref No. KE/BPR/NEPRA/2020/569
June 10, 2020

Subject: **Indicative Generation Capacity Expansion Plan 2047 (IGCEP) Submitted by National Transmission and Despatch Company Limited**

Dear Sir,

This is with reference to NEPRA's letter dated April 28, 2020 received in this office on May 04, 2020, soliciting stakeholder comments on the Indicative Generation Capacity Expansion Plan 2047 ("IGCEP 2047") submitted by National Transmission and Despatch Company Limited.

In this regard, please find our comments on the IGCEP 2047 enclosed as **"Annexure A"** to this letter. Further, please note that the delay in filing of comments is due to the prevailing COVID-19 pandemic and Eid Holidays, and therefore, we humbly request NEPRA to condone the delay and consider our comments.

REGISTRAR
Dy. No: 1787
Dated: 15-06-20

Sincerely,

Ayaz Jaffar Ahmed
Director – Finance & Regulations

For info & n.a pl.
- ADG (Lic) 15/6/2020
Copy to
- SA (Tech)
- SA (T)
- DG (M&E)
- ME
cc: Chairman
- V.C/M (M&E)
- M (T)
- M (CA)
- M (L)

Encl: Annexure A

Cc: Registrar, NEPRA, Islamabad.

The preparation of Indicative Generation Capacity Expansion Plan 2047 ("IGCEP 2047") is a major development towards proactive planning for future electricity needs and security of supply in context of the local power sector as planning oversights from the past have already and continues to cost the sector heavily, and therefore, we appreciate the efforts of NTDC in preparation of the IGCEP 2047.

Further, with respect to the IGCEP 2047, we would like to submit the following observations / comments for consideration, which we understand would enable a more integrated approach and yield better results in the long-term.

a. Study of KE Area as an Independent System

Within the IGCEP 2047 study, KE system has been considered to the extent of 650 MW being currently supplied to KE from the National Grid, and the same is subsequently increased to 1,150 MW after FY 2022, assuming that supply to KE from K2/K3 projects will be available from FY 2023 onwards. Further, IGCEP 2047 states that KE system will be considered as an independent system and a separate study shall be undertaken, the results of which will be shared by NTDC shortly. Responsible for end-to-end planning of the entire value chain, KE is collaborating for provision of required information with NTDC including projected demand growth in KE's service area, KE's planned generation additions etc., and understands that to be meaningful, the results would be discussed with KE for necessary review before submitting to NEPRA.

Here, we would like to highlight that as the only private vertically integrated power utility and serving the commercial hub of the country, to manage the anticipated growth in power demand, and the fact that KE's system was not considered / included in the planning process, along with the uncertainty even around the existing supply from the National Grid, KE had planned capacity additions across the value chain for which KE has already invested considerable time and resources. However, considering that now there is surplus capacity in the National Grid, tariff notification for KE's 700 MW Coal Project has been put on hold by the Government of Pakistan ("GoP") and KE is being asked to absorb the surplus capacity available in the National Grid by pursuing additional power from the National Grid.

It is pertinent to mention here that while KE has been in continuous engagement with relevant stakeholders since 2018, despite a lapse of considerable period, discussions around additional supply to KE from the National Grid are still in progress, and upon their finalization, related interconnection and grid works will commence which may take up to 3 years before such additional power can be evacuated from the National Grid. As a result, with KE's planned generation projects put on hold and delays in additional supply to KE from the National Grid, smooth and reliable supply of power to consumers may be adversely impacted in the short to medium term.

Further, we would like to reiterate that as a vertically integrated utility responsible for planning of the entire value chain, KE remains committed to its planned projects, subject to required approvals, and the consideration for off-take of additional power from the National Grid by KE is in the greater national interest, as this would help reduce the burden of idle capacity payments against already contracted capacity at the national level, which has been a major contributing factor towards circular debt. Moreover, considering the surplus capacity in the National Grid, we would like to highlight that supply of additional power to KE from the National Grid does not require any new commitments to be made by CPPA-G or NTDC.

Moreover, it is important to take into account that the arrangement for additional supply to KE from the National Grid will be of long-term nature and the additional capacity will be utilized to the extent of commitments made under the agreements, and any shortfall in the rest of Pakistan will not be met through any reduction in the commitments made to KE.

b. Must Run Status of Renewable Projects and Intermittent Generation

From planning perspective, it is imperative to take into account the intermittent nature of renewable projects and accordingly plan for contingencies such as sudden unavailability of renewable plants or their variable generation profile. Additionally, due to the must run status of renewable plants, careful considerations should be given to seasonal demand of proximate load centers, choice of renewable technology for a given location, variation in renewable generation and the overall mix of renewable with the baseload generation flowing through the relevant transmission system.

The IGCEP 2047 study envisages over 26,000 MW candidate solar and over 8,000 MW candidate wind projects to be optimized by the year 2047. In addition, the study also optimizes over 37,000 MW candidate hydro projects till the year 2047. However, considering the intermittent nature of renewable projects and system requirements, around **26,000 MW of candidate Open Cycle Gas Turbines (OCGT)** are selected, which are not readily despatched under normal conditions, and thus remain almost at zero plant factor. While from planning perspective, it is important to have a reserve margin in line with prudent utility practices, a holistic analysis of demand projections in view of the external factors along with existing and future capacity additions is necessary to ensure better optimization of planned additions as well as to avoid further over contracting of the capacity, which would otherwise result in aggravation of capacity commitments, culminating with further accumulation of circular debt.

In addition, specifically with respect to solar plants, it is important to take into consideration the possibility of the 'Duck Curve' problem, which suggests that as increasing amounts of solar generation is added into the system, to prevent oversupply of electricity, conventional plants may have to be shutdown. However, moving further into the day, as solar energy starts to fall rapidly, conventional generators may have to be ramped up quickly. A possible issue with this is that conventional plants, may not have the capability to ramp up so fast, which means that even at the time of peak solar generation, these conventional plants will still be required to remain in operation and would add to inefficiency when used at part or minimum load.

Therefore, while the decreasing trend in cost of Renewable Energy (RE) technology along with the targeted shift in fuel mix may be the factors driving aggressive RE addition along with optimization of candidate hydro projects, it is imperative that limitations with respect to variability in their generation profile, especially RE projects are taken into account and accordingly, the overall economic benefit must be considered before new RE projects are added to the network to avoid capacity redundancy as the added cost would be borne by consumers given the nature of existing Power Purchase Agreements (PPA) / Energy Purchase Agreements (EPA).

Accordingly, NEPRA and other stakeholders including Ministry of Energy (Power Division) must take the above into consideration while implementing aggressive targets for RE projects, as assumed within the IGCEP 2047 study and NTDC should also run scenarios for optimal targets of RE capacity in the network, independent of the RE targets set by the GoP, and if there are any possible limitations in following the set RE policy targets, the same must be highlighted to NEPRA and the policy makers. Further, considering the requirement of OCGT plants to cater for the intermittent nature of RE plants, NEPRA and policy makers must also consider and provide clarity with regard to the tariff regimes for these OCGT plants. In addition, a cost benefit analysis should also be undertaken as part of the IGCEP study to evaluate the economic and commercial viability of OCGTs against the possibility of having hybrid RE projects, as being adopted in other markets.

Further, it is pertinent to note here that due to delays in the availability of network transmission capacity as well as low system demand during the last winter, the renewable wind projects in Jhimpir and Gharo corridors faced significant curtailment. The issue of low despatch / idle capacity due to transmission constraints was also highlighted by CPPA-G stating that due to transmission network congestions, expensive generators are despatched while cheap generation remains idle owing to said constraints, thus increasing the overall energy purchase price for the system.

Therefore, care must be exercised in integrated planning to ensure that the transmission network is timely available prior to awarding tariffs and signing EPAs with upcoming renewable projects.

c. Network Capacity Constraints – Transmission & Distribution

Due to lack of integrated planning and little focus on Transmission and Distribution (T&D) segment, adequate investments have not been made in the T&D network. As a result, while the country has surplus in power generation, as also concluded in IGCEP 2047 study, the issue of transmission and distribution capacity constraints continue to impact smooth and reliable supply of power to the load centers.

Therefore, to ensure an integrated planning of the overall power sector, IGCEP must also include the existing T&D capacity and constraints, and related infrastructure requirements to ensure secure and reliable power supply in the future.

d. Proposed Study related to Thar Coal

Under the IGCEP 2047, it is assumed that by the year 2021, 4,000 MW of power generation from local coal of Thar will be evacuated via HVDC transmission line from Matiari to Lahore. However, with respect to Thar coal, the IGCEP 2047 also highlights certain issues such as availability of sufficient water, estimation of optimal amount of mining, etc. and recommends that the same must be considered and evaluated by Private Power Infrastructure Board ("PPIB") through undertaking the required studies in addition to studies by NTDC with respect to power evacuation and transmission of power to the load centers.

Accordingly, we request NEPRA to ensure that in line with NTDC's recommendation in IGCEP 2047, the proposed study is undertaken by PPIB at the earliest, as going forward, there is significant dependence on local coal within the overall energy mix (c. 19% share of local coal in the overall generation mix in 2025 which increases to c. 47% in 2040), and therefore, any possible issues may have a serious impact on the overall electricity security in the country. Further, it is suggested that transportation issues / availability of infrastructure to transport Thar Coal to generation sites at different locations including Karachi, should also be considered for optimal planning.

e. Reliance on Local Coal Projects

Within the existing study, there is significant reliance on local coal power plants contributing around 47% towards the overall projected generation mix in 2040. In addition to issues related to local coal (Thar coal) as discussed above (point d), the possibility of any future international moratorium / restrictions on coal power plants in view of their impact on the environment should also be accounted for from planning perspective and a suitable contingency plan should be in place accordingly.

f. Retirement of Old Existing Plants

Currently, the IGCEP 2047 assumes retirement of 11,511 MW of generation capacity based on expiry of their respective PPAs. It is important to note that as per the data reported in NEPRA's State of Industry Report 2019, some of these plants have efficiency levels of around 40% to 45% and therefore, these plants may be continued rather than going for new generation which would only result in an increase in capacity payments through additional debt / RoE payments.

Similarly, to ensure better planning, it is suggested that retirement of plants should not only be tied with the expiry of PPA, instead existing plants which may become redundant through obsolescence, poor efficiency, or environmental damage should also be evaluated in terms of their reliable despatch towards the overall projected power demand.

g. Technology Selection and Location of Generation Projects

The choice of technology and location of new generation projects is important for long-term reduction in cost of generation. Considering the low plant factor of renewable projects, the distance from generation to the grid needs to be minimal to minimize transmission losses and justify the length of transmission lines to be laid for renewable projects, and accordingly, the same must also be taken into account for optimal planning. It is therefore suggested that the IGCEP should be integrated with Variable Renewable Energy (VRE) locational study and the upcoming transmission network expansion plan, which would help identify specific zones and transmission network availability for prospective RE projects.

Similarly, for thermal projects, the supply of fuel such as coal and LNG needs to be in close proximity to the generation plant to reduce transportation cost of fuel and investment requirement for transmission and distribution infrastructure.

h. Demand Forecast / Demand Side Management

The IGCEP 2047 study does not consider demand side management or planned interventions in this regard, including the impact of Net Metering, Competitive Trading Bilateral Contracts Market ("CTBCM") Model, wheeling of power by Bulk Power Consumers etc. Considering the changing dynamics as explained above along with impact of COVID-19, the demand and load characteristics of energy users may change significantly and therefore, the demand forecasting needs revisions. Further, for better planning, it is important to derive a mechanism to estimate the impact of demand side management initiatives on the projected demand growth.

In this regard, considering the significant growth projected in solar rooftop, not only the expected impact of the same be included for optimal planning, but policy guidelines on the pricing of energy purchased from these rooftop solar must be issued as well. Under the existing regime, select consumer categories having high consumption and low losses which cross-subsidize low-end consumers are being incentivized, and the same may culminate with an adverse impact on DISCOs' consumer mix tilting towards consumers where there is susceptibility of theft and low recovery levels, thus having a significant impact on DISCOs' business sustainability.

In addition, for the purpose of demand forecasting, it is also important to take into account the pending new connection applications. As per NEPRA's State of Industry Report 2019, a total of over 320,000 new connection applications were pending across different DISCOs (as of June 30, 2019), and the same can have a material impact on the actual power demand in the future.

i. Planning Horizon

Considering the rapidly evolving power sector and changes to the regulatory landscape, it is important that planning and strategy must take into account these factors and be reflective of the same. Accordingly, it is suggested that instead of the 5-year review / update period as proposed by NTDC, IGCEP study should be reviewed / updated after every 2 to 3 years.

Further, to enable better and effective planning, the IGCEP must be dynamic such that some level of sensitivity analysis is included to account for delays in commissioning dates of planned projects or change in consumption patterns influencing the overall projected demand levels, as the same could otherwise materially impact the projected demand-supply outlook.

j. Availability of Plant-wise Average Annual Tariff

As the IGCEP 2047 is based on least cost generation, it is suggested that for each of the scenarios included within the study, plant-wise average annual tariff (cents/kWh) in terms of fuel cost, variable O&M and fixed cost should also be reflected in the study which would help analyze the basis for decision making, and will provide greater transparency and visibility into the overall planning and decision-making process.