National Transmission & Despatch Company Limited (NTDC) Pakistan

NTDC

Indicative Generation Capacity Expansion Plan
(IGCEP 2024-34)
April 2024

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Indicative Generation Capacity Expansion Plan

IGCEP 2024

April 2024

Striving for Reliable Grid

National Power Control Centre

National Transmission and Despatch Company Limited

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Acknowledgement

The preparation of Indicative Generation Capacity Expansion Plan (IGCEP) for the country extensively relies on data inputs from a wide range of entities, which include Pakistan Atomic Energy Commission (PAEC), State Bank of Pakistan, Finance Division–Economic Advisory Wing, National Electric Power Regulatory Authority (NEPRA), Ministry of Planning, Development & Special Initiatives (MoPD&SI), Private Power Infrastructure Board (PPIB), Pakhtunkhwa Energy Development Organization (PEDO), Punjab Power Development Board (PPDB), Azad Jammu & Kashmir Private Power Cell (AJKPPC), Azad Jammu & Kashmir Power Development Organization (AJKPDO), Central Power Purchasing Agency-Guarantee (CPPA-G), Power Planning and Monitoring Company (PPMC), National Energy Efficiency and Conservation Authority (NEECA),Thar Coal and Energy Board (TCEB), K-Electric (KE), Water and Power Development Authority (WAPDA) and all DISCOs. This outcome could have not been materialized without timely supply of the requisite information by these entities.

The System Operator is highly indebted to power sector professionals from Ministry of Energy (Power Division), Tariff and Finance Section of NEPRA, LUMS Energy Institute, USAID's Power Sector Improvement Activity (PSIA) Project, Central Power Purchasing Agency-Guarantee (CPPA-G), Private Power Infrastructure Board (PPIB) for their continuous and timely support in developing a 10-year generation capacity expansion plan (IGCEP) 2024-34.

The System Operator team is also grateful to all stake holders for their respective contributions in the preparation, revision and finalization of the IGCEP 2024-34.

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Disclaimer

a. This Indicative Generation Capacity Expansion Plan 2024-34 (the "IGCEP") has been prepared only as an indicative development plan for the period commencing on FY 2024 to FY 2034 (the "Plan"). It does not contain or determine targets or ascertain liabilities pertaining to power purchase or procurement, commissioning of future power projects, regulation or determination of electricity tariff, performance or ascertainment of economic dispatch etc. and is merely a suggested guide subject to finalization as per approval of the competent authority according to applicable law, policy and procedure.

b. The IGCEP has been prepared as per Planning Code (PC-4) of the Grid Code 2023, based on proprietary input data as received from various power sector entities. In order to prepare the IGCEP, reliance is also placed on reference data and bench mark practices of international power sector entities for preparing similar plans, tariff determinations by NEPRA etc. Use of the IGCEP and / or any portion or variation thereof shall be at the sole discretion and risk of the user parties. NTDC shall not be held responsible in any manner whatsoever for the integrity, accuracy, inaccuracy, authenticity, correctness or representation of such data or consequences resulting therefrom. NTDC makes no representation or warranty of any kind, express or implied, statutory or otherwise, including the accuracy or completeness of any data, reports, records, projections, information, or materials made available under the IGCEP and the transactions contemplated as consequence thereof.

c. The optimization of any generation project under Section 6.4 of the IGCEP shall not confer any right or any privilege or any confirmation of the generation project in question in relation to its implementation or execution. As highlighted, the IGCEP is an indicative development plan and confirmation of any new generation project for future procurement shall be subject to approval of respective competent authority as per applicable criteria prescribed in prevailing policies, rules and regulations.

d. The IGCEP is exclusive of any costs relating to power system evacuation and transmission system expansion for optimized generation project. The transmission system expansion and related costs shall be allocated to the optimized generation project following the approval of the transmission system expansion cost allocation criteria by CCI. This may impact the selection / optimization or ranking of the optimized generation project for which NTDC shall in no circumstances be held liable or accountable.

e. Any user or third party relying on the IGCEP or the Plan in any way shall do so at their own commercial, financial and legal risks for which they are encouraged to seek independent legal advice. NTDC makes no representation or warranty, express or implied, statutory or otherwise in relation to the information provided herein and its suitability for any project. NTDC expressly disclaims any and all responsibilities or liability whatsoever for loss or damages that may result from use of the IGCEP or portions or variations thereof and all users and the parties including affiliates and third parties hereby expressly acknowledge and agree to waive any and all recourse against NTDC and hold it harmless for their reliance upon the IGCEP i.e., the Plan including any intended or unintended consequences.

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List of Contents

List of Figures

List of Charts

List of Tables

List of Acronyms

Acronym	Description
$/GJ	US Dollar per Giga joule
$/kW	US Dollar per kilowatt
$/MWh	US Dollar per Megawatt hour
ADB	Asian Development Bank
PPIB	Alternative Energy Development Board
AGL	Attock Generation Limited
Agr	Agriculture
AJKPDO	Azad Jammu & Kashmir Power Development Organization
AJKPPC	Azad Jammu and Kashmir Private Power Cell
ARE	Alternative and Renewable Energy
AT&C	Aggregate Technical & Commercial
BAU	Business as Usual
BCF	Billion Cubic Feet
BESS	Battery Energy Storage System
c/Gcal	Cents per Giga calorie
c/kWh	Cents per kilowatt hour
ckm	Circuit kilometer
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
CASA	Central Asia South Asia
CCGT	Combined Cycle Gas Turbine
CCI	Council of Common Interests
CCoE	Cabinet Committee on Energy
CFPP	Coal Fired Power Project
COD	Commercial Operation Date
Com	Commercial
CPEC	China Pakistan Economic Corridor
CPI	Consumer Price Index
CPPA-G	Central Power Purchasing Agency – Guarantee
Cumm.	Cumulative
Cus.	Customer
DISCO	Distribution Company
DOM	Domestic
DSM	Demand Side Management
EIA	US Energy Information Administration
EOI	Expression of Interest
EPA	Energy Purchase Agreement
EV	Electric Vehicle
FC	Financial Closure
FCC	Fixed Cost Component
FESCO	Faisalabad Electric Supply Company

Acronym	Description
FKPCL	Fauji Kabirwala Power Company Limited
FS	Feasibility Studies
G.R.	Growth Rate
G/s	Grid Station
G2G	Government to Government
GDP	Gross Domestic Product
GENCOs	Generation Companies
GEPCO	Gujranwala Electric Power Company
GoP	Government of Pakistan
GoS	Government of Sindh
GT	Gas Turbine
GTPS	Gas Thermal Power Station
GWh	Gigawatt-hour
HCPC	Habibullah Coastal Power Company
HESCO	Hyderabad Electric Supply Company
HFO	Heavy Furnace Oil
HPP	Hydro Power Projects
HR&A	Human Resource and Administration
HSD	High Speed Diesel
IAEA	International Atomic Energy Agency
IDC	Interest During Construction
IEP	Integrated Energy Plan
IESCO	Islamabad Electric Supply Company
IGCEP	Indicative Generation Capacity Expansion Plan
IIEP	International Institute of Electric Power Ltd.
IMF	International Monetary Fund
Imp.	Imported
Ind	Industry
IPP	Independent Power Producer
JICA	Japan International Corporation Agency
K2	Karachi Coastal Nuclear Unit 2
KAPCO	Kot Addu Power Company
kcal/kWh	kilo calorie per kilowatt hour
KE	K-Electric
KKI	KANUPP Karachi Interconnection
KPI	Key Performance Indicator
KPK	Khyber Pakhtunkhwa
kV	kilo volts
LCP	Least Cost Plan
LED	Light Emitting Diode
LESCO	Lahore Electric Supply Company
LF&GP-PSP Team	Load Forecast and Generation Planning of Power System Planning, NTDC

Acronym	Description
LNG	Liquified Natural Gas
LOI	Letter of Intent
LOLE	Loss of Load Expectation
LOLP	Loss of Load Probability
LOS	Letter of Support
LT	Long-term
M/s	Messers
MEPCO	Multan Electric Power Company
MEPS	Minimum Energy Performance Standards
MoPD & R	Ministry of Planning Development & Reforms
MT	Medium Term
MTPA	Million Ton Per Annum
MVA	Mega volt ampere
MW	Megawatt
MW_p	Megawatt Peak
NEECA	National Energy Efficiency and Conservation Authority
NEPRA	National Electric Power Regulatory Authority
NPCC	National Power Control Center
NPHS	Naya Pakistan Housing Scheme
NPP	National Power Plan
NPSEP	National Power System Expansion Plan
NPV	Net Present Value
NTDC	National Transmission and Despatch Company
O&M	Operation and Maintenance
OLS	Ordinary Least Squares
PAEC	Pakistan Atomic Energy Commission
PASA	Projected Assessment System Adequacy
PC	Planning Code
PEDO	Pakhtunkhwa Energy Development Organization
PEPCO	Pakistan Electric Power Company
PESCO	Peshawar Electric Supply Company
PITC	Power Information Technology Company
PKR	Pakistan Rupee
PP	Project Planning
PPA	Power Purchase Agreement
PPDB	Punjab Power Development Board
PPIB	Private Power Infrastructure Board
PPMC	Planning Power and Monitoring Cell
PSP	Power System Planning, NTDC
PV	Photo Voltaic has
QESCO	Quetta Electric Supply Company
RE	Renewable Energy
RFO	Residual Furnace Oil

Acronym	Description
RLNG	Re-gasified Liquid Natural Gas
ROR	Run of the river
RP	Resource Planning
Rs./kWh	Rupees per kilowatt hour
SCADA	Supervisory Control & Data Acquisition
SEPCO	Sukkur Electric Power Company
SS	System Studies
SSRL	Sino Sindh Resources Limited
STs	Steam Turbines
T&D	Transmission and Distribution
TEL	Thar Energy Limited
TESCO	Tribal Electric Supply Company
TP	Transmission Planning
TSEP	Transmission System Expansion Plan
TWh	Terawatt hour
USA	United States of America
USAID	United States Agency for International Development
VRE	Variable Renewable Energy
WAPDA	Water and Power Development Authority
WPP	Wind Power Project

Stakeholder Entities

Stakeholder Entities	Cyber Link
Azad Jammu Kashmir Power Development Organization (AJKPDO)	http://ajkpdo.com/
Central Power Purchasing Agency (CPPA)	http://www.cppa.gov.pk/
Energy Department, Government of Punjab	http://www.energy.punjab.gov.pk/
Energy Department, Government of Sindh	http://sindhenergy.gov.pk/
Faisalabad Electric Supply Company (FESCO)	http://www.fesco.com.pk/
Federal Ministry of Energy	http://www.mowp.gov.pk/
Federal Ministry of Finance	http://www.finance.gov.pk/
Federal Ministry of Planning, Development & Reforms	https://www.pc.gov.pk/
Government of Azad Jammu and Kashmir	http://www.ajk.gov.pk/
Government of Baluchistan	http://www.balochistan.gov.pk/
Government of Gilgit Baltistan	http://www.gilgitbaltistan.gov.pk/
Government of Khyber Pakhtunkhwa	http://kp.gov.pk/
Government of Pakistan	http://pakistan.gov.pk/
Government of Punjab	https://www.punjab.gov.pk/
Government of Sindh	http://www.sindh.gov.pk/
Gujranwala Electric Power Company (GEPCO)	http://www.gepco.com.pk/
Hyderabad Electric Supply Company (HESCO)	http://www.hesco.gov.pk/
International Monetary Fund	https://www.imf.org/en
Islamabad Electric Supply Company (IESCO)	http://www.iesco.com.pk/
K-Electric (KE)	https://www.ke.com.pk/

Stakeholder Entities	Cyber Link
Lahore Electric Supply Company (LESCO)	http://www.lesco.gov.pk/
LUMS Energy Institute	https://lei.lums.edu.pk/
Multan Electric Power Company (MEPCO)	http://www.mepco.com.pk/
National Electric Power Regulatory Authority (NEPRA)	http://www.nepra.org.pk/
National Transmission and Despatch Company (NTDC)	http://www.ntdc.com.pk/
Pakhtunkhwa Energy Development Organization (PEDO)	http://www.pedo.pk/
Pakistan Atomic Energy Commission (PAEC)	http://www.paec.gov.pk/
Pakistan Bureau of Statistics	http://www.pbs.gov.pk/
Peshawar Electric Supply Company (PESCO)	http://www.pesco.gov.pk/
Power Planning and Monitoring Cell	https://www.pepcopakistan.com
Private Power Infrastructure Board (PPIB)	http://www.ppib.gov.pk/
Quetta Electric Supply Company (QESCO)	http://www.qesco.com.pk/
Sukkur Electric Power Company (SEPCO)	http://www.sepco.com.pk/
Thar Coal and Energy Board	http://www.tceb.gos.pk/
Tribal Areas Electric Supply Company (TESCO)	http://www.tesco.gov.pk/
USAID-Pakistan	https://www.usaid.gov/pakistan
Water and Power Development Authority (WAPDA)	http://www.wapda.gov.pk/

Foreword

As per the Grid Code 2023, National Transmission and Despatch Company Limited (NTDC), through System Operator, is mandated to develop a 10-year Integrated System Plan (ISP) each year, which consists of Demand Forecast, Indicative Generation Capacity Expansion Plan (IGCEP) and Transmission System Expansion Plan (TSEP). This generation planning study presents production simulation results for Pakistan's integrated power system as per the criteria and assumptions specified in the Grid Code 2023, National Electricity Policy (NEP) 2021 and National Electricity Plan.

This IGCEP 2024-34 report provides the grid-connected electricity demand forecast until 2044, optimal generation development sequences under different operating scenarios contemplating the existing, committed and candidate power plants to supply the yearly demand forecast in a cost-effective manner while meeting the minimum reliability criteria.

Ensuring resource adequacy, affordability and reliability have always been a challenge for the System Operator. The Base Case or Reference Scenario provides a least-cost generation development sequence while the Sensitivity Scenarios provide alternatives for increased energy security considerations. These are important in the context of climate change and the high cost of imported fuels.

I commend the Load Forecasting and Generation Planning team for preparing the IGCEP 2024-34. The team's enthusiasm, willingness to learn and collaborate with stakeholders have resulted in a quality outcome.

Deputy Managing Director (System Operation)
NTDC

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Executive Summary

Pursuant to the provisions of the National Electric Power Regulatory Authority (NEPRA) prevailing Grid Code i.e., Planning Code PC 4, NTDC has prepared IGCEP 2024 covering 10 years' time frame from 2024 to 2034 encapsulating power generation additions required to meet the future energy and power demand of the country including NTDC and KE systems.

The report presents the results of the generation capacity expansion planning study which is composed of two key processes: 1) Load forecast; followed by 2) Generation capacity expansion and high-level despatch optimization. Both processes involve complex statistical and computation efforts performed using dedicated software programs.

Three scenarios of long-term forecast, as per prevailing Grid Code, are prepared for the Low (Business as Usual) and Medium (Optimistic) at normal GDP growth of 3.5% and High at high GDP growth rate of 6.0%

Table E1 shows a summary of the forecast results for the horizon 2024-2034.

Table E1: Summary of Load Forecast (2024-34)

FY	High		Medium		Low (Business-as-usual)	
	Energy	Peak Demand	Energy	Peak Demand	Energy	Peak Demand
	GWh	MW	GWh	MW	GWh	MW
2022-23*	144,409	26,902	144,409	26,902	138,795	26,269
2023-24	160,936	30,562	150,115	28,563	142,718	27,303
2024-25	165,172	31,563	152,981	29,377	146,587	28,269
2025-26	167,006	32,078	157,792	30,550	151,803	29,205
2026-27	170,874	32,987	163,906	32,002	158,555	30,444
2027-28	175,777	34,105	171,698	33,806	163,334	31,228
2028-29	182,903	35,692	177,440	35,037	167,841	32,291
2029-30	191,000	37,480	184,053	36,440	172,577	33,346
2030-31	200,778	39,608	191,045	37,935	175,347	34,048
2031-32	211,619	41,940	199,270	39,672	180,121	35,135
2032-33	224,003	44,800	207,965	41,623	183,209	36,069
2033-34	237,655	47,271	213,390	42,708	188,341	37,224
CAGR (2024-2034)	4.0%	4.5%	3.6%	4.1%	2.8%	3.1%

**Actual figures*

The least cost, long-term generation expansion plan for the power system of country is developed using state-of-the-art generation planning software - PLEXOS. The IGCEP 2024 is developed through a rigorous data modelling and optimization exercise based on the existing and future generation power projects, existing policy framework, existing contractual

obligations, natural resource allocations, relevant provisions of prevailing Grid Code, and assumptions laid down in National Electricity Policy 2021 (NEP) along with some additional assumptions.

The base case scenario is developed on low scenario of long-term forecast, existing contractual obligations and retirements of power projects, during the planning horizon of the IGCEP, as per terms of their respective Power Purchase Agreement (PPA), except KAPCO.

For the study, 8,330 MW of existing power generation capacity is retired during the plan horizon, in every scenario.

For the purpose of sensitivity analysis, five (5) scenarios are developed, in addition to the base case scenario, which include i) Medium Demand Scenario; ii) High Demand Scenario iii) Delay of Diamer Bhasha HPP; and iv) Azad Patan and Kohala HPP as committed.

Hourly demand forecast is developed specially to cater for the intermittency of variable renewable energy resources such as wind and solar PV. This is particularly important in view of the aggressive targets pertaining to renewable energy envisioned by the Government of Pakistan. Hence, the energy and peak demand forecast of 87,600 hours have been estimated from the FY 24 to 34.

In the base case, the demand and installed capacity of the whole country is 37,224 MW and 56,046 MW, respectively by the year 2034. It is to highlight that in the said installed capacity, the share from variable renewable energy (VRE) resources include 5,539 MW_p of Solar PV (utility solar & net metering) and 1,942 MW of Wind. Apart from VREs only 87 MW of hydro is optimized by the tool. It is added that the above solar PV quantum includes 2,107 MW_p of net metering spread over the study horizon.

Consequently, salient features of the base case include: i) Inclusion of VREs; ii) Minimal reliance on imported fuels i.e., Coal, RLNG and Residual Furnace Oil (RFO) based technologies, iii) increased share of hydropower. Inclusion of VREs and hydro will help in lowering the basket price of the overall system thus providing much needed relief to the end consumers, though in the long run.

Table E2: Scenario-wise Installed Capacity (MW) by 2033-34

Category	Base Case	Medium Demand	High Demand	Delay In Diamer Bhasha HPP	Azad Patan & Kohala HPP as Committed
Imported Coal	4,980	4,980	4,980	4,980	4,980
Local Coal	3,300	3,300	3,960	3,300	3,300
RLNG	8,238	8,238	9,901	8,238	8,238
Gas	2,538	2,538	2,538	2,538	2,538
Nuclear	4,730	4,730	4,730	4,730	4,730
Bagasse*	1,130	1,130	1,130	1,130	1,130
Solar PV**	5,539	11,219	15,633	7,048	5,539
HPP	21,485	21,908	23,148	21,485	23,309
Cross Border	1,000	1,000	1,000	1,000	1,000
Wind	1,942	2,342	2,927	1,942	1,942
RFO	1,165	1,165	1,165	1,165	1,165
Total (MW)	**56,046**	**62,549**	**71,111**	**57,555**	**57,871**

**Bagasse includes 700 MW from New technology also*
***Solar values are in MW_p*

The Annexures in the report present the detailed results of all the scenarios and sensitivity studies conducted. The results show a shift in the energy mix (GWh) from imported fuel to indigenous ones, i.e., local coal and dominating share of renewables and hydropower. The base case shows a major contribution from renewables, i.e., 46% of hydropower and 10% of variable renewable energy in the overall energy mix by the year 2034. There is minimal reliance on the imported fuels with RFO having no contribution at all in the energy mix, whereas imported coal (due to contractual binding) and RLNG is contributing just 9% and 4% in the total energy requirements, respectively. The share of indigenous fuels stands 31%, i.e., 9% of local coal, 5% of local gas and 17% of nuclear in the overall energy mix.

It is pertinent to mention that the tool assures sufficient firm/base capacity in the form of hydel (existing, committed & optimized), imported coal (existing & committed), RLNG, nuclear and local coal based (existing) power projects are available 24/7 in the system till the end of study horizon to meet the given hourly system demand whilst catering for REs intermittency and system reserve requirements.

Furthermore, the present volume of solar PV and wind power project considered as candidate is subject to change, based on the outcome of operational/stability studies to be conducted in future, in order to determine the optimum quantum of solar PV and wind sources that can be integrated in National Grid. The same will be considered in the next iteration of IGCEP.

PLEXOS tool also computes Net Present Value (NPV) of the power generation operations and investments of existing and future power projects by 2034 based on the objective function for

the optimization exercise. Table E3 shows the total NPV required to manage generation infrastructure construction, operations and maintenance by 2034 separately for all scenarios. The base case scenario indicates 63.31 billion US$ NPV investment requirements both in terms of CAPEX and OPEX of electric power generation by the year 2034.

Table E3: Total Cost Comparison of all Scenarios

#	**Scenario**	**Total Cost (Billion US $) ***
1.	Base Case	63.31
2.	Medium Demand	66.85
3.	High Demand	71.06
4.	Delay of Diamer Bhasha HPP	64.00
5.	Azad Patan and Kohala HPP as Committed	64.28

**Includes cost of optimized and committed power projects*

The generation planning exercise demands extensive data, i.e., both validated and verified. Strenuous efforts are needed to streamline access to data for future exercises pertaining to forecasting, generation capacity expansion and despatch optimization. In addition to access to the available data, provision of certain key targets is essential for the updation of the IGCEP that includes demand side management, net-metering, distributed generation etc.

The IGCEP 2024 also facilitates structural changes in the power sector planning process with enhanced role of distributed generation and reduction in the large projects distant from the load centers. Further, indigenization of RE technologies through local manufacturing is also suggested to lower the basket price, for provision of relief to the end consumer as well as saving precious foreign exchange while maximizing the nature's endowment bestowed upon Pakistan.

In view of the results stated above, the following conditions are proposed herewith for all the candidate projects being optimized in IGCEP 2024:

a. The cost nos (CAPEX & OPEX) approved by NEPRA for an optimized project shall either be equal or less than the cost used in IGCEP, if in any case the cost given by NEPRA to any optimized project is more than the one used in IGCEP, then a re-run shall be required to assess the optimization of that very project on the new cost.
b. For issuance of LOS to the private sector projects and PC-1 approval of the public sector projects, the relevant agency must ensure that the project cost determined/approved by NEPRA shall either be less than or equal to the cost considered in IGCEP for that particular optimized project, otherwise, re-evaluation of the project on the basis of new cost shall be done.

In addition to above, it is re-iterated that the selection of any generation project in IGCEP does not ensure any guarantee to execute that project which shall have to undergo approvals from all the relevant government authorities.

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1. SETTING THE PERSPECTIVE

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1. Setting the Perspective

1.1. Generation Planning – A Subset of Power System Planning

Power system planning is an important subset of the integrated energy planning. Its objective is, therefore, to determine a minimum cost strategy for long-range expansion of the power generation, transmission and distribution systems adequate to supply the load forecast within a set of prevailing technical, economic and political constraints.

Generation expansion planning concerns decisions for investment pertaining to development of different types of power projects over the long-term horizon – 10 years for IGCEP 2024. The goal of this plan is to improve decision-making under different long-term uncertainties while assuring a robust generation expansion plan with least cost and minimum risk.

As depicted in the Figure 1-1, generation planning is at the heart of planning cycle. In an ideal scenario, the Integrated Energy Plan (IEP), a mandate of Ministry of Planning, Development and Special Initiatives is meant to provide the fuel mix targets for all sectors of the economy including the power sector and such targets are adopted under the National Electricity Policy. The IGCEP is prepared to ensure its maximum contribution in energy security, sustainability and affordability while considering policy inputs and broader macroeconomic perspectives. Under Section 32 of NEPRA Act, such integration should be ensured that brings the full dividends of the integrated planning.

However, in absence of the natural resource allocation targets for power generation, the IGCEP minimize the generation costs while ensuring adequate generation capacity is added to meet the hourly forecasted demand.

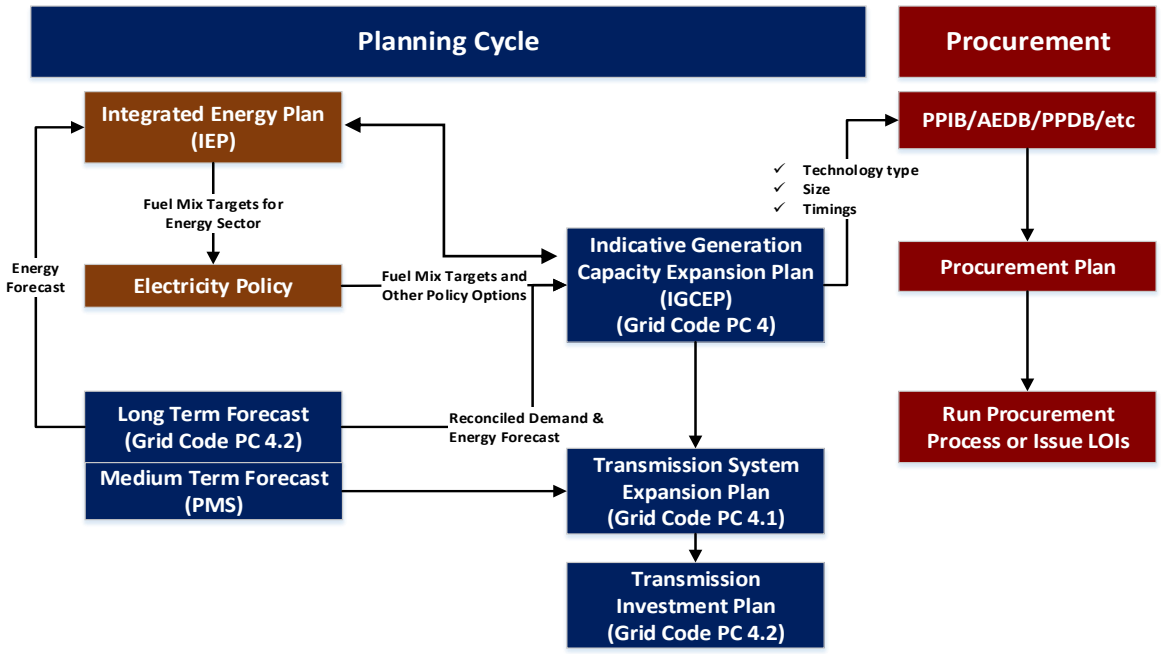

Figure 1-1: Planning Cycle Leading to Procurement

1.2. Preamble

Taking a glimpse at the relevant previous milestones, following seven (07) major generation expansion plans have been formulated by the then WAPDA and now NTDC with the assistance of foreign/local consultants coupled with in-house efforts:

a) National Power Plan (NPP 1994-2018) developed by Canadian Consultant; M/s ACRES International Limited
b) National Power System Expansion Plan (NPSEP 2011-2030) developed by Canadian Consultant; M/s SNC Lavalin
c) Least Cost Plan (LCP 2016-2035) developed by Japanese Consultant; M/s International Institute of Electric Power, Ltd. (IIEP)
d) Indicative Generation Capacity Expansion Plan (IGCEP 2018-40)
e) Indicative Generation Capacity Expansion Plan (IGCEP 2020-47)
f) Indicative Generation Capacity Expansion Plan (IGCEP 2021-30)
g) Indicative Generation Capacity Expansion Plan (IGCEP 2022-31)

This latest iteration of IGCEP 2024 has been developed based on the relevant provisions of Grid Code 2023, and assumptions laid down in National Electricity Policy 2021 (NEP), National Electrcity Plan 2023 - 2027 along with some additional assumptions as finalized the technical committee, constituted by worthy Secretary, Ministry of Energy (Power Division), using generation capacity expansion planning tool i.e., PLEXOS, by considering all the existing, committed and candidate power projects.

It is worth mentioning here that the last four (04) versions of IGCEP were developed for NTDC system only with a fixed quantum (MW) of export to K-Electric, however, pursuant to National Electricity Policy 2021, NTDC is responsible for power system planning of the whole country. In this regard, this iteration of IGCEP comprises of NTDC and K-Electric systems connected with a tie line having a fixed export of 1,100 MW till June 2024 and 2,050 MW till the end of study horizon. Moreover, expansion of candidate power projects has been allowed both in NTDC and K-Electric system, thus covering the whole country.

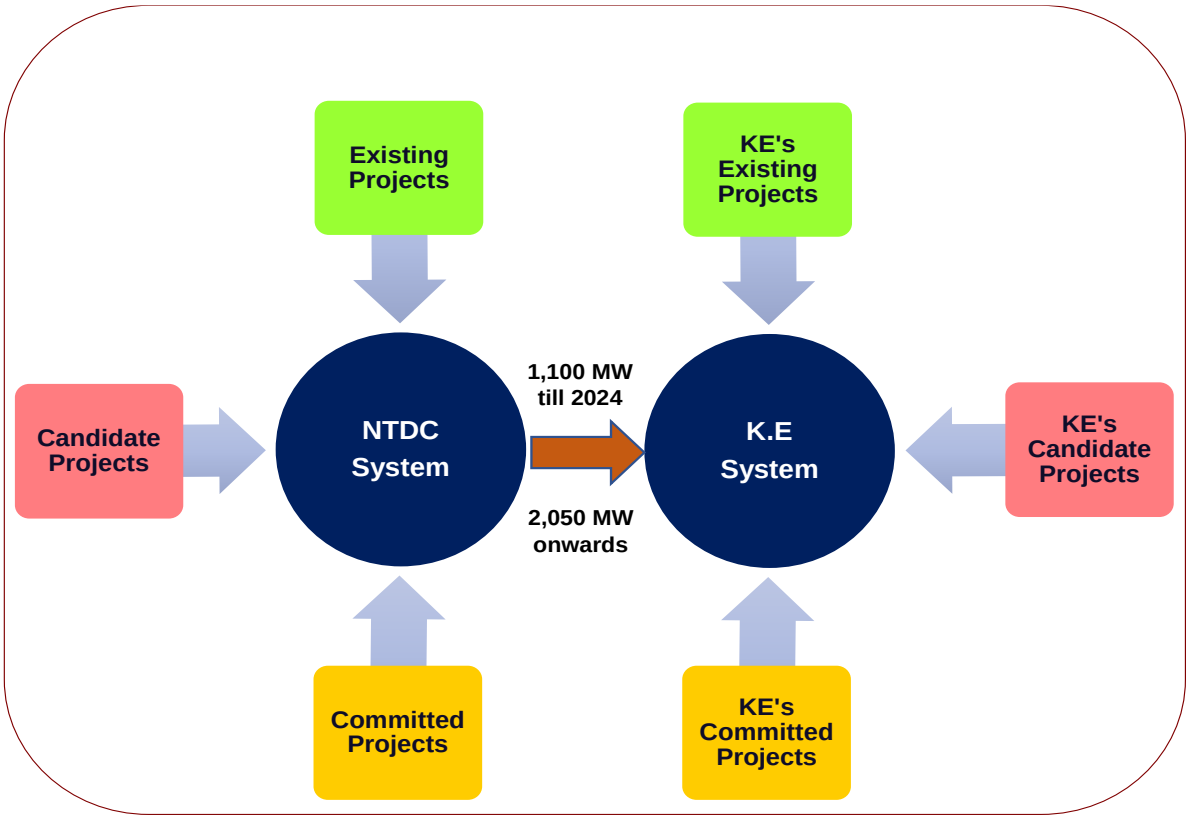

Figure 1-2: IGCEP System (NTDC + K-Electric)

1.3. Introduction

Energy access is an essential requirement of modern society. Therefore, certain electricity indices such as per capita consumption of electricity and access to electricity are used to express the economic strength of a country. Electricity is unique, since it cannot be stored, at least not in large quantities. Power generation and consumption must equate in real time. Additional factors such as seasonal variations make the demand forecast process quite complicated. On the other hand, insufficient or even surplus generation capacity adversely affects the economy. Long-term generation planning is therefore, a complex task, which involves the commitment of large resources, for the power sector and the economy as a whole.

Least cost generation planning is one of the important elements of overall integrated planning of electricity sector. Therefore, and further in compliance to NERPA's approved prevailing Grid Code clause PC-4 (Forecasts and Generation Expansion Plan) and PC-4.1 (Generation Capacity Additions), this long-term least cost generation plan or the IGCEP is prepared for review and approval by NEPRA, the Regulator.

The IGCEP is prepared based on long-term electricity demand forecast, updated generation commitment schedule and other parameters.

Figure 1-3: The IGCEP Objectives

1.4. Objectives of the IGCEP

The IGCEP is envisioned to meet the following objectives, as highlighted in the Figure 1-3:

a. **Identify** new generation requirements by capacity, fuel, technology and commissioning dates on year-by-year basis;
b. **Satisfy** the Loss of Load Probability (LOLP) not more than 1% year to year, as initially set under the Grid Code 2023: PC - 4.2;
c. **Cater** for the long-term load growth forecast and reserve requirements pursuant to the Grid Code 2023; and
d. **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 2034.

1.5. Scope and Planning Horizon

The IGCEP covers the whole country including K-Electric. The later is a vertically integrated power utility, which manages all three key stages – generation, transmission and distribution – for consumers within the jurisdiction of the city of Karachi and nearby subburborn areas. However, the IGCEP 2024 includes an export of 1,100 MW from NTDC system to K-Electric up to June 2024, which is further increased to 2,050 MW after commissioning of 500 kV KANUPP Karachi Interconnection (KKI) grid station by K-Electric, as detailed in proposed tri-

partite agreement among K-Electric, NTDC & CPPA-G, till the end of study horizon. The planning horizon of the IGCEP is from the year 2024 to 2034.

1.6. Purpose of the IGCEP

Overall purpose of the IGCEP is the fulfillment of outlines, actions, and strategies as stipulated in the relevant policies and decisions of Government of Pakistan, latest generation technologies, constraints and certain regulatory obligations. The focus of this plan is to identify generation additions, by capacity and fuel type along with commissioning dates, for a certain plan period, through optimal use of all available generation resources.

The system's optimum expansion is determined by the IGCEP considering various limitations and factors such as governmental policies, investment costs, operation costs, contractual obligations, fuels, reserve requirements, maintenance allowance, etc. For this purpose, generation optimization model based on the generation planning tool i.e., PLEXOS[1] includes consideration of hourly projected electric power demand up to the year 2034 and various other characteristics such as hydrology of hydro power projects, fuel costs estimations and all technical and financial data pertaining to existing and potential generation options i.e., hydro power, thermal and renewables, and optimization of all options. The IGCEP is the starting point for the Transmission System Expansion Plan which is the next step in the PSP process.

The IGCEP should be considered as an indicative generation expansion plan, since it will be updated on yearly basis to account for any change in generation technologies trends, governmental policies, progress/priorities of different project execution agencies and project sponsors in developing the generation facilities, etc.

1.7. Rationale for Preparation of the IGCEP

Pursuant to the provisions of the Grid Code 2023 i.e., Planning Code (PC) – 4, the System Operation (SO) department of NTDC is mandated to prepare the IGCEP on annual basis for review and approval of NEPRA. This plan shall take-into account the objectives/criteria as mentioned under sub-section 1.1 above and shall be used as an input for NTDC's Transmission System Expansion Plan (TSEP) as stated in the PC 4.3.

The IGCEP plays a key role in the expansion of the power system. The Plan ensures that the demand in the system is adequately met by adding generation capacity on least cost basis. The plan takes long term view and therefore is indicative in nature in the long run, however, it provides a perspective to potential investors and other players in the market regarding the future demand and supply situation and the probable generation mix.

Along with serving as guiding document for procurement of power for regulated consumers, the IGCEP will also provide basis for the expansion of the transmission network. The IGCEP identifies the types of generation to be added to the system and also the location in case of

[1] https://www.energyexemplar.com/plexos

hydro power projects. The IGCEP is used as one of the main inputs to the TSEP along with spatial demand growth to work out the power evacuation requirements and serving the load in a reliable manner.

1.8. Generation Capacity Expansion Software

For preparation of the IGCEP, PLEXOS package has been utilized. The objective function seeks to minimize the net present value of build costs plus fixed operations and maintenance costs plus production costs. The core formulation for Long Term (LT) Plan by PLEXOS is thus:

Minimize

- $\sum_y \sum_g DF_y(BuildCost_g * GenBuild_{g,y}) + \sum_y DF_y [FOMCharge_g * 1000 * Pmax_g (Units_g + \sum_{i \le y} GenBuild_{g,i})] + \sum_t DF_{t \in y} L_t [VOLL * USE_t + \sum_g (SRMC_g * GenLoad_{g,t})]$

Subject to constraints:

Equation 1: Energy Balance

$$\sum_g GenLoad_{g,t} + USE_t = Demand_t \; \forall t$$

Equation 2: Feasible Energy Dispatch

$$\sum_g GenLoad_{g,t} \le PMAX_g \left(Units_g + \sum_{i \le y} GenBuild_{g,i} \right)$$

Equation 3: Feasible Builds

$$\sum_{i \le y} GenBuild_{g,i} \le \text{MaxUnitsBuilt}_{g,y}$$

Element	Description	Unit
GenBuild (g,y)	Number of generating units build in year y for Generator g	integer
GenLoad(g,t)	Dispatch level of generating unit g in period t	continuous
USE_t	Unserved energy in dispatch period t	continuous
$CapShort_y$	Capacity shortage in year y	continuous
D	Discount rate. We then derive $DF_y = \frac{1}{(1+D)^y}$ which is the discount factor applied to year, and DF t which is the discount factor applied to dispatch period t	
L_t	Duration of dispatch period t	Hours

$BuildCost_g$	Overnight build cost of generator g	$
$MaxUnitsBuilt_{(g,y)}$	Maximum number of units of generator g allowed to be built by the end of year y	
$PMAX_g$	Maximum generating capacity of each unit of generator g	MW
$Units_g$	Number of installed generating units of generator g	
VoLL	Value of lost load (energy shortage price)	$/MWh
$SRMC_g$	Short-run marginal cost of generator g which is composed of Heat Rate × Fuel Price + VO&M Charge	$/MWh
$FOMCharge_g$	Fixed operations and maintenance charge of generator g	$
$Load_t$	Average power demand in dispatch period t	MW
$PeakLoad_y$	System peak power demand in year y	MW
$ReserveMargin_y$	Margin required over maximum power demand in year y	MW
CapShortPrice	Capacity shortage price	$/MW

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2. POWER SYSTEM OF PAKISTAN

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2. Power System of Pakistan

2.1. Economics of Pakistan Power Sector

Electricity is a critical input for economic development and correspondingly power sector comprises an indispensable infrastructure in any economy. The provision of adequate, reliable and affordable electric power is essential for economic development, human welfare and better living standards. The growth of economy along with its global competitiveness hinges on the availability of reliable and affordable power to all consumers throughout the country. Electricity is central to achieving economic, social and environmental objectives of sustainable human development. Development of different sectors of economy is impossible without matching with development of the power sector.

As an emerging economy, country's demand for electricity is enormous and its GDP is positively related with the sale of electricity as shown in Chart 2-1. This is in concurrence with a similar trend in all developing nations where GDP and sale of electricity have a direct relationship and growth in GDP causes increased sale of electricity.

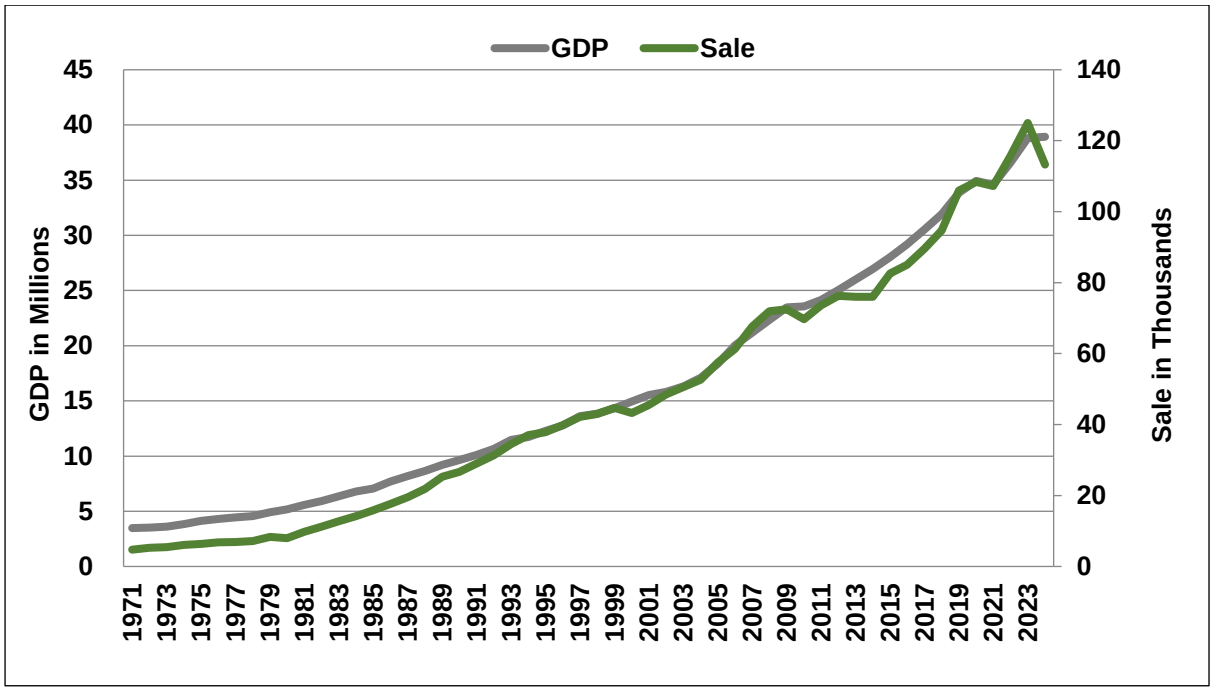

Chart 2-1: GDP (million PKR) vs Sale of Electricity (GWh)

During the fiscal year 2023, the country has seen 0.29% growth rate in total GDP (source: Economic Survey of Pakistan), whereas, the growth rates of 1.5%, -2.94% and 0.86% are observed in agriculture, industrial and commercial/services sectors, respectively. During the same period, 9.5% decline in generation of electricity has been observed. The growth in GDP as well as in usage of electricity shows strong proportionate relation.

2.2. Power Generation

As of June - 2023 the total installed generation capacity of NTDC system reached to 39,454 MW where as net capacity used in IGCEP 24 which is 36,714 MW. Out of which 33% is RE share which comprises of hydro, solar PV, wind and bagasse-based technologies, and 67% share is from thermal projects comprising of local gas, local coal, imported coal, RFO, RLNG and nuclear based technologies, as shown in the Chart 2-2.

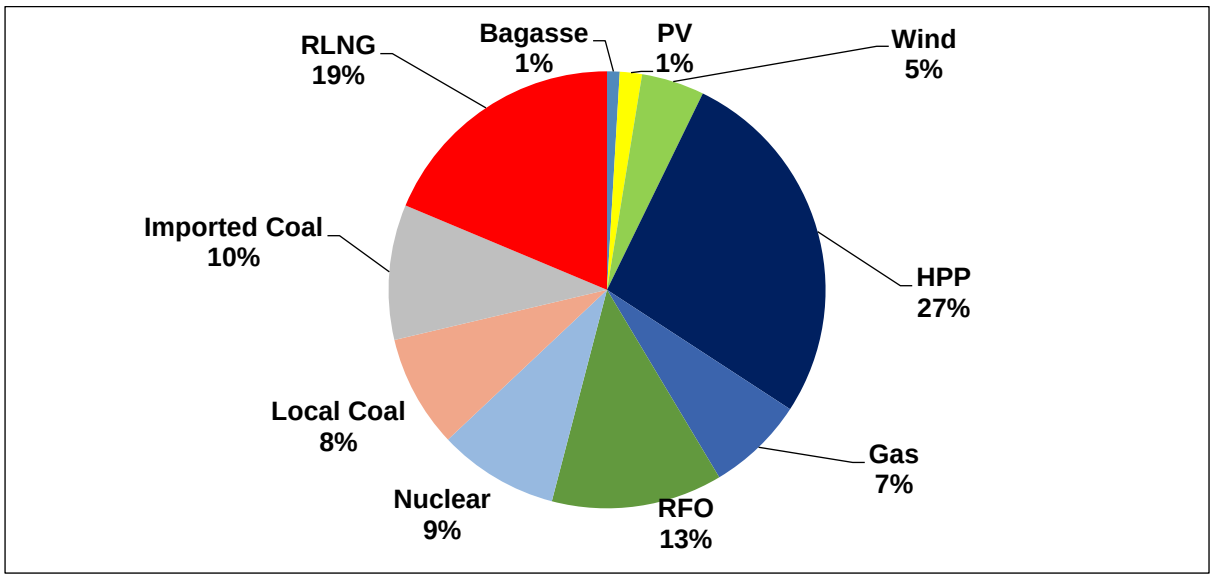

Chart 2-2: NTDC System Installed Capacity (MW)

The energy produced by NTDC system power generation fleet during the fiscal year 2023 was 129,485 GWh which was contributed approximately 28% by hydroelectric projects and 48% by thermal projects on local gas, local coal, imported coal, RFO and RLNG based technologies, 19% by nuclear projects, and 5% by renewable energy power projects which covers solar PV, wind and bagasse-based technologies as shown in the Chart 2-3.

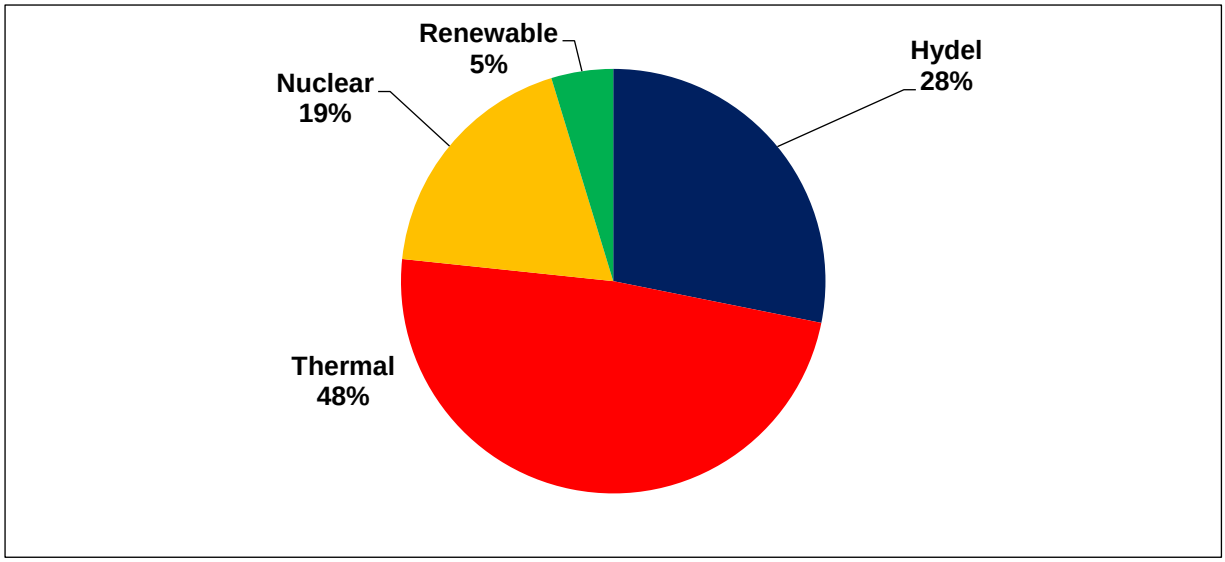

Chart 2-3: NTDC System Annual Energy Generation (GWh) as of 2023

Similarly, the total installed generation capacity of KE system reached to 3,310 MW, out of which 96.2% is thermal projects which comprising of local gas, imported coal and RLNG based technologies and 3.8% RE comprising of solar PV as shown in Chart 2-4.

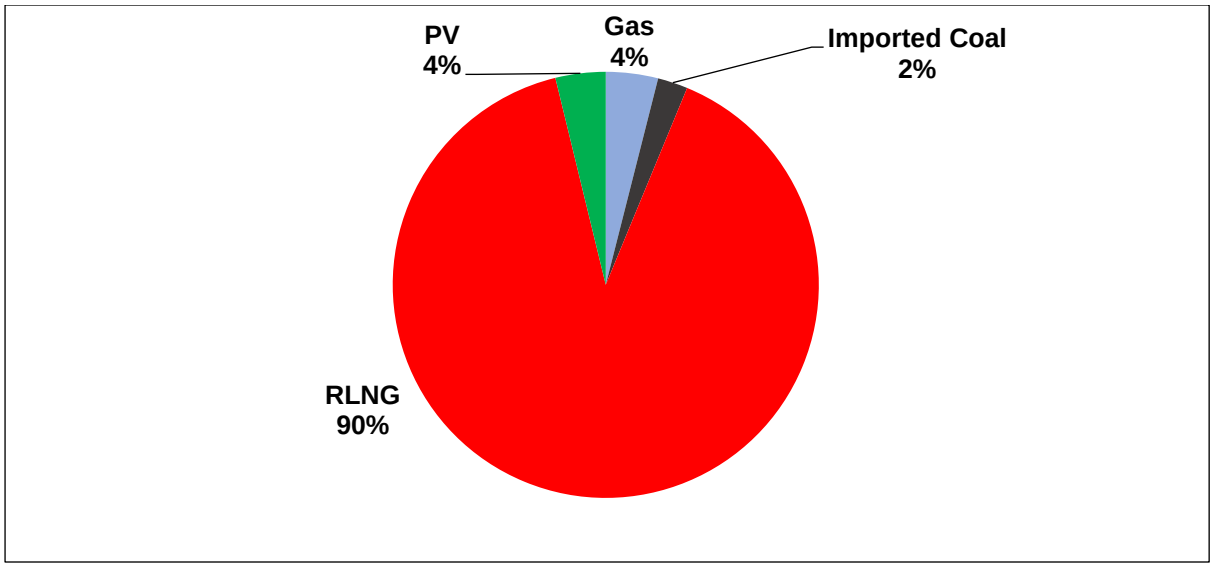

Chart 2-4: K-Electric System Installed Capacity (MW)

The energy produced by K-Electric system power generation fleet during the fiscal year 23 was 9,396 GWh which was contributed primarily 98% by thermal projects on local gas, RFO, HSD, imported coal and RLNG based technologies, 2% renewable based technology as shown in the Chart 2-5.

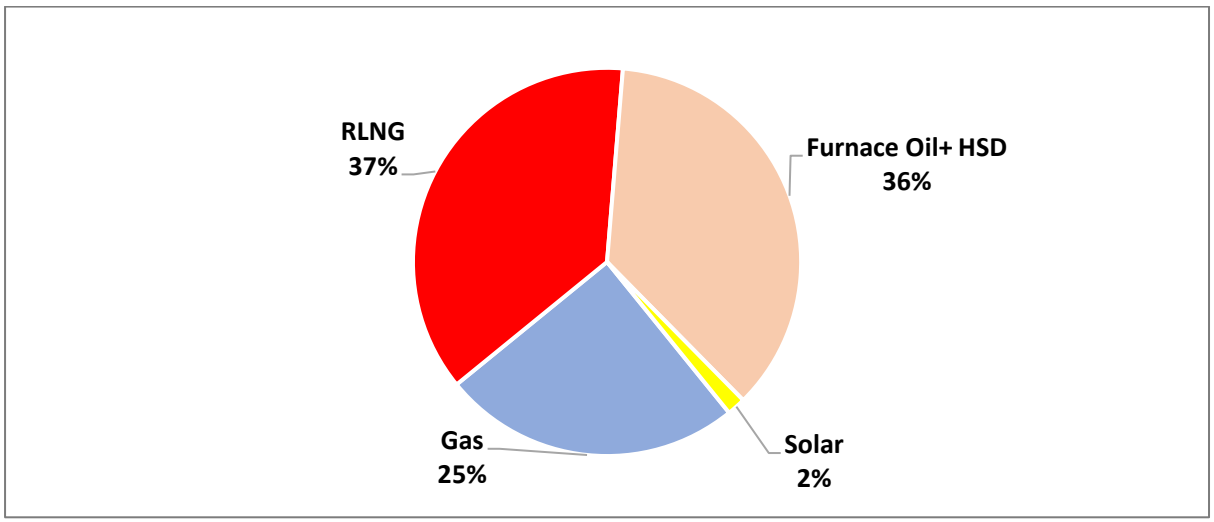

Chart 2-5: K-Electric System Energy Generation (GWh) as of 2022-2023

Furthermore, there has been an increasing trend in the electricity generation (GWh) statistics of the country from fisal year 2014 to 2019, however, a slight decrease is observed in the year 2019-20 due to lesser demand owing to struggling economy coupled with the impacts of COVID-19 pandemic. However, since in FY-2022, the trend is again increasing as shown in the Chart 2-6. During 2023 there is significant decrease in electercity generation due to economic instability, shifting of industry, and increase in fuel prices resulting in loadsheding.

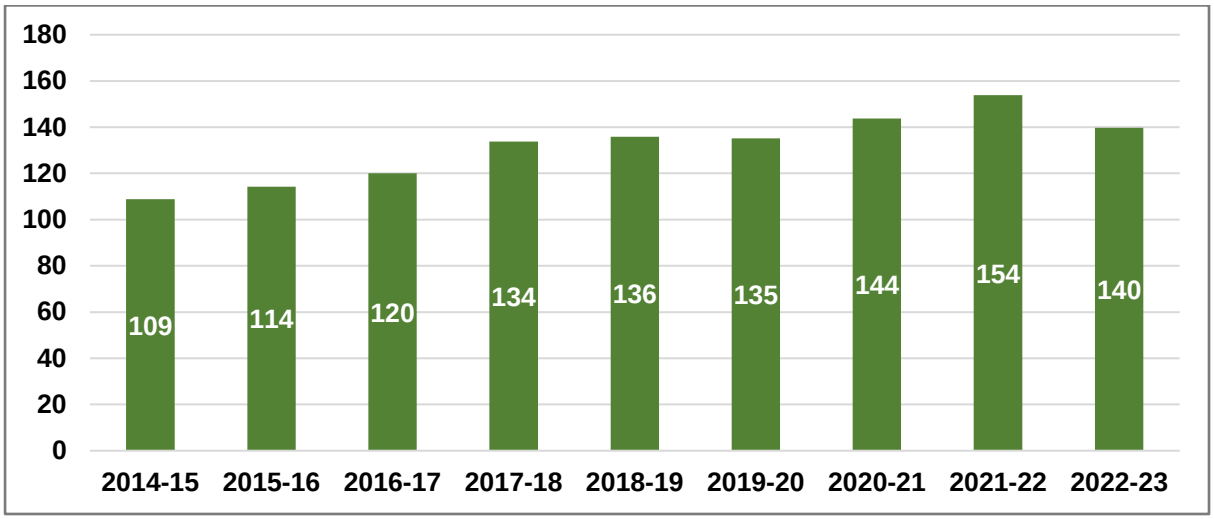

Chart 2-6: Historic Energy Generation (TWh) of Country

Overall, the power demand (MW) has been growing steadily with improved development of electricity supply in the NTDC and KE system as it is evident from the electricity peak demand trend as shown in the Chart 2-7.

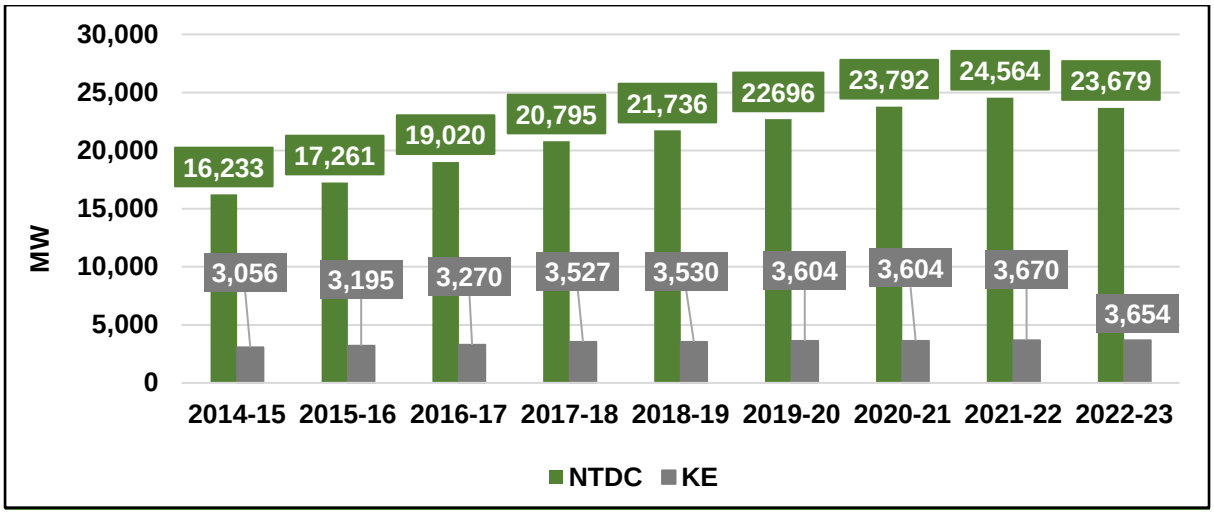

Chart 2-7: Historical Peak Electricity Demand (MW)

Recorded Peak demand of NTDC (including export to K-Electric) and K-Electric during 2023 is 23,679 MW and 3,654 MW respectively.

2.3. Power Distribution

By the year 2023, total number of electricity consumers in the country have reached to 38,243,191 out of which 33,110,629 belong to domestic category, 40,954,003 belong to commercial category, 397,568 consumers fall under industries, 377,069 are agriculture consumers and other consumers are 262,922 as shown in Chart 2-8.

During the year 2022-23, total electricity consumption in country reached to 112,898 GWh, out of which domestic consumption had a share of 56,252 GWh, commercial consumption was 10,016 GWh, industrial consumption was 33,336 GWh, agriculture consumption was 9,543 GWh and 4,227 GWh had been consumed by other categories as shown in Chart 2-9.

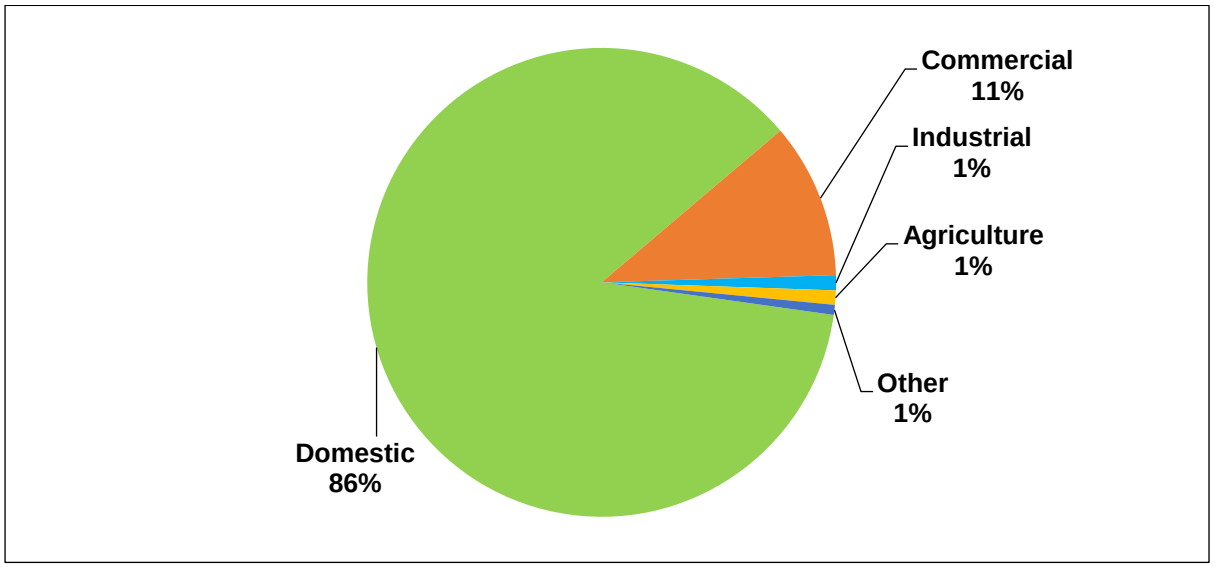

Chart 2-8: Percentage Mix of Number of Electricity Consumers

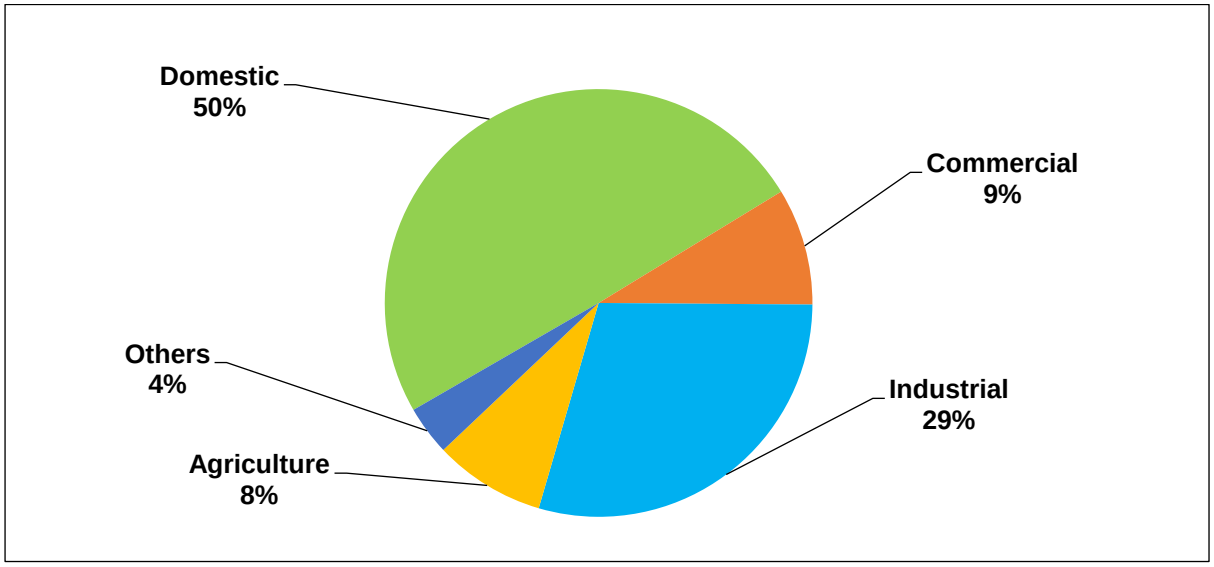

Chart 2-9: Percentage Mix of Category-wise Sale (GWh) of electricity

Electricity consumption in Pakistan is dominated by the domestic sector followed by industrial and agricultural sector as shown in Chart 2-9.

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3. THE IGCEP METHODOLOGY

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3. The IGCEP Methodology

3.1. Regulatory Compliance

Pursuant to the prevailing Grid Code, the IGCEP covers the future development of hydroelectric, thermal, nuclear and renewable energy resources to meet the anticipated load demand by the year 2034. It identifies new generation requirements by capacity, technology, fuel and commissioning dates on year-by-year basis by complying with the various regulatory requirements as set out through the provisions of the prevailing Grid Code including Loss of Load Probability (LOLP), the long-term load growth forecast and system reserve requirements.

3.2. Data Collection Process

The data collection process for the purpose of this study was extremely rigorous; all the concerned project executing entities were approached to provide the requisite data on the prescribed format.The data proformas were made available Online on NTDC website through NTDC Forms (available at the web link https://diplanning.ntdc.com.pk/) for providing the requisite input data on the prescribed format, the same was shared with all the concerned project executing entities. The following process was followed for the collection of various inputs / data / information pertaining to power projects from the concerned entities:

a. Specific data input formats were customized, involving suitable conversions, as per requirements of the generation capacity expansion planning tool i.e., PLEXOS.

b. Concerned entities were approached to share required data on customized data input formats. Multiple reminders were despatched to ensure timely provision of requisite data.

c. All the data received was precisely analyzed for accuracy and completeness, and gaps were identified and rectified / adjusted accordingly.

d. The data was developed / formulated as per requirement of the generation planning tool.

3.3. The IGCEP Data Sources and Associated Data Types

Following agencies have contributed for the preparation of input data to be used in IGCEP 2024:

a. Azad Jammu Kashmir Power Development Organization (AJKPDO)
   - Existing and future hydro power projects under the jurisdiction of AJ&K

b. Azad Jammu Kashmir Private Power Cell (AJKPPC)
   - Existing and future hydro power projects under the jurisdiction of AJ&K

c. Central Power Purchasing Agency Guarantee Limited (CPPA-G)
   - Fuel prices and existing system merit order

d. Energy Department Sindh / Sindh Transmission and Dispatch Company (STDC)

e. GENCOs
   - Existing and future thermal power projects in the public sector

f. K-Electric
   - Hourly energy and power demand forecast
   - Existing and future power plant data

g. Ministry of Planning, Development and Special Intiatives (MoPD&SI)
   - Sector wise GDP projections

h. National Electric Power Regulatory Authority (NEPRA)
   - Different types of input data were collected from NEPRA's publications / website i.e., the latest values from NEPRA quarterly indexation were used to update the costs

i. National Power Control Centre (NPCC)
   - Monthly energy and MW capacities for the existing wind and solar PV power projects

j. Pakhtunkhwa Energy Development Organization (PEDO)
   - Existing and future hydro power projects under the jurisdiction of KPK

k. Pakistan Atomic Energy Commission (PAEC)
   - Existing and future nuclear power projects

l. Pakistan Bureau of Statistics
   - Input data for long-term forecast such as historic GDP and its components, Consumer Price Index (CPI), etc.

m. Power Planning and Monitoring Company (PPMC)
   - Category-wise sale, generation, number of consumers, transmission and distribution losses etc.

n. Private Power Infrastructure Board (PPIB)
   - Existing and future hydro, renewable and thermal power projects under IPP mode

o. Punjab Power Development Board (PPDB)
   - Existing and future hydro, thermal and renewables power projects under the jurisdiction of the Punjab province

p. Thar Coal and Energy Board (TCEB)
   - Block wise Thar Mine's cost and capacity

q. Water and Power Development Authority (WAPDA)
   - Existing and future hydro power projects to be developed by WAPDA

3.4. Financial Parameters

For existing system, cost data has been obtained from the latest merit order provided by CPPA-G, whereas, for the future power projects, cost data shared by the concerned project executing agencies, after indexation, have been used.

3.5. The IGCEP Preparation Process Map

The IGCEP is prepared after following the process illustrated through Figure 3-1 and is submitted to NEPRA for review and approval, following an extensive internal consultative process.

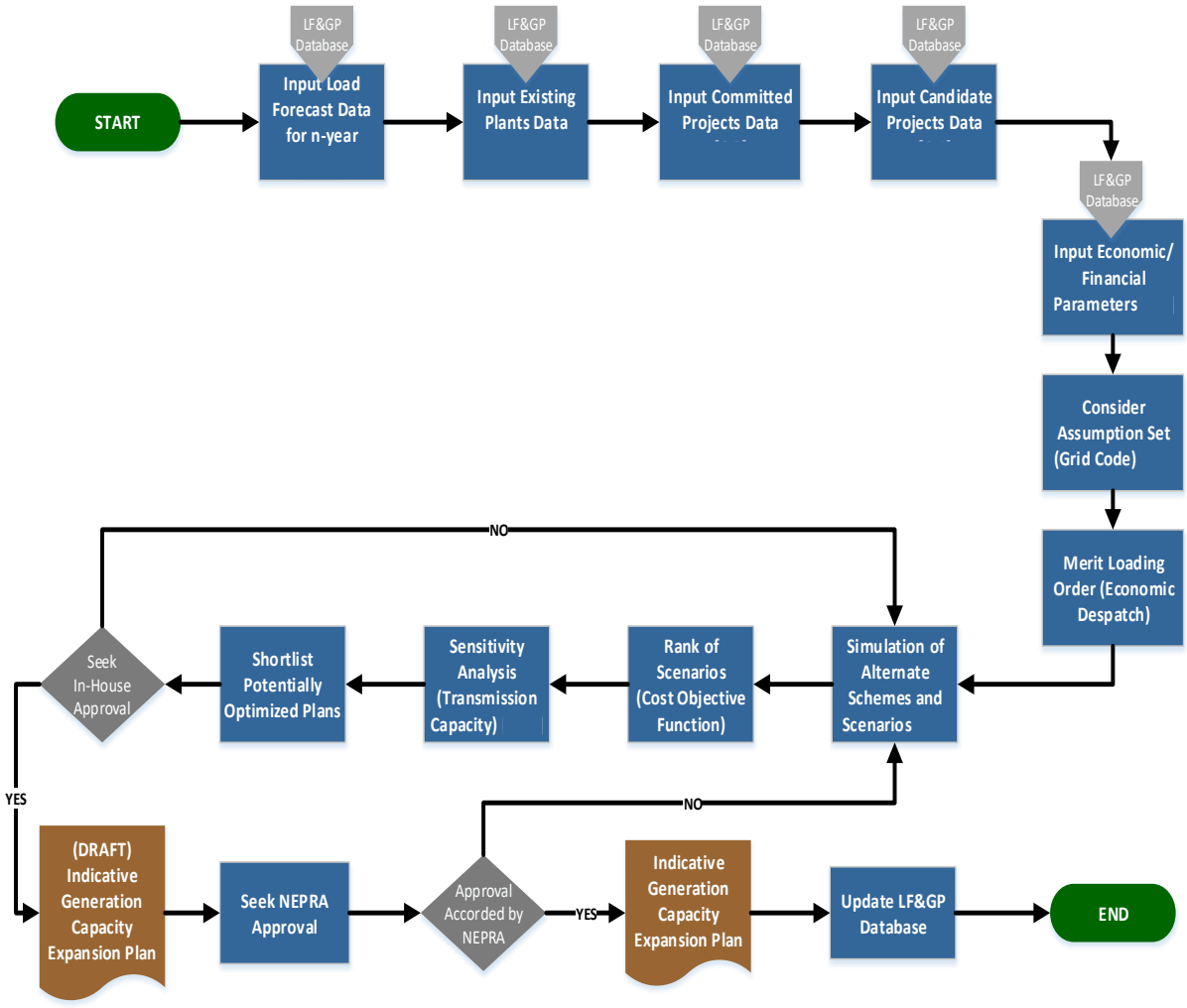

Figure 3-1: The IGCEP Preparation Process

3.6. Criteria and Other Important Considerations for the IGCEP

3.6.1. Planning Timeframe

The planning period taken for this study is from July 1, 2024 to June 30, 2034.

3.6.2. Generation System Reliability

The capability of the generating system to meet the forecasted peak demand remains a major challenge in the generation planning. In this perspective, the IGCEP takes into account the scheduled maintenance and forced outages allowance of all the generating units as well as the seasonal variability in the energy and capacity of the hydroelectric and RE projects.

Loss of Load Expectation (LOLE) in days or equivalently Loss of Load Probability (LOLP) in percentage is considered as generating system reliability criteria. For the purpose of the IGCEP, yearly LOLP criteria of not more than 1%, as stipulated in the prevailing Grid Code, has been adopted.

3.6.3. Hydrological Risk

For the development of IGCEP, seasonal variation in hydro power plants has been considered. In this regrad, the average values of monthly energy and capacity for each respective power plant based on the feasibility study and as conveyed by the concerned project executing agencies, have been used to capture the seasonality factor in the output of hydroelectric projects.

3.6.4. Renewable Energy (RE) Generation

As of June 2023, 500 MW_p utility scale solar PV and 1,845 MW wind power on-grid projects, have been commissioned in NTDC system whereas 100 MW_p utility scale solar PV has been installed in K-Electric system.

Subsequent to Cabinet Committee on Energy (CCoE) decision of April 4, 2019 and June 16, 2020, RE projects, i.e., wind, solar PV, and bagasse (currently under litigation except Shahtaj and Tay Power) defined under Category-I & II, presently at different stages of development are envisaged to be added into the national grid during the next couple of years.

Based on the available data and after multiple rounds of discussions/deliberations with experts committee, PSIA, PPIB and CPPA-G, capacity factors of 22.1%, 17%, 40% and 55% have been considered for candidate utility solar PV, solar net metering, wind and bagasse-based power projects, respectively.

3.6.5. System Reserve Requirement

Reserve of a generating system is a measure of the system's ability to respond to a rapid increase in load or loss of the generating unit(s). In this study, two types of reserves have been modelled as per provisions of the prevailing Grid Code, i.e., contingency and secondary.

3.6.5.1. Contingency Reserve

The contingency reserve is the level of generation over the forecasted demand which is required from real time plus 24 hours so as to cover the uncertainties. This reserve is provided by the generators which are not required to be synchronized but they can be synchronized within 30 minutes of the initiation of the Contingency and the corresponding fall in frequency. As per best industry practices, this is equal to the capacity of the largest thermal generator in the system. In this model, the Contingency Reserve is considered equivalent to 1,145 MW (Karachi Nuclear K-2/K-3 being the largest thermal unit). Moreover, to cater for VRE intermittency, some additional reserve on top of 1,145 MW is added i.e., 2.9% and 5.3% of actual generation (MW) of solar PV and Wind, respectively as per best international practices (considered by M/s Lahmeyer Intl. in 'VRE Integration and Planning study for Pakistan').

3.6.5.2. Secondary Reserve

The secondary reserve is a type of spinning reserve and it is the increase in power output of the online generators following the falling frequency and is fully sustainable for 30 minutes after achieving its maximum value in 30 seconds. It is equal to the one third of the largest unit in the system. Hence, in this model 382 MW of the Secondary Reserve along with 2% of actual generation (MW) of solar PV and wind is considered throughout the planning horizon, to mitigate VRE intermittency.

3.6.6. Scheduled Maintenance of the Generation Projects

Scheduled maintenance plays an important role in retaining the desired efficiency and reliability while at the same time preserving the useful life of a generating unit. It is assumed, for the preparation of the IGCEP, that all generating units, except for VRE and hydro, will undergo an annual maintenance program as provided by the concerned project executing agency.

3.6.7. System Load Characteristics

From the planning perspective, the system load to be met by the generating system is represented by the system's hourly load for each year up till 2034. The country is passing through a transition phase to recover its economic growth, instability, business development, increase in exports, reduction in imports and efficient use of local resources. This all activity will take time to restore; therefore, the current trend of Business as Usual is used in base case which is Low scenario.

3.6.8. Fuel Prices Indexation

Pakistan's electricity generation mix relies heavily on fossil fuels including RLNG, imported / domestic coal, local gas and furnace oil, hence, fuel price uncertainty is one of the major determinants for a long-term generation expansion plan. In this regard, the base fuel prices have been taken as per latest Merit Order of April 2024. These fuel prices are then indexed for future years as per the Energy Information Administration (EIA) Annual Energy Outlook 2023 (except for domestic coal & bagasse where Thar Coal & Energy Board tariff was applied

to domestic coal and upfront tariff of bagasse in 2017 was applied to bagasse). The variable price index for each of the fuel-based technologies is given in Table 3-1.

Table 3-1: Fuel Price Indexation Factors

Year	Furnace Oil	Local Gas / RLNG	Imported Coal	Uranium	Thar Coal	Bagasse
	Variable Price Index for Fuel Based Technologies					
2023-24	1.000	1.000	1.000	1.000	1.000	1.00
2024-25	0.992	0.797	0.998	1.000	0.99	1.02
2025-26	0.938	0.688	0.99	1.000	1.01	1.02
2026-27	0.936	0.602	0.976	1.000	0.94	1.04
2027-28	0.939	0.549	0.967	1.000	0.95	1.04
2028-29	0.939	0.528	0.955	1.000	0.95	1.061
2029-30	0.942	0.527	0.949	0.999	0.94	1.061
2030-31	0.946	0.534	0.95	0.999	0.95	1.082
2031-32	0.949	0.546	0.947	0.999	0.93	1.082
2032-33	0.953	0.561	0.932	0.999	0.7	1.104
2033-34	0.957	0.584	0.927	0.999	0.68	1.104

4. LONG TERM ENERGY AND DEMAND FORECAST

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4. Long Term Energy and Power Demand Forecast

4.1. Energy and Power Demand Forecast

Energy and power demand forecast provides the basis for all planning activities in the power sector. It is one of the decisive inputs for the generation planning. Planning Code (PC-4) of the prevailing Grid Code states:

The SO shall also produce a Global Demand Forecast for three growth levels (Low, Medium, High) based on the econometric modelling approach. This forecast shall be prepared every year for a horizon of at least 20 years. The econometric modelshall take into account (as required):

(a) The economic activity of the country;

(b) Population Trends;

(c) Industrialization;

(d) Impact of net-metering and embedded generation;

(e) Demand Side Management; and

(f) Any other potential variable that may affect the Demand growth

The methodology employed to develop the energy and power demand forecast fulfills the criteria specified in the prevailing Grid Code. The methodology and its results are explained in the following sections.

4.2. Long-Term Demand Forecasting Methodology

The long-term demand forecast is based on multiple regression analysis, which is practiced internationally as an econometric technique to develop robust mathematical relationship between dependent and independent variables. Electricity sale is the variable under study. The electricity consumption pattern varies for different economic sectors of the country namely domestic, industrial, and commercial and agriculture. In regard to this, multiple variables most likely to affect the electricity sales were studied, for every sector individually, and tested for significant quantitative relationships. These include electricity prices, GDP, population, number of consumers, lag variables etc. The variables that impacted the sales most significantly were selected for the final equations for electricity sales. Electricity consumption (GWh) is then regressed on these independent variables using historical data for the period 1970-2023. The methodology of long-term load forecast is illustrated in the process flow map in Figure 4-1.

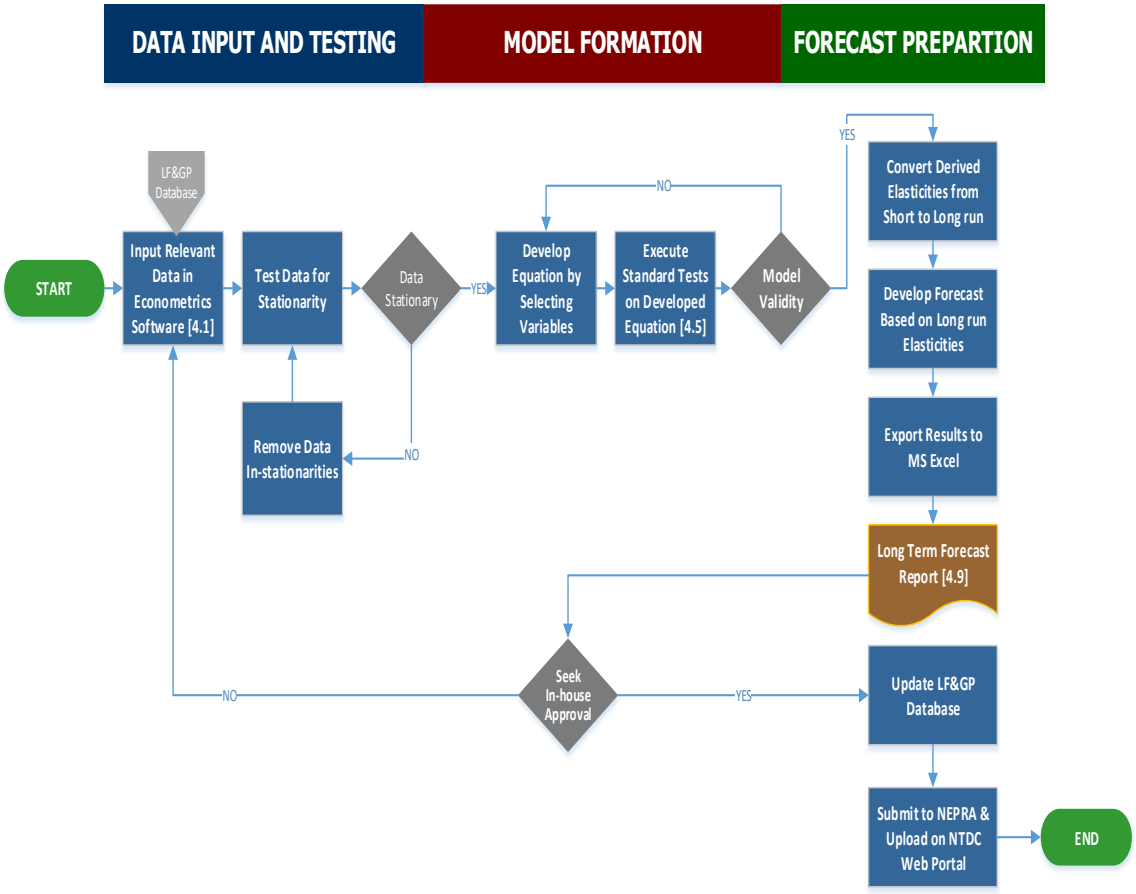

Figure 4-1: Process Flow of Methodology of Long-Term Demand Forecast

4.3 Data Sources

The data sources for the long-term demand forecast are as under:

a. Historical GDP and Consumer Price Index (CPI) are obtained from Economic Survey of Pakistan 2023 published by Finance Division, Government of Pakistan.
b. GDP growth rate projections from FY 2024 to 2035 have been provided by the Ministry of Planning, Developement and Sepecial Iniatives.The GDP growth rate projections which have been considered in this plan for Low (BAU) and High scenario are given in Annexure A-1 and A-2 respectively.
c. Energy Sales, Transmission & Distribution Losses and Energy Purchased data is obtained from DISCOs Performance Statistics by PPMC – June 2023
d. Category-wise average tariff is obtained from DISCOs Performance Statistics by PPMC – June 2023.
e. Peak Demand (MW) and Load management data is obtained from NPCC, KE, PITC and DISCOs
f. The demand side management targets have been provided by NEECA.

4.4 Key Considerations

4.4.1 Demand Side Management

The starting year was 2023 for the calculation of reduction in energy consumption due to "Energy Efficiency" targets, provided by NEECA in December, 2022. The revised energy efficiency targets by NEECA have not been received this year and hence the same are being considered. The base year for the load forecast calculation is 2023 for which the quantum of target determined by NEECA is 1,519 GWh. The real impact of this target on reduction of electricity utilization is assumed to be achieved and already incorporated in the sales data for the year 2023. It is a cumulative impact for future years; therefore, starting from 2028 the targets are rationalized provided by NEECA and subtracted by each future planning year, by Load Forecast team, presented in the Table 4-1 below. These rationalized targets have been used for energy consumption reduction in the formulation of load forecast.

Table 4-1: NEECA Energy Efficiency Targets

Energy Saving through Standardization & Labelling		
Year	**GWh (Provided by NEECA)**	**GWh (Rationalized by NTDC)**
2023-24	1,640	0
2024-25	4,209	0
2025-26	5,691	0
2026-27	6,385	0
2027-28	6,577	2,631
2028-29	7,325	3,663
2029-30	7,325	4,395
2030-31	9,750	6,825
2031-32	9,750	7,800
2032-33	11,385	10,247
2033-34	11,385	11,385

4.4.2. Net Metering

Keeping in view the growing demand of net-metering connections in the country, its impact has been considered in IGCEP. The Net Metering targets for whole country except K-Electric are provided by the respective DISCO's and modelled at the supply side, since the generation through Net Metering will also be contributing towards meeting the Renewable Energy targets. However, the Net Metering targets for K-Electric system are considered at demand side by K-Electric., presented in the Table 4-3 below:

Table 4-2: Net Metering Targets (MW)

FY	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	3034
LESCO	192	227	262	297	333	368	407	449	486	523	564
FESCO	141.9	191.6	241.4	291.1	340.9	390.6	440.4	490.1	539.9	589.7	636
GEPCO	70	91	110	121	133	133	133	133	133	133	143
IESCO	248	328	398	468	538	608	678	748	818	888	957
MEPCO	108	117	128	139	152	166	181	197	214	234	252
PESCO	28	65	115	145	180	190	200	220	230	250	269
HESCO	12	17	22	27	32	37	42	47	52	57	62
QESCO	3.4	4.4	5.4	6.4	7.4	8.4	9.4	10.4	11.4	12.4	13
TESCO	-	-	-	-	-	-	-	-	-	-	-
SEPCO	6.66	8.06	9.46	10.86	12.26	13.66	15.06	16.46	17.86	19.26	21
Total	**810**	**1,050**	**1,291**	**1,506**	**1,729**	**1,914**	**2,105**	**2,311**	**2,503**	**2,706**	**2,917**
		240	**241**	**215**	**223**	**186**	**191**	**205**	**192**	**203**	**211**

4.4.3. Load Management

For preparation of the Long-Term Demand Forecast, load management, being carried out in the country is incorporated in the forecast. Currently, there are six factors that are contributing towards load management namely generation constraints, emergency situations, Industrial cut, technical NTDC constraints, DISCOs' constraints and DISCOs' high loss feeders (known as Aggregate Technical and Commercial (AT&C) load management). Primarily, there are only two major types of load Management i.e., AT&C and Non-AT&C. AT&C load management is being carried out deliberately on the feeders where the revenue recovery is low due to electricity theft and other governance issues. Non-AT&C (4,702 GWh) is being carried out due to system constraints, fuel shortage and voltage profile etc. Now Non-AT&C (4,702 GWh) based load management has been gradually factored in the Low (BAU) demand forecast scenario with the assumption that network constraintswill improve over the time. Whereas AT&C based load management (17,960 GWh) is not considered in Low (BAU) Demand Forecast. In the Medium scenario, Non-AT&C (Technical) Load Management (LM) is taken into account as part of the base year, while AT&C (Non-Technical) LM are rationalized. This

approach aims to streamline the technical aspects of load management while optimizing the non-technical factors to ensure a balanced and efficient electricity distribution system.

Table 4-3: Non-AT&C LM Inclusion in Low Demand Forecast

Year	GWh	Factored-in Percentage (%)
2023-24	940	5
2024-25	1,881	25
2025-26	2,821	50
2026-27	3,762	75
2027-28	4,702	100

4.5. Preparation of Demand Forecast

This year for the purpose of IGCEP country wide demand forecast is developed which includes NTDC system and K Electric System

For NTDC system, the electricity consumption is segregated into the following four major sectors:

a. Domestic;
b. Commercial;
c. Industrial; and
d. Agriculture

These aforesaid sectors typically show different consumption patterns throughout the year. Hence, they are forecasted separately. The load demand forecast of these sectors is then combined to obtain the forecast of total electrical energy demand. In order to forecast the annual consumption of electricity up to the year 2034, a multiple regression model has been used. Electricity energy sale of the respective category is the dependent variable in the regression model, whereas, the independent variables for each category are as follows:

a. Annual total GDP and its components, i.e., agriculture sector, industrial sector and services sector;
b. Tariff - wise electricity prices, i.e., domestic, commercial, agriculture and industrial;
c. Category – wise Number of consumers;
d. Lag of dependent and independent variables;
e. Consumer Price Index; and
f. Dummy variables

Considering the above-mentioned factors, four equations are selected, one for each category of electricity consumption. For statistical analysis, popular statistical software EViews is used.

Ordinary Least Square technique is selected for the estimation of regression equation. The equations are written in logarithmic form to evaluate elasticity in percentage. Various statistical

tests were performed to establish the significance of the relationship between the dependent variable and the independent variables.

After thorough statistical analysis using EViews, the appropriate elasticity coefficients are selected for all the four equations. These elasticities were then converted into long-term elasticities. On the other hand, projection of growth rates for independent variables such as total GDP, electricity price, etc. are taken from various sources. The long-term elasticities and the projected independent variables are subsequently used in the equation to develop the long-term energy forecast of each category using the equation below.

$$Y_T = Y_{T-1} * (1+GR \text{ of } G)^b * (1+GR \text{ of } R)^c * (1+GR \text{ of } L)^d$$

Table 4-4 provides the description of all the variables used in this equation:

Table 4-4: Description of Dependent and Independent Variables

Variable	Description
Y_T	Electricity Demand of current year (Sales GWh)
Y_{T-1}	Electricity Demand of previous year (Sales GWh)
GR	Growth Rate
G, R, L	Independent variable (GDP, Real Price, Lag)
b, c, d	Elasticities of independent variables (GDP, Real Price and Lag respectively)

The demand forecast results of the four categories are combined to calculate the sale forecast at the country level. It is important to mention here that, in order to calculate the elasticities of commercial and industrial sectors the impact of load shedding on their historical data has been considered for the study, provided the fact that load shedding does not hinder or majorly affect the activities in these sectors. This is due to the alternative energy supplies widely used in these sectors which keep their activities going.

In compliance to prevailing Grid Code, three scenarios of load forecast are developed based on the two different projections of GDP such as Busissnes as usual and High projections provided by MoPD&SI categorized as Low scenario, medium scenario and High scenario. In Medium scenario and Low (BAU) scenario, low projections of GDP as given in Annexure A-1 are considered. Thus, the projected energy and demand is on the lower side as given in Table 4-5 and Table 4-7. For High scenario high projection of GDP as given in Annexure A-2 is considered. Thus, the projected energy and demand is on higher side as given in Table 4-6

Required generation (GWh) for each scenario is calculated after adding projected distribution losses at 11 kV and transmission losses at 132 kV, 220 kV and 500 kV. The calculated base

year load factor is projected for the future years which are then used along with projected energy generation to get the peak demand in MW.

The demand forecast of K-Electric is developed and provided by K-Electric from 2024 to 2044. K-Electric has considered the hourly historic pattern and the projection of net-metering connections primarily for developing its forecast.

The country-wide energy forecast is then developed by adding both NTDC and K-Electric forecast for each respective year. For country-wide peak demand forecast, projected hourly pattern of NTDC and K-Electric are added and then the maximum value is sorted out to obtain country-wide demand forecast.

4.6. Energy and Power Demand Forecast Numbers

Based on the variables and methodology explained above, Table 4-5, 4-6 and 4-7 highlights forecast result for the Low, High and Medium scenarios respectively.

Table 4-5: Long-Term Energy & Power Demand Forecast – Low (BAU) Growth Scenario

Years	NTDC		K-Electric		Country	
	Energy (GWh)	Peak Demand (MW)	Energy (GWh)	Peak Demand (MW)	Energy (GWh)	Peak Demand (MW)
2022-23*	120,438	22,615	18,357	3,654	138,795	26,269
2023-24	122,743	24,453	19,975	4,114	142,718	27,303
2024-25	126,330	25,090	20,257	4,234	146,587	28,269
2025-26	130,991	25,936	20,813	4,347	151,803	29,205
2026-27	137,285	27,099	21,271	4,463	158,555	30,444
2027-28	141,619	27,870	21,714	4,571	163,334	31,228
2028-29	145,809	28,819	22,032	4,706	167,841	32,291
2029-30	150,200	29,817	22,377	4,833	172,577	33,346
2030-31	152,579	30,422	22,768	4,963	175,347	34,048
2032-32	156,799	31,401	23,323	5,084	180,121	35,135
2032-33	159,357	32,197	23,852	5,235	183,209	36,069

2033-34	163,880	33,111	24,460	5,481	188,341	37,224
CAGR	2.9%	3.1%	2.0%	2.9%	2.8%	3.1%

Table 4-6: Long-Term Energy & Power Demand Forecast - High Growth Scenario

Years	NTDC		K-Electric		Country	
	Energy (GWh)	Peak Demand (MW)	Energy (GWh)	Peak Demand (MW)	Energy (GWh)	Peak Demand (MW)
2022-23*	126,052	23,641	18,357	3,654	144,409	26,902
2023-24	139,039	26,902	21,897	4,172	160,936	30,562
2024-25	142,901	27,767	22,271	4,349	165,172	31,563
2025-26	144,672	28,231	22,334	4,420	167,006	32,078
2026-27	148,013	29,007	22,861	4,586	170,874	32,987
2027-28	152,829	30,080	22,948	4,646	175,777	34,105
2028-29	159,156	31,461	23,747	4,901	182,903	35,692
2029-30	166,852	33,125	24,148	5,060	191,000	37,480
2030-31	175,887	35,072	24,891	5,285	200,778	39,608
2032-32	186,304	37,312	25,315	5,395	211,619	41,940
2032-33	197,995	40,004	26,007	5,602	224,003	44,800
2033-34	210,921	42,242	26,734	5,902	237,655	47,271
CAGR	4.3%	4.6%	2.0%	3.5%	4.0%	4.5%

Table 4-7: Long-Term Energy & Power Demand Forecast – Medium Growth Scenario

Years	NTDC		K-Electric		Country	
	Energy (GWh)	Peak Demand (MW)	Energy (GWh)	Peak Demand (MW)	Energy (GWh)	Peak Demand (MW)
2022-23*	126,052	23,641	18,357	3,654	144,409	26,902
2023-24	128,240	24,812	21,874	4,168	150,115	28,563
2024-25	131,012	25,579	21,969	4,290	152,981	29,377
2025-26	135,536	26,706	22,256	4,404	157,792	30,550
2026-27	141,361	28,112	22,545	4,522	163,906	32,002
2027-28	148,822	29,872	22,877	4,631	171,698	33,806
2028-29	154,340	31,059	23,100	4,768	177,440	35,037
2029-30	160,690	32,420	23,363	4,896	184,053	36,440
2030-31	167,363	33,853	23,682	5,028	191,045	37,935
2032-32	175,103	35,510	24,167	5,150	199,270	39,672
2032-33	183,343	37,374	24,622	5,303	207,965	41,623
2033-34	188,234	38,371	25,156	5,553	213,390	42,708
CAGR	3.9%	4.5%	1.4%	2.9%	3.6%	4.1%

The Chart 4-1 shows peak demand projections of Medium, Low and High growth scenarios:

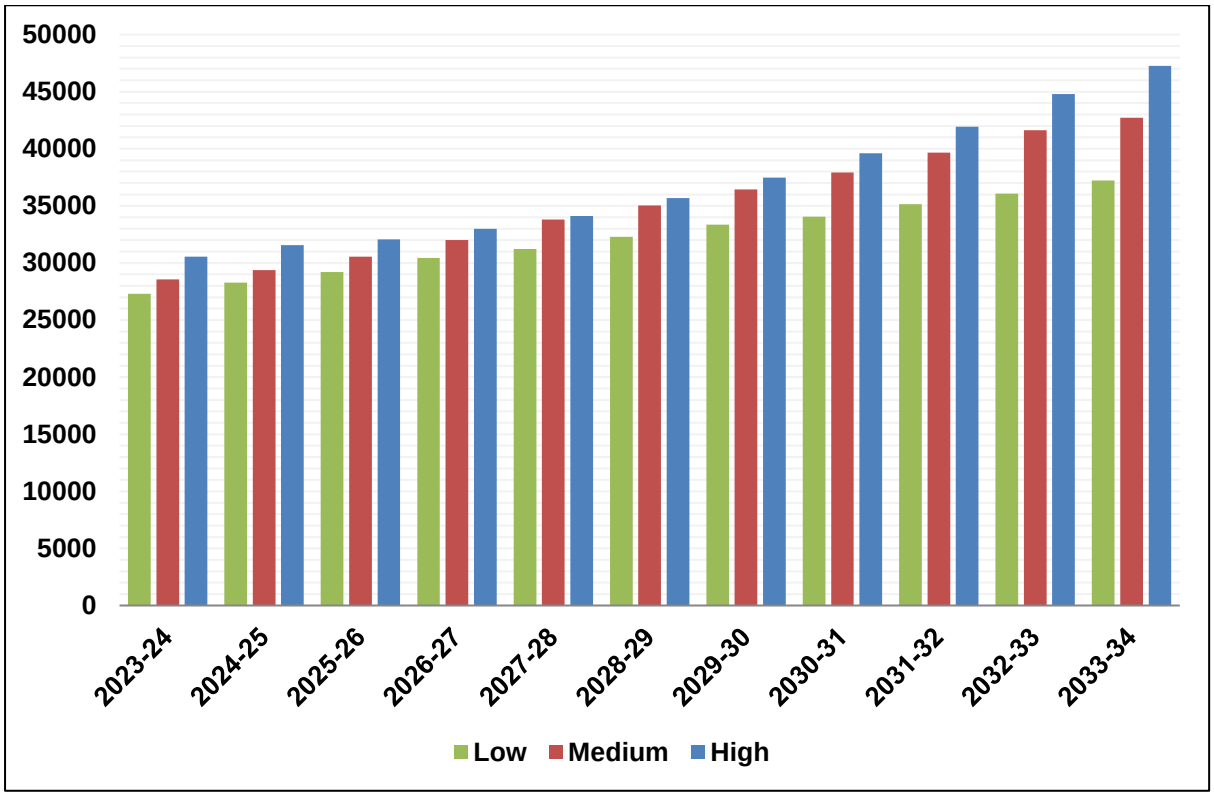

Chart 4-1: Peak Demand (MW) Forecast 2024-2034

4.7. Hourly Demand Forecast

Hourly demand forecast has been developed to cater for the intermittency of variable renewable energy sources. This is particularly important in view of the aggressive targets envisioned by the GoP pertaining to renewable energy. Hence, the demand forecast of 87,600 hours has been estimated for the plan horizon. In this process, the forecasted annual peak demand was converted into hourly demand based on the recent historical hourly demand and generation pattern which is then adjusted to cater for the upcoming net – metering connections in the country. The load duration curve for the year 2027-28 and 2023-34 is given Chart 4-2.

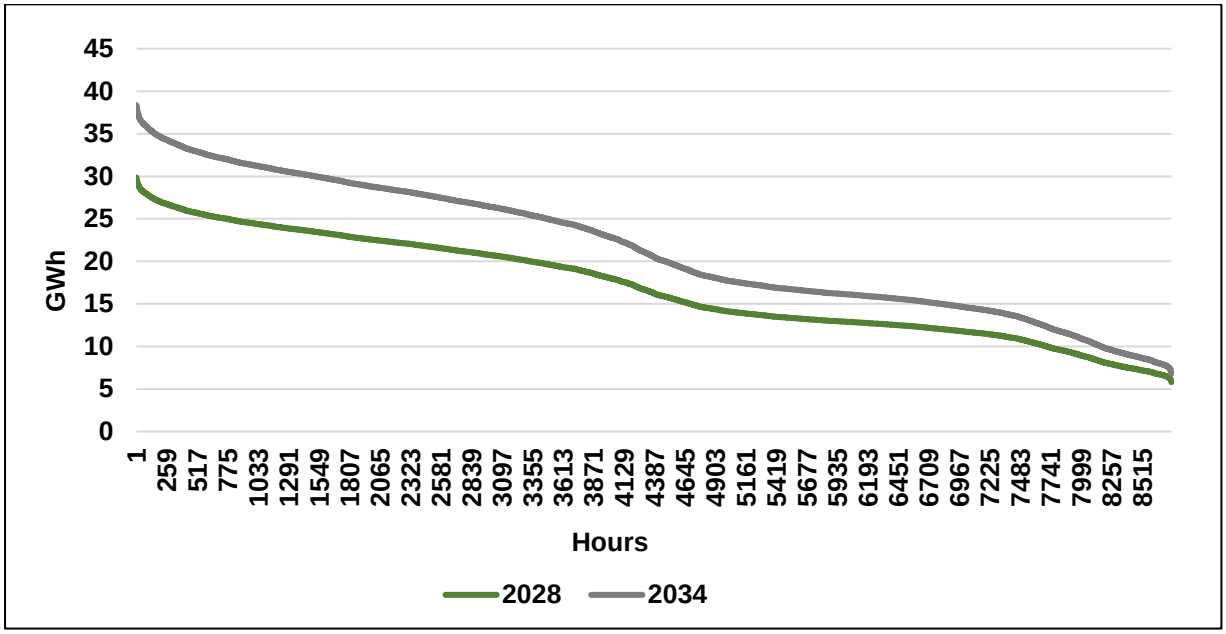

Chart 4-2: Load Duration Curve (FY 2028 & 2034)

5. INSIDE THE IGCEP

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5. Inside the IGCEP

5.1. Introduction

The key objective of IGCEP is to develop a least cost, 10-year indicative generation expansion plan for the whole country to meet the power and energy demand in a reliable and sustainable manner while maximizing use of indigenous resources for energy security. NTDC prepares this IGCEP every year to meet its regulatory requirement, as stipulated in the Planning Code 4 of the prevailing Grid Code, which takes into account the assumptions laid down in National Electricity Policy 2021 (NEP) along with some additional assumptions and identified constraints, if any. The plan is to be reviewed and approved by NEPRA – the electricity regulator. The following section describes the key parameters and results of the generation planning study.

5.2. Assumptions of IGCEP

The IGCEP 2024-34 was developed in alignment with the criteria laid down in the National Electricity Policy (NEP). Furthermore, a technical committee, constituted by worthy Secretary (Power Division) on November 30, 2023 and headed by CEO (CPPA-G) was tasked with scrutinizing the assumptions of the IGCEP. This initiative aimed to alleviate the burden of surplus power on consumers. The committee comprised industrial experts and professionals from relevant power sector entities i.e., CPPA-G, NEPRA, PPIB, NTDC, and SO. Subsequently, after multiple rounds of committee meetings/discussion, due deliberation and mutual consensus among committee members the finalized assumptions are listed below:

1. Out of three loads forecast scenarios, Low (Buisness as Usual) Scenario is used in base case.
2. Reserve and reliability requirements (LOLP = 1%) have been considered as per prevailing Grid Code.
3. Retirement of existing thermal power Project including GENCOs has been considered as per expiry of contractual term of corresponding PPA.
4. Till the expiry of contractual term of corresponding PPA and GSA, existing imported coal-based projects and certain indigenous/domestic gas-based projects have been given a minimum dispatch as per contractual obligations of 50%.
5. Fuel costs as per Merit order of April 2024, have been considered.
6. Cost data i.e., CAPEX, fixed (O&M), Variable (O&M) and Fixed FCC (for local coal only) of all the projects has been taken as per data/information provided by the concerned project executing agency, NEPRA determined tariff and as per NEPRA's guidelines, pertaining to respective technology.
7. A project has been considered as **'committed'**, provided the project fulfills at least one of the following pre-requisites:
    a) Private sector projects having either financial close or under construction with a valid Letter of Support (LOS) along with a signed Project document (EPA/PPA and IA).

b) Public sector projects having either strategic importance or under construction with PC-1 approved and financing arranged.
c) Government to Government (G2G) projects
d) RE Project (Wind, Solar, Bagasse) enlisted in Category I & II of CCoE's decision dated 4th April 2019.

8. A yearly block of 100 MW of new/disruptive/nascent technology has been considered as committed from the year 2028 and onwards, till the end of study horizon.
9. All years correspond to fiscal years e.g., 2025 is the fiscal year from July 1, 2024 to June 30, 2025.
10. No candidate thermal (except Jamshoro Coal U# 2) and RE projects have been considered by name.
11. Pursuant to approved NE Policy 2021, K-Electric system has also been included in the current version.
12. In order to cater for network requirements/constraints, some existing projects located near load center have been considered as "Must Run", for summer months, i.e., May to September uptill year 2027.
13. All the costs have been indexed as of Dec 2023.

5.3. Conditions for Optimized / Selected Power Projects

The following conditions are proposed herewith for all the candidate projects being optimized in IGCEP 2024-34 for consideration of Authority while issuing tariff:

a. The cost nos (CAPEX & OPEX) approved by NEPRA for an optimized project shall either be equal or less than the cost used in IGCEP, if in any case the cost given by NEPRA to any optimized project is more than the one used in IGCEP, then a re-run shall be required to assess the viability / optimization of that very project on the new cost.
b. For issuance of LOS to the private sector projects and PC-1 approval of the public sector projects, the relevant agency must ensure that the project cost determined/approved by NEPRA shall either be less than or equal to the cost considered in IGCEP for that particular optimized project, otherwise, re-evaluation of the project on the basis of new cost shall be done.
c. In addition to above, it is re-iterated that selection of any generation project in IGCEP does not ensure any guarantee to execute that project which shall have to undergo approvals from all the relevant government authorities.

5.4. Adherence to Contractual Obligations

In order to develop an effective least cost generation capacity expansion plan that will meet the future power needs of the country, the IGCEP adheres to the existing constraints such as take or pay contractual obligations of at least minimum annual despatch of 50% for existing imported coal-based power projects (Sahiwal, China HUBCO & Port Qasim), and three low btu gas-based projects (Uch-II, Engro and Foundation).

5.5. Approach and Methodology

The development of the least cost generation capacity expansion plan is the process of optimizing i) existing and committed generation facilities and ii) addition of generation from available supply technologies/options, which would balance the projected demand while satisfying the specified reliability criteria. For the purpose of the IGCEP, following methodology has been adopted as illustrated in Figure 5-1:

a. First Step: Review the existing generation facilities, committed power projects and explore the range of generation addition options available to meet the future demand.
b. Second Step: Determine the economically attractive / viable generation option (s).
c. Third Step: Define the Base Case subsequent to identification of the economically attractive options.
d. Fourth Step: Develop the least cost plan whilst considering the reliability criteria and reserve requirements under the already defined Base Case using the PLEXOS tool.

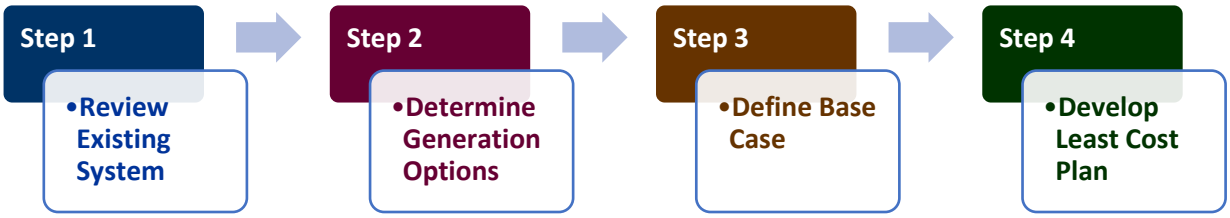


Figure 5-1: The IGCEP Data Modelling Approach

5.6. Planning Basis

The generation planning criteria tabulated in the Table 5-1 is adopted for this study.

Table 5-1: Generation Planning Criteria

Parameter	Value
Discount Rate	10%
Reliability Criteria (LOLP)	1%
Dollar Rate	Rs. 289.1 (Oct 2023)
CPI (US)	307.026
NCPI (Local)	239.27

5.7. Existing Power Generation of Country

Total installed capacity of whole country is 42,864 MW as of June 2023, whereas the net capacity is equivalent to 39,720 MW.

5.8. Retirement of Existing Power Projects

A significant quantum i.e 8,330 MW of the existing thermal power projects are scheduled to be retired from NTDC system during the planning horizon of the IGCEP 2024. The retirement schedule for the IGCEP 2024-34 is provided in the Table 5-2. For the purpose of the IGCEP, a power project stands retired as per its PPA/EPA term. Major retirement of generation capacity for the IGCEP 2024-34 corresponds to RFO based power projects, followed by Local Gas and then RLNG based power projects.

Table 5-2: Retirement Schedule of Power Projects in the Existing System

Sr. #	Name of Power Station	Installed Capacity (MW)	Fuel Type	Retirement Year (FY)									Rationale
				24	25	27	28	29	30	31	33	34	
NTDC System													
1	Jamshoro-I U1	250	RFO					✓					GENCOs Retirements
2	Jamshoro-II U4	200	RFO					✓					
3	Muzaffargarh-I U1	210	RFO									✓	
4	Muzaffargarh-I U2	210	RFO									✓	
5	Muzaffargarh-I U3	210	RFO									✓	
6	Muzaffargarh-II U4	320	RFO									✓	
7	Guddu-II U	620	Gas									✓	
8	KAPCO*	1300	RLNG			✓							Network constraints
9	Liberty	235	Gas				✓						PPA expiry
10	HUBCO	1,292	RFO			✓							
11	Kohinoor	131	RFO			✓							
12	AES Lalpir	362	RFO					✓					
13	AES Pakgen	365	RFO					✓					
14	FKPCL	157	RLNG							✓			
15	Saba	136	RFO						✓				
16	Uch	586	Gas							✓			
17	Rousch	450	RLNG								✓		
18	Altern Energy Limited	31	RLNG						✓				
19	AGL	163	RFO									✓	
Total (MW)		**7,228**											
K-Electric System													
20	BQPS1-U1	210	RLNG		✓								PPA expiry
21	BQPS1-U2	210	RLNG		✓								
22	BQPS1-U5	210	RLNG			✓							
23	BQPS1-U6	210	RLNG								✓		
24	GAEL	136	RFO		✓								

Sr. #	Name of Power Station	Installed Capacity (MW)	Fuel Type	Retirement Year (FY)									Rationale
				24	25	27	28	29	30	31	33	34	
25	TPL	126	RFO		✓								
Total (MW)		**1,102**											

5.9 List of Committed Projects

The committed projects considered in the IGCEP are listed in the Table 5-4. It is to add here that the 2,400 MW solar block allocation has been kept as strategic investment, however, in the meanwhile, private sector investment for import of solar panels for roof top / off-grid options have come in a big way in Pakistan. Therefore, the allocation of the said quantum of strategic solar may be re-assessed and diverted to the private sector roof top / off-grid solar options.

Table 5-3: List of Committed Projects

#	Name of Project	Fuel Type	Agency	Installed Capacity (MW)	Dependable	Status	Expected Schedule of Commissioning
1	Helios	PV	PPIB	50	50	Category-II Project	Dec-23
2	HNDS	PV	PPIB	50	50	Category-II Project	Dec-23
3	Meridian	PV	PPIB	50	50	Category-II Project	Dec-23
4	Jabori	Hydro	GoKPK	10.2	10.2	PC-1 Approved	May-24
5	Suki Kinari (U#1)	Hydro	PPIB	221	221	Financial Close	Aug-24
6	Suki Kinari (U#2)	Hydro	PPIB	221	221	Financial Close	Sep-24
7	Suki Kinari (U#3)	Hydro	PPIB	221	221	Financial Close	Oct-24
8	Suki Kinari (U#4)	Hydro	PPIB	221	221	Financial Close	Nov-24
9	Jamshoro Coal	Imported Coal	GENCO Holding	660	629	PC-1 Approved	Jun-24
10	Zorlu	PV	PPDB	100	100	Category-II Project	Oct-24
11	Lawi	Hydro	GoKPK	69	69	PC-1 Approved	Dec-24
12	Jagran-II	Hydro	AJK-HEB	48	48	PC-1 Approved	Dec-24
13	Koto	Hydro	GoKPK	40.8	40.8	PC-1 Approved	Jun-24
14	Shahtaj	Bagasse	PPIB	32	32	Category-I Project	Jun-24
15	Chamfall	Hydro	AJK-HEB	3.22	3.22	PC-1 Approved	Jun-24
16	Kurram Tangi	Hydro	C&M-WAPDA	18	18	PC-1 Approved	Jun-24
17	Karora	Hydro	GoKPK	11.8	11.8	PC-1 Approved	Jul-24
18	Access_Solar	PV	PPIB	11.52	11.52	Category-I Project	Sep-24
19	Access_Electric	PV	PPIB	10	10	Category-I Project	Sep-24
20	Safe	PV	PPIB	10	10	Category-I Project	Nov-24
21	Tarbela_Ext_5 (U#1)	Hydro	WAPDA	510	510	PC-1 Approved	Nov-25
22	Tarbela_Ext_5 (U#2)	Hydro	WAPDA	510	510	PC-1 Approved	Dec-25
23	Tarbela_Ext_5 (U#3)	Hydro	WAPDA	510	510	PC-1 Approved	Jan-26
24	Gorkin Matiltan	Hydro	GoKPK	84	84	PC-1 Approved	Aug-25
25	TAY	Bagasse	PPIB	30	30	Category-II Project	Aug-25
26	Riali-II (U#1)	Hydro	PPIB	3.5	3.5	LOS (Issued)	Jun-25
27	Riali-II (U#2)	Hydro	PPIB	3.5	3.5	LOS (Issued)	Jun-25
28	Nardagian	Hydro	AJK-HEB	3.22	3.22	PC-1 Approved	Dec-25
29	Dasu (U#1)	Hydro	WAPDA	360	360	PC-1 Approved	Mar-27
30	Dasu (U#2)	Hydro	WAPDA	360	360	PC-1 Approved	Apr-27
31	Dasu (U#3)	Hydro	WAPDA	360	360	PC-1 Approved	May-27
32	Dasu (U#4)	Hydro	WAPDA	360	360	PC-1 Approved	Oct-27
33	Dasu (U#5)	Hydro	WAPDA	360	360	PC-1 Approved	Nov-27
34	Dasu (U#6)	Hydro	WAPDA	360	360	PC-1 Approved	Dec-27

#	Name of Project	Fuel Type	Agency	Installed Capacity (MW)	Dependable	Status	Expected Schedule of Commissioning
35	Mohmand Dam (U#1)	Hydro	WAPDA	200	200	PC-1 Approved	Dec-26
36	Mohmand Dam (U#2)	Hydro	WAPDA	200	200	PC-1 Approved	Jan-27
37	Mohmand Dam (U#3)	Hydro	WAPDA	200	200	PC-1 Approved	Mar-27
38	Mohmand Dam (U#4)	Hydro	WAPDA	200	200	PC-1 Approved	Apr-27
39	Kathai-II (U#1)	Hydro	PPIB	4	4	LOS (Issued)	Jul-26
40	Kathai-II (U#2)	Hydro	PPIB	4	4	LOS (Issued)	Jul-26
41	PV_Committed_A	PV	PPIB	600	600	Committed	Jan-27
42	PV_Committed_B	PV	PPIB	600	600	Committed	Apr-27
43	PV_Committed_C	PV	PPIB	1200	1200	Committed	Nov-27
44	CASA	Hydro	GoP	1000	1000	G2G	Aug-27
45	Gwadar	Imported Coal	PPIB	300	273	G2G/CPEC	Dec-27
46	Balakot	Hydro	GoKPK	300	300	PC-1 Approved	Dec-27
47	Siachen	PV	GoS	100	100	Category-II Project	Jun-28
48	Manjhand	PV	PPIB/GoS	50	50	PC-1 Approved	Jun-28
49	Trans_Atlantic	Wind	PPIB	50	50	Category-II Project	Jun-28
50	Western	Wind	PPIB	50	50	Category-II Project	Jun-28
51	Diamer Bhasha (U#1)	Hydro	WAPDA	375	375	PC-1 Approved	Jan-29
52	Diamer Bhasha (U#2)	Hydro	WAPDA	375	375	PC-1 Approved	Feb-29
53	Diamer Bhasha (U#3)	Hydro	WAPDA	375	375	PC-1 Approved	Apr-29
54	Diamer Bhasha (U#4)	Hydro	WAPDA	375	375	PC-1 Approved	May-29
55	Diamer Bhasha (U#5)	Hydro	WAPDA	375	375	PC-1 Approved	Jun-29
56	Diamer Bhasha (U#6)	Hydro	WAPDA	375	375	PC-1 Approved	Jul-29
57	Diamer Bhasha (U#7)	Hydro	WAPDA	375	375	PC-1 Approved	Aug-29
58	Diamer Bhasha (U#8)	Hydro	WAPDA	375	375	PC-1 Approved	Sep-29
59	Diamer Bhasha (U#9)	Hydro	WAPDA	375	375	PC-1 Approved	Oct-29
60	Diamer Bhasha (U#10)	Hydro	WAPDA	375	375	PC-1 Approved	Nov-29
61	Diamer Bhasha (U#11)	Hydro	WAPDA	375	375	PC-1 Approved	Jan-30
62	Diamer Bhasha (U#12)	Hydro	WAPDA	375	375	PC-1 Approved	Feb-30
63	C-5	Nuclear	PAEC	1200	1117	PC-1 Approved	Sep-30
Total Committed (MW):				**16,631**			
1	Net Meter	PV	DISCOs	240	240	Committed	Jul-24
2	Net Meter	PV	DISCOs	241	241	Committed	Jul-25
3	Net Meter	PV	DISCOs	215	215	Committed	Jul-26
4	Net Meter	PV	DISCOs	223	223	Committed	Jul-27
5	Net Meter	PV	DISCOs	186	186	Committed	Jul-28
6	Net Meter	PV	DISCOs	191	191	Committed	Jul-29
7	Net Meter	PV	DISCOs	205	205	Committed	Jul-30
8	Net Meter	PV	DISCOs	92	92	Committed	Jul-31
9	Net Meter	PV	DISCOs	303	303	Committed	Jul-32
10	Net Meter	PV	DISCOs	211	211	Committed	Jul-33
Total Net Meter (MW_p):				**2,107**			
1	New Technology	-	PPIB/PPDB	100	100	Committed	Jul-27
2	New Technology	-	PPIB/PPDB	100	100	Committed	Jul-28

#	Name of Project	Fuel Type	Agency	Installed Capacity (MW)	Dependable	Status	Expected Schedule of Commissioning
3	New Technology	-	PPIB/PPDB	100	100	Committed	Jul-29
4	New Technology	-	PPIB/PPDB	100	100	Committed	Jul-30
5	New Technology	-	PPIB/PPDB	100	100	Committed	Jul-31
6	New Technology	-	PPIB/PPDB	100	100	Committed	Jul-32
7	New Technology	-	PPIB/PPDB	100	100	Committed	Jul-33
Total New Technology (MW):				**700**			

5.10. New Generation Options

The candidate generation technologies, selected to be fed into the model, are as follows:

For NTDC system:

a. Steam Turbine New Local Coal candidate (330 MW); reference – Thar Energy Limited (TEL) and CAPEX from upfront generation tariff for projects on Thar Coal

b. Steam Turbine New Local Coal candidate (660 MW); reference – SSRL Thar Block-1 and CAPEX from upfront generation tariff for projects on Thar Coal

c. Gas Turbine on RLNG (400 MW); reference – Punjab Thermal (Trimmu) Open Cycle Gas Turbine (operational data) and CAPEX as per data available with international source (JICA)

d. Combined Cycle Gas Turbine on RLNG (1263 MW); reference – Punjab Thermal (Trimmu) parameters

e. Nuclear Steam PP on Uranium (1,200 MW); reference – Chashma Nuclear (C-5)

f. Wind Turbine

   i. 1000 MW each year starting from July 2027

   ii. Reference cost and parameters – as per Trans Atlanatic tariff and NEPRA's Guidelines

g. Solar PV

   i. Utility scale: 1300 MWp each year starting from July 2027

   ii. Net Metering as provided by DISCOs.

   iii. Reference cost and parameters – as per Zorlu tariff and NEPRA's Guidelines

h. Bagasse (Block of ≤ 100 MW); reference – operational parameters -Upfront Tariff 2017 and CAPEX from Shahtaj

For K-Electric system:

a. Steam Turbine New Local Coal candidate (330 MW); reference – Thar Energy Limited (TEL) and CAPEX from upfront generation tariff for projects on Thar Coal

b. Steam Turbine New Local Coal candidate (660 MW); reference – SSRL Thar Block-1 and CAPEX from upfront generation tariff for projects on Thar Coal

c. Wind Turbine (Block of ≤ 300 MW in July 2025 and Block of ≤ 100 MW each year till end of study horizon); reference cost and parameters – as per Trans Atlanatic tariff and NEPRA's Guidelines

d. Solar PV (Block of ≤ 300 MW_p in July 2025 and Block of ≤ 200 MW_p each year till end of study horizon); reference cost and parameters – as per Zorlu tariff and NEPRA's Guidelines

5.11. Hydro Projects and Screening

Data for hydro power projects was obtained from the relevant project executing agencies. A total of 46 Hydro Candidates are given to the model for optimization. The candidate hydro projects considered for optimization with their Indexed Capital Cost and Annualized Cost as per latest NEPRA available indexation are presented in Annexure B-3 & Annexure B-5 respectively.

5.12. Performance Characteristics of Generic Thermal Candidates

Generic Candidate thermal options include Gas Turbines (GTs) using RLNG and Steam Turbines (STs) using Local Coal and Nuclear Fuel. In order to develop a least cost generation expansion plan, it is necessary to examine the economic viability of each thermal option and select the least cost supply options taking into account technical characteristics, economic and financial parameters and operational requirements. Table 5-5 shows the performance characteristics of the thermal candidate projects.

Table 5-4: Performance Characteristics of Generic Thermal Power Projects

	Performance Characteristics	Jamshoro Coal 2	Coal Fired Steam at Thar	Coal Fired Steam at Thar-K-Electric	Coal Fired Steam-II at Thar	Combustion Turbine on RLNG	Combined Cycle on RLNG	Generic Nuclear PP	Bagasse
A	Installed Capacity (MW)	660	660	330	330	400	1263	1200	100
B	Net Capacity (MW)	629	607	301	301	396	1224	1117	100
	Technical Parameters								
C	Heat Rate (GJ/MWh)	9.0	9.23	9.72	9.72	9	6.52	9.57	12.68
D	Forced Outage (Hours %)	6.8	6.8	6.8	6.8	6.8	4	1	-
E	Economic Life (years)	30	30	30	30	30	30	60	30
	O&M								
G	Fixed ($/kW-year)	35.6	35.91 +	41.395 +	41.395 +	18.557	19.62	35.628	21.54

	Performance Characteristics	Jamshoro Coal 2	Coal Fired Steam at Thar	Coal Fired Steam at Thar-K-Electric	Coal Fired Steam-II at Thar	Combustion Turbine on RLNG	Combined Cycle on RLNG	Generic Nuclear PP	Bagasse
			71.81*	71.81*	71.81*				
H	Variable ($/MWh)	0.82	4.13	4.13	4.13	3.405	3.405	0	3.68
I	CAPEX ($/kW)	744	1568	1640	1640	587	746	3505	923.6
J	Earliest availability (year)	2026	2028	2028	2028	2027	2028	2029	2026

*Fixed Fuel Cost Component (FCC)

All candidate thermal technologies are assessed and ranked in terms of annualized unit cost by using screening curve analysis. Screening curves are used to determine the best possible technology to be inducted at a particular time frame from the available supply options. Two types of screening curves are given below:

a. Annualized Cost ($/kW/year) - Screening Curve (Annexure B-4.1)
b. Unit Generation Cost (cents/kWh) - Screening Curve (Annexure B-4.2)

Although the mechanism of project selection by the tool is done through complex computations and optimization techniques, however, these curves give the generic idea / trend about the selection / viability of different candidate thermal power projects at various project factors.

These curves are the plots of unit generation cost on the y-axis and the project capacity factors on the x-axis. The total cost includes the annual capital recovery factor, fuel cost and annual O&M cost. The projects are ranked for each range of operating factors i.e., base load, intermediate and peak load operation. The project ranked lowest is introduced / selected first and remaining projects follow based on increasing order of merit / rank as per the system requirement.

5.13. Parameters of the Candidate REs

RE generation options include Solar PV and Wind. Solar PV and Wind technologies are modelled as candidates, subject to data provision by the relevant agencies. Table 5-6 shows the parameters of the candidate wind and solar PV projects.

Table 5-5: Parameters of Candidate Wind and Solar PV Projects

#	Technology	Installed Capacity	Earliest Availability	FO&M	Installed Cost	Annual Energy	Project Factor	Annualized Cost of Energy	
		(MW)	(Year)	($/kW-Yr)	($/kW)	(GWh)	(%)	(c/kWh)	($/kW-Yr)
1	Solar PV Utility*	100	2027	11.05	688	201.2	22.1%	3.91	80.38
3	Wind	50	2027	28.33	1,401	175	40%	4.74	169.83

**Solar values are in MW_p*

6. THE IGCEP STUDY OUTPUT

6. The IGCEP Study Output

6.1. Introduction

The key objective of IGCEP is to develop a least cost, 10-year indicative generation expansion plan for the whole country to meet the load and energy demand in a reliable and sustainable manner while maximizing use of indigenous resources. NTDC prepares this IGCEP every year to meet its regulatory requirement, as stipulated in the Planning Code 4 of the prevailing Grid Code, which takes into account the Assumption Sets as mentioned in section 5.2 and assumptions laid down in NEP. The plan is to be reviewed and approved by NEPRA – the electricity regulator. The following section describes the key parameters and results of the generation planning study.

6.2. Defining Base Case

Major features of the Base Case are as follows:

a. Assumption Set as mentioned in section 5.2 and assumptions laid down in NEP
b. GDP projections by MoPD&SI (average GDP growth rate 3.50%)
c. Inclusion of technical load management gradually (1st to 5th year) in recorded value
d. Incorporation of NEECA's energy conservation measures gradually from 5th year
e. Low (Business as Usual) scenario of long-term load forecast
f. Existing contractual obligations - maintained till the end of contract

6.3. Other Scenarios

In addition to the base case, following scenarios have also been simulated through this study:

a. Scenario - I: Medium (Optimistic) Demand Scenario

All other parameters are same as those of the base case except for the demand numbers i.e., addition of technical load management in the base year, policy-based load management gradually beyond three years and average GDP growth rate of 3.50% has been used to devise load demand forecast till 2034. The results are attached as Annexure – C.

b. Scenario - II: High Demand Scenario

All other parameters are same as those of the base case except for the demand numbers i.e., addition of technical load management in the base year, policy-based load management gradually beyond three years and average GDP growth rate of 6.0% has been used to devise load demand forecast till 2034. The results are attached as Annexure – D.

c. Scenario - III: Delay of Diamer Bhasha HPP

Although Diamer Bhasha HPP is considered in the Base case, owing to its COD in study horizon, however a sensitivity analysis has been carried out by considering Diamer Bhasha HPP delayed by three years as a committed power project. The results are attached as Annexure – E.

d. Scenario – IV: Azad Patan and Kohala HPP as committed

Although Azad Patan and Kohala HPP have been considered as candidate projects in the base case owing to unavailability of financing arrangements and delay in financial close. However, being CPEC projects a sensitivity analysis has been carried out by considering both the HPPs as committed power projects in the year 2032. The results are attached as Annexure – F.

6.4. Future Demand and Capacity Additions

The Base Case Chart 6-1 depicts the relationship between the projected peak demand of the system and the future installed capacity of the system, in terms of different types of energy sources for the period 2024 – 2034. It is evident that the trend of the demand is similar to the capacity additions as both are increasing in the positive direction and there is gradual increment during the horizon of this plan. In the year 2023-24, the installed capacity of the whole country from all generation sources will be around 43,728 MW and the demand will be equal to 27,303 MW whereas in 2033-34, and installed capacity will be 56,046 MW and demand will be equal to 37,224 MW. Chart 6-1 shows that sufficient generation shall be added to satisfy the specified reliability criteria and reserve requirements of the system.

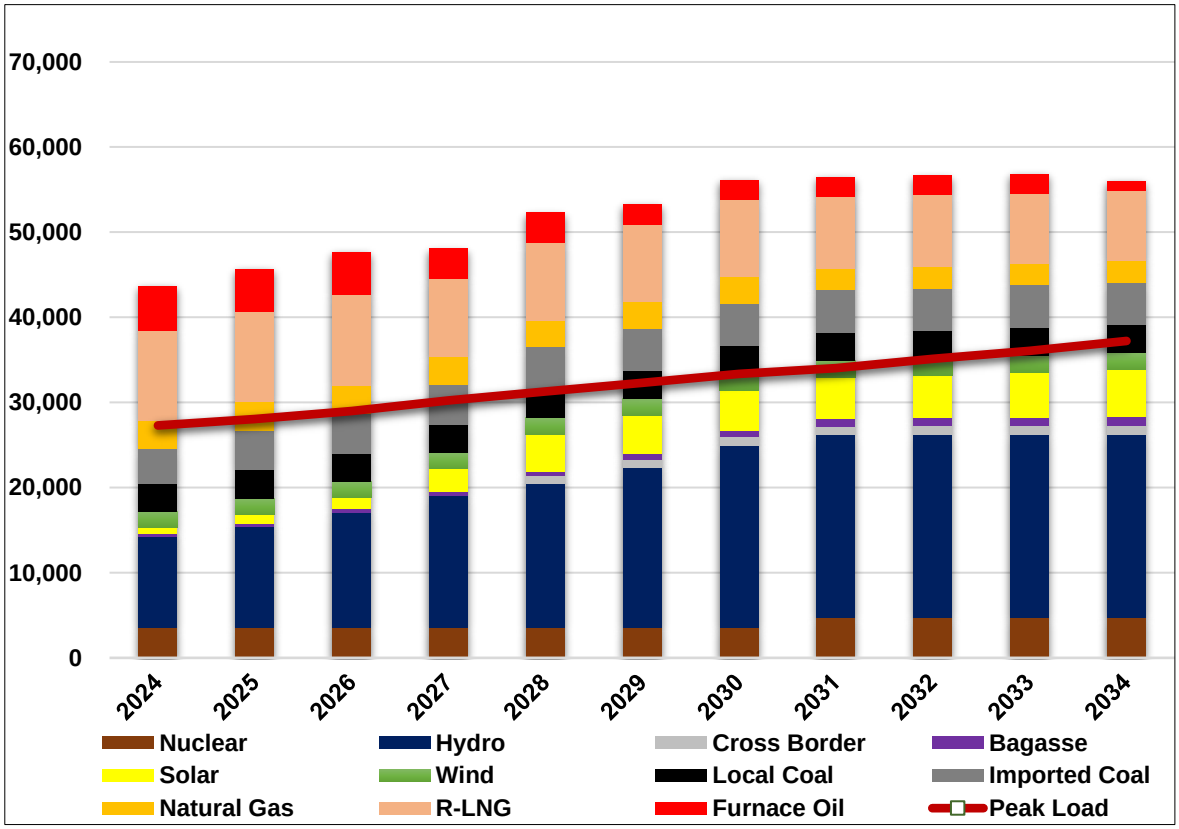


Chart 6-1: Installed Capacity vs Peak Demand (MW) 2023-24 to 2033-2034

On the other hand, energy generation by the power projects in the country has been optimized with the energy forecast by the year 2033-34 as shown in Chart 6-2. By the year 2033-34, 188,341 GWh of the energy demand is met, in which 56% of energy generation is contributed by RE sources comprising of 46% by hydro, 2% by baggase, 3% by wind and 5% by solar PV. The remaining 44% is provided by conventional thermal sources.

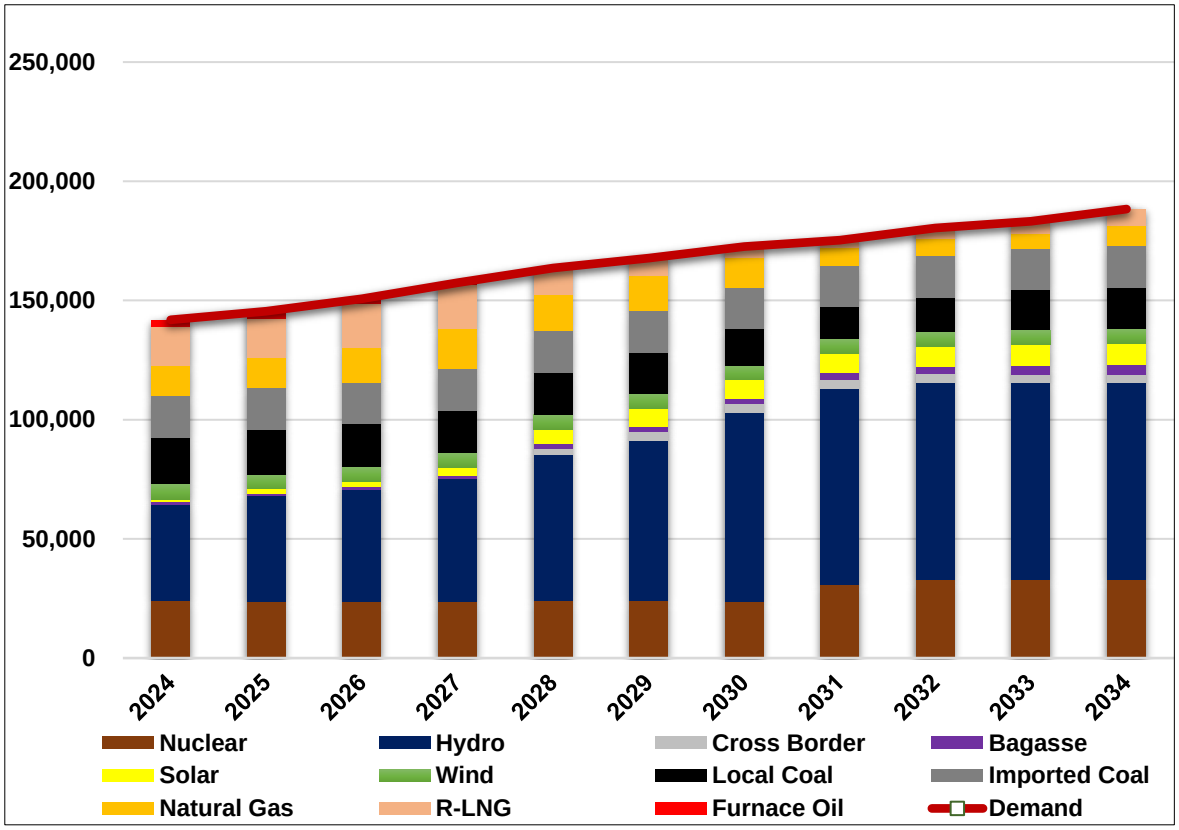
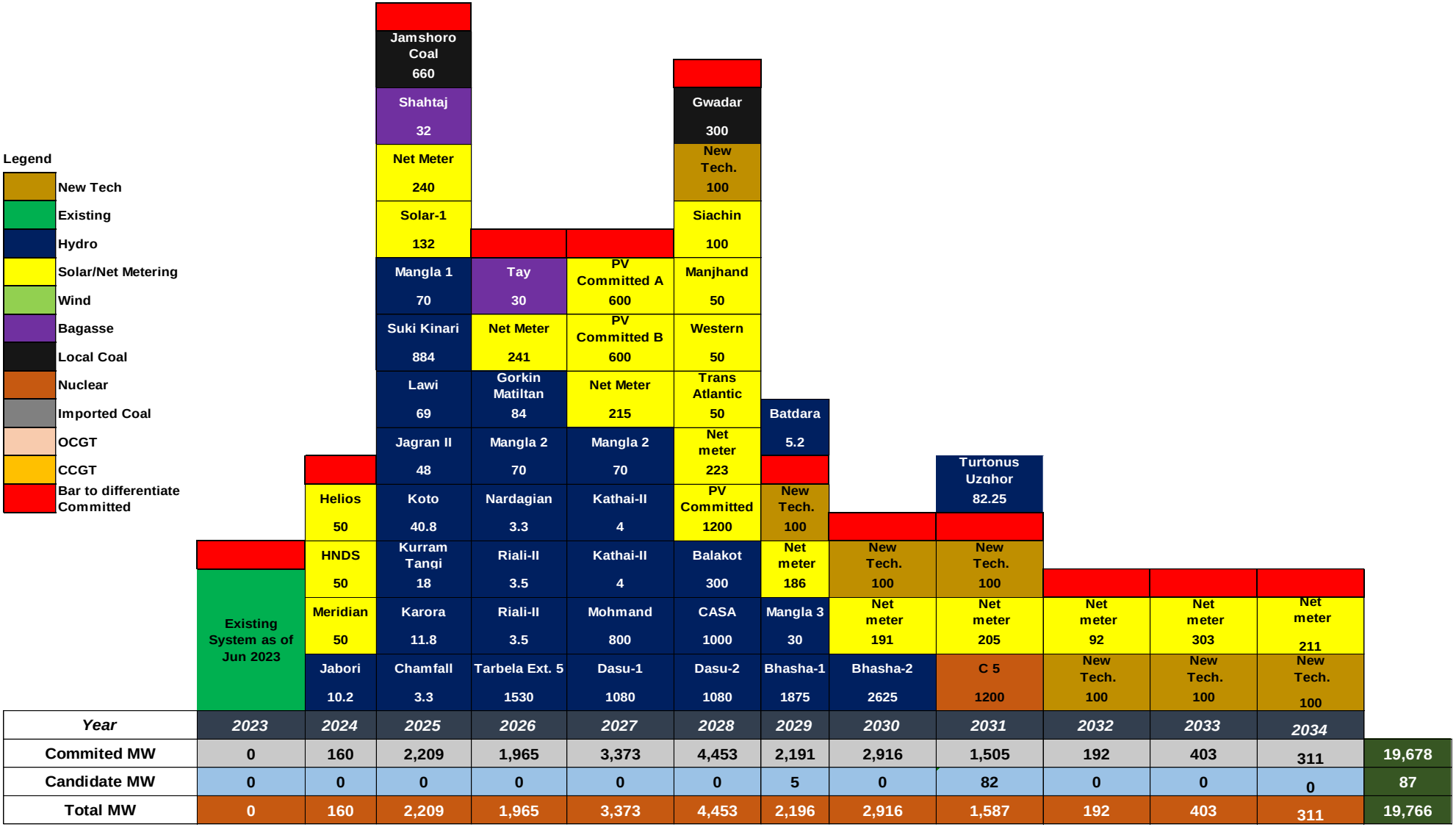


Chart 6-2: Annual Energy Generation vs Demand (GWh) 2023-24 to 2033-34

Table 6-1: Optimized Generation Capacity Additions (2024-34)

Fiscal Year	Coal Fired Steam Local Coal	Coal Fired Steam Local Coal KE	Combined Cycle on RLNG	Combustion Turbine on RLNG	Nuclear	HPP	Solar Utility MW_p	Net Meter MW_p	Solar KE MW_p	Wind NTDC	Wind KE	Bagasse	Per Year Capacity Addition*	Cumulative Capacity Addition
2024	-	-	-	-	-	-	-	-	-	-	-	-	0	0
2025	-	-	-	-	-	-	-	240	-	-	-	-	0	0
2026	-	-	-	-	-	-	-	241	-	-	-	-	0	0
2027	-	-	-	-	-	-	-	215	-	-	-	-	0	0
2028	-	-	-	-	-	-	-	223	-	-	-	-	0	0
2029	-	-	-	-	-	5	-	186	-	-	-	-	5	5
2030	-	-	-	-	-	-	-	191	-	-	-	-	0	5
2031	-	-	-	-	-	82	-	205	-	-	-	-	82	87
2032	-	-	-	-	-	-	-	92	-	-	-	-	0	87
2033	-	-	-	-	-	-	-	303	-	-	-	-	0	87
2034	-	-	-	-	-	-	-	211	-	-	-	-	0	87
Total	**-**	**-**	**-**	**-**	**-**	**87**	**-**	**2,107**	**-**	**-**	**-**	**-**	**87**	

**Does not include 2,107 MW of Net Metering, being committed*



Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	
Commited MW	0	160	2,209	1,965	3,373	4,453	2,191	2,916	1,505	192	403	311	19,678
Candidate MW	0	0	0	0	0	0	5	0	82	0	0	0	87
Total MW	0	160	2,209	1,965	3,373	4,453	2,196	2,916	1,587	192	403	311	19,766

Figure 6-1: IGCEP 2024-34 Generation Sequence

Due to limited space, in Figure 6-1, several projects (Solar PV and Hydro) being commissioned in the same year are combined together in the form of blocks for the purpose of reporting. The detail of these blocks, is provided in Table 6-2.

Table-6-2: Break-up of Blocks

Sr.No.	Year	Block	Name of Project	Installed Capacity
				MW
1	2025	Suki Kinari	Suki Kinari U#1	221
2			Suki Kinari U#1	221
3			Suki Kinari U#3	221
4			Suki Kinari U#4	221
6		Solar-1	Zorlu	100
7			Safe	10
8			Access Electric	10
9			Access Solar	12
Total (2025)				**1,016**
5	2026	Tarbela Ext 5	Tarbela_Ext_5 U#1	510
6			Tarbela_Ext_5 U#2	510
7			Tarbela_Ext_5 U#3	510
Total (2026)				**1,530**
8	2027	Dasu-1	Dasu U#1	360
9			Dasu U#2	360
10			Dasu U#3	360
11		Mohmand Dam	Mohmand Dam U#1	200
12			Mohmand Dam U#2	200
13			Mohmand Dam U#3	200
14			Mohmand Dam U#4	200
Total (2027)				**1,880**
15	2028	Dasu-2	Dasu U#4	360
16			Dasu U#5	360
17			Dasu U#6	360
Total (2028)				**1,080**
18	2029	Bhasha-1	Diamer Bhasha U#1	375
19			Diamer Bhasha U#2	375
20			Diamer Bhasha U#3	375
21			Diamer Bhasha U#4	375
22			Diamer Bhasha U#5	375
Total (2029)				**1,875**
23	2030	Bhasha-2	Diamer Bhasha U#6	375
24			Diamer Bhasha U#7	375
25			Diamer Bhasha U#8	375
26			Diamer Bhasha U#9	375
27			Diamer Bhasha U#10	375
28			Diamer Bhasha U#11	375
29			Diamer Bhasha U#12	375
Total (2030)				**2,625**

The final output of PLEXOS simulation, comprising year-wise addition of all committed and candidate power projects is given below in Table 6-3.

Table 6-3: PLEXOS Annual Addition of Power Projects 2024-2034

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
2023-24							
1	Helios	PV	50	50	PPIB	Category-II Project	Dec-23
2	HNDS	PV	50	50	PPIB	Category-II Project	Dec-23
3	Meridian	PV	50	50	PPIB	Category-II Project	Dec-23
4	Jabori	Hydro	10.2	10.2	GoKPK	PC-1 Approved	May-24
Generation Additions in 2023-24 (MW)			**160**	**160**			
Cumulative Addition up till 2023-24 (MW)			**160**	**160**			
2024-25							
1	Suki Kinari (U#1)	Hydro	221	221	PPIB	Financial Close	Aug-24
2	Suki Kinari (U#2)	Hydro	221	221	PPIB	Financial Close	Sep-24
3	Suki Kinari (U#3)	Hydro	221	221	PPIB	Financial Close	Oct-24
4	Suki Kinari (U#4)	Hydro	221	221	PPIB	Financial Close	Nov-24
5	Jamshoro Coal	Imported Coal	660	629	GENCO Holding	PC-1 Approved	Jun-24
6	Zorlu	PV	100	100	PPDB	Category-II Project	Oct-24
7	Lawi	Hydro	69	69	GoKPK	PC-1 Approved	Dec-24
8	Jagran-II	Hydro	48	48	AJK-HEB	PC-1 Approved	Dec-24
9	Koto	Hydro	40.8	40.8	GoKPK	PC-1 Approved	Jun-24
10	Shahtaj	Bagasse	32	32	PPIB	Category-I Project	Jun-24
11	Access_Solar	PV	11.52	11.52	PPIB	Category-I Project	Sep-24
12	Access_Electric	PV	10	10	PPIB	Category-I Project	Sep-24
13	Safe	PV	10	10	PPIB	Category-I Project	Nov-24
14	Chamfall	Hydro	3.22	3.22	AJK-HEB	PC-1 Approved	Jun-24
15	Kurram Tangi	Hydro	18	18	C&M-WAPDA	PC-1 Approved	Jun-24
16	Karora	Hydro	11.8	11.8	GoKPK	PC-1 Approved	Jul-24

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
17	Mangla Refurbishment U#3,4	Hydro	70	70	WAPDA	Committed	Jul-24
18	Net Meter	PV	240	240	DISCOs	Committed	Jul-24
Generation Additions in 2024-25 (MW)			**2,208**	**2,177**			
Cumulative Addition up till 2025 (MW)			**2,369**	**2,338**			
2025-26							
1	Tarbela_Ext_5 (U#1)	Hydro	510	510	WAPDA	PC-1 Approved	Nov-25
2	Tarbela_Ext_5 (U#2)	Hydro	510	510	WAPDA	PC-1 Approved	Dec-25
3	Tarbela_Ext_5 (U#3)	Hydro	510	510	WAPDA	PC-1 Approved	Jan-26
4	Gorkin Matiltan	Hydro	84	84	GoKPK	PC-1 Approved	Aug-25
5	TAY	Bagasse	30	30	PPIB	Category-II Project	Aug-25
6	Riali-II (U#1)	Hydro	3.5	3.5	PPIB	LOS (Issued)	Jun-25
7	Riali-II (U#2)	Hydro	3.5	3.5	PPIB	LOS (Issued)	Jun-25
8	Nardagian	Hydro	3.22	3.22	AJK-HEB	PC-1 Approved	Dec-25
9	Mangla Refurbishment U#1,2	Hydro	70	70	WAPDA	Committed	Dec-25
10	Net Meter	PV	241	241	DISCOs	Committed	Jul-25
Generation Additions in 2025-26 (MW)			**1,965**	**1,965**			
Cumulative Addition up till 2026 (MW)			**4,334**	**4,303**			
2026-27							
1	Dasu (U#1)	Hydro	360	360	WAPDA	PC-1 Approved	Mar-27
2	Dasu (U#2)	Hydro	360	360	WAPDA	PC-1 Approved	Apr-27
3	Dasu (U#3)	Hydro	360	360	WAPDA	PC-1 Approved	May-27
4	Mohmand Dam (U#1)	Hydro	200	200	WAPDA	PC-1 Approved	Dec-26
5	Mohmand Dam (U#2)	Hydro	200	200	WAPDA	PC-1 Approved	Jan-27
6	Mohmand Dam (U#3)	Hydro	200	200	WAPDA	PC-1 Approved	Mar-27
7	Mohmand Dam (U#4)	Hydro	200	200	WAPDA	PC-1 Approved	Apr-27

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
8	PV_Committed_A	PV	600	600	PPIB	Committed	Jan-27
9	PV_Committed_B	PV	600	600	PPIB	Committed	Apr-27
10	Kathai-II (U#1)	Hydro	4	4	PPIB	LOS (Issued)	Jul-26
11	Kathai-II (U#2)	Hydro	4	4	PPIB	LOS (Issued)	Jul-26
12	Mangla Refurbishment U#9,10	Hydro	70	70	WAPDA	Committed	Apr-27
13	Net Meter	PV	215	215	DISCOs	Committed	Jul-26
Generation Additions in 2026-27 (MW)			**3,373**	**3,373**			
Cumulative Addition up till 2027 (MW)			**7,707**	**7,676**			
2027-28							
1	Dasu (U#4)	Hydro	360	360	WAPDA	PC-1 Approved	Oct-27
2	Dasu (U#5)	Hydro	360	360	WAPDA	PC-1 Approved	Nov-27
3	Dasu (U#6)	Hydro	360	360	WAPDA	PC-1 Approved	Dec-27
4	PV_Committed_C	PV	1200	1200	PPIB	Committed	Nov-27
5	CASA	Hydro	1000	1000	GoP	G2G	Aug-27
6	Gwadar	Imported Coal	300	273	PPIB	G2G/CPEC	Dec-27
7	Balakot	Hydro	300	300	GoKPK	PC-1 Approved	Dec-27
8	Siachen	PV	100	100	GoS	Category-II Project	Jun-28
9	Manjhand	PV	50	50	PPIB/GoS	PC-1 Approved	Jun-28
10	Trans_Atlantic	Wind	50	50	PPIB	Category-II Project	Jun-28
11	Western	Wind	50	50	PPIB	Category-II Project	Jun-28
12	Net Meter	PV	223	223	DISCOs	Committed	Jul-27
13	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-27
Generation Additions in 2027-28 (MW)			**4,453**	**4,426**			
Cumulative Addition up till 2028 (MW)			**12,160**	**12,102**			
2028-29							

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
1	Diamer Bhasha (U#1)	Hydro	375	375	WAPDA	PC-1 Approved	Jan-29
2	Diamer Bhasha (U#2)	Hydro	375	375	WAPDA	PC-1 Approved	Feb-29
3	Diamer Bhasha (U#3)	Hydro	375	375	WAPDA	PC-1 Approved	Apr-29
4	Diamer Bhasha (U#4)	Hydro	375	375	WAPDA	PC-1 Approved	May-29
5	Diamer Bhasha (U#5)	Hydro	375	375	WAPDA	PC-1 Approved	Jun-29
6	Mangla Refurbishment U#7,8	Hydro	30	30	WAPDA	Committed	Sep-28
7	Net Meter	PV	186	186	DISCOs	Committed	Jul-28
8	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-28
9	Batdara	Hydel	5.2	5.2	AJK-HEB	Optimized	Jul-28
Generation Additions in 2028-29 (MW)			**2196.2**	**2196.2**			
Cumulative Addition up till 2029 (MW)			**14,356**	**14,298**			
2029-30							
1	Diamer Bhasha (U#6)	Hydro	375	375	WAPDA	PC-1 Approved	Jul-29
2	Diamer Bhasha (U#7)	Hydro	375	375	WAPDA	PC-1 Approved	Aug-29
3	Diamer Bhasha (U#8)	Hydro	375	375	WAPDA	PC-1 Approved	Sep-29
4	Diamer Bhasha (U#9)	Hydro	375	375	WAPDA	PC-1 Approved	Oct-29
5	Diamer Bhasha (U#10)	Hydro	375	375	WAPDA	PC-1 Approved	Nov-29
6	Diamer Bhasha (U#11)	Hydro	375	375	WAPDA	PC-1 Approved	Jan-30
7	Diamer Bhasha (U#12)	Hydro	375	375	WAPDA	PC-1 Approved	Feb-30
8	Net Meter	PV	191	191	DISCOs	Committed	Jul-29
9	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-29
Generation Additions in 2029-30 (MW)			**2,916**	**2,916**			
Cumulative Addition up till 2030 (MW)			**17,272**	**17,214**			
2030-31							
1	C-5	Nuclear	1200	1117	PAEC	PC-1 Approved	Sep-30

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
2	Net Meter	PV	205	205	DISCOs	Committed	Jul-30
3	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-30
4	Turtonas Uzghor	Hydel	82.25	82.25	PPIB	Optimized	Jul-30
Generation Additions in 2030-31 (MW)			**1,587**	**1,504**			
Cumulative Addition up till 2031 (MW)			**18,859**	**18,718**			
2031-32							
1	Net Meter	PV	92	92	DISCOs	Committed	Jul-31
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-31
Generation Additions in 2031-32 (MW)			**192**	**192**			
Cumulative Addition up till 2032 (MW)			**19,051**	**18,910**			
2032-33							
1	Net Meter	PV	303	303	DISCOs	Committed	Jul-32
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-32
Generation Additions in 2032-33 (MW)			**403**	**403**			
Cumulative Addition up till 2033 (MW)			**19,454**	**19,313**			
2033-34							
1	Net Meter	PV	211	211	DISCOs	Committed	Jul-33
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-33
Generation Additions in 2033-34 (MW)			**311**	**311**			
Cumulative Addition up till 2034 (MW)			**19,765**	**19,624**			

Note: Solar values are in MW_p

6.5. Annual Capacity Factors

The annual capacity factors information based on the Installed Capacity for the corresponding year, as shows in the Table 6-4.

Table 6-4: Annual Capacity Factors (%age)

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
1	Almoiz	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
2	Chanar	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
3	Chiniot	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
4	CSP	Bagasse	0.00	0.00	44.50	44.49	44.49	44.49	44.50	44.49	44.49
5	Fatima	Bagasse	6.53	6.53	6.55	6.53	2.80	2.75	2.74	2.75	2.75
6	Hamza	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
7	JDW-II	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
8	JDW-III	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
9	New_Bagasse	Bagasse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Ryk_Mills	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
11	Shahtaj	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
12	TAY	Bagasse	65.87	54.68	54.81	54.68	54.68	54.68	54.81	54.68	54.68
13	Thal_Layyah	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
14	Access_Electric	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
15	Access_Solar	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
16	Appolo	PV	18.86	18.86	18.86	18.86	18.92	18.92	18.92	18.92	18.92
17	Atlas_Solar(Zhenfa)	PV	16.43	16.43	16.42	16.43	16.33	16.33	16.31	16.33	16.33
18	Best	PV	18.40	18.40	18.40	18.40	18.48	18.48	18.48	18.48	18.48
19	Crest	PV	19.08	19.08	19.09	19.08	19.24	19.24	19.24	19.24	19.24
20	Helios	PV	20.35	20.35	20.33	20.35	20.22	20.22	20.20	20.22	20.22
21	HNDS	PV	20.35	20.35	20.33	20.35	20.22	20.22	20.20	20.22	20.22
22	Manjhand	PV	0.00	0.00	26.69	20.35	20.22	20.22	20.20	20.22	20.22
23	Meridian	PV	20.35	20.35	20.33	20.35	20.22	20.22	20.20	20.22	20.22
24	Net_Meter	PV	17.79	17.79	17.78	17.79	17.89	17.89	17.88	17.89	17.89
25	New_Solar_North/Center	PV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	New_Solar_South	PV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	PV_Committed_A	PV	0.00	17.33	19.21	19.23	19.11	19.11	19.09	19.11	19.11
28	PV_Committed_B	PV	0.00	23.90	19.21	19.23	19.11	19.11	19.09	19.11	19.11
29	PV_Committed_C	PV	0.00	0.00	17.41	19.23	19.11	19.11	19.09	19.11	19.11
30	QA_Solar	PV	17.36	17.36	17.37	17.36	17.46	17.46	17.47	17.46	17.46
31	Safe	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
32	Siachen	PV	0.00	0.00	26.69	20.35	20.22	20.22	20.20	20.22	20.22
33	Zorlu	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
34	Gharo	KE_PV	26.36	26.36	26.35	26.36	26.08	26.08	26.08	26.08	26.08
35	KE_New_Solar	KE_PV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36	Oursun	KE_PV	22.17	22.17	22.17	22.17	21.89	21.89	21.90	21.89	21.89
37	Act	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
38	Act_2	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
39	Artistic_wind	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
40	Artistic_Wind_2	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
41	Dawood	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
42	Din	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
43	FFC	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
44	FWEL-I	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
45	FWEL-II	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
46	Gul Ahmed	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
47	Gul_Electric	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
48	Hawa	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
49	Indus_Energy	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
50	Jhimpir	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
51	Lakeside	Wind	43.96	43.96	43.89	43.96	41.56	41.56	41.49	41.56	41.56
52	Liberty_Wind_1	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
53	Liberty_Wind_2	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
54	Master	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
55	Master_Green	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
56	Metro_Power	Wind	38.06	38.06	37.99	38.06	36.60	36.60	36.54	36.60	36.60
57	Metro_Wind	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
58	NASDA	Wind	43.96	43.96	43.89	43.96	41.56	41.56	41.49	41.56	41.56
59	New_Wind	Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	Sachal	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
61	Sapphire_Wind	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
62	Tenaga	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
63	Three_Gorges_I	Wind	38.06	38.06	37.99	38.06	36.60	36.60	36.54	36.60	36.60
64	Three_Gorges_II	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
65	Three_Gorges_III	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
66	Trans_Atlantic	Wind	0.00	0.00	34.42	38.97	38.48	38.48	38.41	38.48	38.48
67	Tricom	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
68	Tricon_A	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
69	Tricon_B	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
70	Tricon_C	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
71	UEP	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
72	Western	Wind	0.00	0.00	34.54	42.84	40.49	40.49	40.42	40.49	40.49
73	Yunus	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
74	Zephyr	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
75	Zorlu_Wind	Wind	38.06	38.06	37.99	38.06	36.60	36.60	36.54	36.60	36.60
76	KE_New_Wind	KE_Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
77	CASA	Interconnection	0.00	0.00	36.42	41.92	41.92	41.92	41.80	41.92	41.92
78	Balkani	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
79	Batdara	HPP Candidate <=20	0.00	0.00	0.00	47.66	47.66	47.66	47.53	47.66	47.66

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
80	Daral Khwar-II	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81	Deg Outfall	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
82	Ghail	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
83	Jhing-II	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
84	Nandihar	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
85	Arkari Gol	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
86	Artistic-I	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
87	Artistic-II	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
88	Ashkot	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
89	Asrit Kedam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90	Athmuqam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
91	Azad Pattan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
92	Bankhwar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93	Bata Kundi	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
94	Chakoti Hatian	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95	CJ	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
96	Dowarian	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
97	Gabral Kalam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
98	Gabral Utror	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
99	Gumat Nar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	Harigehl-Majeedgala	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101	Jagran-III	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102	Jagran-IV	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
103	Kaigah	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
104	Kalam Asrit	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	Keyal Khwar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
106	Kohala	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
107	Lower Spat Gah	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
108	Luat	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
109	Madyan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110	Mahl	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
111	Mastuj	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112	Nagdar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
113	Naran	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
114	Nila Da Katha	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115	Qadirabad	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
116	Rajdhani	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117	Shalfalam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
118	Sharmai	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
119	Shigo Kas	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	Shounter	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
121	Soan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
122	Taunsa	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
123	Turtonas Uzghor	HPP Candidate	0.00	0.00	0.00	0.00	0.00	51.90	51.76	51.90	51.90
124	Allai Khwar	HPP Existing	44.43	44.43	44.31	44.43	44.43	44.43	44.31	44.43	44.43
125	Chashma	HPP Existing	48.91	48.91	48.78	48.91	48.91	48.91	48.78	48.91	48.91
126	Daral Khwar	HPP Existing	38.77	38.77	38.66	38.77	38.77	38.77	38.66	38.77	38.77
127	Dubair Khwar	HPP Existing	54.57	54.57	54.42	54.57	54.57	54.57	54.42	54.57	54.57
128	Ghazi Brotha	HPP Existing	52.78	52.78	52.63	52.78	52.78	52.78	52.63	52.78	52.78
129	Golen Gol	HPP Existing	9.15	9.15	9.12	9.15	9.15	9.15	9.12	9.15	9.15
130	Gulpur	HPP Existing	28.92	28.92	28.84	28.92	28.92	28.92	28.84	28.92	28.92
131	Jagran-I	HPP Existing	49.49	49.49	49.35	49.49	49.49	49.49	49.35	49.49	49.49
132	Jinnah	HPP Existing	25.74	25.74	25.67	25.74	25.74	25.74	25.67	25.74	25.74
133	Karot	HPP Existing	45.48	45.48	45.36	45.48	45.48	45.48	45.36	45.48	45.48
134	Khan Khwar	HPP Existing	40.22	40.22	40.11	40.22	40.22	40.22	40.11	40.22	40.22
135	Malakand-III	HPP Existing	54.04	54.04	53.89	54.04	54.04	54.04	53.89	54.04	54.04
136	Mangla	HPP Existing	53.10	53.55	52.91	54.46	54.60	54.60	54.45	54.60	54.60
137	Neelum Jehlum	HPP Existing	53.48	53.48	53.33	53.48	53.48	53.48	53.33	53.48	53.48
138	New Bong	HPP Existing	55.49	55.49	55.34	55.49	55.49	55.49	55.34	55.49	55.49
139	Patrind	HPP Existing	43.76	43.76	43.64	43.76	43.76	43.76	43.64	43.76	43.76
140	Small Hydel	HPP Existing	45.59	45.59	45.46	45.59	45.59	45.59	45.46	45.59	45.59
141	Tarbela 1-14	HPP Existing	38.23	38.23	38.13	38.23	38.23	38.23	38.13	38.23	38.23
142	Tarbela_Ext_4	HPP Existing	30.33	30.33	30.25	30.33	30.33	30.33	30.25	30.33	30.33
143	Warsak	HPP Existing	50.63	50.63	50.49	50.63	50.63	50.63	50.49	50.63	50.63
144	Engro 90MW	CCGT_Gas	29.32	48.52	48.57	43.11	13.17	9.65	8.45	7.62	8.68
145	Foundation	CCGT_Gas	61.49	76.84	74.17	74.33	53.85	53.85	53.85	53.85	53.85
146	Guddu-I	CCGT_Gas	69.90	70.63	74.64	74.43	74.43	74.43	74.64	35.61	65.40
147	Guddu-II	CCGT_Gas	48.55	61.20	58.25	58.27	20.53	15.12	18.28	19.17	21.81
148	Guddu-V (747)	CCGT_Gas	58.71	68.58	66.16	75.56	71.74	17.61	19.40	21.08	42.03
149	Liberty	CCGT_Gas	40.17	40.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150	Uch	CCGT_Gas	64.06	70.75	55.89	38.92	38.92	0.00	0.00	0.00	0.00
151	Uch-II	CCGT_Gas	59.94	69.88	71.14	71.20	56.67	56.67	56.67	56.67	56.67
152	SNPC-I	KE_CCGT_Gas	62.62	69.53	66.29	66.89	53.29	53.29	53.29	53.29	53.29
153	SNPC-II	KE_CCGT_Gas	63.19	70.47	68.57	70.01	53.31	53.31	53.31	53.31	53.31
154	AES Lalpir	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
155	AES Pakgen	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
156	HUBCO	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
157	Jamshoro-I U1	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
158	Jamshoro-II U4	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
159	Muzaffargarh-I U1	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
160	Muzaffargarh-I U2	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
161	Muzaffargarh-I U3	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
162	Muzaffargarh-II U4	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
163	Saba	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
164	AGL	DG_RFO	36.81	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
165	Atlas	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
166	Engro 127MW	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
167	HuB N	DG_RFO	36.81	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
168	Kohinoor	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
169	Liberty Tech	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
170	Nishat C	DG_RFO	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
171	Nishat P	DG_RFO	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
172	GAEL	KE_DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
173	TPL	KE_DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
174	NEW OCGT_North/Center	OCGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
175	NEW OCGT_South	OCGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
176	C-1	Nuclear	81.11	81.11	81.33	81.11	81.11	81.11	81.33	81.11	81.11
177	C-2	Nuclear	79.61	79.61	79.83	79.61	79.61	79.61	79.83	79.61	79.61
178	C-3	Nuclear	81.01	81.01	81.23	81.01	81.01	81.01	81.23	81.01	81.01
179	C-4	Nuclear	81.01	81.01	81.23	81.01	81.01	81.01	81.23	81.01	81.01
180	C-5	Nuclear	0.00	0.00	0.00	0.00	0.00	67.29	90.21	89.96	89.96
181	K-2	Nuclear	85.07	85.07	85.30	85.07	85.07	85.07	85.30	85.07	85.07
182	K-3	Nuclear	85.07	85.07	85.30	85.07	85.07	85.07	85.30	85.07	85.07
183	NEW_Nuclear_North/Center	Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
184	NEW_Nuclear_South	Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
185	Engro Thar	Local Coal	82.51	82.51	82.74	82.18	82.51	75.15	77.73	73.33	73.64
186	Lucky	Local Coal	2.56	0.76	0.00	0.00	0.00	0.00	0.00	0.28	1.52
187	NEW_L.Coal 330	Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
188	NEW_L.Coal 660	Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
189	Thal Nova	Local Coal	84.98	84.98	85.21	84.98	84.98	83.74	85.18	84.98	84.98
190	Thar TEL	Local Coal	84.98	84.98	85.21	84.98	84.98	84.98	85.21	84.98	84.98
191	Thar-I (SSRL)	Local Coal	84.10	84.31	83.53	77.94	59.11	45.47	54.97	80.35	82.61
192	K.E_NEW_L.Coal 330	KE_Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
193	K.E_NEW_L.Coal 660	KE_Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
194	China HUBCO	Imported Coal	56.16	56.16	56.16	56.16	56.16	56.16	56.16	56.16	56.16
195	Gwadar	Imported Coal	0.00	0.00	0.20	0.00	0.00	0.00	0.24	0.33	1.75
196	Jamshoro Coal	Imported Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
197	Jamshoro Coal 2	Imported Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
198	Port Qasim	Imported Coal	56.72	56.72	56.72	56.72	56.72	56.72	56.72	56.72	56.72
199	Sahiwal Coal	Imported Coal	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47
200	FPCL	KE_Imported Coal	7.12	18.82	2.33	2.13	1.46	1.45	1.16	0.87	0.87
201	Altern	Gas Engine_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
202	Davis	DG_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
203	Balloki	CCGT_RLNG	6.38	25.83	31.59	18.65	15.13	6.47	11.41	12.80	20.50
204	Bhikki	CCGT_RLNG	1.57	4.86	0.68	0.27	0.07	0.05	0.48	1.53	3.03
205	FKPCL	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
206	Halmore	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
207	Haveli	CCGT_RLNG	39.00	74.21	61.94	42.30	22.59	16.62	22.73	27.64	30.42
208	KAPCO 1	CCGT_RLNG	35.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
209	KAPCO 2	CCGT_RLNG	11.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	Nandipur	CCGT_RLNG	36.38	21.87	0.00	0.00	0.00	0.00	0.00	0.00	0.17
211	NEW_CCGT_North/Center	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
212	NEW_CCGT_South	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
213	Orient	CCGT_RLNG	37.73	22.99	0.00	0.00	0.00	0.00	0.00	0.00	1.38
214	Rousch	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
215	Saif	CCGT_RLNG	37.73	22.86	0.00	0.00	0.00	0.00	0.00	0.00	0.30
216	Saphire	CCGT_RLNG	37.73	22.99	0.00	0.00	0.00	0.00	0.00	0.00	0.31
217	Trimmu	CCGT_RLNG	16.28	10.97	8.39	5.08	1.61	0.67	2.56	5.22	8.98
218	BQPS2	KE_CCGT_RLNG	12.89	45.26	12.85	14.00	10.73	9.59	10.32	7.77	6.45
219	BQPS3	KE_CCGT_RLNG	77.79	14.97	0.98	0.98	0.89	0.91	1.09	1.73	1.70
220	KCCPP	KE_CCGT_RLNG	5.50	31.21	6.10	7.00	4.18	3.79	4.17	2.34	2.22
221	KTGTPS	KE_CCGT_RLNG	3.52	21.86	3.95	4.11	2.39	2.32	2.69	1.03	0.92
222	SGTPS	KE_CCGT_RLNG	2.60	13.12	2.98	3.20	1.99	1.75	1.50	0.50	0.87
223	BQPS1-U1	KE_ST_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
224	BQPS1-U5	KE_ST_RLNG	1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
225	BQPS1-U6	KE_ST_RLNG	1.24	2.89	0.16	0.79	0.38	0.45	0.66	0.00	0.00
226	BQPS1-U2	KE_GT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
227	Balakot	UC Hydro_Committed	0.00	0.00	41.63	41.96	41.96	41.96	41.85	41.96	41.96
228	Chamfall	UC Hydro_Committed	48.01	48.01	47.88	48.01	48.01	48.01	47.88	48.01	48.01
229	Dasu	UC Hydro_Committed	0.00	99.00	61.91	64.52	64.52	64.52	64.34	64.52	64.52
230	Diamer Bhasha	UC Hydro_Committed	0.00	0.00	0.00	56.86	42.74	44.40	44.28	44.40	44.40
231	Gorkin Matiltan	UC Hydro_Committed	40.11	44.77	44.65	44.77	44.77	44.77	44.65	44.77	44.77
232	Jabori	UC Hydro_Committed	82.38	82.38	82.23	82.38	82.38	82.38	82.23	82.38	82.38
233	Jagran-II	UC Hydro_Committed	51.22	51.22	51.08	51.22	51.22	51.22	51.08	51.22	51.22
234	Karora	UC Hydro_Committed	72.12	72.12	71.99	72.12	72.12	72.12	71.99	72.12	72.12
235	Kathai-II	UC Hydro_Committed	0.00	60.14	61.57	61.74	61.74	61.74	61.57	61.74	61.74
236	Koto	UC Hydro_Committed	59.06	59.06	58.90	59.06	59.06	59.06	58.90	59.06	59.06
237	Kurram Tangi	UC Hydro_Committed	17.05	17.05	17.01	17.05	17.05	17.05	17.01	17.05	17.05
238	Lawi	UC Hydro_Committed	48.96	48.96	48.84	48.96	48.96	48.96	48.84	48.96	48.96
239	Mohmand Dam	UC Hydro_Committed	0.00	72.83	43.14	43.26	43.26	43.26	43.14	43.26	43.26
240	Nardagian	UC Hydro_Committed	43.81	48.50	48.37	48.50	48.50	48.50	48.37	48.50	48.50
241	Riali-II	UC Hydro_Committed	54.79	54.79	54.64	54.79	54.79	54.79	54.64	54.79	54.79
242	Suki Kinari	UC Hydro_Committed	51.16	51.16	51.02	51.16	51.16	51.16	51.02	51.16	51.16
243	Tarbela_Ext_5	UC Hydro_Committed	6.49	10.05	10.02	10.05	10.05	10.05	10.02	10.05	10.05

6.6. Year-wise Discounted and Un-Discounted Cost

The year wise cost breakup is shown in Table 6-5 and 6-6.

Table 6-5: Year wise Discounted Cost (Million US$)

FY	FO&M Cost	Generation Cost	Total Cost	Objective Function (Cumulative)*
2024	2,376	4,183	6,559	6,559
2025	2,196	3,547	5,743	12,302
2026	2,012	3,084	5,096	17,398
2027	1,825	2,514	4,339	21,737
2028	1,708	1,800	3,508	25,245
2029	1,578	1,494	3,072	28,317
2030	1,491	1,226	2,717	31,034
2031	1,391	1,051	2,442	33,476
2032	1,269	1,004	2,273	35,749
2033	1,151	909	2,060	37,809
2034	1,041	880	1,921	39,730

**CAPEX of committed power projects not included*

Table 6-6: Year wise Un-Discounted Cost (Million US$)

FY	FO&M Cost	Generation Cost	Total Cost	Objective Function (Cumulative)*
2024	2,376	4,183	6,559	6,559
2025	2,415	3,902	6,317	12,876
2026	2,435	3,732	6,166	19,043
2027	2,429	3,346	5,775	24,818
2028	2,501	2,635	5,136	29,954
2029	2,541	2,406	4,947	34,901

FY	FO&M Cost	Generation Cost	Total Cost	Objective Function (Cumulative)*
2030	2,641	2,173	4,814	39,715
2031	2,710	2,048	4,759	44,473
2032	2,720	2,152	4,871	49,345
2033	2,713	2,144	4,857	54,202
2034	2,701	2,282	4,983	59,185

**CAPEX of committed power projects not included*

6.7. Salient Features of the IGCEP

In order to balance a projected peak load of 37,224 MW by the year 2033-34, the PLEXOS model proposes 56,046 MW of installed generation capacity; salient features of the study are as follows:

a. Significant Induction of VREs (clean and indigenous)

b. Substantial utilization of hydro-based power

c. Balancing the overall basket price with increased share of hydro power and REs

d. Optimal indigenization: less reliance on imported fuel i.e., Imported Coal, RFO, RLNG etc.

e. Substantial reduction in carbon emissions owing to induction of REs and hydro

f. All optimized generation projects are indigenous without any imported fuel

Meanwhile, a capacity of 7,530 MW is meant to be retired by the year 2033-34. In order to provide a quick understanding of the generation mix of the IGCEP 2024-34, the report includes the Table 6-7 which highlights addition and retirement of different types of generation capacities. Moreover, fuel-wise capacity in megawatts, energy in GWh and their monthly share in the total generated energy, over the period of this plan, which are further illustrated by the Chart 6-4 through 6-6, Chart 6-7 through 6-9 and Chart 6-10 through 6-11 respectively.

Table 6-7: Year wise Installed Generation Capacity Addition (MW)

Year	Net Capacity Addition Over the Plan Period (2023-34)											
	Local Coal	Hydro	RLNG	Nuclear	Imported Coal	RE	New Tech.	Natural Gas	Furnace Oil	Cross Border	Net Yearly Addition	Cumulative Total
	MW											
Jun-23	3,300	10,663	10,185	3,530	4,020	2,810	-	2,964	5,273	-	-	42,745
2024	-	27	411	-	-	150	-	395	-	-	983	43,728
2025	-	1,145	-	-	660	404	-	-	-262	-	1,946	45,674
2026	-	1,694	-	-	-	271	-	-	-	-	1,965	47,640
2027	-	1,958	-1,510	-	-	1,415	-	-	-1,423	-	440	48,080
2028	-	1,380	-	-	300	1,673	100	-235	-	1,000	4,218	52,298
2029	-	1,910	-	-	-	186	100	-	-1,177	-	1,019	53,317
2030	-	2,625	-	-	-	191	100	-	-136	-	2,780	56,097
2031	-	82	-638	1,200	-	205	100	-586	-	-	363	56,460
2032	-	-	-	-	-	92	100	-	-	-	192	56,652
2033	-	-	-210	-	-	303	100	-	-	-	193	56,845
2034	-	-	-	-	-	211	100	-	-1,110	-	-799	56,046
Total	**3,300**	**21,485**	**8,238**	**4,730**	**4,980**	**7,910**	**700**	**2,538**	**1,165**	**1,000**	**56,046**	

6.8. Comparison of Scenarios

In addition to the base case, five scenarios have been developed to facilitate the decision makers to reach an informed decision. Scenario-I and Scenario-II comprise of Medium Demand Forecast and High Demand Forecast respectively, whereas, Scenario-III and Scenario-IV have base case demand along with Delay of Diamer Bhasha HPP and Azad Patan & Kohala HPP as committed, respectively.

The base case results show an optimized capacity addition of 87 MW of hydro, throughout the study horizon. In Scenario-I (Medium Demand), the optimization increases candidate hydro by 424 MW by the year 2033-34. Moreover, 5,680 MW_P of solar PV and 400 MW of wind-based projects are added by 2033-34. In Scenario-II (High Demand), the tool optimizes 1,663 MW more hydro as compared to base case alongwith 10,094 MW_P, 985 MW, 660 MW and 1,663 MW of solar PV, wind, local coal and RLNG based generation, respectively.

For Scenario-III (Delay of Diamer Bhasha HPP), the tool optimizes 1,509 MW_P of solar PV as compared to the base case by the year 2033-34. In Scenario-IV (Azad Pata and Kohala HPP as Committed), there is same generation addition as of base case i.e., 87 MW hydro only.

A comparison of CODs for all the candidate projects (HPPs and thermal) optimized by the tool for the base case along with scenarios mentioned above is given in Annexure B-6.

The installed capacities for base case and all the scenarios for the year 2030-31 are summarized in Table 6-8.

Table 6-8: Scenario-wise Installed Capacity (MW) by 2033-34

Category	Base	Medium Demand	High Demand	Delay in Diamer Bhasha HPP	Azad Patan & Kohala HPP as Committed
Imported Coal	4,980	4,980	4,980	4,980	4,980
Local Coal	3,300	3,300	3,960	3,300	3,300
RLNG	8,238	8,238	9,901	8,238	8,238
Gas	2,538	2,538	2,538	2,538	2,538
Nuclear	4,730	4,730	4,730	4,730	4,730
Bagasse	1,130	1,130	1,130	1,130	1,130
Solar PV	5,539	11,219	15,633	7,048	5,539
HPP	21,485	21,908	23,148	21,485	23,309
Cross Border	1,000	1,000	1,000	1,000	1,000
Wind	1,942	2,342	2,927	1,942	1,942
RFO	1,165	1,165	1,165	1,165	1,165
Total (MW)	**56,046**	**62,549**	**71,111**	**57,555**	**57,871**

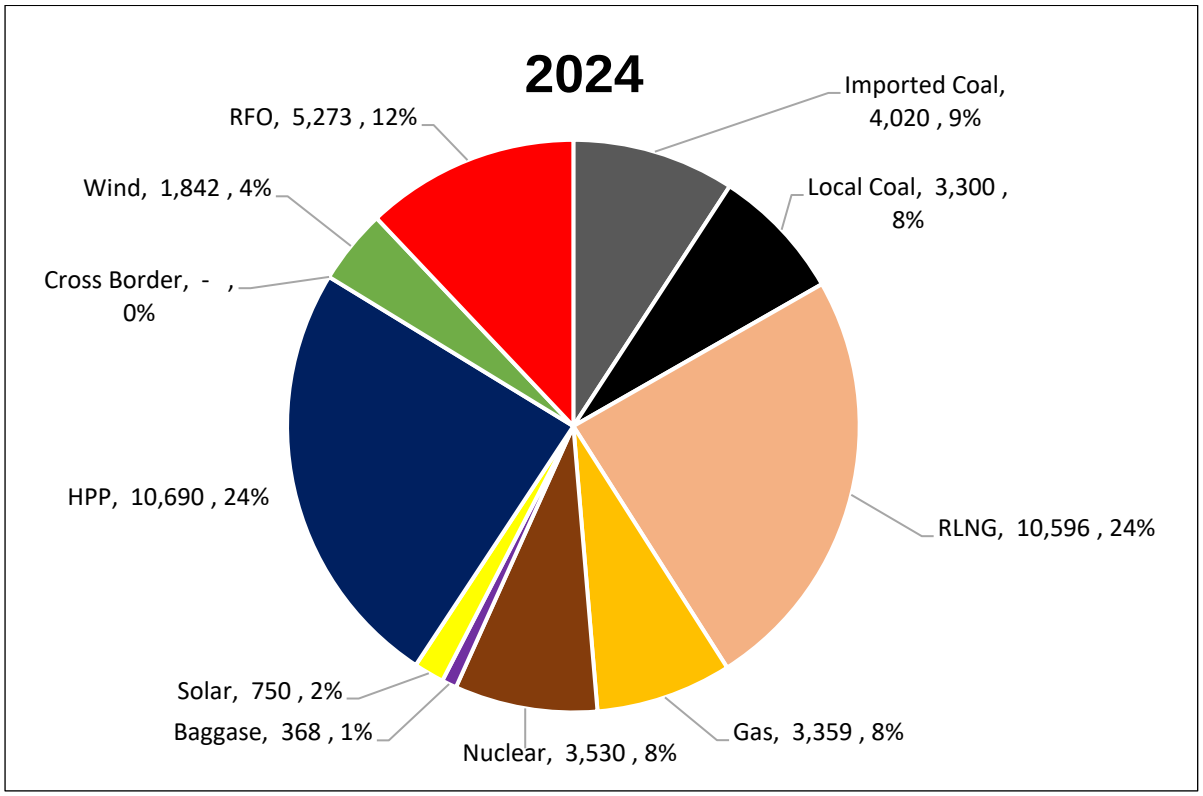


Chart 6-4: IGCEP Generation Mix 2024

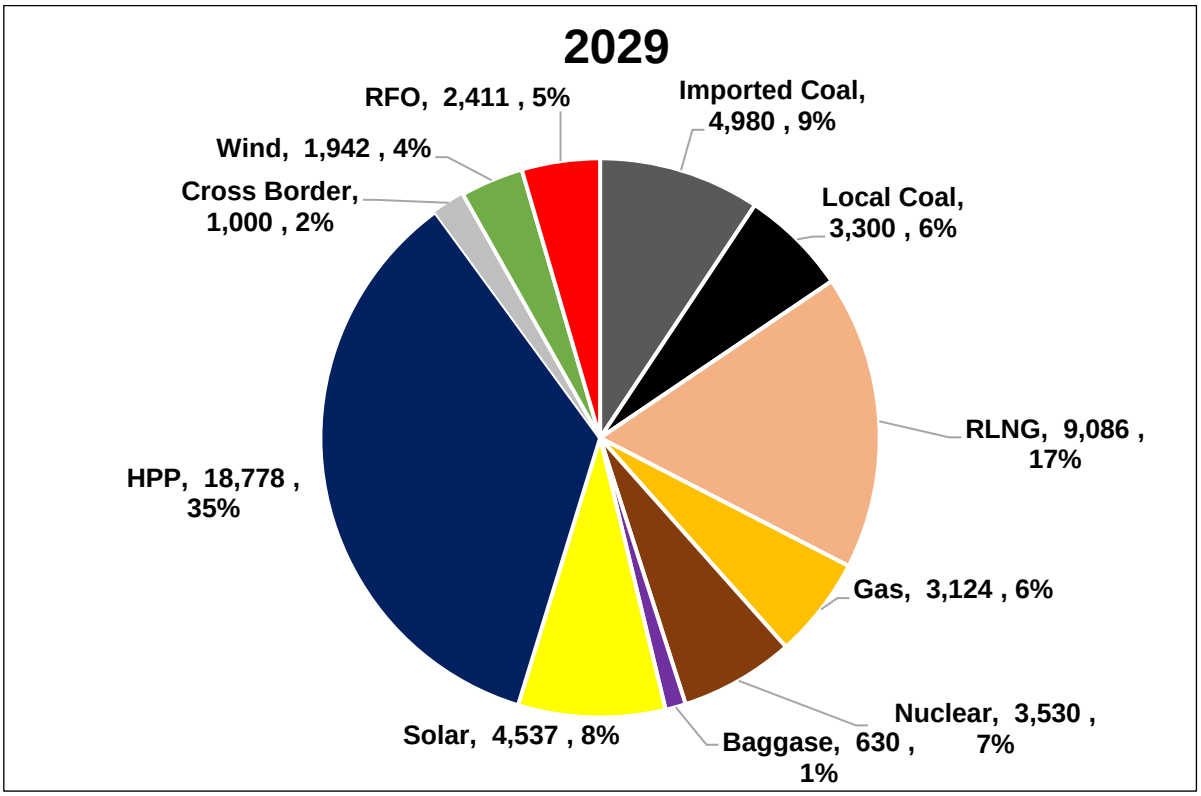


Chart 6-5: IGCEP Generation Mix 2029

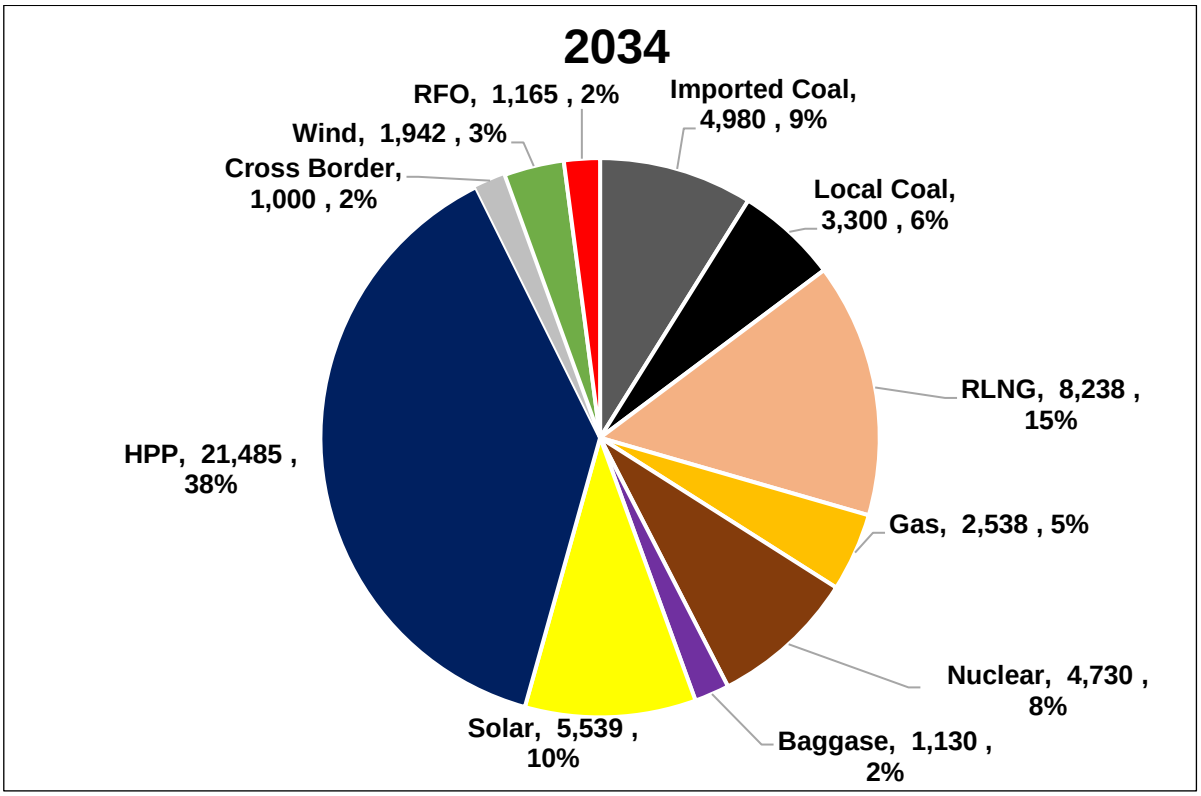


Chart 6-6: IGCEP Generation Mix 2034

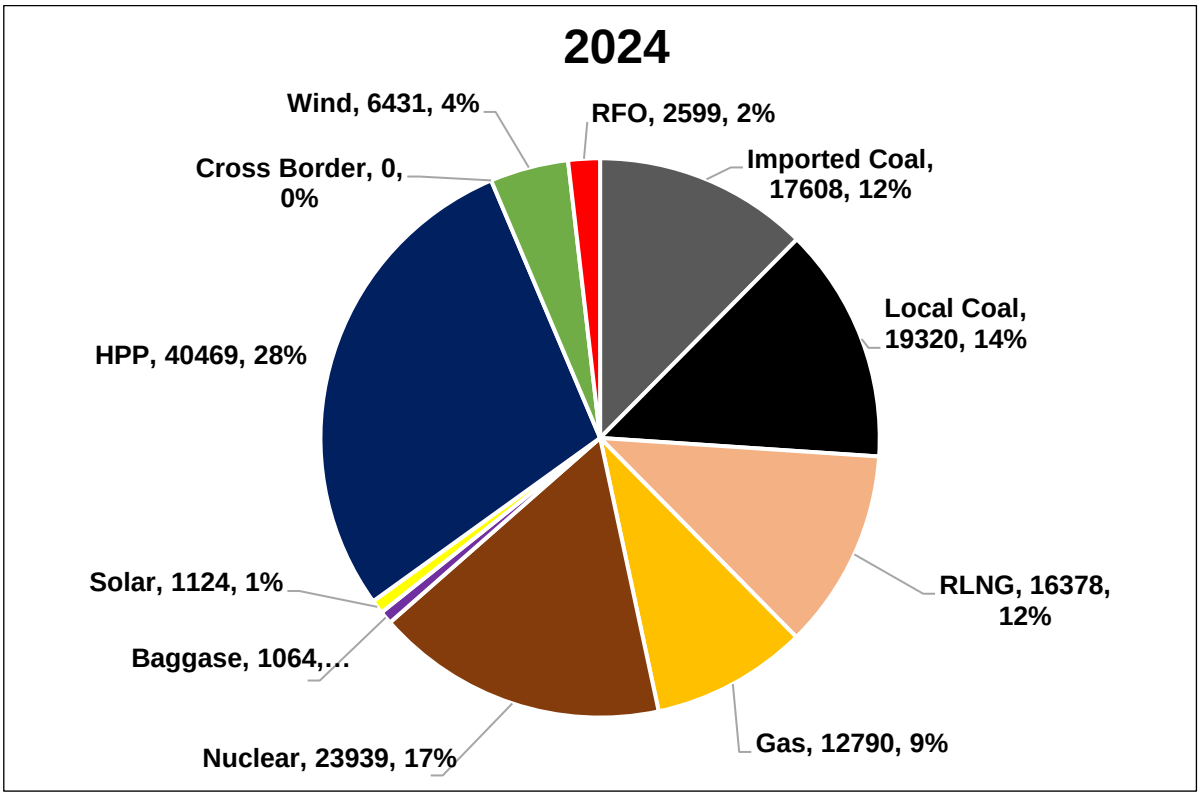


Chart 6-7: IGCEP Generation Mix 2024

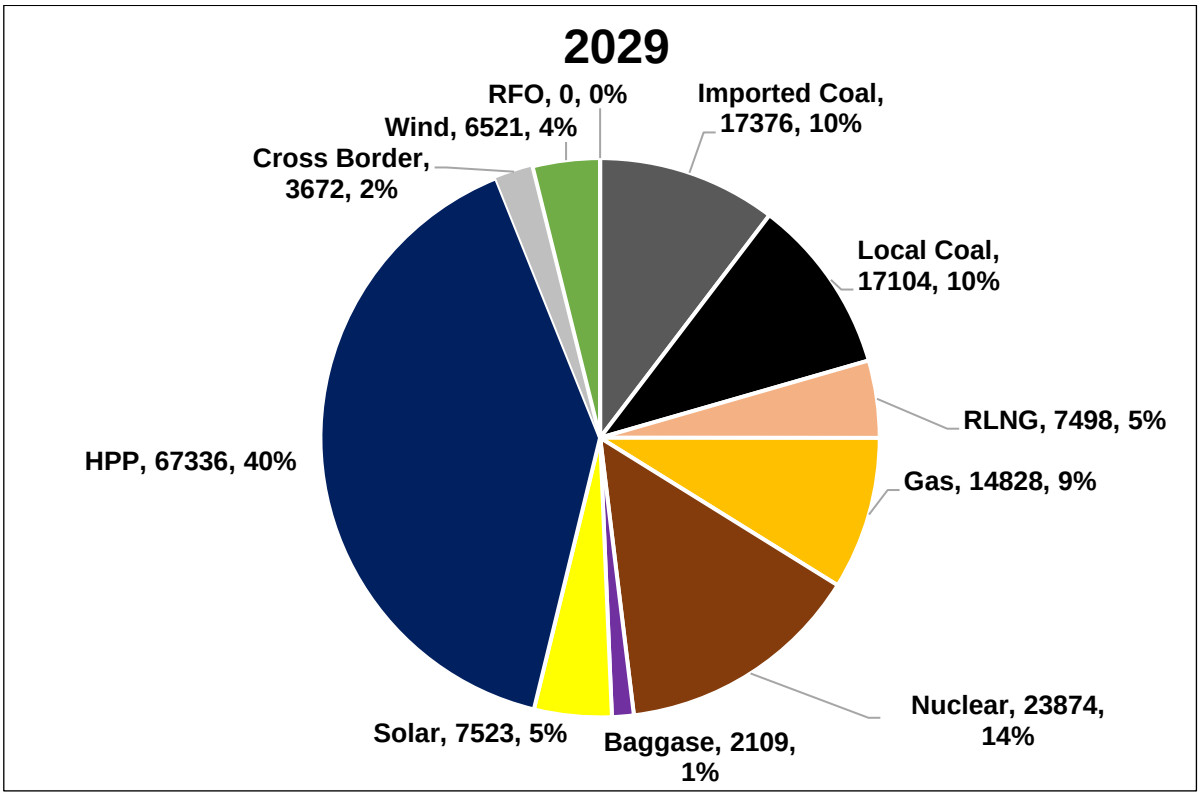


Chart 6-8: IGCEP Generation Mix 2029

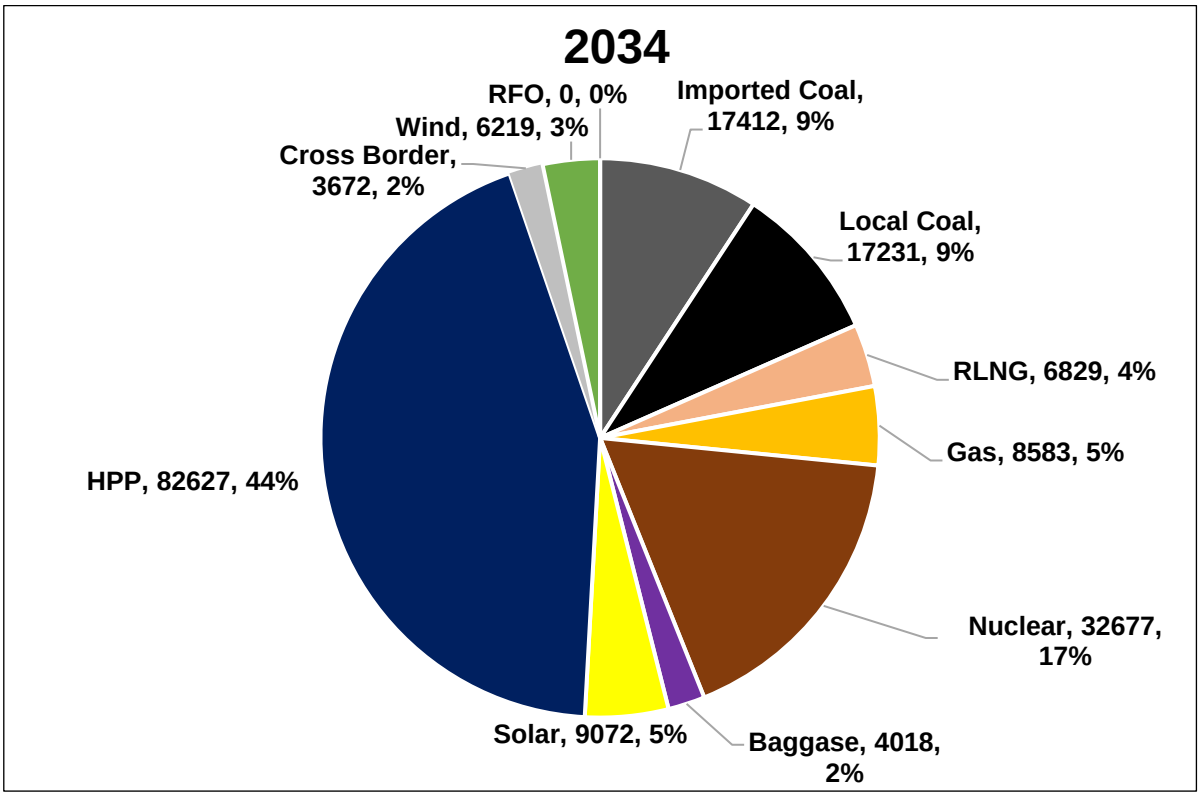


Chart 6-9: IGCEP Generation Mix 2034

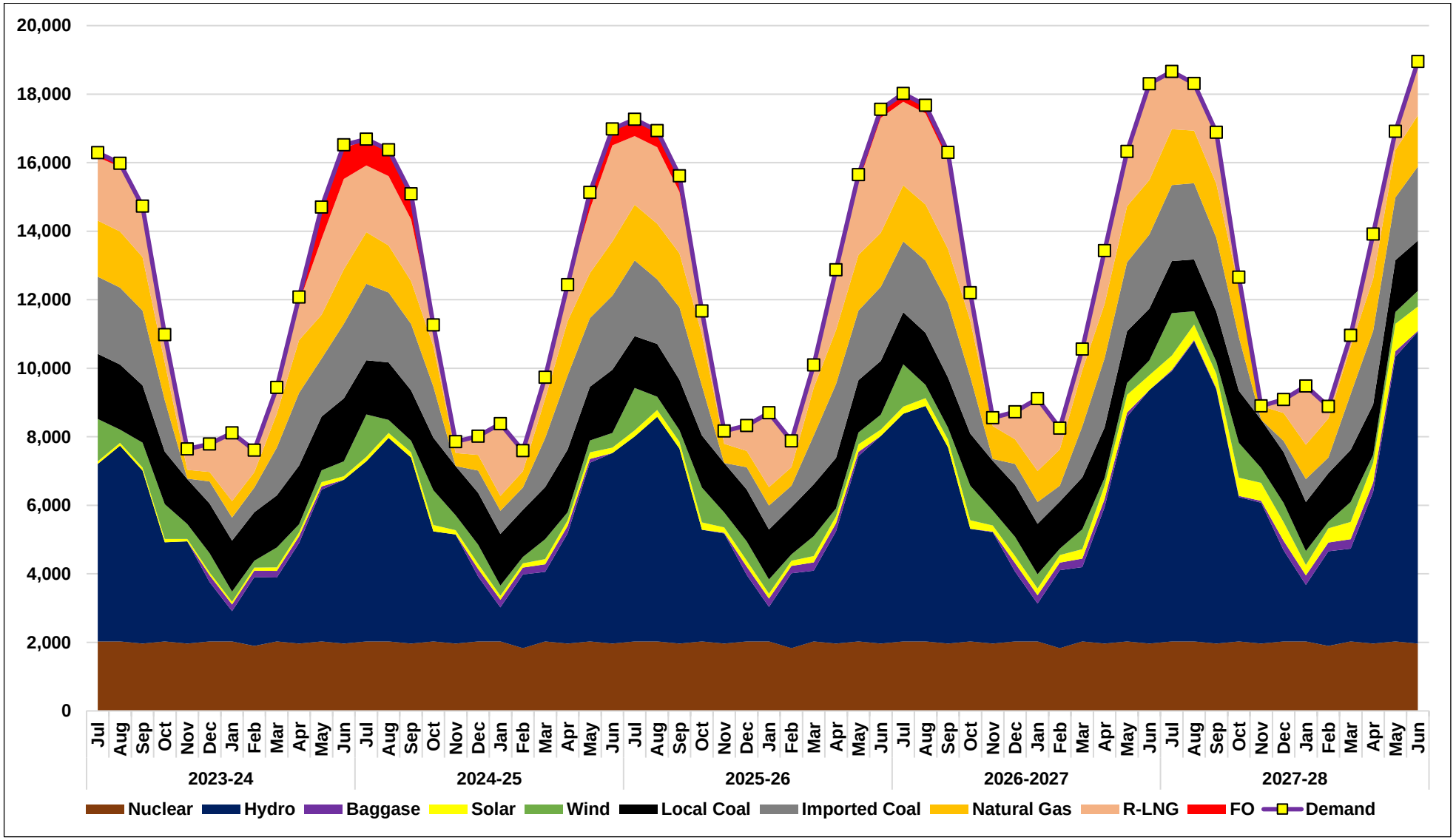


Chart 6-10: IGCEP Monthly Generation Mix 2024-2028 (GWh)

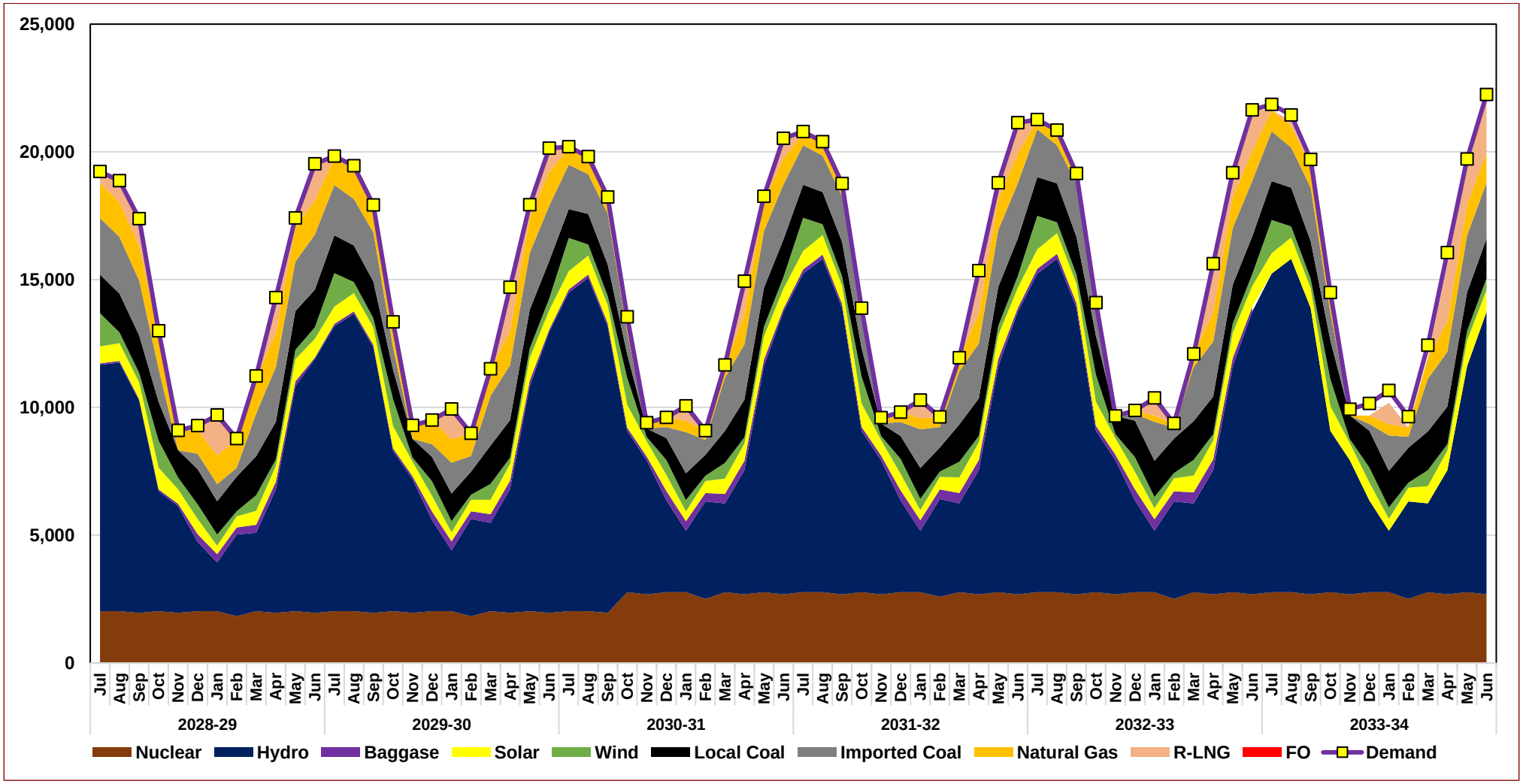


Chart 6-11: IGCEP Monthly Generation Mix 2029-2034 (GWh)

6.9. Carbon Emissions Reduction

Pakistan, like other South Asian countries, grapples with the challenges of a large and growing population, combined with rapidly growing energy needs. Heavily dependent on fossil-fuel imports, the country finds itself vulnerable to global oil price volatility and effects of increased carbon footprint due to power generation by fossil-fuel based technologies.

Pakistan has abundant renewable energy resources that can be utilized for power generation. Hydropower, with its potential in the Northern part of the country, has traditionally been the most prominent source of renewable energy in Pakistan. In addition to hydropower potential, Pakistan is blessed with huge variable renewable resources, however, its harnessing, in true sense, is yet to be materialized.

Pakistan ranks #26 globally, #11 in Asia, #2 among SAARC member states in carbon emissions index, with 200 $MtCO_2$ territorial emissions, all GHG emissions from a country's territory, apart from those associated with international aviation and shipping, in 2022 according to the Global Carbon Atlas.

IGCEP 2024-34 addresses the pursuit of low-carbon energy options, to sustain the relatively low carbon emissions, to bolster energy security and to spur sustainable economic growth. Based on the IGCEP output, carbon emissions have been calculated for existing and upcoming power generation for base case scenario as shown in Chart 7-6 and for all other scenarios. Carbon emissions in the country by power generation accounts for 0.340 kg-CO_2/kWh in FY 2023-2024 and this indicator reduces to 0.209 kg-CO_2/kWh by FY 33-34 which is even less than current average of OECD countries. The value of the carbon emission indicator for Pakistan as per IGCEP 2024-34 is smaller than prevailing world average (.52) as well as non-OECD countries (.60).

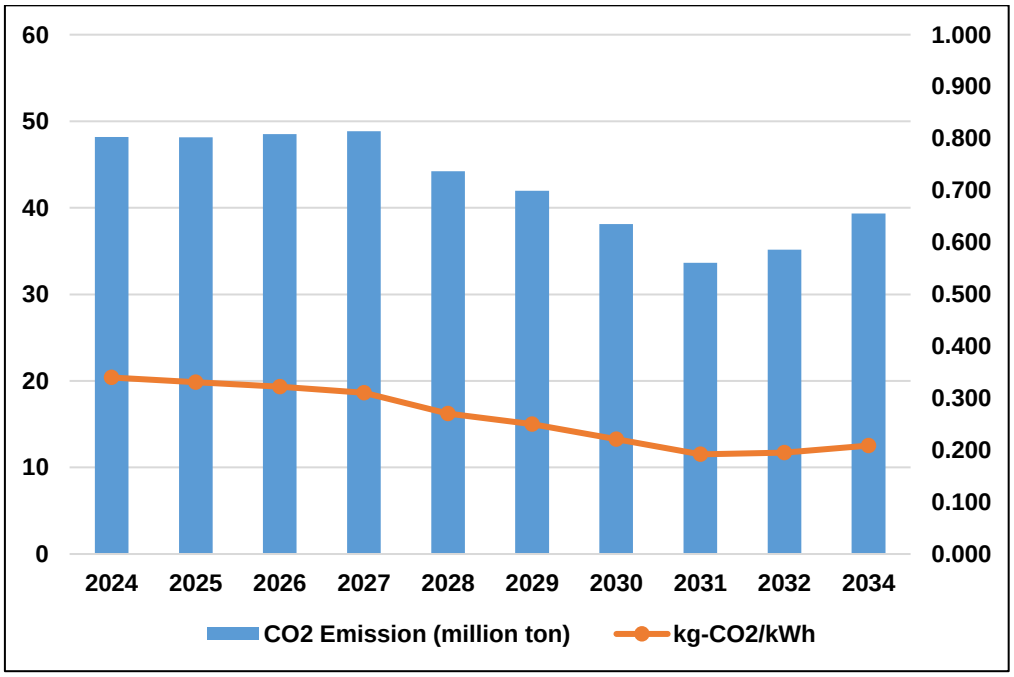


Chart 6-12: Annual CO2 Emission

6.10. Indegenization of Energy Mix

World Energy Council defines energy security as the management of primary energy supply from domestic/indigenous and external sources, reliability of energy infrastructure, ability to meet current and future demand.

Pakistan remains an energy insecure country in context of the on-going economic situation of Pakistan. A major challenge still remains in the power sector is the provision of uninterrupted availability of energy sources at an affordable price.

IGCEP 2024-34 deals with long-term energy security with timely investments to supply energy in line with economic developments and environmental needs. According to IGCEP 2024-34 simulation results, indigenization ratio, which is ratio of energy generated by indigenize generation resources to the energy generated by all generation resources, has been computed for base case scenario as shown in Chart 7-5 and all other sensitivity scenarios to indicate how much energy security, the IGCEP has achieved by FY 2033-34. In 2023-2024, the indigenization ratio of energy is 74.2% that increases with a steep slope to 76.5% by 2027 due to inclusion of hydro, wind and solar based power plants. There is an overall increase to 87.13% by the year 2034 This remains an invaluable aspect for Pakistan power sector on the part of IGCEP 2024-34.

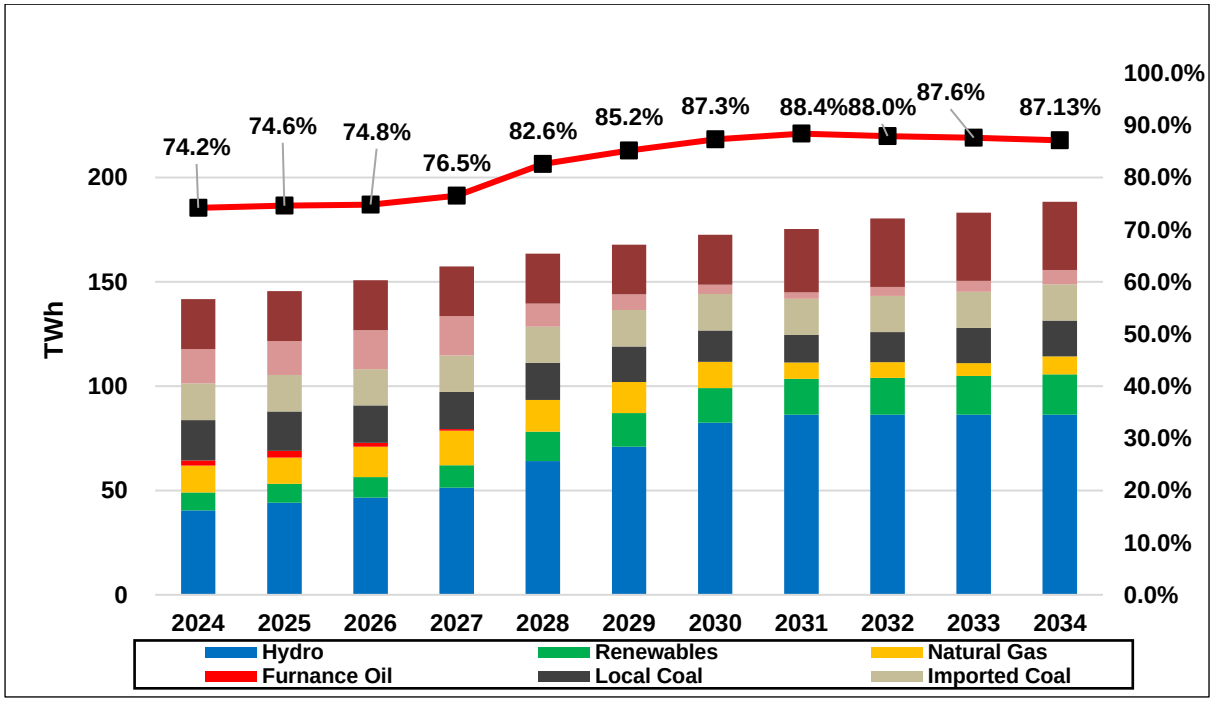


Chart 6-13: Indegenization of Energy Mix

7. THE WAY FORWARD

7. The Way Forward

A few suggestions are offered in this section to further enhance the contents and quality of the future editions of the IGCEP as well as the planning process on the whole.

7.1 Proposed Actions for the Future Generation Plans

a. More options for Demand Side Management (DSM) other than energy efficiency targets, provided by NEECA for the IGCEP 2024, shall be explored for next iterations of the IGCEP by coordinating and working closely with all relevant entities in the country.

b. 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.

c. Access to relevant and quality data must be facilitated. A central data repository may be formed to facilitate planners and policy makers, having specific data privileges and to ensure access to quality data, for data modeling and decision making. 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.

d. 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 staff.

7.2 Making Way for the High Share of Renewables in the Grid

In order to ensure indigenization of energy mix with higher share of clean energy, future plans are required to be aligned with international best practices pertaining to renewable energy.

7.2.1 Hybridization of Variable Renewable Energy Projects

a. Though not envisaged in the prevailing schemes, wind power projects can provide grid support such as frequency regulation, voltage regulation, and reserve power provided hybridization is opted with solar PV as well as battery energy storage. Grid impact and economic implication studies for individual wind power project will need to be carried out by the stakeholders.

b. The combination of wind and solar PV has the advantage that the two sources will complement each other since the peak operating times for each system occur at different times of the day and year. The power generation of such a hybrid system including battery storage, is more continuous i.e., fluctuates less in terms of time and frequency if these are developed and operated jointly. Enabling environment including regulatory and commercial arrangements as well as technical studies should be undertaken for this purpose to maximize the value of indigenous energy resources. The relevant project execution agencies should provide data hybrid RE technologies.

c. All the stakeholders including the sponsors should join hands on setting up and sustaining an energy forecasting system with consensus on some suitable business model for the above purpose. This will significantly help in combatting the existing challenges with respect to dispatch of renewable energy.

7.2.2 Operational Challenges and Solutions for VRE Integration

System operational performance and grid flexibility studies are required to be carried out for VRE intermittency management to ensure its optimal region wise penetration by considering ramping up/down capability by synchronous generators in the system and FACTS / BESS applications. The quantum and/or timelines of wind and solar may vary in future as a result of these studies.

In order to utilize huge renewable resource potential of Pakistan in a sustainable manner, the VRE 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 & regulation and maintaining the reactive power balance.
c. Reserve power even when the renewable resource is not available.

Further, those technologies should be promoted which can be manufactured locally with the ultimate goal of achieving manufacturing of complete WTG, solar PV and associated equipment. All stakeholders should try to maximize local value addition.

7.3 Focusing on Indigenization through Harnessing the Potential of Local Coal

Thar coal reserves are estimated by the Geological Survey of Pakistan to be approximately 175 billion tons – making it one of the largest lignite coal reserves in the world. Thar coalfield, Block II area has exploitable lignite coal reserves of 1.57 billion tons. The total mining capacity of the project is expected to be 20.6 MT/annum. (Source: Engro report).

The power system planners should be communicated, by the project execution agencies, of the study-based analysis of block-wise potential of Thar coal that can be exploited for generation of electric power so it can be adequately modelled in the generation capacity expansion software for the next iterations. Similarly, the precision and authenticity of data and information pertaining to hydrology of upcoming hydro power projects needs to be validated by the concerned project execution agencies in the most meticulous manner.

7.4 Tapping Nuclear Potential

Sustainability of generation is a key factor in power system planning. Nuclear generation is a sustainable energy resource and is also important to mitigate the climate change issues. The nuclear power project is of base load nature, have higher capital cost but lower operational cost with much longer life as compared to other baseload project. Nuclear generation is a very reliable source of energy all around the year especially during low / lean hydro months in Pakistan. Moreover, the addition of nuclear power Project can diversify energy mix of the country in years to come. The location of the potential nuclear power project at Chashma is near northern/mid-country load centers, thus requiring relatively lower transmission evacuation infrastructure as compared to the remotely located baseload power projects.

Therefore, there is a need to compare the viability of the nuclear power project with other indigenous baseload power projects by considering their respective generation and transmission evacuation costs.

7.5 Thinking, Synergizing and Enhancing the Vision Beyond the Borders

It is a well-known fact that there is a severe lack of research culture in the country. It is high time that concrete initiatives are taken to inculcate a thinking culture in the power sector of Pakistan. Role of academia, which is currently restricted to at best a couple of initiatives, may be further encouraged and enhanced by launching certain projects especially envisioned for this purpose. Academia along with the established think-tanks may add much needed value to the power sector interventions in all three segments. For this purpose, securing maximum benefits from the regional and international experience is critical. Power sector professionals need to know the success as well as failure stories of rest of the world in order to customize the best strategies for power sector of Pakistan. Perhaps our professionals and decision makers need to understand that borders are not the hurdles but opportunities for exponential growth.

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ANNEXURES (A – H)

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Annexure A. Load Forecast Data

A-1. Projected GDP Growth Rate by Sector – Business-as-Usual (Low)

FY	GDP Growth Rate (%)			
	Total	Commercial	Industrial	Agriculture
2023	0.29	0.86	-2.94	1.55
2024	3.50	3.50	3.50	3.40
2025	3.60	3.62	3.80	3.40
2026	3.70	3.68	4.00	3.50
2027	3.80	3.75	4.20	3.60
2028	3.74	3.80	4.10	3.30
2029	2.90	3.21	2.30	2.60
2030	3.20	3.38	3.00	2.90
2031	3.50	3.65	3.40	3.20
2032	3.60	3.75	3.50	3.30
2033	3.60	3.78	3.40	3.30
2034	3.40	3.58	3.20	3.10

A-2. Projected GDP Growth Rate by Sector - High Scenario

FY	GDP Growth Rate (%)			
	Total	Commercial	Industrial	Agriculture
2023	0.29	0.86	-2.94	1.55
2024	3.90	4.10	3.50	3.50
2025	4.40	4.72	4.50	3.50
2026	4.80	5.03	5.30	3.80
2027	5.30	5.54	6.10	4.00
2028	5.70	5.89	7.00	4.10
2029	6.10	6.32	7.50	4.30
2030	6.50	6.77	7.80	4.60
2031	7.10	7.36	8.90	4.70
2032	7.30	7.60	9.10	4.70
2033	7.50	7.84	9.20	4.80
2034	7.60	7.87	9.40	4.90

A-3. Historical GDP at constant cost factor 2015-16, Consumer Price Index

FY	GDP				Consumer Price Index (CPI)	CPI (G.R)
	Total	Commercial	Industrial	Agriculture		
	(Rs. Million)					
1970	3,477,476	1,517,378	477,776	1,729,191	1.68	-
1971	3,520,384	1,556,098	508,239	1,676,108	1.80	7.40%
1972	3,602,006	1,611,306	500,689	1,734,279	2.01	11.40%
1973	3,846,978	1,766,671	552,502	1,763,158	2.30	14.60%
1974	4,133,676	1,939,625	598,978	1,836,870	2.90	26.30%
1975	4,294,016	2,134,321	610,694	1,797,951	3.56	22.60%
1976	4,433,709	2,165,345	640,637	1,878,401	3.77	5.90%
1977	4,559,744	2,230,936	659,513	1,925,846	4.11	9.00%
1978	4,912,256	2,465,328	722,262	1,980,167	4.40	7.20%
1979	5,183,791	2,615,929	777,330	2,041,501	4.81	9.30%
1980	5,563,617	2,770,440	861,038	2,176,410	5.35	11.20%
1981	5,919,785	2,952,677	941,818	2,256,034	6.15	15.00%
1982	6,367,416	3,185,884	1,042,956	2,362,607	6.63	7.80%
1983	6,799,664	3,480,310	1,094,458	2,466,669	7.10	7.00%
1984	7,069,819	3,755,140	1,171,753	2,347,665	7.57	6.70%
1985	7,685,466	4,052,662	1,263,542	2,604,130	8.16	7.80%
1986	8,174,492	4,286,484	1,365,891	2,759,042	8.44	3.50%
1987	8,649,496	4,537,778	1,483,977	2,848,812	8.92	5.60%
1988	9,206,192	4,844,842	1,629,723	2,926,623	9.57	7.40%
1989	9,648,855	5,029,418	1,705,522	3,127,690	10.35	8.10%
1990	10,091,613	5,254,644	1,815,185	3,222,480	11.29	9.10%
1991	10,653,444	5,528,425	1,939,678	3,382,383	12.72	12.60%
1992	11,475,327	5,902,079	2,089,644	3,703,754	13.91	9.40%
1993	11,735,975	6,175,579	2,204,839	3,507,972	15.18	9.10%

FY	GDP				Consumer Price Index (CPI)	CPI (G.R)
	Total	Commercial	Industrial	Agriculture		
	(Rs. Million)					
1994	12,268,880	6,435,085	2,304,984	3,691,351	16.99	11.90%
1995	12,775,892	6,743,837	2,320,908	3,933,790	19.05	12.10%
1996	13,618,986	7,080,474	2,430,537	4,394,954	21.01	10.30%
1997	13,850,875	7,336,143	2,422,634	4,400,387	23.63	12.50%
1998	14,334,813	7,456,814	2,570,784	4,599,181	25.16	6.50%
1999	14,934,552	7,829,010	2,697,295	4,688,803	26.09	3.70%
2000	15,517,929	8,154,084	2,731,596	4,974,532	27.42	5.1%
2001	15,823,202	8,406,031	2,844,471	4,866,220	28.11	2.5%
2002	16,315,604	8,806,394	2,921,215	4,871,251	29.16	3.7%
2003	17,086,643	9,265,776	3,044,976	5,073,273	29.72	1.9%
2004	18,365,293	9,806,968	3,540,180	5,196,531	32.23	8.5%
2005	20,010,403	10,639,778	3,969,088	5,533,564	35.05	8.7%
2006	21,174,660	11,329,945	4,132,022	5,882,009	37.73	7.6%
2007	22,347,017	11,962,655	4,451,424	6,083,380	40.37	7.0%
2008	23,461,708	12,553,428	4,828,575	6,193,327	49.06	21.5%
2009	23,546,340	12,720,576	4,577,158	6,409,945	57.42	17.0%
2010	24,153,955	13,128,428	4,733,888	6,424,659	63.22	10.1%
2011	25,029,238	13,645,735	4,947,262	6,550,711	71.85	13.7%
2012	25,989,532	14,245,756	5,073,292	6,787,987	79.76	11.0%
2013	26,946,755	14,977,029	5,111,364	6,969,568	85.63	7.4%
2014	28,039,002	15,644,927	5,342,921	7,143,565	93.01	8.6%
2015	29,176,784	16,327,237	5,619,686	7,295,725	97.22	4.5%
2016	30,508,205	17,261,613	5,939,636	7,306,957	100.0	2.9%
2017	31,914,207	18,232,012	6,213,295	7,468,900	104.8	4.8%
2018	33,859,620	19,317,324	6,783,864	7,758,432	109.7	4.7%

FY	GDP				Consumer Price Index (CPI)	CPI (G.R)
	Total	Commercial	Industrial	Agriculture		
	(Rs. Million)					
2019	34,916,041	20,284,070	6,800,675	7,831,296	117.2	6.8%
2020	34,586,665	20,038,838	6,409,966	8,137,860	129.8	10.7%
2021	36,572,644	21,241,331	6,910,607	8,420,705	141.3	8.9%
2022	**38,755,090**	22,555,934	7,407,709	8,791,447	158.5	12.2%
2023	**38,927,390**	**22,816,361**	**7,191,050**	**8,919,979**	200.1	26.3%

A-4. Category-wise Nominal Tariff

Nominal Tariff (Excluding K Electric) (Rs/kWh)									
Year	**Dom**	**Com**	**Ind**	**Agr**	**Year**	**Dom**	**Com**	**Ind**	**Agr**
1973	0.20	0.27	0.14	0.10	**1998**	1.85	6.55	4.11	1.87
1974	0.20	0.32	0.18	0.11	**1999**	2.35	7.18	4.48	2.33
1975	0.21	0.36	0.21	0.12	**2000**	2.33	7.04	4.16	2.31
1976	0.23	0.46	0.28	0.16	**2001**	2.59	7.04	4.16	2.58
1977	0.25	0.53	0.34	0.16	**2002**	3.18	7.08	4.19	2.93
1978	0.24	0.60	0.37	0.14	**2003**	3.34	7.03	4.42	3.33
1979	0.29	0.72	0.46	0.21	**2004**	4.34	6.85	4.46	3.51
1980	0.35	0.95	0.57	0.28	**2005**	3.40	6.60	4.25	3.49
1981	0.40	1.00	0.63	0.32	**2006**	3.68	8.07	5.09	3.57
1982	0.42	1.08	0.68	0.36	**2007**	3.76	8.21	5.17	3.64
1983	0.43	1.18	0.76	0.38	**2008**	4.36	10.10	6.56	3.55
1984	0.44	1.21	0.76	0.43	**2009**	5.40	11.54	7.48	5.02
1985	0.44	1.23	0.78	0.38	**2010**	6.54	13.24	8.94	6.15
1986	0.49	1.43	0.92	0.43	**2011**	7.31	14.90	9.60	7.99
1987	0.48	1.40	0.89	0.37	**2012**	8.41	16.64	10.90	9.35
1988	0.52	1.71	1.11	0.40	**2013**	8.83	17.87	12.18	11.38
1989	0.62	2.13	1.33	0.46	**2014**	9.48	21.27	15.83	12.02
1990	0.66	2.46	1.50	0.55	**2015**	10.22	22.24	15.39	14.00
1991	0.76	2.76	1.66	0.57	**2016**	10.48	20.17	13.75	12.66
1992	0.81	3.16	1.89	0.63	**2017**	10.65	20.22	14.12	10.64
1993	0.84	3.31	1.99	0.66	**2018**	11.14	21.04	14.92	11.25
1994	0.96	3.86	2.29	0.74	**2019**	12.86	26.12	18.23	11.29
1995	1.10	4.27	2.68	0.94	**2020**	13.62	29.77	23.18	10.60
1996	1.36	5.37	3.36	1.31	**2021**	14.29	31.10	22.48	13.65
1997	1.56	5.66	3.75	1.63	**2022**	18.52	36.99	28.23	16.84

Nominal Tariff (Excluding K Electric) (Rs/kWh)									
Year	**Dom**	**Com**	**Ind**	**Agr**	**Year**	**Dom**	**Com**	**Ind**	**Agr**
2023	26.83	53.78	39.08	26.49	**-**	-	-	-	-

A-5. Category-wise Real Tariff

Real Tariff (Excluding K Electric) (Rs/kWh)									
Year	**Dom**	**Com**	**Ind**	**Agr**	**Year**	**Dom**	**Com**	**Ind**	**Agr**
1973	8.58	11.56	6.23	4.33	**1998**	7.36	26.03	16.33	7.43
1974	6.85	10.96	6.07	3.69	**1999**	9.00	27.53	17.19	8.95
1975	5.88	10.16	5.97	3.37	**2000**	8.51	25.66	15.18	8.43
1976	6.11	12.33	7.47	4.12	**2001**	9.21	25.03	14.79	9.17
1977	6.09	13.01	8.17	3.83	**2002**	10.92	24.29	14.36	10.04
1978	5.50	13.55	8.50	3.26	**2003**	11.24	23.65	14.87	11.20
1979	5.93	14.90	9.61	4.37	**2004**	13.46	21.25	13.84	10.89
1980	6.46	17.69	10.68	5.32	**2005**	9.70	18.83	12.13	9.96
1981	6.43	16.26	10.26	5.23	**2006**	9.75	21.39	13.49	9.46
1982	6.28	16.25	10.20	5.41	**2007**	9.31	20.34	12.81	9.02
1983	6.10	16.62	10.65	5.41	**2008**	12.43	28.83	18.72	10.14
1984	5.79	16.02	10.10	5.63	**2009**	14.32	30.58	19.83	13.32
1985	5.38	15.03	9.62	4.70	**2010**	16.21	32.79	22.14	15.23
1986	5.86	16.92	10.89	5.12	**2011**	10.18	20.74	13.36	11.11
1987	5.33	15.66	10.00	4.13	**2012**	10.55	20.87	13.66	11.72
1988	5.46	17.89	11.61	4.17	**2013**	10.31	20.87	14.22	13.29
1989	6.01	20.62	12.85	4.42	**2014**	10.19	22.87	17.02	12.92
1990	5.85	21.78	13.31	4.83	**2015**	10.51	22.88	15.83	14.40
1991	5.98	21.73	13.02	4.44	**2016**	10.48	20.17	13.75	12.66
1992	5.79	22.68	13.57	4.54	**2017**	10.16	19.29	13.47	10.16
1993	5.54	21.81	13.10	4.36	**2018**	10.15	19.18	13.60	10.25

1994	5.65	22.69	13.48	4.34	**2019**	10.97	22.29	15.56	9.63
1995	5.79	22.43	14.08	4.91	**2020**	10.50	22.94	17.86	8.17
1996	6.48	25.56	16.00	6.22	**2021**	10.17	22.13	15.99	9.71
1997	6.59	23.93	15.85	6.90	**2022**	11.87	23.70	18.09	10.79
2023	13.41	26.87	19.53	13.24	**-**	-	-	-	-

A-6. Category-wise Electricity Consumption (Excluding K Electric)-GWh

Year	Dom	Com	Ind	Agr	Street-Light	Bulk	Others	Total
1970	367	125	1,646	956	20	487	0	3,600
1971	382	152	1,689	1,080	24	638	0	3,966
1972	392	142	2,109	997	75	422	0	4,137
1973	462	165	2,236	1,184	22	530	0	4,599
1974	523	179	2,267	1,142	20	569	42	4,742
1975	566	184	2,245	1,531	20	604	63	5,212
1976	678	222	2,262	1,386	26	697	45	5,315
1977	780	246	2,357	1,400	29	597	43	5,452
1978	1,004	305	2,596	1,718	42	784	42	6,490
1979	1,240	336	2,770	1,666	70	856	43	6,981
1980	1,564	389	3,154	2,057	50	900	46	8,160
1981	1,858	445	3,482	2,125	58	1,056	44	9,068
1982	2,408	574	3,960	2,357	74	873	42	10,288
1983	2,866	634	4,427	2,546	78	992	44	11,587
1984	3,470	739	4,708	2,663	75	1,069	38	12,762
1985	3,887	796	5,061	2,783	77	1,115	37	13,756
1986	4,513	875	5,894	2,880	90	1,215	36	15,504
1987	5,357	991	6,436	3,452	110	1,361	38	17,745
1988	6,290	1,054	7,236	4,394	117	1,571	40	20,702
1989	6,939	1,068	7,578	4,356	127	1,795	35	21,982
1990	7,647	1,106	8,360	5,004	148	1,646	38	24,121

Year	Dom	Com	Ind	Agr	Street-Light	Bulk	Others	Total
1991	8,617	1,152	9,115	5,596	178	1,700	33	26,585
1992	9,691	1,192	10,213	5,823	229	1,799	29	29,267
1993	11,220	1,303	10,913	5,595	195	1,925	27	31,272
1994	11,963	1,318	10,532	5,743	216	1,964	27	32,131
1995	13,448	1,490	10,604	6,220	252	2,112	22	35,032
1996	14,792	1,648	10,335	6,657	301	2,377	20	36,925
1997	15,594	1,757	10,115	7,018	308	2,485	19	38,529
1998	16,367	1,768	10,238	6,888	307	2,694	16	39,422
1999	16,927	1,825	9,945	5,575	159	2,646	15	38,900
2000	18,942	2,003	10,773	4,512	150	2,676	15	40,910
2001	20,019	2,120	11,744	4,896	146	2,634	14	43,384
2002	20,549	2,285	12,637	5,582	149	2,662	12	45,204
2003	20,855	2,516	13,462	5,986	166	2,626	10	47,421
2004	22,668	2,884	14,476	6,624	192	2,796	9	51,492
2005	24,049	3,192	15,568	6,921	227	2,892	12	55,278
2006	27,009	3,768	16,596	7,873	279	3,031	13	62,405
2007	28,944	4,289	17,603	8,097	316	3,252	13	67,419
2008	28,711	4,358	17,299	8,380	340	3,319	11	66,489
2009	27,755	4,203	16,035	8,695	347	3,188	10	65,248
2010	29,479	4,465	16,372	9,585	371	3,357	10	68,847
2011	30,972	4,683	17,700	8,847	374	3,607	10	71,642
2012	30,365	4,563	18,403	8,414	360	3,509	43	71,341
2013	30,329	4,435	18,636	7,548	351	3,659	60	70,481
2014	33,325	4,795	20,550	8,130	351	3,872	32	76,496
2015	34,567	4,853	21,086	7,866	330	3,909	33	78,071
2016	37,123	5,417	21,150	8,364	295	4,239	34	81,682
2017	41,412	6,114	20,067	9,063	298	4,566	31	86,628

Year	Dom	Com	Ind	Agr	Street-Light	Bulk	Others	Total
2018	46,114	6,753	23,274	9,978	319	5,014	450	97,030
2019	45,590	6,629	24,285	9,676	291	5,082	2,335	98,844
2020	47,643	6,260	21,489	9,642	273	4,887	2,597	98,197
2021	49,814	6,688	24,663	10,116	314	4,973	2,802	99,370
2022	52,407	7,387	28,115	10,922	347	5,382	3,306	107,866
2023	46,153	7,074	25,738	9,477	474	5,150	3,272	97,338

A-7. Category-wise Number of Consumers (Excluding K Electric)

Year	Dom	Com	Ind	Agr	Street Light	Bulk & Others	Total
1971	930,350	238,147	64,494	50,212	587	434	1,284,224
1972	998,922	258,328	67,056	52,343	663	477	1,377,789
1973	1,070,192	275,273	72,158	58,472	684	530	1,477,309
1974	1,137,676	300,219	78,277	63,730	718	534	1,581,154
1975	1,232,621	322,252	80,730	69,687	740	560	1,706,590
1976	1,347,122	347,167	85,250	76,508	801	524	1,857,372
1977	1,498,747	376,284	91,365	81,813	926	722	2,049,857
1978	1,670,213	422,901	95,036	90,341	1,018	832	2,280,341
1979	1,866,550	462,950	100,946	95,666	1,315	787	2,528,214
1980	2,049,728	471,757	101,228	98,268	1,477	821	2,723,279
1981	2,479,453	571,800	111,484	104,108	2,090	1,010	3,269,945
1982	2,732,903	624,900	115,890	111,278	2,161	1,118	3,588,250
1983	2,989,397	674,600	119,417	114,390	2,390	1,225	3,901,419
1984	3,261,362	724,462	123,508	118,265	2,511	1,428	4,231,536
1985	3,500,171	770,465	128,441	120,905	2,447	1,541	4,523,970
1986	3,779,838	834,127	133,573	124,918	2,647	1,684	4,876,787
1987	4,106,424	898,118	139,537	130,034	2,801	1,772	5,278,686
1988	4,525,987	964,377	147,439	136,860	3,017	1,943	5,779,623
1989	5,077,686	1,039,033	153,042	143,869	3,462	2,075	6,419,167
1990	5,467,690	1,088,932	158,800	149,554	3,453	2,250	6,870,679

Year	Dom	Com	Ind	Agr	Street Light	Bulk & Others	Total
1991	5,805,382	1,134,754	162,624	152,169	3,531	2,261	7,260,721
1992	6,219,656	1,185,723	169,436	155,305	3,759	2,362	7,736,241
1993	6,622,977	1,221,223	172,145	153,088	3,829	2,488	8,175,750
1994	6,995,561	1,257,887	174,577	157,710	3,730	2,577	8,592,042
1995	7,376,032	1,342,946	179,392	162,303	3,954	2,649	9,067,276
1996	7,783,832	1,344,975	181,092	165,114	3,990	2,728	9,481,731
1997	8,154,894	1,354,940	184,301	167,245	4,064	3,168	9,868,612
1998	8,455,442	1,396,973	186,539	170,562	4,645	2,911	10,217,072
1999	8,911,587	1,517,199	190,084	173,078	4,708	2,979	10,799,635
2000	9,553,828	1,653,870	194,566	174,456	4,892	3,045	11,584,657
2001	10,045,035	1,737,199	195,511	180,411	4,993	3,195	12,166,344
2002	10,482,804	1,803,132	199,839	184,032	4,854	3,361	12,678,022
2003	11,043,530	1,867,226	206,336	191,961	5,441	3,739	13,318,233
2004	11,737,078	1,935,462	210,296	198,829	5,800	3,873	14,091,338
2005	12,490,189	1,983,216	212,233	200,756	6,171	3,677	14,896,242
2006	13,389,762	2,068,312	222,283	220,501	6,550	3,753	15,911,161
2007	14,354,365	2,151,971	233,162	236,255	6,990	3,811	16,986,554
2008	15,226,711	2,229,403	242,401	245,640	7,337	3,874	17,955,366
2009	15,859,373	2,291,628	253,089	258,368	7,680	3,976	18,674,114
2010	16,673,015	2,362,312	263,507	271,268	8,034	4,088	19,582,224
2011	17,322,140	2,421,221	273,067	280,603	8,386	4,066	20,309,483
2012	17,978,395	2,482,702	286,401	286,287	8,698	4,128	21,046,611
2013	18,713,537	2,550,808	296,849	301,115	9,107	4,184	21,875,600
2014	19,323,307	2,635,086	305,294	310,578	9,369	4,236	22,587,870
2015	20,148,495	2,723,708	315,116	318,081	9,554	4,293	23,519,247
2016	21,040,707	2,814,234	325,816	321,055	9,857	5,030	24,516,699
2017	21,991,479	2,905,517	336,045	323,524	10,124	5,114	25,571,803
2018	23,173,856	3,028,054	339,853	315,021	10,426	149,335	27,016,545
2019	24,465,300	3,144,247	342,949	326,656	10,567	183,350	28,473,069
2020	25,803,759	3,245,508	348,087	344,690	10,932	204,393	29,957,369
2021	27,227,283	3,359,777	357,366	359,124	11,284	210,353	31,529,604

Year	Dom	Com	Ind	Agr	Street Light	Bulk & Others	Total
2022	28,743,039	3,475,468	367,736	369,356	11,807	222,390	33,189,796
2023	30,108,981	3,576,002	373,950	374,973	12,365	231,119	34,677,390

Annexure B. Generation Planning Data

B-1(i) NTDC Existing Installed Capacity (As of June 2023)

Sr. No.	Name of Power Project	Fuel	Installed Capacity	Dependable Capacity
			(MW)	
Public Sector				
WAPDA Hydro				
1	Allai Khwar	Hydro	121	121
2	Chashma	Hydro	184	184
3	Dubair Khwar	Hydro	130	130
4	Ghazi Brotha	Hydro	1,450	1,450
5	Golen Gol	Hydro	108	108
6	Jinnah	Hydro	96	96
7	Khan Khwar	Hydro	72	72
8	Mangla	Hydro	1,070	1,070
9	Neelum Jehlum	Hydro	969	969
10	Tarbela 1-14	Hydro	3,478	3,478
11	Tarbela_Ext_04	Hydro	1,410	1,410
12	Warsak	Hydro	243	243
Sub Total: WAPDA Hydro			**9,331**	**9,331**
Small Hydel				
12	Gomal Zam	Hydro	17	17
13	Rasul	Hydro	22	22
14	Dargai	Hydro	20	20

Sr. No.	Name of Power Project	Fuel	Installed Capacity	Dependable Capacity
			(MW)	
15	Nandipur	Hydro	14	14
16	Shadiwal	Hydro	14	14
17	Chichoki	Hydro	13	13
18	Kurram Garhi	Hydro	4	4
19	Renala	Hydro	1	1
20	Chitral	Hydro	1	1
21	Jabban	Hydro	22	22
Total Small Hydel			**128**	**128**
Sub Total: WAPDA Hydro			**9,459**	**9,459**
GENCOs				
22	Jamshoro - I U1	RFO	250	250
23	Jamshoro - II U4	RFO	200	200
24	Jamshoro - II U2	RFO	-	-
25	Jamshoro - II U3	RFO	-	-
Sub Total: GENCOs – I			**450**	**450**
26	Guddu - I U (11-13)	Gas	-	-
27	Guddu - II U (5-10)	Gas	620	265
28	Guddu 747	Gas	747	721
Sub Total: GENCOs – II			**1,367**	**1,012**
29	Muzaffargarh - I U1	RFO	210	210
30	Muzaffargarh - I U2	RFO	210	210

Sr. No.	Name of Power Project	Fuel	Installed Capacity	Dependable Capacity
			(MW)	
31	Muzaffargarh - I U3	RFO	210	210
32	Muzaffargarh - II U4	RFO	320	320
33	Muzaffargarh - II U5	RFO	-	-
34	Muzaffargarh - II U6	RFO	-	-
35	GTPS Block 4 U (5-9)	RLNG	0	0
36	Nandipur	RLNG	525	525
Sub Total: GENCOs – III			**1,475**	**1,475**
Total GENCOs (Public Sector)			**3,292**	**2,937**
Nuclear				
37	CHASHNUPP - I	Nuclear	325	300
38	CHASHNUPP-II	Nuclear	325	300
39	CHASHNUPP-III	Nuclear	340	315
40	CHASHNUPP-IV	Nuclear	340	315
41	K-2	Nuclear	1,100	1,059
42	K-3	Nuclear	1,100	1,059
Sub Total: Nuclear			**3,530**	**3,348**
Private Sector				
Hydel IPPs				
43	Jagran - I	Hydro	30	30
44	Malakand - III	Hydro	81	81
45	New Bong	Hydro	84	84

Sr. No.	Name of Power Project	Fuel	Installed Capacity	Dependable Capacity
			(MW)	
46	Daral Khwar	Hydro	37	37
47	Gul Pur	Hydro	103	103
48	Patrind	Hydro	150	150
49	Ranolia	Hydro	17	18
50	Karot	Hydro	720	720
Sub Total: IPPs Hydro			**1,222**	**1,205**
Thermal IPPs				
51	AES Pakgen	RFO	365	350
52	AGL	RFO	160	156
53	Atlas	RFO	219	214
54	Balloki	RLNG	1,223	1,157
55	Bhikki	RLNG	1,186	1,117
56	China HUBCO	Imp. Coal	1,320	1,249
57	Davis	RLNG	14	14
58	Engro	Gas	217	217
59	Engro Thar	Local Coal	660	660
60	FKPCL	RLNG	157	151
61	Foundation	Gas	178	174
62	Halmore	RLNG	215	200
63	Haveli	RLNG	1231	1168
64	HuB N	RFO	219	214

Sr. No.	Name of Power Project	Fuel	Installed Capacity	Dependable Capacity
			(MW)	
65	HUBCO	RFO	1292	1200
66	KAPCO 1&2	RLNG	500	500
67	Kohinoor	RFO	131	124
68	Lalpir	RFO	362	350
69	Liberty	Gas	235	212
70	Liberty Tech	RFO	200	196
71	Nishat C	RFO	200	196
72	Nishat P	RFO	200	195
73	Orient	RLNG	218	208
74	Port Qasim	Imp. Coal	1,320	1,243
75	Rousch	RLNG	450	395
76	Saba	RFO	136	136
77	Sahiwal Coal	Imp. Coal	1,320	1,244
78	Saif	RLNG	209	204
79	Sapphire	RLNG	209	206
80	Trimmu	RLNG	1263	1244
81	Uch	Gas	586	549
82	Uch-II	Gas	404	359
83	Lucky Coal	Local Coal	660	660
84	Thal Nova	Local Coal	330	330
85	Thar TEL	Local Coal	330	330

Sr. No.	Name of Power Project	Fuel	Installed Capacity	Dependable Capacity
			(MW)	
86	Thar-I (SSRL)	Local Coal	1320	1214
Sub Total (IPPs Fossil Fuels)			**19,238**	**18,336**
Bagasse Based Power Projects				
87	Almoiz	Bagasse	36	36
88	Chanar	Bagasse	26	21
89	Chiniot	Bagasse	63	63
90	Fatima Energy (FEL)	Bagasse	120	120
91	Hamza	Bagasse	15	15
92	JDW - II	Bagasse	26	25
93	JDW - III	Bagasse	27	26
94	Ryk_Mills	Bagasse	30	30
95	Thal_Layyah	Bagasse	25	24
Sub Total Bagasse			**368**	**364**
Wind Power Projects				
96	Act/Tapal Wind	Wind	30	30
97	Artistic_Wind	Wind	50	50
98	Artistic_Wind-2	Wind	50	50
99	Dawood	Wind	50	50
100	Din Wind Energy	Wind	50	50
101	FFC	Wind	50	50
102	FWEL-I	Wind	50	50

Sr. No.	Name of Power Project	Fuel	Installed Capacity	Dependable Capacity
			(MW)	
103	FWEL-II	Wind	50	50
104	Gul Ahmed	Wind	50	50
105	Gul Ahmed-II	Wind	50	50
106	Hawa	Wind	50	50
107	Indus	Wind	50	50
108	Jhimpir	Wind	50	50
109	Lakeside Wind	Wind	50	50
110	Liberty Wind-I	Wind	50	50
111	Master	Wind	50	50
112	Master Green	Wind	50	50
113	Metro_Wind	Wind	50	50
114	Metro_Wind-II	Wind	60	60
115	NASDA Green Wind	Wind	50	50
116	Sachal	Wind	50	50
117	Sapphire_Wind	Wind	50	50
118	Tapal Wind-2	Wind	50	50
119	Tenaga	Wind	50	50
120	Three_Gorges_I	Wind	50	50
121	Three_Gorges_II	Wind	50	50
122	Three_Gorges_III	Wind	50	50
123	Tricom	Wind	50	50

Sr. No.	Name of Power Project	Fuel	Installed Capacity	Dependable Capacity
			(MW)	
124	Tricon_A	Wind	50	50
125	Tricon_B	Wind	50	50
126	Tricon_C	Wind	50	50
127	UEP	Wind	99	99
128	Yunus	Wind	50	50
129	Zephyr	Wind	50	50
130	Zorlu_Wind	Wind	56	56
131	Liberty Wind-II	Wind	50	50
Sub Total (Wind)			**1,845**	**1,845**
Solar Power Projects				
132	Appolo Solar	Solar PV	100	100
133	Best	Solar PV	100	100
134	Crest	Solar PV	100	100
135	QA_Solar	Solar PV	100	100
136	Zhenfa	Solar PV	100	100
Sub Total Solar Power Project			**500**	**500**
Import from Iran			**100**	**100**
Total Public Sector			**16,281**	**15,926**
Total Private Sector			**23,173**	**22,267**
Total Installed Capacity (MW)			**39,554**	**38,293**

B-1 (ii). K-Electric Existing Installed Capacity (As of June 2023)

K-Electric System				
1	SNPC-I	KE_CCGT_Gas	52	51
2	SNPC-II	KE_CCGT_Gas	52	52
3	FPCL	KE_Imported Coal	60	52
4	BQPS2	KE_CCGT_RLNG	573	493
5	BQPS3	KE_CCGT_RLNG	909	889
6	KCCPP	KE_CCGT_RLNG	248	212
7	KTGTPS	KE_CCGT_RLNG	107	92
8	SGTPS	KE_CCGT_RLNG	107	93
9	BQPS1-U5	KE_ST_RLNG	210	188
10	BQPS1-U6	KE_ST_RLNG	210	191
11	BQPS1-U1	KE_ST_RLNG	210	188
12	BQPS1-U2	KE_ST_RLNG	210	191
13	Gharo	KE_PV	50	50
14	Oursun	KE_PV	50	50
15	GAEL	KE_DG_RFO	136	123
16	TPL	KE_DG_RFO	126	120
Total K-Electric System			**3,310**	**3,036**

B-2. Cost Data of Existing, Committed and Candidate Thermal Projects

#	Project Name	Fuel	Fixed O&M	Variable O&M	Fuel Cost	Heat Rate	Unit Cost	
			($/kW/Year)	($/MWh)	($/GJ)	(GJ/MWh)	($/MWh)	Rs/kWh
Existing Power Projects								
1	Engro 90MW	Gas	16.67	3.73	3.97	9.23	36.65	10.60
2	Foundation	Gas	27.62	4.22	3.97	7.52	29.83	8.62
3	Guddu-I	Gas	17.92	0.24	3.58	9.00	32.23	9.32
4	Guddu-II	Gas	11.04	0.24	3.58	10.00	35.81	10.35
5	Guddu-V (747)	Gas	20.43	3.82	3.58	7.32	26.20	7.58
6	Liberty upto 61 GWh	Gas	92.04	3.58	2.30	6.97	16.02	4.63
7	Liberty above61 GWh	Gas	92.04	3.58	11.42	6.97	79.58	23.01
8	Uch upto 152 GWh	Gas	14.46	2.59	2.29	3.57	8.17	2.36
9	Uch-II	Gas	14.37	2.45	6.55	7.52	49.24	14.23
10	SNPC-I	Gas	118.86	5.48	3.45	8.64	29.80	8.61
11	SNPC-II	Gas	150.67	5.48	3.45	8.58	29.61	8.56
12	AES Lalpir	RFO	19.48	1.86	12.92	9.81	126.70	36.63
13	AES Pakgen	RFO	19.48	1.86	13.08	9.81	128.35	37.11
14	HUBCO	RFO	21.36	1.55	13.08	10.10	132.19	38.22
15	Jamshoro-I U1	RFO	14.97	0.32	11.74	11.46	134.52	38.89
16	Jamshoro-II U4	RFO	14.97	0.32	11.74	12.26	143.90	41.60
17	Muzaffargarh-I U1	RFO	30.88	0.56	14.63	11.65	170.45	49.28
18	Muzaffargarh-I U2	RFO	30.88	0.56	14.63	11.81	172.75	49.94
19	Muzaffargarh-I U3	RFO	30.88	0.56	14.63	11.40	166.77	48.21
20	Muzaffargarh-II U4	RFO	30.88	0.56	14.63	11.38	166.54	48.15
21	Saba	RFO	19.48	1.86	16.08	9.69	155.84	45.05
22	AGL	RFO	10.40	29.96	12.40	8.40	104.16	30.11
23	Atlas	RFO	10.24	25.19	12.17	8.40	102.24	29.56
24	Engro 127MW	RFO	3.56	16.67	28.97	9.23	267.36	77.29
25	HuB N	RFO	9.15	22.85	13.72	8.00	109.79	31.74
26	Kohinoor	RFO	6.49	19.48	12.59	8.86	111.59	32.26
27	Liberty Tech	RFO	11.23	26.48	13.31	8.40	111.84	32.33
28	Nishat C	RFO	10.21	26.05	13.04	8.40	109.57	31.68

#	Project Name	Fuel	Fixed O&M	Variable O&M	Fuel Cost	Heat Rate	Unit Cost	
			($/kW/Year)	($/MWh)	($/GJ)	(GJ/MWh)	($/MWh)	Rs/kWh
29	Nishat P	RFO	10.24	26.11	12.21	8.40	102.59	29.66
30	GAEL	RFO	94.33	4.63	11.53	8.83	101.81	29.43
31	TPL	RFO	79.65	4.34	11.53	8.70	100.31	29.00
32	C-1	Uranium	84.80	0.00	0.85	10.91	9.27	2.68
33	C-2	Uranium	121.14	0.00	0.85	10.91	9.27	2.68
34	C-3	Uranium	90.86	0.00	0.85	10.91	9.27	2.68
35	C-4	Uranium	90.86	0.00	0.85	10.91	9.27	2.68
36	K-2	Uranium	62.59	0.00	0.83	10.00	8.30	2.40
37	K-3	Uranium	62.59	0.00	0.83	10.00	8.30	2.40
38	Engro Thar	Local Coal	29.54	4.56	1.45	10.77	15.61	4.51
39	Lucky	Local Coal	27.62	2.38	4.88	10.83	52.85	15.28
40	Thal Nova	Local Coal	29.54	4.56	1.45	10.77	15.62	4.52
41	Thar TEL	Local Coal	29.54	4.56	1.45	10.69	15.51	4.48
42	Thar-I (SSRL)	Local Coal	24.62	4.13	1.70	10.70	18.17	5.25
43	China HUBCO	Imported Coal	27.62	2.43	6.89	4.06	27.94	8.08
44	Port Qasim	Imported Coal	27.61	1.32	5.25	9.37	49.15	14.21
45	Sahiwal Coal	Imported Coal	27.61	1.31	9.99	10.74	107.37	31.04
46	FPCL	Imported Coal	613.84	1.12	6.73	12.30	82.75	23.92
47	Altern	RLNG	95.84	8.37	13.05	7.98	104.13	30.10
48	Davis	RLNG	23.22	3.81	12.16	9.90	120.40	34.81
49	Balloki	RLNG	11.26	1.52	11.26	6.60	74.31	21.48
50	Bhikki	RLNG	11.26	1.20	11.26	6.69	75.28	21.76
51	FKPCL	RLNG	14.07	8.16	14.07	7.35	103.44	29.90
52	Halmore	RLNG	12.47	4.37	12.47	7.25	90.44	26.15
53	Haveli	RLNG	11.26	1.36	11.26	6.55	73.73	21.31
54	KAPCO 1	RLNG	36.91	2.20	36.91	2.75	101.50	29.34
55	KAPCO 2	RLNG	36.91	2.19	36.91	3.01	111.10	32.12
56	Nandipur	RLNG	12.47	2.63	12.47	7.35	91.63	26.49
57	Orient	RLNG	12.47	2.56	12.47	7.20	89.82	25.97
58	Rousch	RLNG	11.26	3.04	11.26	8.84	99.53	28.77

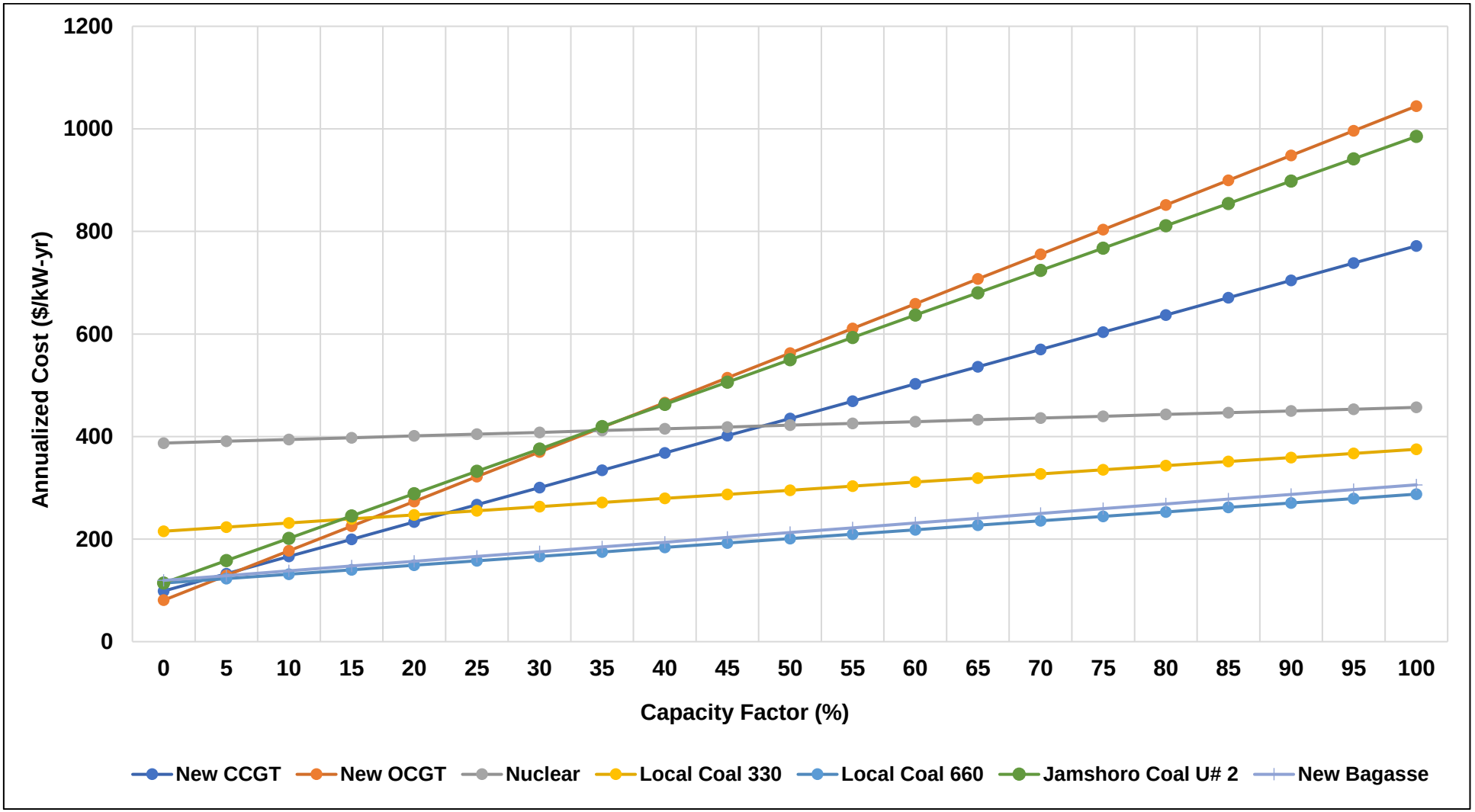
#	Project Name	Fuel	Fixed O&M	Variable O&M	Fuel Cost	Heat Rate	Unit Cost	
			($/kW/Year)	($/MWh)	($/GJ)	(GJ/MWh)	($/MWh)	Rs/kWh
59	Saif	RLNG	12.47	4.35	12.47	7.20	89.82	25.97
60	Saphire	RLNG	12.47	4.30	12.47	7.20	89.82	25.97
61	Trimmu	RLNG	11.26	3.41	11.26	6.52	73.42	21.22
62	BQPS2	RLNG	143.42	2.29	13.01	8.74	113.74	32.88
63	BQPS3	RLNG	114.08	1.46	12.02	6.78	81.55	23.58
64	KCCPP	RLNG	157.13	6.64	13.01	8.76	113.96	32.95
65	KTGTPS	RLNG	77.19	7.46	13.01	9.49	123.42	35.68
66	SGTPS	RLNG	86.20	7.82	13.01	9.66	125.66	36.33
67	BQPS1-U1	RLNG	24.66	1.23	13.01	11.93	155.18	44.86
68	BQPS1-U5	RLNG	97.85	0.91	13.01	10.72	139.51	40.33
69	BQPS1-U6	RLNG	98.07	1.44	13.01	11.96	155.57	44.97
70	BQPS1-U2	RLNG	24.88	1.15	13.01	11.46	149.09	43.10
Committed Power Projects								
71	C-5	Nuclear	35.63	0.00	0.83	9.57	7.95	2.30
72	Gwadar	Imported Coal	32.50	3.37	4.90	9.66	50.76	14.68
73	Jamshoro Coal	Imported Coal	35.60	0.82	10.82	8.71	95.05	27.48
Candidate Power Projects								
74	New CCGT	RLNG	14.74	3.405	11.26	6.52	76.82	22.21
75	New OCGT	RLNG	14.74	3.405	11.26	6.52	76.82	22.21
76	Nuclear	Nuclear	9.02	0	0.83	9.57	7.94	2.30
77	Local Coal 330	Local Coal	29.54	4.13	1.45	9.73	18.24	5.27
78	Local Coal 660	Local Coal	24.62	4.13	1.70	9.23	19.80	5.72
79	Jamshoro Coal U# 2	Imported Coal	14.74	0.82	10.82	8.71	95.04	27.48
80	New Bagasse	Bagasse	9.69	3.697	1.39	12.69	21.27	6.15

B-3. Indexed Project Cost of Candidate Hydro Power Projects

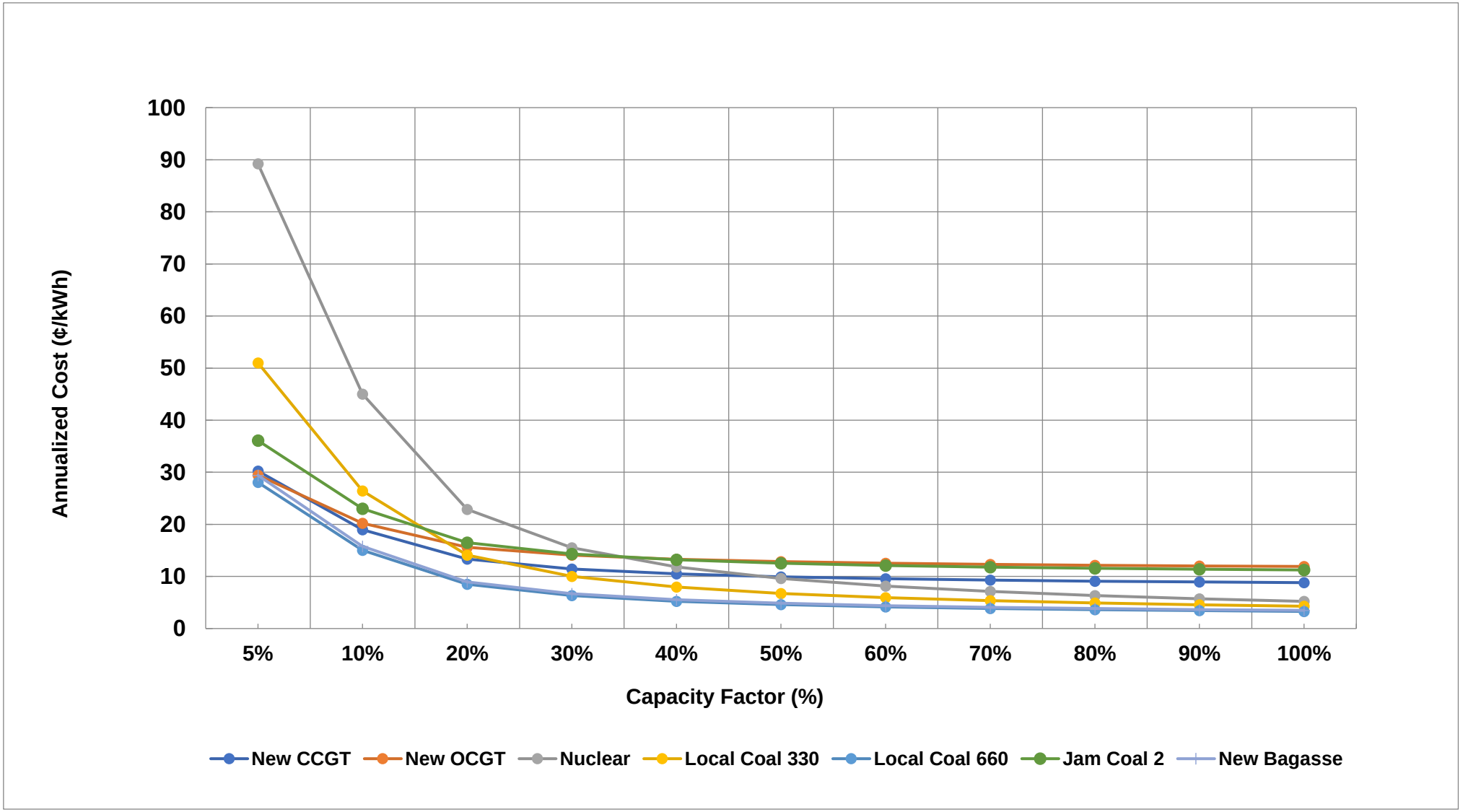
Sr #	Plant Name	Project Cost	Sr #	Plant Name	Project Cost
		$/kW			$/kW
1	Arkari Gol	2524	24	Jhing-II	3622
2	Artistic-I	4188	25	Kaigah	360
3	Artistic-II	2234	26	Kalam Asrit	2316
4	Ashkot	1733	27	Keyal Khwar	2119
5	Asrit Kedam	2386	28	Kohala	2689
6	Athmuqam	3543	29	Lower Spat Gah	2302
7	Azad Pattan	2216	30	Luat	3648
8	Balkani	2287	31	Madyan	3830
9	Bankhwar	3297	32	Mahl	1947
10	Bata Kundi	2303	33	Mastuj	3727
11	Batdara	946	34	Nagdar	1568
12	Chakoti Hatian	2495	35	Nandihar	5018
13	CJ	2296	36	Naran	2829
14	Daral Khwar-II	3301	37	Nila Da Katha	2811
15	Deg Outfall	7139	38	Qadirabad	2545
16	Dowarian	1654	39	Rajdhani	2550
17	Gabral Kalam	3252	40	Shalfalam	2622
18	Gabral Utror	2976	41	Sharmai	2679
19	Ghail	6194	42	Shigo Kas	2667
20	Gumat Nar	3859	43	Shounter	1774
21	Harigehl-Majeedgala	2847	44	Soan	2339
22	Jagran-III	3050	45	Taunsa	2026
23	Jagran-IV	2708	46	Turtonas Uzghor	2125

B-4. Screening Curve for Candidate Thermal Projects

B - 4.1. Screening Curve For Candidate Thermal Projects ($/kW/Yr)



B - 4.2 Screening Curve for candidate Projects (¢/kWh)



B-5. Annualized Cost of Candidate Hydro Power Projects

#	Power Plant	Installed Capacity (MW)	Earliest Availability	FO&M $/kW/Yr	Installed Cost ($/KW)	Annual Energy (GWh)	Economic Life	Plant Factor	Annualized Cost of Energy	
									c/kWh	$/kW /Yr
1	Arkari Gol	99	2031	17.15	2,524	379.10	50	44%	7.31	280
2	Artistic-I	62.606	2031	48.26	4,188	306.56	50	56%	9.91	485
3	Artistic-II	55.032	2031	22.45	2,234	211.75	50	44%	6.80	261
4	Ashkot	300	2031	21.22	1,733	1263.30	50	48%	4.86	205
5	Asrit Kedam	229.4	2033	32.45	2,386	970.60	50	48%	6.69	283
6	Athmuqam	450	2033	48.49	3,543	1981.50	50	50%	9.57	422
7	Azad Pattan	700.8	2032	39.64	2,216	3264.00	50	53%	5.92	276
8	Balkani	7.75	2030	32.14	2,287	35.00	50	52%	6.00	271
9	Bankhwar	35	2030	26.91	3,297	123.76	50	40%	10.24	362
10	Bata Kundi	96	2032	9.89	2,303	510.89	50	61%	4.63	246
11	Batdara	5.2	2028	14.90	946	21.71	30	50%	3.54	154
12	Chakoti Hatian	500	2030	256.31	2,495	2429.70	50	55%	10.67	519
13	CJ	25	2029	24.25	2,296	110.60	50	51%	6.02	266
14	Daral Khwar-II	9.5	2028	31.11	3,301	43.82	50	53%	8.10	374
15	Deg Outfall	4.04	2025	65.47	7,040	27.65	30	78%	12.72	871
16	Dowarian	40	2029	14.90	1,654	173.60	30	50%	5.29	230
17	Gabral Kalam	88	2028	34.85	3,252	273.60	50	35%	11.89	370
18	Gabral Utror	79	2032	39.40	2,976	311.04	50	45%	8.89	350
19	Ghail	1.1	2028	0.08	6,194	5.07	50	53%	13.67	630
20	Gumat Nar	49.5	2030	2.70	3,859	220.17	50	51%	8.88	395
21	Harigehl-Majeedgala	40.32	2031	0.30	2,847	226.98	50	64%	5.57	314
22	Jagran-III	35	2031	1.74	3,050	162.30	30	53%	7.29	338
23	Jagran-IV	22	2028	16.65	2,708	95.96	30	50%	8.01	349

#	Power Plant	Installed Capacity (MW)	Earliest Availability	FO&M $/kW/Yr	Installed Cost ($/KW)	Annual Energy (GWh)	Economic Life	Plant Factor	Annualized Cost of Energy	
									c/kWh	$/kW /Yr
24	Jhing-II	6.05	2029	0.82	3,622	33.81	50	64%	6.92	387
25	Kaigah	545	2033	64.09	360	374.00	50	8%	15.02	103
26	Kalam Asrit	238.2	2033	31.10	2,316	972.63	50	47%	6.72	274
27	Keyal Khwar	128	2029	11.79	2,119	595.00	50	53%	7.29	339
28	Kohala	1124	2032	35.63	2,689	5140.00	50	52%	7.62	349
29	Lower Spat Gah	470	2032	34.99	2,302	1925.00	50	47%	6.79	278
30	Luat	49	2030	2.56	3,648	212.64	50	50%	8.75	380
31	Madyan	157	2029	22.11	3,830	731.85	50	53%	9.33	435
32	Mahl	640	2032	29.14	1,947	4684.01	50	84%	3.50	256
33	Mastuj	48.6	2032	3.06	3,727	239.23	30	56%	8.34	410
34	Nagdar	35.2	2029	13.53	1,568	151.96	30	50%	5.12	222
35	Nandihar	12.3	2031	48.19	5,018	82.71	50	77%	8.58	577
36	Naran	188	2032	9.85	2,829	704.17	50	43%	8.07	302
37	Nila Da Katha	31.3	2030	19.65	2,811	141.58	50	52%	6.90	312
38	Qadirabad	23	2035	24.25	2,545	54.61	50	27%	11.96	284
39	Rajdhani	132	2031	67.59	2,550	677.01	50	59%	6.62	339
40	Shalfalam	60	2032	13.74	2,622	269.24	50	51%	6.43	289
41	Sharmai	152.12	2032	54.60	2,679	689.79	50	52%	7.31	332
42	Shigo Kas	102	2031	39.39	2,667	525.45	50	59%	6.23	321
43	Shounter	48	2029	17.43	1,774	208.37	30	50%	4.79	208
44	Soan	25	2036	24.25	2,339	113.00	50	52%	5.99	271
45	Taunsa	135	2029	24.01	2,026	650.89	50	55%	4.97	240
46	Turtonas Uzghor	82.25	2030	28.83	2,125	380.80	50	53%	5.61	260

B-6. Candidate Hydro projects COD optimized by PLEXOS for different scenarios

#	Candidate Plants Name	Category	Capacity	COD given to PLEXOS	Base Case	Scenarios			
						Medium Demand	High Demand	Delay of Diamer Bhasha	Azad Patan and Kohala HPPs as Committed
					Year	Year	Year	Year	Year
1	Arkari Gol	Hydro	99	Jan-31	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
2	Artistic-I	Hydro	63	Dec-30	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
3	Artistic-II	Hydro	55	Dec-30	Not Picked	Not Picked	2034	Not Picked	Not Picked
4	Ashkot	Hydro	300	Sep-30	Not Picked	2034	2033	Not Picked	Not Picked
5	Asrit Kedam	Hydro	229	Dec-32	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
6	Athmuqam	Hydro	450	Mar-33	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
7	Azad Pattan	Hydro	701	Dec-31	Not Picked	Not Picked	2034	Not Picked	Not Picked
8	Balkani	Hydro	8	Jul-29	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
9	Bankhwar	Hydro	35	Jul-29	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
10	Bata Kundi	Hydro	96	Dec-31	Not Picked	Not Picked	2033	Not Picked	Not Picked
11	Batdara	Hydro	5	Jun-28	2029	2029	2029	2029	2029
12	Chakoti Hatian	Hydro	500	Dec-29	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
13	CJ	Hydro	25	Dec-28	Not Picked	Not Picked	2034	Not Picked	Not Picked
14	Daral Khwar-II	Hydro	10	Dec-27	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked

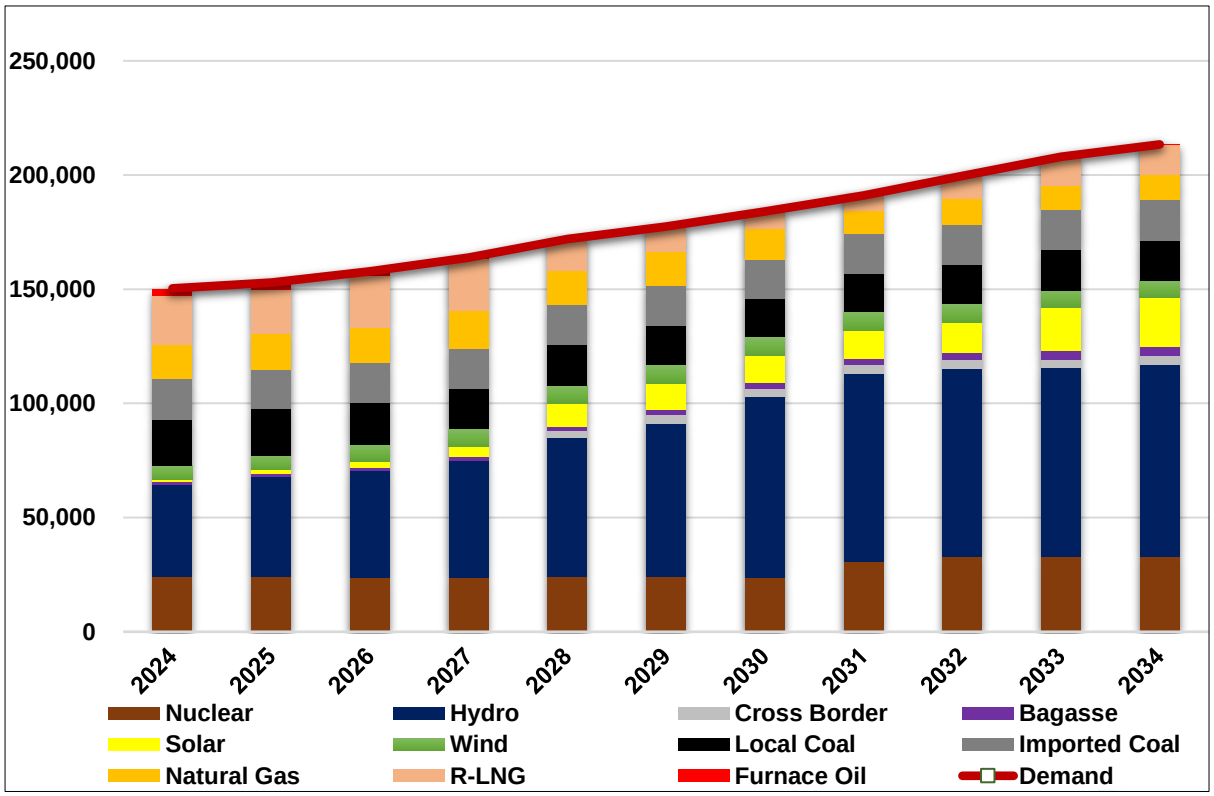
#	Candidate Plants Name	Category	Capacity	COD given to PLEXOS	Base Case	Scenarios			
						Medium Demand	High Demand	Delay of Diamer Bhasha	Azad Patan and Kohala HPPs as Committed
					Year	Year	Year	Year	Year
15	Deg Outfall	Hydro	4	Nov-24	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
16	Dowarian	Hydro	40	Dec-28	Not Picked	2033	2032	Not Picked	Not Picked
17	Gabral Kalam	Hydro	88	Nov-27	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
18	Gabral Utror	Hydro	79	Sep-31	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
19	Ghail	Hydro	1	Dec-27	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
20	Gumat Nar	Hydro	50	Jun-30	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
21	Harigehl-Majeedgala	Hydro	40	Jan-31	Not Picked	Not Picked	2034	Not Picked	Not Picked
22	Jagran-III	Hydro	35	Jan-31	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
23	Jagran-IV	Hydro	22	Jan-28	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
24	Jhing-II	Hydro	6	Jul-28	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
25	Kaigah	Hydro	545	Mar-33	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
26	Kalam Asrit	Hydro	238	Jun-33	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
27	Keyal Khwar	Hydro	128	Aug-28	Not Picked	Not Picked	2034	Not Picked	Not Picked
28	Kohala	Hydro	1,124	Mar-32	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
29	Lower Spat Gah	Hydro	470	Mar-32	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked

#	Candidate Plants Name	Category	Capacity	COD given to PLEXOS	Base Case	Scenarios			
						Medium Demand	High Demand	Delay of Diamer Bhasha	Azad Patan and Kohala HPPs as Committed
					Year	Year	Year	Year	Year
30	Luat	Hydro	49	Jun-30	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
31	Madyan	Hydro	157	Mar-29	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
32	Mahl	Hydro	640	Mar-32	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
33	Mastuj	Hydro	49	Jun-32	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
34	Nagdar	Hydro	35	Jul-28	Not Picked	2033	2032	Not Picked	Not Picked
35	Nandihar	Hydro	12	Jun-31	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
36	Naran	Hydro	188	Dec-31	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
37	Nila Da Katha	Hydro	31	Jul-29	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
38	Qadirabad	Hydro	23	Dec-34	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
39	Rajdhani	Hydro	132	Jun-31	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
40	Shalfalam	Hydro	60	Dec-31	Not Picked	Not Picked	2034	Not Picked	Not Picked
41	Sharmai	Hydro	152	Jun-32	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
42	Shigo Kas	Hydro	102	Dec-30	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked
43	Shounter	Hydro	48	Jun-29	Not Picked	2034	2033	Not Picked	Not Picked
44	Soan	Hydro	25	Dec-35	Not Picked	Not Picked	Not Picked	Not Picked	Not Picked

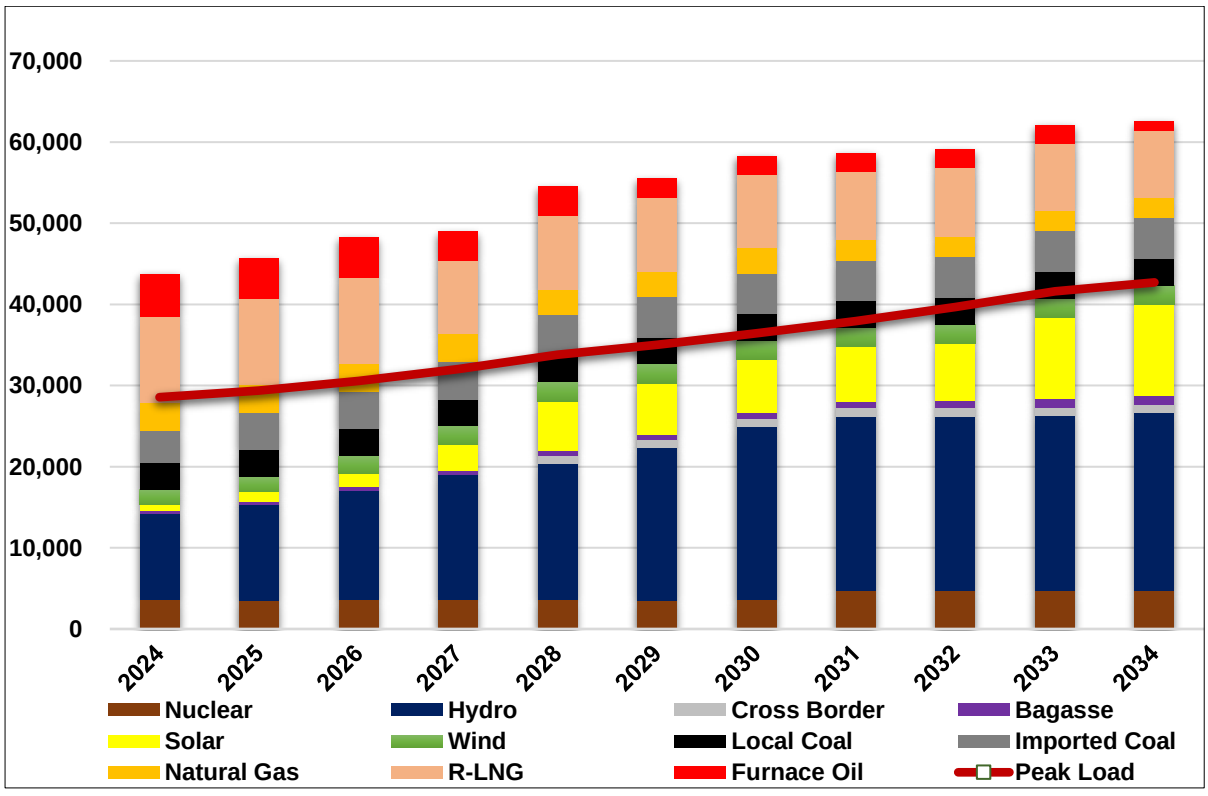
#	Candidate Plants Name	Category	Capacity	COD given to PLEXOS	Base Case	Scenarios			
						Medium Demand	High Demand	Delay of Diamer Bhasha	Azad Patan and Kohala HPPs as Committed
					Year	Year	Year	Year	Year
45	Taunsa	Hydro	135	Jul-28	Not Picked	Not Picked	2033	Not Picked	Not Picked
46	Turtonas Uzghor	Hydro	82	Jul-29	2031	2031	2031	2031	2031

Annexure C. Medium Demand Scenario

C-1. Annual Energy Generation Vs Annual Energy Demand (GWh) - Country



C-2. Installed Capacity Vs Peak Demand (MW) - Country



C-3. Optimized Generation Capacity Additions (MW)

Fiscal Year	Coal Fired Steam Local Coal	Coal Fired Steam Local Coal KE	Combined Cycle on RLNG	Combustion Turbine on RLNG	Nuclear	HPP	Solar Utility MW_p	Net Meter MW_p	Solar KE MW_p	Wind NTDC	Wind KE	Bagasse	Per Year Capacity Addition*	Cummulative Capacity Addition
2024	-	-	-	-	-	-	-	-	-	-	-	-	0	0
2025	-	-	-	-	-	-	-	240	-	-	-	-	0	0
2026	-	-	-	-	-	-	-	241	300	-	300	-	600	600
2027	-	-	-	-	-	-	-	215	200	-	100	-	300	900
2028	-	-	-	-	-	-	1,300	223	-	-	-	-	1,300	2,200
2029	-	-	-	-	-	5	-	186	-	-	-	-	5	2,205
2030	-	-	-	-	-	-	-	191	-	-	-	-	0	2,205
2031	-	-	-	-	-	82	-	205	-	-	-	-	82	2,287
2032	-	-	-	-	-	-	217	92	-	-	-	-	217	2,504
2033	-	-	-	-	-	75	2,444	303	286	-	-	-	2,805	5,310
2034	-	-	-	-	-	348	632	211	301	-	-	-	1,281	6,591
Total	**-**	**-**	**-**	**-**	**-**	**511**	**4,593**	**2,107**	**1,087**	**-**	**400**	**-**	**6,591**	

*Does not include 2,107 MWP of Net Metering, being committed

C-4. List of Projects uptill 2031 (Committed + Optimized)

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
2023-24							
1	Helios	PV	50	50	PPIB	Category-II Project	Dec-23
2	HNDS	PV	50	50	PPIB	Category-II Project	Dec-23
3	Meridian	PV	50	50	PPIB	Category-II Project	Dec-23
4	Jabori	Hydro	10.2	10.2	GoKPK	PC-1 Approved	Oct-27
Generation Additions in 2023-24 (MW)			**160**	**160**			
Cumulative Addition up till 2024 (MW)			**160**	**160**			
2024-25							
1	Suki Kinari (U#1)	Hydro	221	221	PPIB	Financial Close	Aug-24
2	Suki Kinari (U#2)	Hydro	221	221	PPIB	Financial Close	Sep-24
3	Suki Kinari (U#3)	Hydro	221	221	PPIB	Financial Close	Oct-24
4	Suki Kinari (U#4)	Hydro	221	221	PPIB	Financial Close	Nov-24
5	Jamshoro Coal	Imported Coal	660	629	GENCO Holding	PC-1 Approved	Jun-24
6	Zorlu	PV	100	100	PPDB	Category-II Project	Oct-24
7	Lawi	Hydro	69	69	GoKPK	PC-1 Approved	Dec-24
8	Jagran-II	Hydro	48	48	AJK-HEB	PC-1 Approved	Dec-24
9	Koto	Hydro	40.8	40.8	GoKPK	PC-1 Approved	Jun-24
10	Shahtaj	Bagasse	32	32	PPIB	Category-I Project	Jun-24
11	Access_Solar	PV	11.52	11.52	PPIB	Category-I Project	Sep-24
12	Access_Electric	PV	10	10	PPIB	Category-I Project	Sep-24
13	Safe	PV	10	10	PPIB	Category-I Project	Nov-24
14	Chamfall	Hydro	3.22	3.22	AJK-HEB	PC-1 Approved	Jun-24
15	Kurram Tangi	Hydro	18	18	C&M-WAPDA	PC-1 Approved	Apr-29
16	Karora	Hydro	11.8	11.8	GoKPK	PC-1 Approved	Dec-27

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
17	Mangla Refurbishment U#3,4	Hydro	70	70	WAPDA	Committed	Jul-24
18	Net Meter	PV	240	240	DISCOs	Committed	Jul-24
Generation Additions in 2024-25 (MW)			**2,208**	**2,177**			
Cumulative Addition up till 2025 (MW)			**2,369**	**2,338**			
2025-26							
1	Tarbela_Ext_5 (U#1)	Hydro	510	510	WAPDA	PC-1 Approved	Nov-25
2	Tarbela_Ext_5 (U#2)	Hydro	510	510	WAPDA	PC-1 Approved	Dec-25
3	Tarbela_Ext_5 (U#3)	Hydro	510	510	WAPDA	PC-1 Approved	Jan-26
4	Gorkin Matiltan	Hydro	84	84	GoKPK	PC-1 Approved	Aug-25
5	TAY	Bagasse	30	30	PPIB	Category-II Project	Aug-25
6	Riali-II (U#1)	Hydro	3.5	3.5	PPIB	LOS (Issued)	Jun-25
7	Riali-II (U#2)	Hydro	3.5	3.5	PPIB	LOS (Issued)	Jun-25
8	Nardagian	Hydro	3.22	3.22	AJK-HEB	PC-1 Approved	Dec-25
9	Mangla Refurbishment U#1,2	Hydro	70	70	WAPDA	Committed	Dec-25
10	Net Meter	PV	241	241	DISCOs	Committed	Jul-25
11	KE_New_Solar	PV	300	300	KE	Optimized	Jul-25
12	KE_New_Wind	Wind	300	300	KE	Optimized	Jul-25
Generation Additions in 2025-26 (MW)			**2,565**	**2,565**			
Cumulative Addition up till 2026 (MW)			**4,934**	**4,903**			
2026-27							
1	Dasu (U#1)	Hydro	360	360	WAPDA	PC-1 Approved	Mar-27
2	Dasu (U#2)	Hydro	360	360	WAPDA	PC-1 Approved	Apr-27
3	Dasu (U#3)	Hydro	360	360	WAPDA	PC-1 Approved	May-27
4	Mohmand Dam (U#1)	Hydro	200	200	WAPDA	PC-1 Approved	Dec-26
5	Mohmand Dam (U#2)	Hydro	200	200	WAPDA	PC-1 Approved	Jan-27

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
6	Mohmand Dam (U#3)	Hydro	200	200	WAPDA	PC-1 Approved	Mar-27
7	Mohmand Dam (U#4)	Hydro	200	200	WAPDA	PC-1 Approved	Apr-27
8	PV_Committed_A	PV	600	600	PPIB	Committed	Jan-27
9	PV_Committed_B	PV	600	600	PPIB	Committed	Apr-27
10	Kathai-II (U#1)	Hydro	4	4	PPIB	LOS (Issued)	Jul-26
11	Kathai-II (U#2)	Hydro	4	4	PPIB	LOS (Issued)	Jul-26
12	Mangla Refurbishment U#9,10	Hydro	70	70	WAPDA	Committed	Apr-27
13	Net Meter	PV	215	215	DISCOs	Committed	Jul-26
14	KE_New_Solar	PV	300	200	KE	Optimized	Jul-26
15	KE_New_Wind	Wind	300	100	KE	Optimized	Jul-26
Generation Additions in 2026-27 (MW)			**3,973**	**3,673**			
Cumulative Addition up till 2027 (MW)			**8,907**	**8,576**			
2027-28							
1	Dasu (U#4)	Hydro	360	360	WAPDA	PC-1 Approved	Oct-27
2	Dasu (U#5)	Hydro	360	360	WAPDA	PC-1 Approved	Nov-27
3	Dasu (U#6)	Hydro	360	360	WAPDA	PC-1 Approved	Dec-27
4	PV_Committed_C	PV	1200	1200	PPIB	Committed	Nov-27
5	CASA	Hydro	1000	1000	GoP	G2G	Aug-27
6	Gwadar	Imported Coal	300	273	PPIB	G2G/CPEC	Dec-27
7	Balakot	Hydro	300	300	GoKPK	PC-1 Approved	Dec-27
8	Siachen	PV	100	100	GoS	Category-II Project	Jun-28
9	Manjhand	PV	50	50	PPIB/GoS	PC-1 Approved	Jun-28
10	Trans_Atlantic	Wind	50	50	PPIB	Category-II Project	Jun-28
11	Western	Wind	50	50	PPIB	Category-II Project	Jun-28
12	Net Meter	PV	223	223	DISCOs	Committed	Jul-27

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
13	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-27
14	New Solar NTDC	PV	1300	1300	PPIB	Optimized	Jul-27
Generation Additions in 2027-28 (MW)			**5,753**	**5,726**			
Cumulative Addition up till 2028 (MW)			**14,660**	**14,302**			
2028-29							
1	Diamer Bhasha (U#1)	Hydro	375	375	WAPDA	PC-1 Approved	Jan-29
2	Diamer Bhasha (U#2)	Hydro	375	375	WAPDA	PC-1 Approved	Feb-29
3	Diamer Bhasha (U#3)	Hydro	375	375	WAPDA	PC-1 Approved	Apr-29
4	Diamer Bhasha (U#4)	Hydro	375	375	WAPDA	PC-1 Approved	May-29
5	Diamer Bhasha (U#5)	Hydro	375	375	WAPDA	PC-1 Approved	Jun-29
6	Mangla Refurbishment U#7,8	Hydro	30	30	WAPDA	Committed	Sep-28
7	Net Meter	PV	186	186	DISCOs	Committed	Jul-28
8	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-28
9	Batdara	Hydel	5.2	5.2	AJK-HEB	Optimized	Jul-28
Generation Additions in 2028-29 (MW)			**2196.2**	**2196.2**			
Cumulative Addition up till 2029 (MW)			**16,856**	**16,498**			
2029-30							
1	Diamer Bhasha (U#6)	Hydro	375	375	WAPDA	PC-1 Approved	Jul-29
2	Diamer Bhasha (U#7)	Hydro	375	375	WAPDA	PC-1 Approved	Aug-29
3	Diamer Bhasha (U#8)	Hydro	375	375	WAPDA	PC-1 Approved	Sep-29
4	Diamer Bhasha (U#9)	Hydro	375	375	WAPDA	PC-1 Approved	Oct-29
5	Diamer Bhasha (U#10)	Hydro	375	375	WAPDA	PC-1 Approved	Nov-29
6	Diamer Bhasha (U#11)	Hydro	375	375	WAPDA	PC-1 Approved	Jan-30
7	Diamer Bhasha (U#12)	Hydro	375	375	WAPDA	PC-1 Approved	Feb-30
8	Net Meter	PV	191	191	DISCOs	Committed	Jul-29

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
9	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-29
Generation Additions in 2029-30 (MW)			**2,916**	**2,916**			
Cumulative Addition up till 2030 (MW)			**19,772**	**19,414**			
2030-31							
1	C-5	Nuclear	1200	1117	PAEC	PC-1 Approved	Sep-30
2	Net Meter	PV	205	205	DISCOs	Committed	Jul-30
3	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-30
4	Turtonas Uzghor	Hydel	82.25	82.25	KE	Optimized	Jul-30
Generation Additions in 2030-31 (MW)			**1,587**	**1,504**			
Cumulative Addition up till 2031 (MW)			**21,359**	**20,918**			
2031-32							
1	Net Meter	PV	92	92	DISCOs	Committed	Jul-31
2	New Technology	0	100	100	PPIB/PPDB	Committed	Jul-31
3	New Solar NTDC	PV	217	217	PPIB	Optimized	Jul-31
Generation Additions in 2031-32 (MW)			**409**	**409**			
Cumulative Addition up till 2032 (MW)			**21,768**	**21,327**			
2032-33							
1	Net Meter	PV	303	303	DISCOs	Committed	Jul-32
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-32
3	New Solar NTDC	PV	2444	2444	PPIB	Optimized	Jul-32
4	New Solar KE	PV	286	286	KE	Optimized	Jul-32
5	Dowarian	Hydel	40	40	AJK-HEB	Optimized	Jul-32
6	Nagdar	Hydel	35.2	35.2	AJK-HEB	Optimized	Jul-32
Generation Additions in 2032-33 (MW)			**3,208**	**3,208**			
Cumulative Addition up till 2033 (MW)			**24,976**	**24,535**			

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
2033-34							
1	Net Meter	PV	211	211	DISCOs	Committed	Jul-33
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-33
3	New Solar NTDC	PV	632	632	PPIB	Optimized	Jul-33
4	New Solar KE	PV	301	301	KE	Optimized	Jul-33
5	Ashkot	Hydel	300	300	PPIB	Optimized	Jul-33
6	Shounter	Hydel	48	48	AJK-HEB	Optimized	Jul-33
Generation Additions in 2033-34 (MW)			**1,592**	**1,592**			
Cumulative Addition up till 2034 (MW)			**26,568**	**26,127**			

C-5. Annual Capacity Factors (%age)

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
1	Almoiz	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
2	Chanar	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
3	Chiniot	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
4	CSP	Bagasse	0.00	0.00	44.50	44.49	44.49	44.49	44.50	44.49	44.49
5	Fatima	Bagasse	6.53	6.53	6.50	6.51	2.80	2.75	6.01	3.30	6.08
6	Hamza	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
7	JDW-II	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
8	JDW-III	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
9	New_Bagasse	Bagasse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Ryk_Mills	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
11	Shahtaj	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
12	TAY	Bagasse	65.87	54.68	54.81	54.68	54.68	54.68	54.81	54.68	54.68
13	Thal_Layyah	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
14	Access_Electric	PV	20.27	20.27	20.07	20.09	20.09	20.09	20.07	19.11	19.11
15	Access_Solar	PV	20.27	20.27	20.07	20.09	20.09	20.09	20.07	19.11	19.11
16	Appolo	PV	19.78	19.78	19.64	19.64	19.64	19.64	19.64	18.92	18.92
17	Atlas_Solar(Zhenfa)	PV	17.50	17.50	17.33	17.35	17.35	17.35	17.33	16.33	16.33
18	Best	PV	19.35	19.35	19.20	19.20	19.20	19.20	19.20	18.48	18.48
19	Crest	PV	20.10	20.10	19.95	19.95	19.95	19.95	19.95	19.24	19.24
20	Helios	PV	21.35	21.35	21.14	21.16	21.16	21.16	21.14	20.22	20.22
21	HNDS	PV	21.35	21.35	21.14	21.16	21.16	21.16	21.14	20.22	20.22
22	Manjhand	PV	0.00	0.00	38.19	21.16	21.16	21.16	21.14	20.22	20.22
23	Meridian	PV	21.35	21.35	21.14	21.16	21.16	21.16	21.14	20.22	20.22
24	Net_Meter	PV	18.00	18.00	18.01	18.01	18.01	18.01	18.01	17.89	17.89
25	New_Solar_North/Center	PV	0.00	0.00	25.55	25.55	25.55	25.55	25.55	25.39	25.39
26	New_Solar_South	PV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	PV_Committed_A	PV	0.00	19.67	20.07	20.09	20.09	20.09	20.07	19.11	19.11
28	PV_Committed_B	PV	0.00	27.85	20.07	20.09	20.09	20.09	20.07	19.11	19.11
29	PV_Committed_C	PV	0.00	0.00	18.71	20.09	20.09	20.09	20.07	19.11	19.11
30	QA_Solar	PV	18.25	18.25	18.10	18.09	18.09	18.09	18.10	17.46	17.46
31	Safe	PV	20.27	20.27	20.07	20.09	20.09	20.09	20.07	19.11	19.11
32	Siachen	PV	0.00	0.00	38.19	21.16	21.16	21.16	21.14	20.22	20.22
33	Zorlu	PV	20.27	20.27	20.07	20.09	20.09	20.09	20.07	19.11	19.11
34	Gharo	KE_PV	26.40	26.40	26.38	26.39	26.39	26.39	26.38	26.08	26.08
35	KE_New_Solar	KE_PV	23.11	23.11	23.11	23.12	23.12	23.12	23.11	22.96	22.96
36	Oursun	KE_PV	21.87	21.87	21.88	21.88	21.88	21.88	21.88	21.89	21.89
37	Act	Wind	37.41	37.41	37.85	37.91	37.91	37.91	37.85	35.45	35.45
38	Act_2	Wind	42.94	42.94	43.81	43.89	43.89	43.89	43.81	40.49	40.49
39	Artistic_wind	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
40	Artistic_Wind_2	Wind	42.94	42.94	43.81	43.89	43.89	43.89	43.81	40.49	40.49

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
41	Dawood	Wind	37.41	37.41	37.85	37.91	37.91	37.91	37.85	35.45	35.45
42	Din	Wind	42.94	42.94	43.81	43.89	43.89	43.89	43.81	40.49	40.49
43	FFC	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
44	FWEL-I	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
45	FWEL-II	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
46	Gul Ahmed	Wind	37.41	37.41	37.85	37.91	37.91	37.91	37.85	35.45	35.45
47	Gul_Electric	Wind	42.94	42.94	43.81	43.89	43.89	43.89	43.81	40.49	40.49
48	Hawa	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
49	Indus_Energy	Wind	42.94	42.94	43.81	43.89	43.89	43.89	43.81	40.49	40.49
50	Jhimpir	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
51	Lakeside	Wind	44.07	44.07	44.97	45.04	45.04	45.04	44.97	41.56	41.56
52	Liberty_Wind_1	Wind	42.94	42.94	43.81	43.89	43.89	43.89	43.81	40.49	40.49
53	Liberty_Wind_2	Wind	42.94	42.94	43.81	43.89	43.89	43.89	43.81	40.49	40.49
54	Master	Wind	37.41	37.41	37.85	37.91	37.91	37.91	37.85	35.45	35.45
55	Master_Green	Wind	42.94	42.94	43.81	43.89	43.89	43.89	43.81	40.49	40.49
56	Metro_Power	Wind	38.62	38.62	39.07	39.14	39.14	39.14	39.07	36.60	36.60
57	Metro_Wind	Wind	42.94	42.94	43.81	43.89	43.89	43.89	43.81	40.49	40.49
58	NASDA	Wind	44.07	44.07	44.97	45.04	45.04	45.04	44.97	41.56	41.56
59	New_Wind	Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	Sachal	Wind	37.41	37.41	37.85	37.91	37.91	37.91	37.85	35.45	35.45
61	Sapphire_Wind	Wind	37.41	37.41	37.85	37.91	37.91	37.91	37.85	35.45	35.45
62	Tenaga	Wind	37.41	37.41	37.85	37.91	37.91	37.91	37.85	35.45	35.45
63	Three_Gorges_I	Wind	38.62	38.62	39.07	39.14	39.14	39.14	39.07	36.60	36.60
64	Three_Gorges_II	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
65	Three_Gorges_III	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
66	Trans_Atlantic	Wind	0.00	0.00	76.83	41.96	41.96	41.96	41.89	38.48	38.48
67	Tricom	Wind	42.94	42.94	43.81	43.89	43.89	43.89	43.81	40.49	40.49
68	Tricon_A	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
69	Tricon_B	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
70	Tricon_C	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
71	UEP	Wind	37.41	37.41	37.85	37.91	37.91	37.91	37.85	35.45	35.45
72	Western	Wind	0.00	0.00	75.90	43.89	43.89	43.89	43.81	40.49	40.49
73	Yunus	Wind	37.41	37.41	37.85	37.91	37.91	37.91	37.85	35.45	35.45
74	Zephyr	Wind	34.36	34.36	35.36	35.42	35.42	35.42	35.36	32.73	32.73
75	Zorlu_Wind	Wind	38.62	38.62	39.07	39.14	39.14	39.14	39.07	36.60	36.60
76	KE_New_Wind	KE_Wind	41.00	41.00	41.89	41.96	41.96	41.96	41.89	38.48	38.48
77	CASA	Interconnection	0.00	0.00	36.42	41.92	41.92	41.92	41.80	41.92	41.92
78	Balkani	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
79	Batdara	HPP Candidate <=20	0.00	0.00	0.00	47.66	47.66	47.66	47.53	47.66	47.66
80	Daral Khwar-II	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81	Deg Outfall	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
82	Ghail	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
83	Jhing-II	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
84	Nandihar	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
85	Arkari Gol	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
86	Artistic-I	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
87	Artistic-II	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
88	Ashkot	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.93
89	Asrit Kedam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90	Athmuqam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
91	Azad Pattan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
92	Bankhwar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93	Bata Kundi	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
94	Chakoti Hatian	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95	CJ	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
96	Dowarian	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.54	49.54
97	Gabral Kalam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
98	Gabral Utror	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
99	Gumat Nar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	Harigehl-Majeedgala	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101	Jagran-III	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102	Jagran-IV	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
103	Kaigah	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
104	Kalam Asrit	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	Keyal Khwar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
106	Kohala	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
107	Lower Spat Gah	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
108	Luat	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
109	Madyan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110	Mahl	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
111	Mastuj	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112	Nagdar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.28	49.28
113	Naran	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
114	Nila Da Katha	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115	Qadirabad	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
116	Rajdhani	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117	Shalfalam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
118	Sharmai	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
119	Shigo Kas	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	Shounter	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.56
121	Soan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122	Taunsa	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
123	Turtonas Uzghor	HPP Candidate	0.00	0.00	0.00	0.00	0.00	51.90	51.76	51.90	51.90
124	Allai Khwar	HPP Existing	44.43	44.43	44.31	44.43	44.43	44.43	44.31	44.43	44.43
125	Chashma	HPP Existing	48.91	48.91	48.78	48.91	48.91	48.91	48.78	48.91	48.91
126	Daral Khwar	HPP Existing	38.77	38.77	38.66	38.77	38.77	38.77	38.66	38.77	38.77
127	Dubair Khwar	HPP Existing	54.57	54.57	54.42	54.57	54.57	54.57	54.42	54.57	54.57
128	Ghazi Brotha	HPP Existing	52.78	52.78	52.63	52.78	52.78	52.78	52.63	52.78	52.78
129	Golen Gol	HPP Existing	9.15	9.15	9.12	9.15	9.15	9.15	9.12	9.15	9.15
130	Gulpur	HPP Existing	28.92	28.92	28.84	28.92	28.92	28.92	28.84	28.92	28.92
131	Jagran-I	HPP Existing	49.49	49.49	49.35	49.49	49.49	49.49	49.35	49.49	49.49
132	Jinnah	HPP Existing	25.74	25.74	25.67	25.74	25.74	25.74	25.67	25.74	25.74
133	Karot	HPP Existing	45.48	45.48	45.36	45.48	45.48	45.48	45.36	45.48	45.48
134	Khan Khwar	HPP Existing	40.22	40.22	40.11	40.22	40.22	40.22	40.11	40.22	40.22
135	Malakand-III	HPP Existing	54.04	54.04	53.89	54.04	54.04	54.04	53.89	54.04	54.04
136	Mangla	HPP Existing	53.10	53.55	52.91	54.46	54.60	54.60	54.45	54.60	54.60
137	Neelum Jehlum	HPP Existing	53.48	53.48	53.33	53.48	53.48	53.48	53.33	53.48	53.48
138	New Bong	HPP Existing	55.49	55.49	55.34	55.49	55.49	55.49	55.34	55.49	55.49
139	Patrind	HPP Existing	43.76	43.76	43.64	43.76	43.76	43.76	43.64	43.76	43.76
140	Small Hydel	HPP Existing	45.59	45.59	45.46	45.59	45.59	45.59	45.46	45.59	45.59
141	Tarbela 1-14	HPP Existing	38.23	38.23	38.13	38.23	38.23	38.23	38.13	38.23	38.23
142	Tarbela_Ext_4	HPP Existing	30.33	30.33	30.25	30.33	30.33	30.33	30.25	30.33	30.33
143	Warsak	HPP Existing	50.63	50.63	50.49	50.63	50.63	50.63	50.49	50.63	50.63
144	Engro 90MW	CCGT_Gas	32.90	53.10	45.13	39.39	22.45	16.41	19.43	17.07	15.18
145	Foundation	CCGT_Gas	67.22	77.75	75.10	74.61	74.08	53.85	76.68	73.73	75.49
146	Guddu-I	CCGT_Gas	71.12	71.33	74.64	74.43	74.43	74.43	74.64	65.43	65.60
147	Guddu-II	CCGT_Gas	51.86	60.58	58.91	58.57	33.81	27.66	56.98	37.08	42.75
148	Guddu-V (747)	CCGT_Gas	64.73	69.53	66.30	75.56	70.86	49.59	65.35	65.48	65.47
149	Liberty	CCGT_Gas	40.17	40.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150	Uch	CCGT_Gas	69.29	70.75	54.72	38.92	38.92	0.00	0.00	0.00	0.00
151	Uch-II	CCGT_Gas	62.43	72.69	70.02	70.03	56.67	56.67	56.67	56.67	56.67
152	SNPC-I	KE_CCGT_Gas	65.57	69.21	67.18	67.40	53.29	53.29	53.29	53.29	53.29
153	SNPC-II	KE_CCGT_Gas	66.05	73.48	67.47	67.40	53.31	53.31	53.31	53.31	53.31
154	AES Lalpir	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
155	AES Pakgen	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
156	HUBCO	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
157	Jamshoro-I U1	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
158	Jamshoro-II U4	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
159	Muzaffargarh-I U1	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00
160	Muzaffargarh-I U2	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.00
161	Muzaffargarh-I U3	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00
162	Muzaffargarh-II U4	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.00
163	Saba	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
164	AGL	DG_RFO	36.81	22.13	0.00	0.00	0.00	0.00	0.00	0.30	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
165	Atlas	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.45	1.48
166	Engro 127MW	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.62
167	HuB N	DG_RFO	36.81	22.13	0.00	0.00	0.00	0.00	0.00	0.30	1.48
168	Kohinoor	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
169	Liberty Tech	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.60
170	Nishat C	DG_RFO	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.60
171	Nishat P	DG_RFO	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.48	1.49
172	GAEL	KE_DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
173	TPL	KE_DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
174	NEW OCGT_North/Center	OCGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
175	NEW OCGT_South	OCGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
176	C-1	Nuclear	81.11	81.11	81.33	81.11	81.11	81.11	81.33	81.11	81.11
177	C-2	Nuclear	79.61	79.61	79.83	79.61	79.61	79.61	79.83	79.61	79.61
178	C-3	Nuclear	81.01	81.01	81.23	81.01	81.01	81.01	81.23	81.01	81.01
179	C-4	Nuclear	81.01	81.01	81.23	81.01	81.01	81.01	81.23	81.01	81.01
180	C-5	Nuclear	0.00	0.00	0.00	0.00	0.00	67.29	90.21	89.96	89.96
181	K-2	Nuclear	85.07	85.07	85.30	85.07	85.07	85.07	85.30	85.07	85.07
182	K-3	Nuclear	85.07	85.07	85.30	85.07	85.07	85.07	85.30	85.07	85.07
183	NEW_Nuclear_North /Center	Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
184	NEW_Nuclear_Sout h	Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
185	Engro Thar	Local Coal	82.51	82.49	82.74	81.41	82.51	78.42	82.28	74.09	74.39
186	Lucky	Local Coal	7.47	2.09	0.59	0.00	0.00	0.54	1.65	6.82	7.07
187	NEW_L.Coal 330	Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
188	NEW_L.Coal 660	Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
189	Thal Nova	Local Coal	84.98	84.96	85.21	84.98	84.98	84.98	85.21	84.98	84.98
190	Thar TEL	Local Coal	84.98	84.96	85.21	84.98	84.98	84.98	85.21	84.98	84.98
191	Thar-I (SSRL)	Local Coal	83.93	83.86	82.99	79.02	74.16	75.27	77.15	82.53	82.81
192	K.E_NEW_L.Coal 330	KE_Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
193	K.E_NEW_L.Coal 660	KE_Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
194	China HUBCO	Imported Coal	56.16	56.16	56.16	56.16	56.16	56.16	56.16	56.16	56.16
195	Gwadar	Imported Coal	0.00	0.00	0.58	0.78	0.41	0.94	5.25	7.06	8.08
196	Jamshoro Coal	Imported Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.15	1.43	2.06
197	Jamshoro Coal 2	Imported Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
198	Port Qasim	Imported Coal	56.72	56.72	56.72	56.72	56.72	56.72	56.72	56.72	56.72
199	Sahiwal Coal	Imported Coal	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47
200	FPCL	KE_Imported Coal	5.86	17.07	2.04	2.33	1.72	1.32	1.98	4.65	5.82
201	Altern	Gas Engine_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
202	Davis	DG_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.53	1.88	2.28
203	Balloki	CCGT_RLNG	8.59	46.51	35.07	30.60	23.02	19.40	27.66	32.10	33.36
204	Bhikki	CCGT_RLNG	4.09	8.16	3.23	1.80	0.98	2.53	6.77	8.90	10.04
205	FKPCL	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
206	Halmore	CCGT_RLNG	0.00	0.31	0.00	0.00	0.00	0.00	0.61	2.43	2.84
207	Haveli	CCGT_RLNG	67.25	84.60	66.25	56.55	36.03	30.66	39.18	46.18	48.53
208	KAPCO 1	CCGT_RLNG	35.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
209	KAPCO 2	CCGT_RLNG	11.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	Nandipur	CCGT_RLNG	36.38	21.87	0.00	0.24	0.11	0.29	1.22	2.50	3.88
211	NEW_CCGT_North/ Center	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
212	NEW_CCGT_South	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
213	Orient	CCGT_RLNG	37.73	23.25	0.86	0.92	0.30	0.61	5.00	6.23	6.78
214	Rousch	CCGT_RLNG	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
215	Saif	CCGT_RLNG	37.73	22.94	0.29	0.61	0.30	0.30	1.52	4.24	6.11
216	Saphire	CCGT_RLNG	37.73	22.99	0.62	0.62	0.30	0.30	1.52	6.06	6.46
217	Trimmu	CCGT_RLNG	23.86	16.89	22.93	14.08	8.58	7.23	14.31	19.86	21.28
218	BQPS2	KE_CCGT_RLNG	12.72	41.89	12.79	13.10	11.57	10.08	10.57	13.40	14.75
219	BQPS3	KE_CCGT_RLNG	77.83	10.88	0.92	0.93	0.98	1.17	1.95	3.93	4.71
220	KCCPP	KE_CCGT_RLNG	4.61	29.90	5.47	5.60	5.06	4.73	4.85	7.29	8.11
221	KTGTPS	KE_CCGT_RLNG	3.25	21.79	4.07	4.31	4.19	3.49	3.73	5.70	5.89
222	SGTPS	KE_CCGT_RLNG	2.03	13.18	3.25	3.67	2.97	1.91	2.58	4.87	5.13
223	BQPS1-U1	KE_ST_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
224	BQPS1-U5	KE_ST_RLNG	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
225	BQPS1-U6	KE_ST_RLNG	0.97	1.93	0.06	0.91	0.84	0.58	0.94	0.00	0.00
226	BQPS1-U2	KE_GT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
227	Balakot	UC Hydro_Committed	0.00	0.00	41.63	41.96	41.96	41.96	41.85	41.96	41.96
228	Chamfall	UC Hydro_Committed	48.01	48.01	47.88	48.01	48.01	48.01	47.88	48.01	48.01
229	Dasu	UC Hydro_Committed	0.00	99.00	62.98	64.52	64.52	64.52	64.34	64.52	64.52
230	Diamer Bhasha	UC Hydro_Committed	0.00	0.00	0.00	56.86	42.74	44.40	44.28	44.40	44.40
231	Gorkin Matiltan	UC Hydro_Committed	40.11	44.77	44.65	44.77	44.77	44.77	44.65	44.77	44.77
232	Jabori	UC Hydro_Committed	82.38	82.38	82.23	82.38	82.38	82.38	82.23	82.38	82.38
233	Jagran-II	UC Hydro_Committed	51.22	51.22	51.08	51.22	51.22	51.22	51.08	51.22	51.22
234	Karora	UC Hydro_Committed	72.12	72.12	71.99	72.12	72.12	72.12	71.99	72.12	72.12
235	Kathai-II	UC Hydro_Committed	0.00	60.14	61.57	61.74	61.74	61.74	61.57	61.74	61.74
236	Koto	UC Hydro_Committed	59.06	59.06	58.90	59.06	59.06	59.06	58.90	59.06	59.06
237	Kurram Tangi	UC Hydro_Committed	17.05	17.05	17.01	17.05	17.05	17.05	17.01	17.05	17.05
238	Lawi	UC Hydro_Committed	48.96	48.96	48.84	48.96	48.96	48.96	48.84	48.96	48.96
239	Mohmand Dam	UC Hydro_Committed	0.00	72.83	43.14	43.26	43.26	43.26	43.14	43.26	43.26
240	Nardagian	UC Hydro_Committed	43.81	48.50	48.37	48.50	48.50	48.50	48.37	48.50	48.50
241	Riali-II	UC Hydro_Committed	54.79	54.79	54.64	54.79	54.79	54.79	54.64	54.79	54.79
242	Suki Kinari	UC Hydro_Committed	51.16	51.16	51.02	51.16	51.16	51.16	51.02	51.16	51.16
243	Tarbela_Ext_5	UC Hydro_Committed	6.83	10.05	10.02	10.05	10.05	10.05	10.02	10.05	10.05

C-6. Year-wise Installed Capacity Addition (MW)

Year	Net Capacity Addition Over the Plan Period (2023-34)											
	Local Coal	Hydro	RLNG	Nuclear	Imported Coal	RE	New Tech.	Natural Gas	Furnace Oil	Cross Border	Net Yearly Addition	Cumulative Total
	MW											
Jun-23	3,300	10,663	10,185	3,530	4,020	2,810	-	2,964	5,273	-	-	42,745
2024	-	27	411	-	-	150	-	395	-	-	983	43,728
2025	-	1,145	-	-	660	404	-	-	-262	-	1,946	45,674
2026	-	1,694	-	-	-	871	-	-	-	-	2,565	48,240
2027	-	1,958	-1,510	-	-	1,715	-	-	-1,423	-	740	48,980
2028	-	1,380	-	-	300	2,973	100	-235	-	1,000	5,518	54,498
2029	-	1,910	-	-	-	186	100	-	-1,177	-	1,019	55,517
2030	-	2,625	-	-	-	191	100	-	-136	-	2,780	58,297
2031	-	82	-638	1,200	-	205	100	-586	-	-	363	58,660
2032	-	-	-	-	-	309	100	-	-	-	409	59,069
2033	-	75	-210	-	-	3,033	100	-	-	-	2,998	62,067
2034	-	348	-	-	-	1,144	100	-	-1,110	-	482	62,549
Total	**3,300**	**21,908**	**8,238**	**4,730**	**4,980**	**13,990**	**700**	**2,538**	**1,165**	**1,000**	**62,549**	

C-7. IGCEP Generation Mix 2024-2034 (GWh)

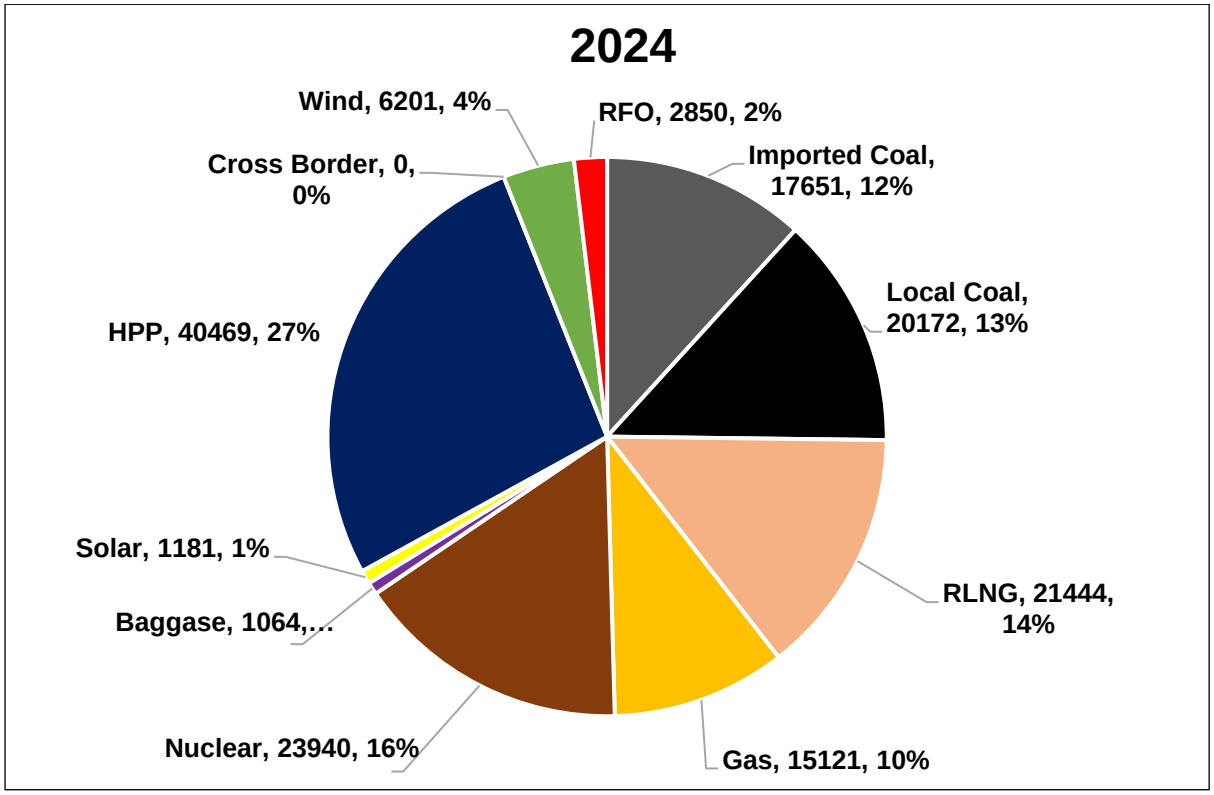


Chart C-1: IGCEP Generation Mix 2024 (GWh)

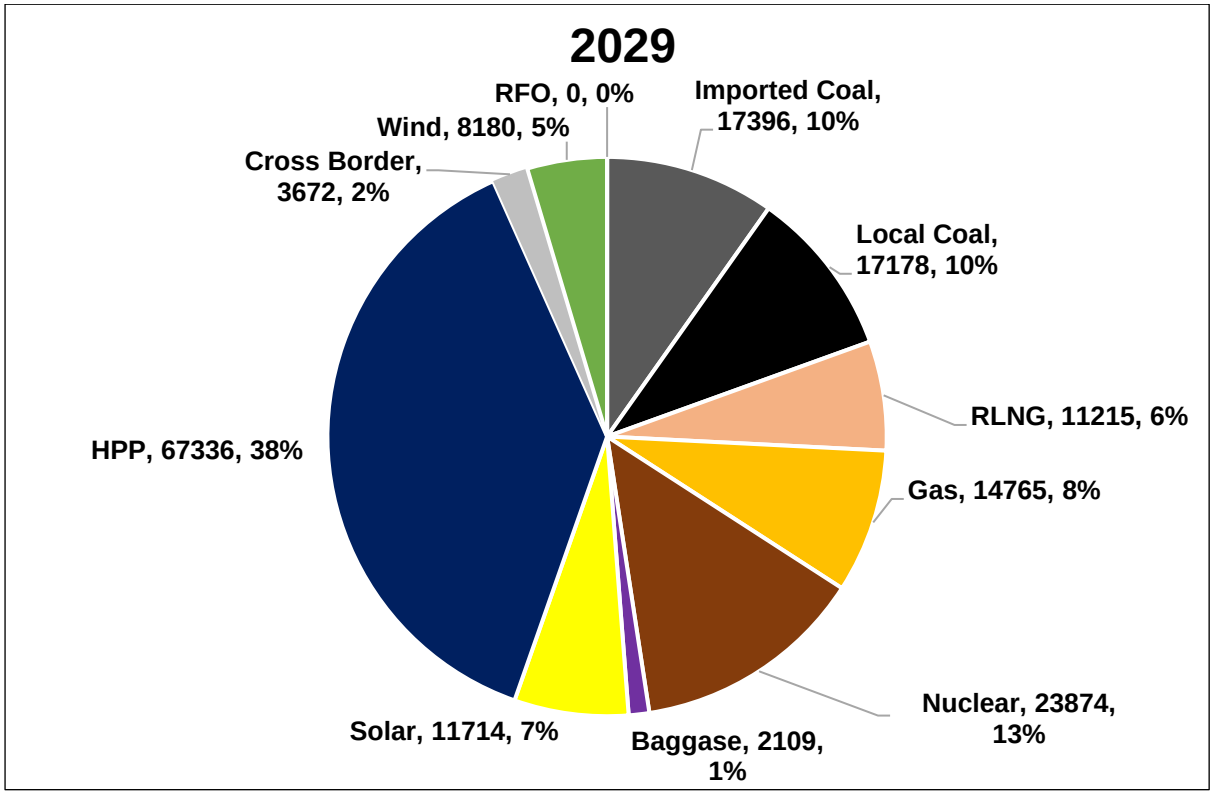


Chart C-2: IGCEP Generation Mix 2029 (GWh)

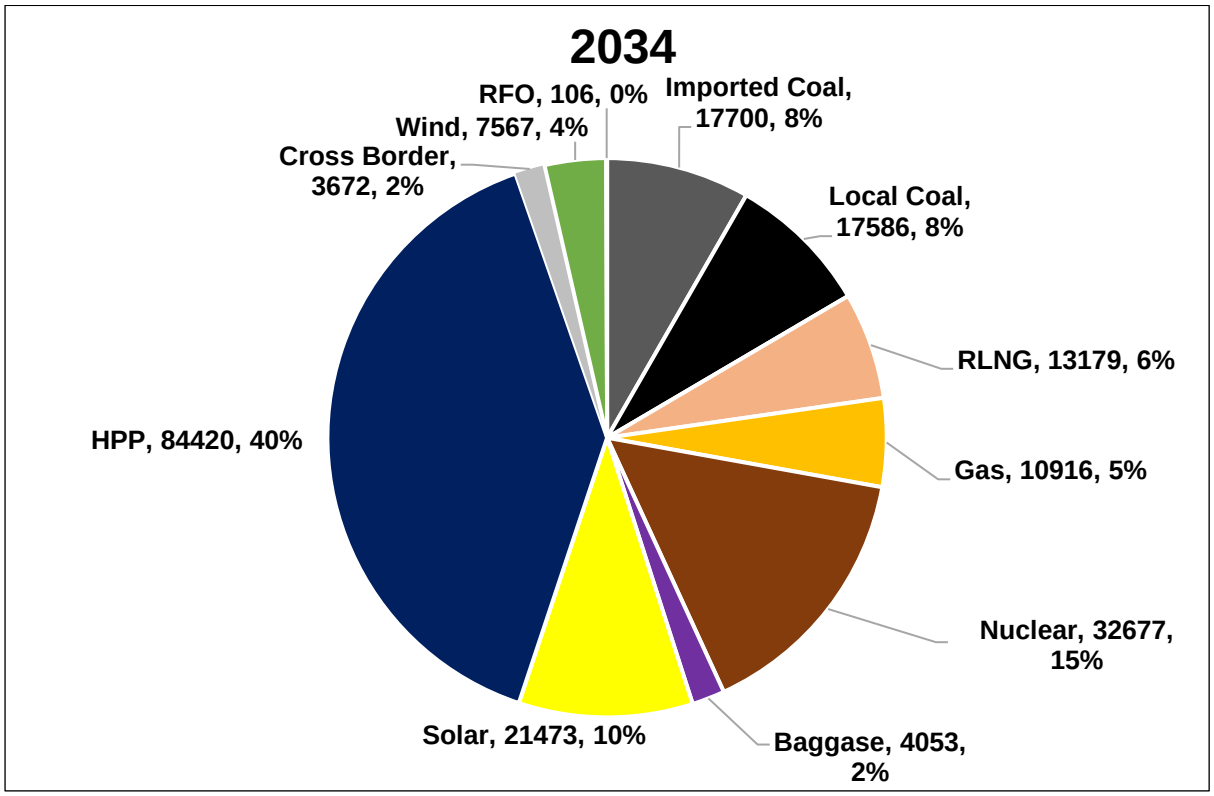


Chart C-3: IGCEP Generation Mix 2034 (GWh)

C-8. IGCEP Generation Mix 2023-34 (MW)

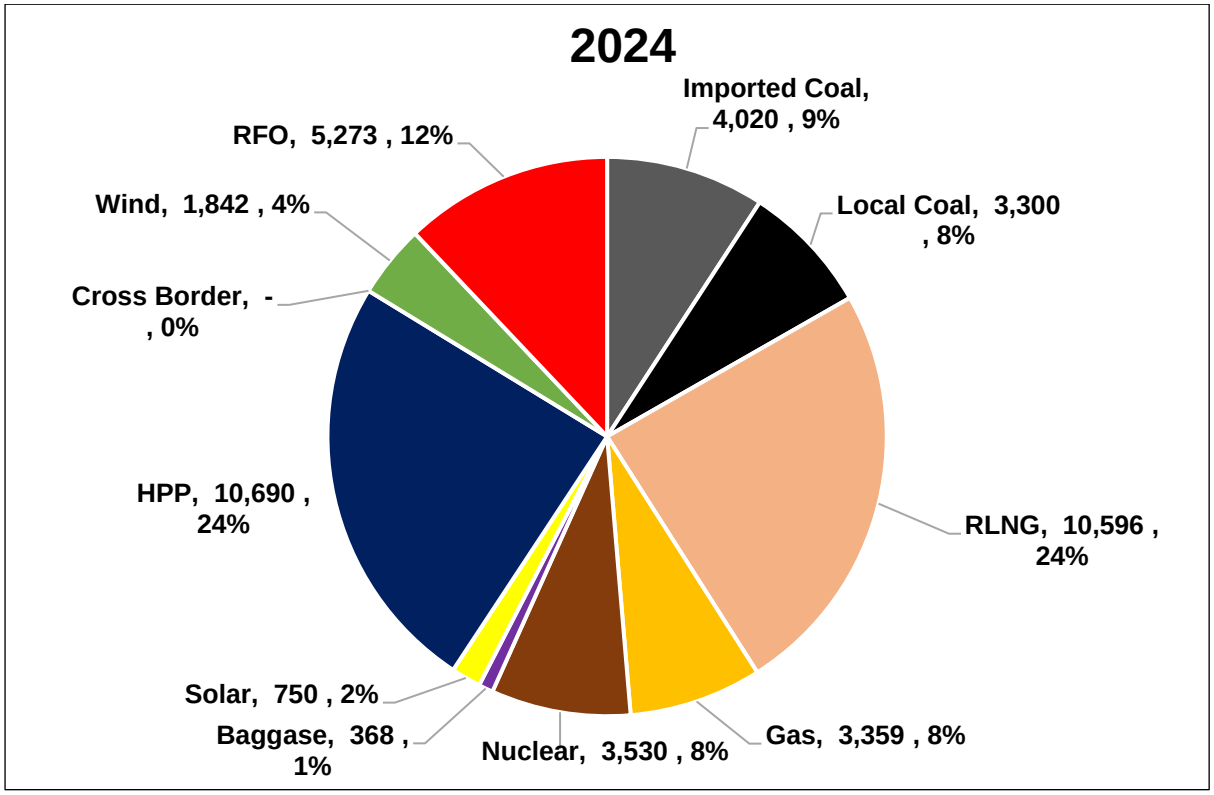


Chart C-4: IGCEP Generation Mix 2024 (MW)

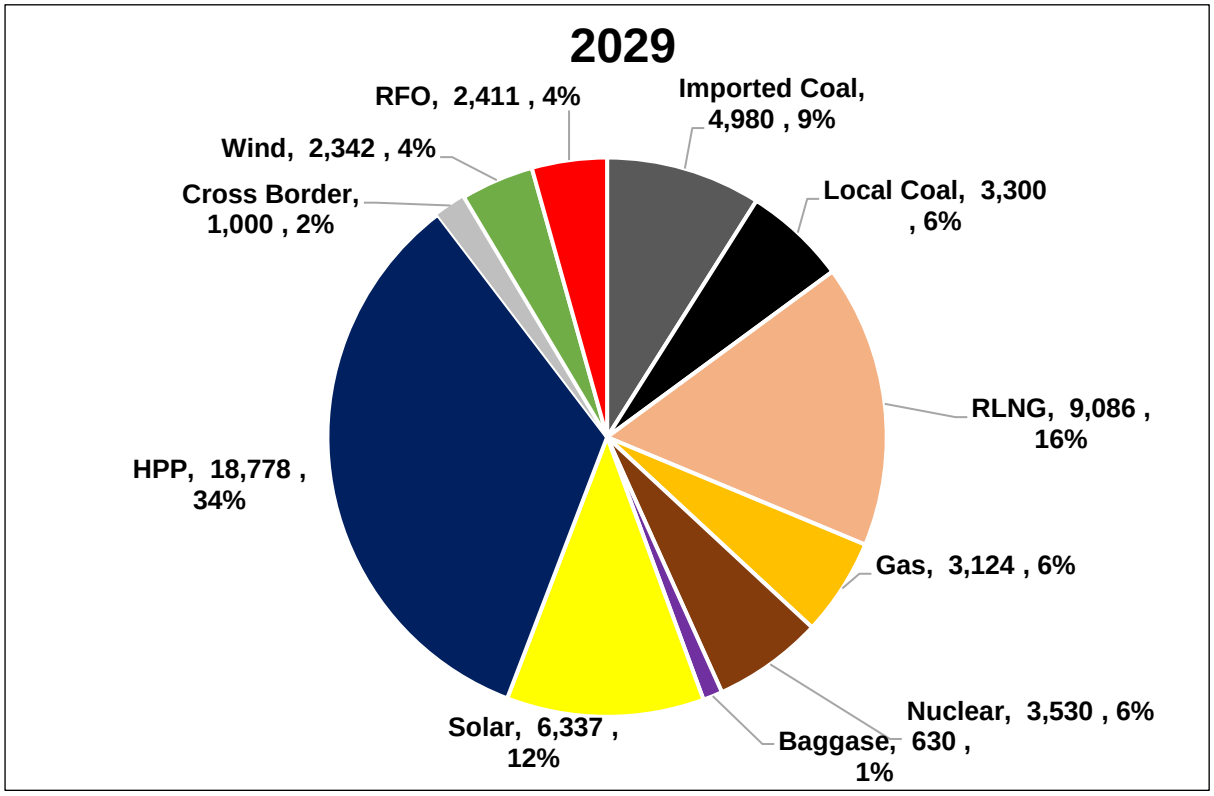


Chart C-5: IGCEP Generation Mix 2029 (MW)

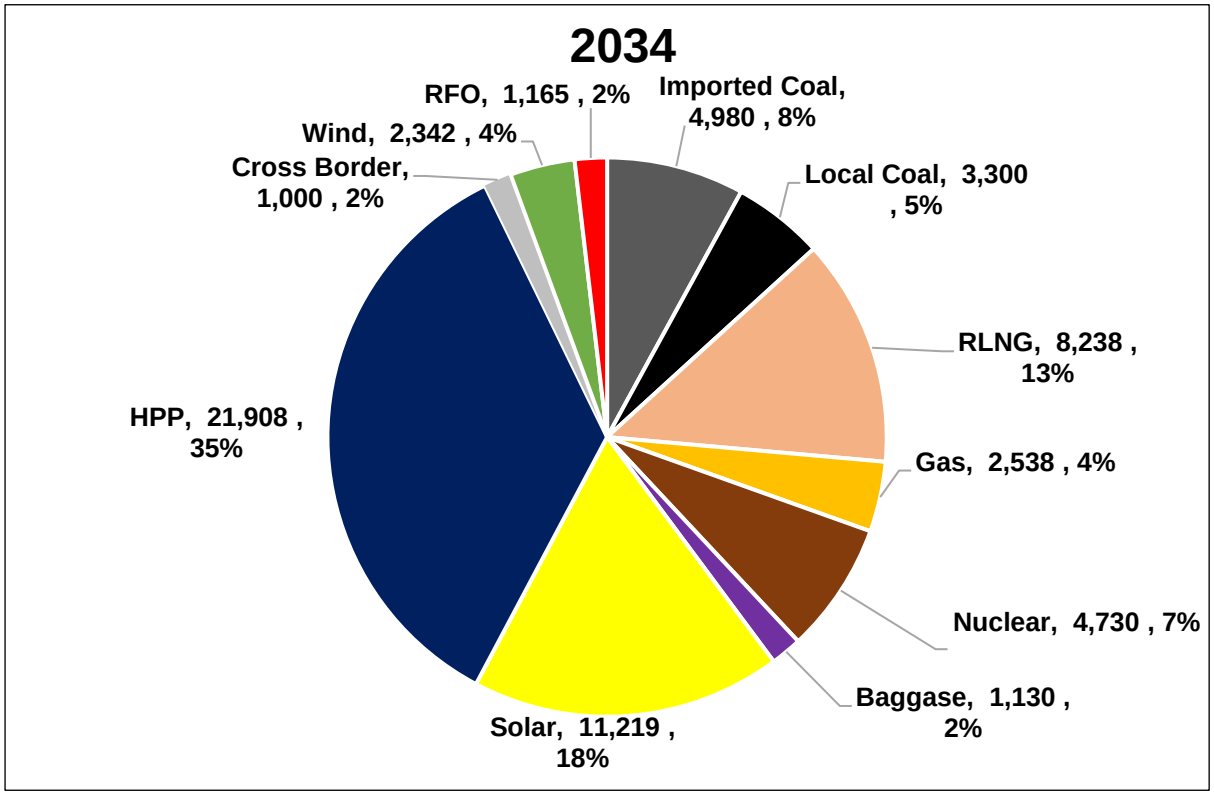
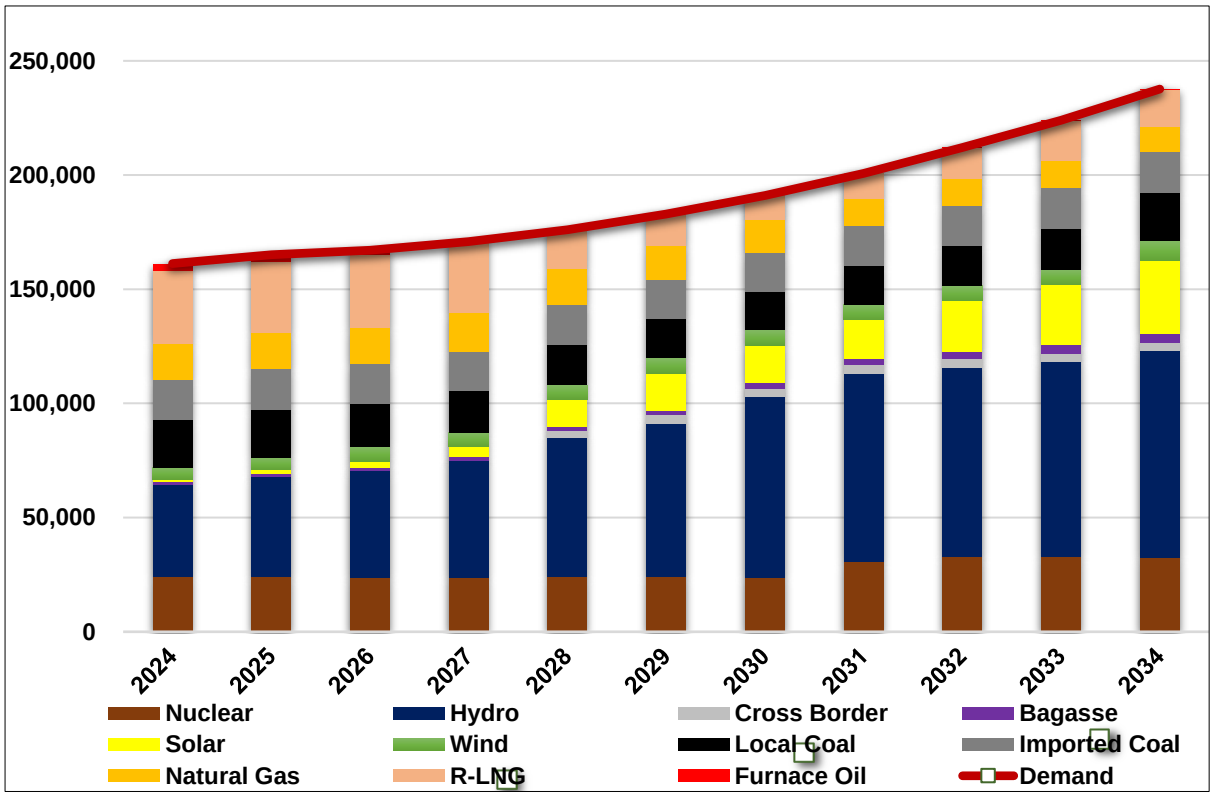


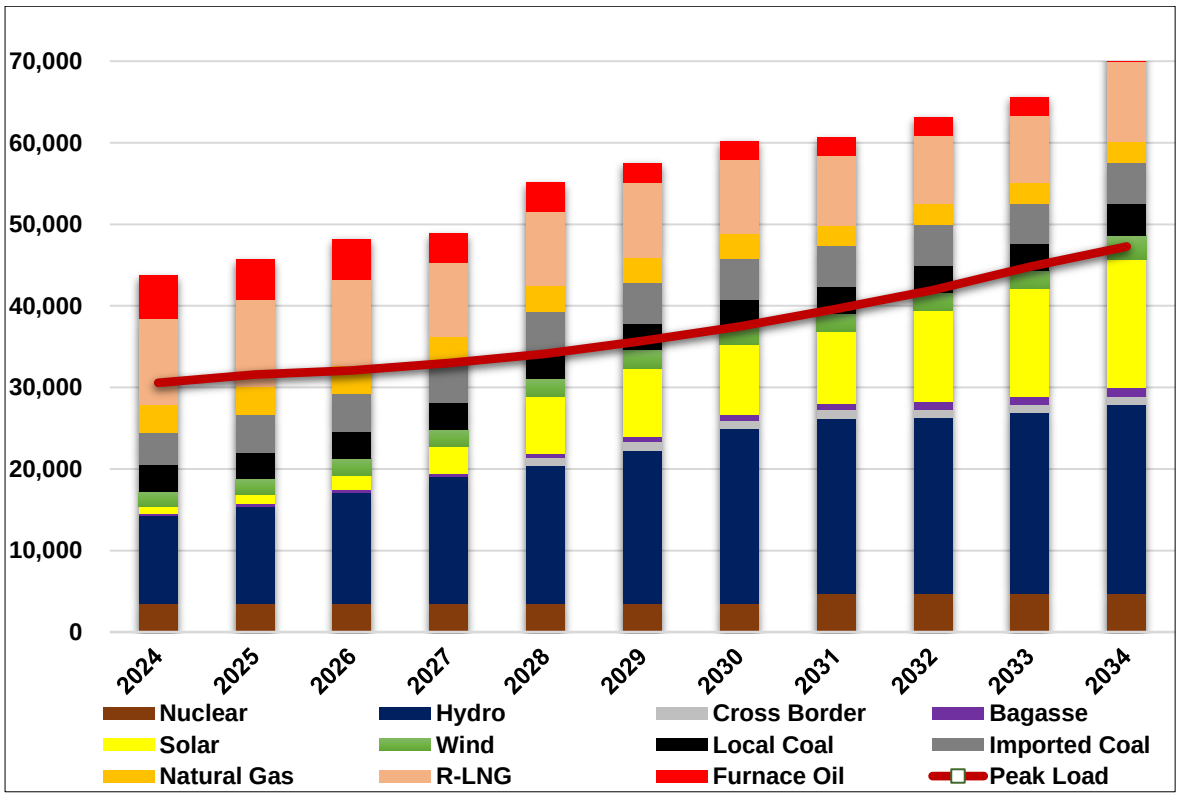
Chart C-6: IGCEP Generation Mix 2034 (MW)

Annexure D. High Demand Scenario

D-1. Annual Energy Generation Vs Annual Energy Demand (GWh) - Country



D-2. Installed Capacity Vs Peak Demand (MW) - Country



D-3. Optimized Generation Capacity Additions (MW)

Fiscal Year	Coal Fired Steam Local Coal	Coal Fired Steam Local Coal KE	Combined Cycle on RLNG	Combustion Turbine on RLNG	Nuclear	HPP	Solar Utility MW_p	Net Meter MW_p	Solar KE MW_p	Wind NTDC	Wind KE	Bagasse	Per Year Capacity Addition	Cumulative Capacity Addition
2024	-	-	-	-	-	-	-	-	-	-	-	-	0	0
2025	-	-	-	-	-	-	-	240	-	-	-	-	0	0
2026	-	-	-	-	-	-	-	241	300	-	271	-	571	571
2027	-	-	-	-	-	-	-	215	200	-	-	-	200	771
2028	-	-	-	-	-	-	1,873	223	182	-	-	-	2,055	2,826
2029	-	-	-	-	-	5	1,300	186	-	-	-	-	1,305	4,131
2030	-	-	-	-	-	-	-	191	-	-	-	-	0	4,131
2031	-	-	-	-	-	82	-	205	-	-	-	-	82	4,213
2032	-	-	-	-	-	75	2,314	92	-	-	-	-	2,389	6,603
2033	-	-	-	-	-	579	1,675	303	-	-	-	-	2,254	8,857
2034	660	-	1,263	400	-	1,009	2,229	211	21	-	714	-	6,296	15,153
Total	**660**	**-**	**1,263**	**400**	**-**	**1,751**	**9,391**	**2,107**	**703**	**-**	**985**	**-**	**15,153**	

*Does not include 2,107 MWP of Net Metering, being committed

D-4. List of Projects uptill 2034 (Committed + Optimized)

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
2023-24							
1	Helios	PV	50	50	PPIB	Category-II Project	Dec-23
2	HNDS	PV	50	50	PPIB	Category-II Project	Dec-23
3	Meridian	PV	50	50	PPIB	Category-II Project	Dec-23
4	Jabori	Hydro	10.2	10.2	GoKPK	PC-1 Approved	May-24
Generation Additions in 2023-24 (MW)			**160**	**160**			
Cumulative Addition up till 2023-24 (MW)			**160**	**160**			
2024-25							
1	Suki Kinari (U#1)	Hydro	221	221	PPIB	Financial Close	Aug-24
2	Suki Kinari (U#2)	Hydro	221	221	PPIB	Financial Close	Sep-24
3	Suki Kinari (U#3)	Hydro	221	221	PPIB	Financial Close	Oct-24
4	Suki Kinari (U#4)	Hydro	221	221	PPIB	Financial Close	Nov-24
5	Jamshoro Coal	Imported Coal	660	629	GENCO Holding	PC-1 Approved	Jun-24
6	Zorlu	PV	100	100	PPDB	Category-II Project	Oct-24
7	Lawi	Hydro	69	69	GoKPK	PC-1 Approved	Dec-24
8	Jagran-II	Hydro	48	48	AJK-HEB	PC-1 Approved	Dec-24
9	Koto	Hydro	40.8	40.8	GoKPK	PC-1 Approved	Jun-24
10	Shahtaj	Bagasse	32	32	PPIB	Category-I Project	Jun-24
11	Access_Solar	PV	11.52	11.52	PPIB	Category-I Project	Sep-24
12	Access_Electric	PV	10	10	PPIB	Category-I Project	Sep-24
13	Safe	PV	10	10	PPIB	Category-I Project	Nov-24
14	Chamfall	Hydro	3.22	3.22	AJK-HEB	PC-1 Approved	Jun-24
15	Kurram Tangi	Hydro	18	18	C&M-WAPDA	PC-1 Approved	Jun-24
16	Karora	Hydro	11.8	11.8	GoKPK	PC-1 Approved	Jul-24

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
17	Mangla Refurbishment U#3,4	Hydro	70	70	WAPDA	Committed	Jul-24
18	Net Meter	PV	240	240	DISCOs	Committed	Jul-24
Generation Additions in 2024-25 (MW)			**2,208**	**2,177**			
Cumulative Addition up till 2025 (MW)			**2,369**	**2,338**			
2025-26							
1	Tarbela_Ext_5 (U#1)	Hydro	510	510	WAPDA	PC-1 Approved	Nov-25
2	Tarbela_Ext_5 (U#2)	Hydro	510	510	WAPDA	PC-1 Approved	Dec-25
3	Tarbela_Ext_5 (U#3)	Hydro	510	510	WAPDA	PC-1 Approved	Jan-26
4	Gorkin Matiltan	Hydro	84	84	GoKPK	PC-1 Approved	Aug-25
5	TAY	Bagasse	30	30	PPIB	Category-II Project	Aug-25
6	Riali-II (U#1)	Hydro	3.5	3.5	PPIB	LOS (Issued)	Jun-25
7	Riali-II (U#2)	Hydro	3.5	3.5	PPIB	LOS (Issued)	Jun-25
8	Nardagian	Hydro	3.22	3.22	AJK-HEB	PC-1 Approved	Dec-25
9	Mangla Refurbishment U#1,2	Hydro	70	70	WAPDA	Committed	Dec-25
10	Net Meter	PV	241	241	DISCOs	Committed	Jul-25
11	KE_New_Solar	PV	300	300	K.E	Optimized	Jul-25
12	KE_New_Wind	Wind	271	300	K.E	Optimized	Jul-25
Generation Additions in 2025-26 (MW)			**2,536**	**2,565**			
Cumulative Addition up till 2026 (MW)			**4,905**	**4,903**			
2026-27							
1	Dasu (U#1)	Hydro	360	360	WAPDA	PC-1 Approved	Mar-27
2	Dasu (U#2)	Hydro	360	360	WAPDA	PC-1 Approved	Apr-27
3	Dasu (U#3)	Hydro	360	360	WAPDA	PC-1 Approved	May-27
4	Mohmand Dam (U#1)	Hydro	200	200	WAPDA	PC-1 Approved	Dec-26

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
5	Mohmand Dam (U#2)	Hydro	200	200	WAPDA	PC-1 Approved	Jan-27
6	Mohmand Dam (U#3)	Hydro	200	200	WAPDA	PC-1 Approved	Mar-27
7	Mohmand Dam (U#4)	Hydro	200	200	WAPDA	PC-1 Approved	Apr-27
8	PV_Committed_A	PV	600	600	PPIB	Committed	Jan-27
9	PV_Committed_B	PV	600	600	PPIB	Committed	Apr-27
10	Kathai-II (U#1)	Hydro	4	4	PPIB	LOS (Issued)	Jul-26
11	Kathai-II (U#2)	Hydro	4	4	PPIB	LOS (Issued)	Jul-26
12	Mangla Refurbishment U#9,10	Hydro	70	70	WAPDA	Committed	Apr-27
13	Net Meter	PV	215	215	DISCOs	Committed	Jul-26
14	KE_New_Solar	PV	200	200	K.E	Optimized	Jul-26
Generation Additions in 2026-27 (MW)			**3,573**	**3,573**			
Cumulative Addition up till 2027 (MW)			**8,478**	**8,476**			
2027-28							
1	Dasu (U#4)	Hydro	360	360	WAPDA	PC-1 Approved	Oct-27
2	Dasu (U#5)	Hydro	360	360	WAPDA	PC-1 Approved	Nov-27
3	Dasu (U#6)	Hydro	360	360	WAPDA	PC-1 Approved	Dec-27
4	PV_Committed_C	PV	1200	1200	PPIB	Committed	Nov-27
5	CASA	Hydro	1000	1000	GoP	G2G	Aug-27
6	Gwadar	Imported Coal	300	273	PPIB	G2G/CPEC	Dec-27
7	Balakot	Hydro	300	300	GoKPK	PC-1 Approved	Dec-27
8	Siachen	PV	100	100	GoS	Category-II Project	Jun-28
9	Manjhand	PV	50	50	PPIB/GoS	PC-1 Approved	Jun-28
10	Trans_Atlantic	Wind	50	50	PPIB	Category-II Project	Jun-28
11	Western	Wind	50	50	PPIB	Category-II Project	Jun-28
12	Net Meter	PV	223	223	DISCOs	Committed	Jul-27

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
13	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-27
14	New Solar NTDC	PV	1873	1873	PPIB	Optimized	Jul-27
15	KE_New_Solar	PV	182	200	K.E	Optimized	Jul-27
Generation Additions in 2027-28 (MW)			**6,508**	**6,499**			
Cumulative Addition up till 2028 (MW)			**14,986**	**14,975**			
2028-29							
1	Diamer Bhasha (U#1)	Hydro	375	375	WAPDA	PC-1 Approved	Jan-29
2	Diamer Bhasha (U#2)	Hydro	375	375	WAPDA	PC-1 Approved	Feb-29
3	Diamer Bhasha (U#3)	Hydro	375	375	WAPDA	PC-1 Approved	Apr-29
4	Diamer Bhasha (U#4)	Hydro	375	375	WAPDA	PC-1 Approved	May-29
5	Diamer Bhasha (U#5)	Hydro	375	375	WAPDA	PC-1 Approved	Jun-29
6	Mangla Refurbishment U#7,8	Hydro	30	30	WAPDA	Committed	Sep-28
7	Net Meter	PV	186	186	DISCOs	Committed	Jul-28
8	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-28
9	Batdara	Hydel	5.2	5.2	AJK-HEB	Optimized	Jul-28
10	New Solar NTDC	PV	1300	1300	PPIB	Optimized	Jul-28
Generation Additions in 2028-29 (MW)			**3496.2**	**3496.2**			
Cumulative Addition up till 2029 (MW)			**18,482**	**18,471**			
2029-30							
1	Diamer Bhasha (U#6)	Hydro	375	375	WAPDA	PC-1 Approved	Jul-29
2	Diamer Bhasha (U#7)	Hydro	375	375	WAPDA	PC-1 Approved	Aug-29
3	Diamer Bhasha (U#8)	Hydro	375	375	WAPDA	PC-1 Approved	Sep-29
4	Diamer Bhasha (U#9)	Hydro	375	375	WAPDA	PC-1 Approved	Oct-29
5	Diamer Bhasha (U#10)	Hydro	375	375	WAPDA	PC-1 Approved	Nov-29
6	Diamer Bhasha (U#11)	Hydro	375	375	WAPDA	PC-1 Approved	Jan-30

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
7	Diamer Bhasha (U#12)	Hydro	375	375	WAPDA	PC-1 Approved	Feb-30
8	Net Meter	PV	191	191	DISCOs	Committed	Jul-29
9	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-29
Generation Additions in 2029-30 (MW)			**2,916**	**2,916**			
Cumulative Addition up till 2030 (MW)			**21,398**	**21,387**			
2030-31							
1	C-5	Nuclear	1200	1117	PAEC	PC-1 Approved	Sep-30
2	Net Meter	PV	205	205	DISCOs	Committed	Jul-30
3	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-30
4	Turtonas Uzghor	Hydel	82.25	82.25	K.E	Optimized	Jul-30
Generation Additions in 2030-31 (MW)			**1,587**	**1,504**			
Cumulative Addition up till 2031 (MW)			**22,985**	**22,891**			
2031-32							
1	Net Meter	PV	92	92	DISCOs	Committed	Jul-31
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-31
3	New Solar NTDC	PV	2314	2314	PPIB	Optimized	Jul-31
4	Dowarian	Hydel	40	40	AJK-HEB	Optimized	Jul-31
5	Nagdar	Hydel	35.2	35.2	AJK-HEB	Optimized	Jul-31
Generation Additions in 2031-32 (MW)			**2,581**	**2,581**			
Cumulative Addition up till 2032 (MW)			**25,566**	**25,472**			
2032-33							
1	Net Meter	PV	303	303	DISCOs	Committed	Jul-32
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-32
3	New Solar NTDC	PV	1675	1675	PPIB	Optimized	Jul-32
4	Ashkot	Hydel	300	300	PPIB	Optimized	Jul-32

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
5	Taunsa	Hydel	135	135	PPDB	Optimized	Jul-32
6	Bata Kundi	Hydel	96	96	GoKPK	Optimized	Jul-32
7	Shounter	Hydel	48	48	AJK-HEB	Optimized	Jul-32
Generation Additions in 2032-33 (MW)			**2,657**	**2,657**			
Cumulative Addition up till 2033 (MW)			**28,223**	**28,129**			
2033-34							
1	Net Meter	PV	211	211	DISCOs	Committed	Jul-33
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-33
3	New Solar NTDC	PV	2229	2229	PPIB	Optimized	Jul-33
4	New Solar KE	PV	21	21	KE	Optimized	Jul-33
5	KE_New_Wind	Wind	714	714	K.E	Optimized	Jul-33
6	Azad Pattan	Hydel	700.7	700.7	PPIB	Optimized	Jul-33
7	NEW_L.Coal 660	Local Coal	660	607	PPIB	Optimized	Jul-33
8	Keyal Khwar	Hydel	128	128	C&M-WAPDA	Optimized	Jul-33
9	Shalfalam	Hydel	60	60	PEDO	Optimized	Jul-33
10	Artistic-II	Hydel	55.032	55.032	PEDO	Optimized	Jul-33
11	Harigehl-Majeedgala	Hydel	40.32	40.32	AJK-PPC	Optimized	Jul-33
12	CJ	Hydel	25	25	PPDB	Optimized	Jul-33
13	New OCGT	Thermal	1263	1224	PPIB	Optimized	Jul-33
14	New CCGT	Thermal	400	396	PPIB	Optimized	Jul-33
Generation Additions in 2033-34 (MW)			**6,607**	**6,511**			
Cumulative Addition up till 2034 (MW)			**34,830**	**34,640**			

D-5. Annual Capacity Factors (%age)

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
1	Almoiz	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
2	Chanar	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
3	Chiniot	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
4	CSP	Bagasse	0.00	0.00	44.50	44.49	44.49	44.49	44.50	44.49	44.49
5	Fatima	Bagasse	6.53	6.53	6.55	6.53	6.53	6.28	6.25	6.18	6.05
6	Hamza	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
7	JDW-II	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
8	JDW-III	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
9	New_Bagasse	Bagasse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Ryk_Mills	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
11	Shahtaj	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
12	TAY	Bagasse	65.87	54.68	54.81	54.68	54.68	54.68	54.81	54.68	54.68
13	Thal_Layyah	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
14	Access_Electric	PV	20.50	20.50	20.48	20.50	20.50	20.50	20.48	20.50	20.50
15	Access_Solar	PV	20.50	20.50	20.48	20.50	20.50	20.50	20.48	20.50	20.50
16	Appolo	PV	19.67	19.67	19.67	19.67	19.67	19.67	19.67	19.67	19.67
17	Atlas_Solar(Zhenfa)	PV	17.75	17.75	17.73	17.75	17.75	17.75	17.73	17.75	17.75
18	Best	PV	19.29	19.29	19.29	19.29	19.29	19.29	19.29	19.29	19.29
19	Crest	PV	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94	19.94
20	Helios	PV	21.57	21.57	21.56	21.57	21.57	21.57	21.56	21.57	21.57
21	HNDS	PV	21.57	21.57	21.56	21.57	21.57	21.57	21.56	21.57	21.57
22	Manjhand	PV	0.00	0.00	40.24	21.57	21.57	21.57	21.56	21.57	21.57
23	Meridian	PV	21.57	21.57	21.56	21.57	21.57	21.57	21.56	21.57	21.57
24	Net_Meter	PV	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67	17.67
25	New_Solar_North/Center	PV	0.00	0.00	25.49	25.50	25.50	25.50	25.49	25.50	25.50
26	New_Solar_South	PV	0.00	0.00	25.49	25.50	25.50	25.50	25.49	25.50	25.50
27	PV_Committed_A	PV	0.00	20.14	20.48	20.50	20.50	20.50	20.48	20.50	20.50
28	PV_Committed_B	PV	0.00	28.56	20.48	20.50	20.50	20.50	20.48	20.50	20.50
29	PV_Committed_C	PV	0.00	0.00	19.33	20.50	20.50	20.50	20.48	20.50	20.50
30	QA_Solar	PV	18.18	18.18	18.19	18.18	18.18	18.18	18.19	18.18	18.18
31	Safe	PV	20.50	20.50	20.48	20.50	20.50	20.50	20.48	20.50	20.50
32	Siachen	PV	0.00	0.00	40.24	21.57	21.57	21.57	21.56	21.57	21.57
33	Zorlu	PV	20.50	20.50	20.48	20.50	20.50	20.50	20.48	20.50	20.50
34	Gharo	KE_PV	26.06	26.06	26.06	26.06	26.06	26.06	26.06	26.06	26.06
35	KE_New_Solar	KE_PV	22.73	22.73	22.73	22.73	22.73	22.73	22.73	22.73	22.73
36	Oursun	KE_PV	21.70	21.70	21.70	21.70	21.70	21.70	21.70	21.70	21.70
37	Act	Wind	32.06	32.06	31.99	32.06	32.06	32.06	31.99	32.06	32.06
38	Act_2	Wind	37.72	37.72	37.63	37.72	37.72	37.72	37.63	37.72	37.72
39	Artistic_wind	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
40	Artistic_Wind_2	Wind	37.72	37.72	37.63	37.72	37.72	37.72	37.63	37.72	37.72
41	Dawood	Wind	32.06	32.06	31.99	32.06	32.06	32.06	31.99	32.06	32.06
42	Din	Wind	37.72	37.72	37.63	37.72	37.72	37.72	37.63	37.72	37.72
43	FFC	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
44	FWEL-I	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
45	FWEL-II	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
46	Gul Ahmed	Wind	32.06	32.06	31.99	32.06	32.06	32.06	31.99	32.06	32.06
47	Gul_Electric	Wind	37.72	37.72	37.63	37.72	37.72	37.72	37.63	37.72	37.72
48	Hawa	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
49	Indus_Energy	Wind	37.72	37.72	37.63	37.72	37.72	37.72	37.63	37.72	37.72
50	Jhimpir	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
51	Lakeside	Wind	38.72	38.72	38.62	38.72	38.72	38.72	38.62	38.72	38.72
52	Liberty_Wind_1	Wind	37.72	37.72	37.63	37.72	37.72	37.72	37.63	37.72	37.72
53	Liberty_Wind_2	Wind	37.72	37.72	37.63	37.72	37.72	37.72	37.63	37.72	37.72
54	Master	Wind	32.06	32.06	31.99	32.06	32.06	32.06	31.99	32.06	32.06
55	Master_Green	Wind	37.72	37.72	37.63	37.72	37.72	37.72	37.63	37.72	37.72
56	Metro_Power	Wind	33.09	33.09	33.02	33.09	33.09	33.09	33.02	33.09	33.09
57	Metro_Wind	Wind	37.72	37.72	37.63	37.72	37.72	37.72	37.63	37.72	37.72
58	NASDA	Wind	38.72	38.72	38.62	38.72	38.72	38.72	38.62	38.72	38.72
59	New_Wind	Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	Sachal	Wind	32.06	32.06	31.99	32.06	32.06	32.06	31.99	32.06	32.06
61	Sapphire_Wind	Wind	32.06	32.06	31.99	32.06	32.06	32.06	31.99	32.06	32.06
62	Tenaga	Wind	32.06	32.06	31.99	32.06	32.06	32.06	31.99	32.06	32.06
63	Three_Gorges_I	Wind	33.09	33.09	33.02	33.09	33.09	33.09	33.02	33.09	33.09
64	Three_Gorges_II	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
65	Three_Gorges_III	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
66	Trans_Atlantic	Wind	0.00	0.00	38.00	35.43	35.43	35.43	35.34	35.43	35.43
67	Tricom	Wind	37.72	37.72	37.63	37.72	37.72	37.72	37.63	37.72	37.72
68	Tricon_A	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
69	Tricon_B	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
70	Tricon_C	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
71	UEP	Wind	32.06	32.06	31.99	32.06	32.06	32.06	31.99	32.06	32.06
72	Western	Wind	0.00	0.00	39.39	37.72	37.72	37.72	37.63	37.72	37.72
73	Yunus	Wind	32.06	32.06	31.99	32.06	32.06	32.06	31.99	32.06	32.06
74	Zephyr	Wind	29.83	29.83	29.75	29.83	29.83	29.83	29.75	29.83	29.83
75	Zorlu_Wind	Wind	33.09	33.09	33.02	33.09	33.09	33.09	33.02	33.09	33.09
76	KE_New_Wind	KE_Wind	35.43	35.43	35.34	35.43	35.43	35.43	35.34	35.43	35.43
77	CASA	Interconnection	0.00	0.00	36.42	41.92	41.92	41.92	41.80	41.92	41.92
78	Balkani	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
79	Batdara	HPP Candidate <=20	0.00	0.00	0.00	47.66	47.66	47.66	47.53	47.66	47.66

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
80	Daral Khwar-II	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81	Deg Outfall	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
82	Ghail	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
83	Jhing-II	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
84	Nandihar	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
85	Arkari Gol	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
86	Artistic-I	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
87	Artistic-II	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43.34
88	Ashkot	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	47.93	47.93
89	Asrit Kedam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90	Athmuqam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
91	Azad Pattan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	53.16
92	Bankhwar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93	Bata Kundi	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	59.60	59.60
94	Chakoti Hatian	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95	CJ	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.71
96	Dowarian	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	49.41	49.54	49.54
97	Gabral Kalam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
98	Gabral Utror	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
99	Gumat Nar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	Harigehl-Majeedgala	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	63.71
101	Jagran-III	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102	Jagran-IV	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
103	Kaigah	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
104	Kalam Asrit	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	Keyal Khwar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.96
106	Kohala	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
107	Lower Spat Gah	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
108	Luat	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
109	Madyan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110	Mahl	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
111	Mastuj	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112	Nagdar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	49.15	49.28	49.28
113	Naran	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
114	Nila Da Katha	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115	Qadirabad	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
116	Rajdhani	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117	Shalfalam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.01
118	Sharmai	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
119	Shigo Kas	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
120	Shounter	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	49.56	49.56
121	Soan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122	Taunsa	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.04	55.04
123	Turtonas Uzghor	HPP Candidate	0.00	0.00	0.00	0.00	0.00	51.90	51.76	51.90	51.90
124	Allai Khwar	HPP Existing	44.43	44.43	44.31	44.43	44.43	44.43	44.31	44.43	44.43
125	Chashma	HPP Existing	48.91	48.91	48.78	48.91	48.91	48.91	48.78	48.91	48.91
126	Daral Khwar	HPP Existing	38.77	38.77	38.66	38.77	38.77	38.77	38.66	38.77	38.77
127	Dubair Khwar	HPP Existing	54.57	54.57	54.42	54.57	54.57	54.57	54.42	54.57	54.57
128	Ghazi Brotha	HPP Existing	52.78	52.78	52.63	52.78	52.78	52.78	52.63	52.78	52.78
129	Golen Gol	HPP Existing	9.15	9.15	9.12	9.15	9.15	9.15	9.12	9.15	9.15
130	Gulpur	HPP Existing	28.92	28.92	28.84	28.92	28.92	28.92	28.84	28.92	28.92
131	Jagran-I	HPP Existing	49.49	49.49	49.35	49.49	49.49	49.49	49.35	49.49	49.49
132	Jinnah	HPP Existing	25.74	25.74	25.67	25.74	25.74	25.74	25.67	25.74	25.74
133	Karot	HPP Existing	45.48	45.48	45.36	45.48	45.48	45.48	45.36	45.48	45.48
134	Khan Khwar	HPP Existing	40.22	40.22	40.11	40.22	40.22	40.22	40.11	40.22	40.22
135	Malakand-III	HPP Existing	54.04	54.04	53.89	54.04	54.04	54.04	53.89	54.04	54.04
136	Mangla	HPP Existing	53.10	53.55	52.91	54.46	54.60	54.60	54.45	54.60	54.60
137	Neelum Jehlum	HPP Existing	53.48	53.48	53.33	53.48	53.48	53.48	53.33	53.48	53.48
138	New Bong	HPP Existing	55.49	55.49	55.34	55.49	55.49	55.49	55.34	55.49	55.49
139	Patrind	HPP Existing	43.76	43.76	43.64	43.76	43.76	43.76	43.64	43.76	43.76
140	Small Hydel	HPP Existing	45.59	45.59	45.46	45.59	45.59	45.59	45.46	45.59	45.59
141	Tarbela 1-14	HPP Existing	38.23	38.23	38.13	38.23	38.23	38.23	38.13	38.23	38.23
142	Tarbela_Ext_4	HPP Existing	30.33	30.33	30.25	30.33	30.33	30.33	30.25	30.33	30.33
143	Warsak	HPP Existing	50.63	50.63	50.49	50.63	50.63	50.63	50.49	50.63	50.63
144	Engro 90MW	CCGT_Gas	34.17	57.00	47.12	41.95	26.93	22.56	20.10	25.76	15.43
145	Foundation	CCGT_Gas	69.83	77.97	71.97	72.24	71.34	73.68	74.14	74.08	70.85
146	Guddu-I	CCGT_Gas	71.30	71.38	74.64	74.43	74.43	74.43	74.64	64.35	62.10
147	Guddu-II	CCGT_Gas	52.82	61.32	57.38	57.54	56.69	55.18	58.56	58.77	55.37
148	Guddu-V (747)	CCGT_Gas	65.94	69.73	67.65	75.56	73.37	64.08	64.07	63.63	60.83
149	Liberty	CCGT_Gas	40.17	40.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150	Uch	CCGT_Gas	70.75	71.04	60.29	38.92	38.92	0.00	0.00	0.00	0.00
151	Uch-II	CCGT_Gas	63.36	73.04	69.93	70.06	62.89	56.67	69.16	71.60	65.32
152	SNPC-I	KE_CCGT_Gas	66.34	71.63	68.35	68.79	57.18	53.29	53.29	71.77	53.29
153	SNPC-II	KE_CCGT_Gas	66.84	73.80	68.41	69.09	57.52	53.31	53.31	72.99	53.31
154	AES Lalpir	ST_RFO	0.15	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
155	AES Pakgen	ST_RFO	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
156	HUBCO	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
157	Jamshoro-I U1	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
158	Jamshoro-II U4	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
159	Muzaffargarh-I U1	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.53	1.59	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
160	Muzaffargarh-I U2	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.44	1.60	0.00
161	Muzaffargarh-I U3	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.54	1.60	0.00
162	Muzaffargarh-II U4	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.54	1.61	0.00
163	Saba	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
164	AGL	DG_RFO	36.81	22.13	0.00	0.00	0.00	0.00	0.42	1.73	0.00
165	Atlas	DG_RFO	0.58	0.00	0.00	0.00	0.00	0.00	0.89	1.82	1.49
166	Engro 127MW	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29	0.93
167	HuB N	DG_RFO	36.81	22.13	0.00	0.00	0.00	0.00	0.29	1.50	1.28
168	Kohinoor	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
169	Liberty Tech	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.90
170	Nishat C	DG_RFO	22.30	0.00	0.00	0.00	0.00	0.00	0.05	1.50	1.15
171	Nishat P	DG_RFO	22.72	0.00	0.00	0.00	0.00	0.00	0.45	1.80	1.49
172	GAEL	KE_DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
173	TPL	KE_DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
174	NEW OCGT_North/Center	OCGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
175	NEW OCGT_South	OCGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.98
176	C-1	Nuclear	81.11	81.11	81.33	81.11	81.11	81.11	81.33	81.11	81.11
177	C-2	Nuclear	79.61	79.61	79.83	79.61	79.61	79.61	79.83	79.61	79.61
178	C-3	Nuclear	81.01	81.01	81.23	81.01	81.01	81.01	81.23	81.01	81.01
179	C-4	Nuclear	81.01	81.01	81.23	81.01	81.01	81.01	81.23	81.01	81.01
180	C-5	Nuclear	0.00	0.00	0.00	0.00	0.00	67.29	90.21	89.96	89.75
181	K-2	Nuclear	85.07	85.07	85.30	85.07	85.07	85.07	85.30	85.07	85.07
182	K-3	Nuclear	85.07	85.07	85.30	85.07	85.07	85.07	85.30	85.07	85.07
183	NEW_Nuclear_North/Center	Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
184	NEW_Nuclear_South	Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
185	Engro Thar	Local Coal	82.49	82.49	82.74	80.95	82.51	82.51	82.74	76.44	71.14
186	Lucky	Local Coal	20.06	4.42	1.28	0.58	0.58	3.13	6.54	11.46	7.77
187	NEW_L.Coal 330	Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
188	NEW_L.Coal 660	Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	84.25
189	Thal Nova	Local Coal	84.96	84.96	85.21	84.98	84.98	84.98	85.21	84.98	82.17
190	Thar TEL	Local Coal	84.96	84.96	85.21	84.98	84.98	84.98	85.21	84.98	83.10
191	Thar-I (SSRL)	Local Coal	83.94	83.89	82.75	77.74	72.62	76.52	77.46	83.10	78.10
192	K.E_NEW_L.Coal 330	KE_Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
193	K.E_NEW_L.Coal 660	KE_Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
194	China HUBCO	Imported Coal	57.30	56.16	56.16	56.16	56.16	56.16	56.16	56.16	56.16
195	Gwadar	Imported Coal	0.00	0.00	1.16	1.59	1.46	5.53	7.75	12.57	8.85
196	Jamshoro Coal	Imported Coal	0.72	0.00	0.00	0.00	0.00	0.00	1.43	3.34	1.33
197	Jamshoro Coal 2	Imported Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
198	Port Qasim	Imported Coal	56.72	56.72	56.72	56.72	56.72	56.72	56.72	56.72	56.72
199	Sahiwal Coal	Imported Coal	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
200	FPCL	KE_Imported Coal	9.91	19.62	1.37	2.15	2.04	3.15	3.62	8.12	5.32
201	Altern	Gas Engine_RLNG	1.47	0.92	0.00	0.00	0.00	0.88	0.00	0.00	0.00
202	Davis	DG_RLNG	1.42	0.84	0.00	0.00	0.00	0.79	1.58	5.68	2.05
203	Balloki	CCGT_RLNG	22.29	80.81	41.77	35.91	29.95	31.69	33.00	44.75	37.34
204	Bhikki	CCGT_RLNG	10.13	15.65	6.45	5.06	5.02	6.48	9.72	15.54	11.22
205	FKPCL	CCGT_RLNG	1.67	1.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
206	Halmore	CCGT_RLNG	5.07	2.95	0.10	0.92	0.40	1.12	3.53	7.07	4.74
207	Haveli	CCGT_RLNG	89.99	91.96	84.60	69.42	51.08	46.64	50.40	56.70	52.40
208	KAPCO 1	CCGT_RLNG	35.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
209	KAPCO 2	CCGT_RLNG	11.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	Nandipur	CCGT_RLNG	36.38	24.46	0.75	1.16	0.88	1.18	5.08	7.42	4.89
211	NEW_CCGT_North/Center	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.71
212	NEW_CCGT_South	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
213	Orient	CCGT_RLNG	42.34	29.60	2.17	2.15	1.53	5.62	7.21	10.03	7.35
214	Rousch	CCGT_RLNG	2.44	1.94	0.00	0.10	0.14	0.00	0.00	0.00	0.00
215	Saif	CCGT_RLNG	42.18	29.58	0.92	1.37	1.02	1.53	5.83	8.73	5.86
216	Saphire	CCGT_RLNG	42.18	29.58	1.00	1.53	1.33	1.90	6.17	9.11	6.58
217	Trimmu	CCGT_RLNG	63.41	33.28	30.50	17.18	12.45	12.46	21.67	29.03	26.32
218	BQPS2	KE_CCGT_RLNG	18.03	45.41	15.07	15.44	14.10	15.52	17.19	20.93	13.67
219	BQPS3	KE_CCGT_RLNG	77.82	19.81	0.32	0.23	0.23	0.95	2.68	6.69	4.49
220	KCCPP	KE_CCGT_RLNG	7.08	34.19	6.24	7.24	6.52	8.61	10.05	12.48	7.74
221	KTGTPS	KE_CCGT_RLNG	3.92	24.03	3.45	4.30	3.76	5.64	7.42	9.47	4.66
222	SGTPS	KE_CCGT_RLNG	2.61	14.22	2.05	2.81	2.51	4.21	5.03	7.80	4.14
223	BQPS1-U1	KE_ST_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
224	BQPS1-U5	KE_ST_RLNG	1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
225	BQPS1-U6	KE_ST_RLNG	0.96	3.08	0.00	1.19	1.10	0.56	1.69	0.00	0.00
226	BQPS1-U2	KE_GT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
227	Balakot	UC Hydro_Committed	0.00	0.00	41.63	41.96	41.96	41.96	41.85	41.96	41.96
228	Chamfall	UC Hydro_Committed	48.01	48.01	47.88	48.01	48.01	48.01	47.88	48.01	48.01
229	Dasu	UC Hydro_Committed	0.00	99.00	62.98	64.52	64.52	64.52	64.34	64.52	64.52
230	Diamer Bhasha	UC Hydro_Committed	0.00	0.00	0.00	56.86	42.74	44.40	44.28	44.40	44.40
231	Gorkin Matiltan	UC Hydro_Committed	40.11	44.77	44.65	44.77	44.77	44.77	44.65	44.77	44.77
232	Jabori	UC Hydro_Committed	82.38	82.38	82.23	82.38	82.38	82.38	82.23	82.38	82.38
233	Jagran-II	UC Hydro_Committed	51.22	51.22	51.08	51.22	51.22	51.22	51.08	51.22	51.22
234	Karora	UC Hydro_Committed	72.12	72.12	71.99	72.12	72.12	72.12	71.99	72.12	72.12
235	Kathai-II	UC Hydro_Committed	0.00	60.14	61.57	61.74	61.74	61.74	61.57	61.74	61.74
236	Koto	UC Hydro_Committed	59.06	59.06	58.90	59.06	59.06	59.06	58.90	59.06	59.06
237	Kurram Tangi	UC Hydro_Committed	17.05	17.05	17.01	17.05	17.05	17.05	17.01	17.05	17.05
238	Lawi	UC Hydro_Committed	48.96	48.96	48.84	48.96	48.96	48.96	48.84	48.96	48.96
239	Mohmand Dam	UC Hydro_Committed	0.00	72.83	43.14	43.26	43.26	43.26	43.14	43.26	43.26

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
240	Nardagian	UC Hydro_Committed	43.81	48.50	48.37	48.50	48.50	48.50	48.37	48.50	48.50
241	Riali-II	UC Hydro_Committed	54.79	54.79	54.64	54.79	54.79	54.79	54.64	54.79	54.79
242	Suki Kinari	UC Hydro_Committed	51.16	51.16	51.02	51.16	51.16	51.16	51.02	51.16	51.16
243	Tarbela_Ext_5	UC Hydro_Committed	6.83	10.05	10.02	10.05	10.05	10.05	10.02	10.05	10.05

D-6. Year-wise Installed Capacity Addition (MW)

Year	Net Capacity Addition Over the Plan Period (2023-34)											
	Local Coal	Hydro	RLNG	Nuclear	Imported Coal	RE	New Tech.	Natural Gas	Furnace Oil	Cross Border	Net Yearly Addition	Cumulative Total
	MW											
Jun-23	3,300	10,663	10,185	3,530	4,020	2,810	-	2,964	5,273	-	-	42,745
2024	-	27	411	-	-	150	-	395	-	-	983	43,728
2025	-	1,145	-	-	660	404	-	-	-262	-	1,946	45,674
2026	-	1,694	-	-	-	842	-	-	-	-	2,536	48,211
2027	-	1,958	-1,510	-	-	1,615	-	-	-1,423	-	640	48,851
2028	-	1,380	-	-	300	3,728	100	-235	-	1,000	6,273	55,124
2029	-	1,910	-	-	-	1,486	100	-	-1,177	-	2,319	57,443
2030	-	2,625	-	-	-	191	100	-	-136	-	2,780	60,223
2031	-	82	-607	1,200	-	205	100	-586	-	-	394	60,617
2032	-	75	-31	-	-	2,406	100	-	-	-	2,550	63,167
2033	-	579	-210	-	-	1,978	100	-	-	-	2,447	65,614
2034	660	1,009	1,663	-	-	3,175	100	-	-1,110	-	5,497	71,111
Total	**3,960**	**23,148**	**9,901**	**4,730**	**4,980**	**18,989**	**700**	**2,538**	**1,165**	**1,000**	**71,111**	

D-7. IGCEP Generation Mix 2024-2034 (GWh)

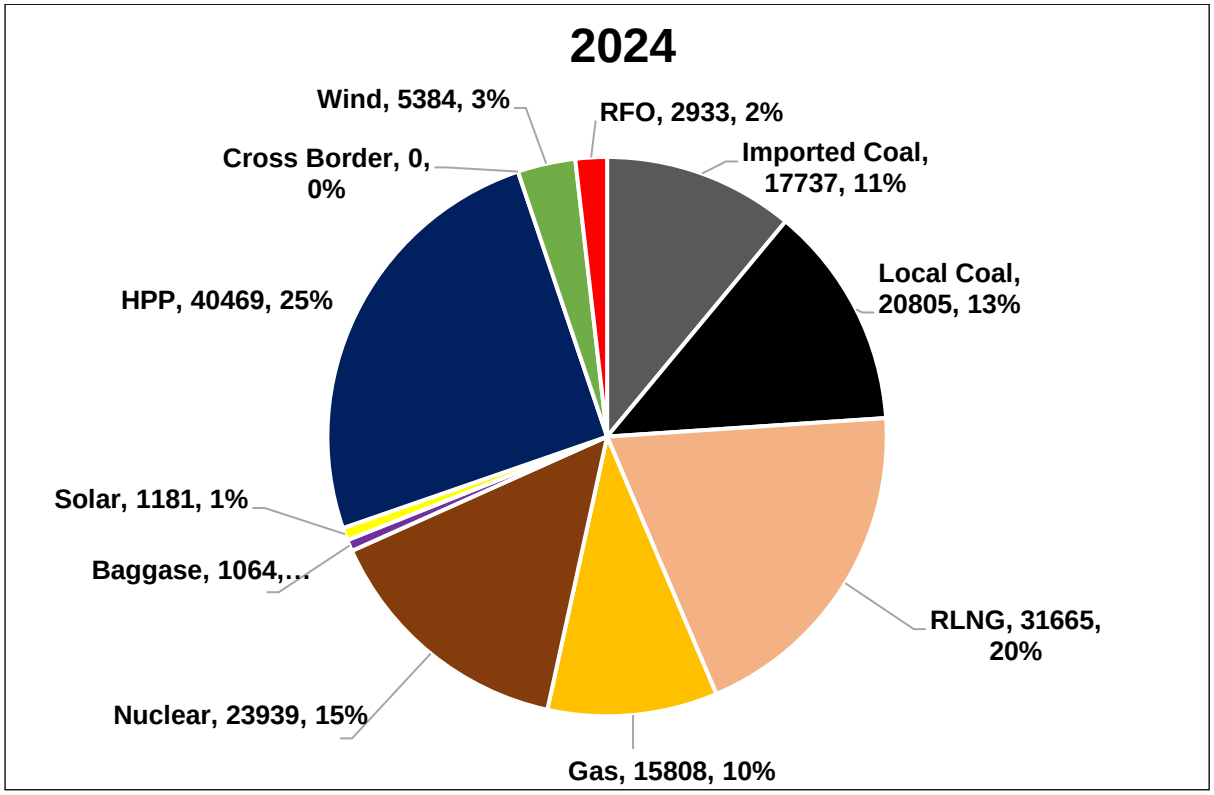


Chart D-1: IGCEP Generation Mix 2024 (GWh)

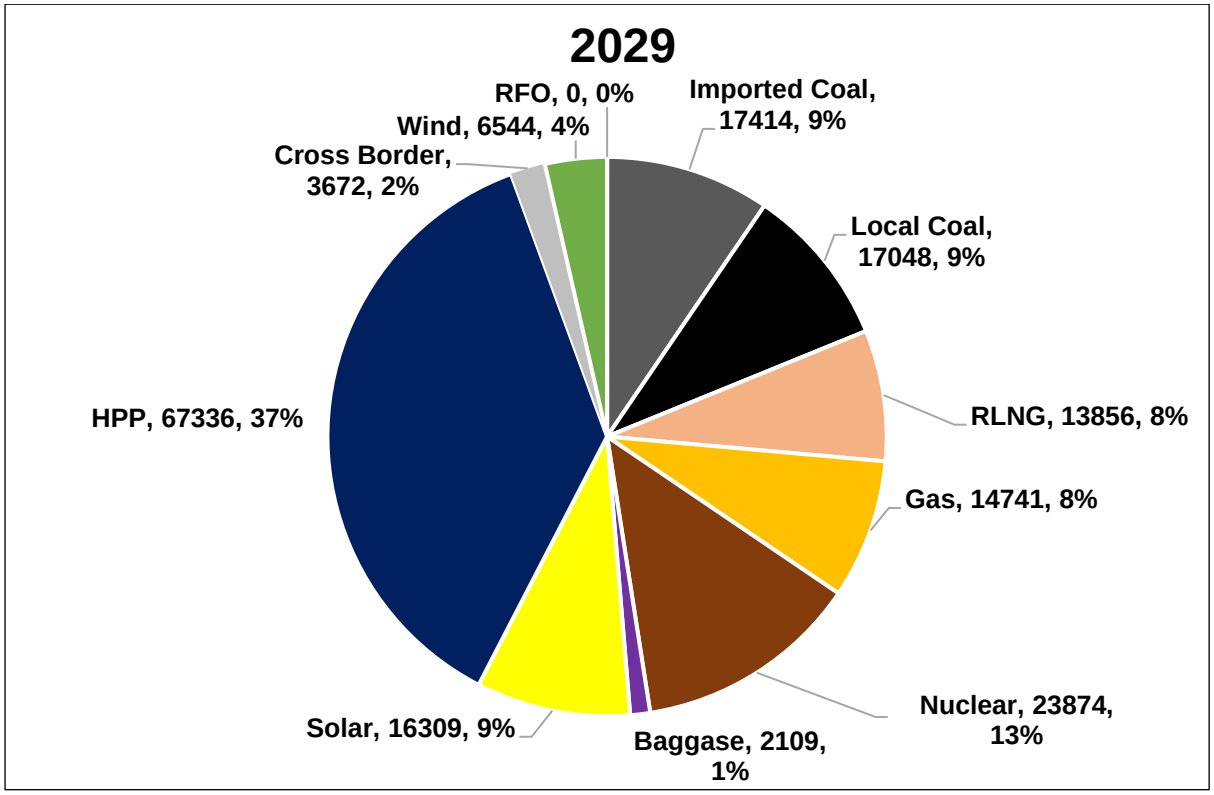


Chart D-2: IGCEP Generation Mix 2029 (GWh)

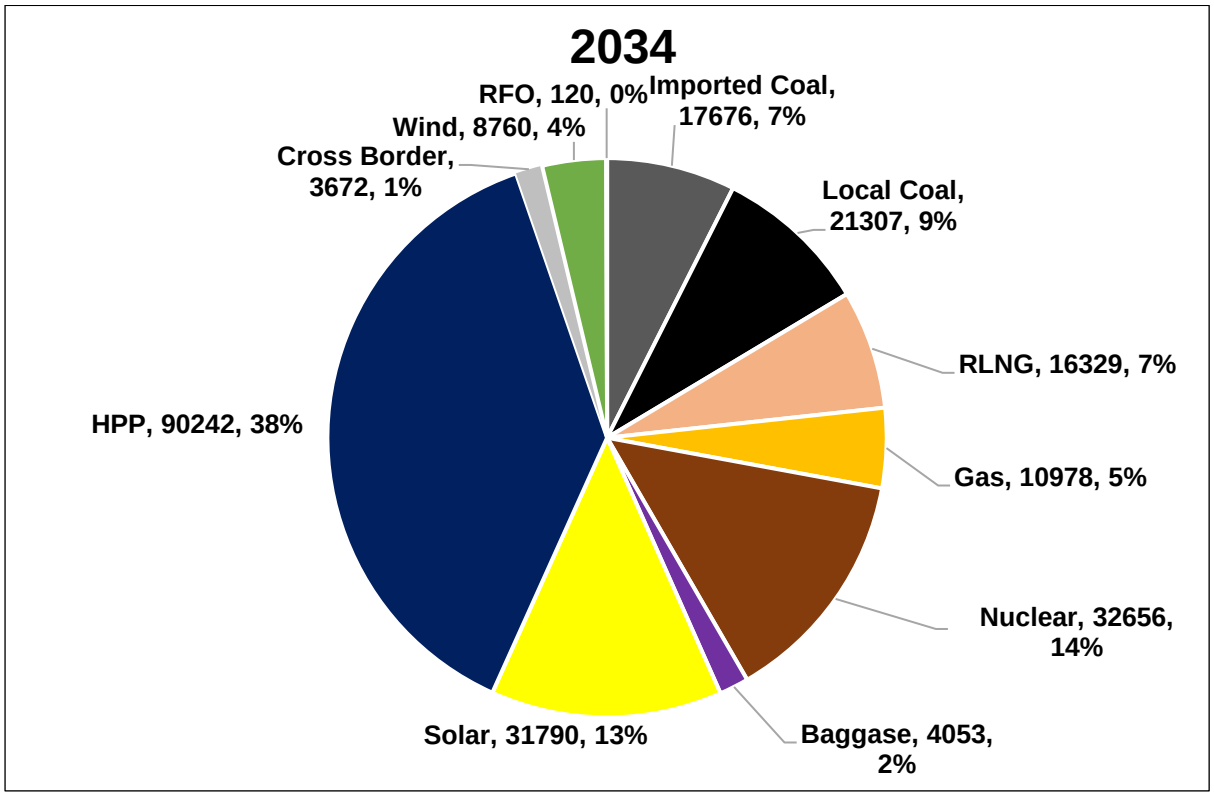


Chart D-3: IGCEP Generation Mix 2034 (GWh)

D-8. IGCEP Generation Mix 2024-34 (MW)

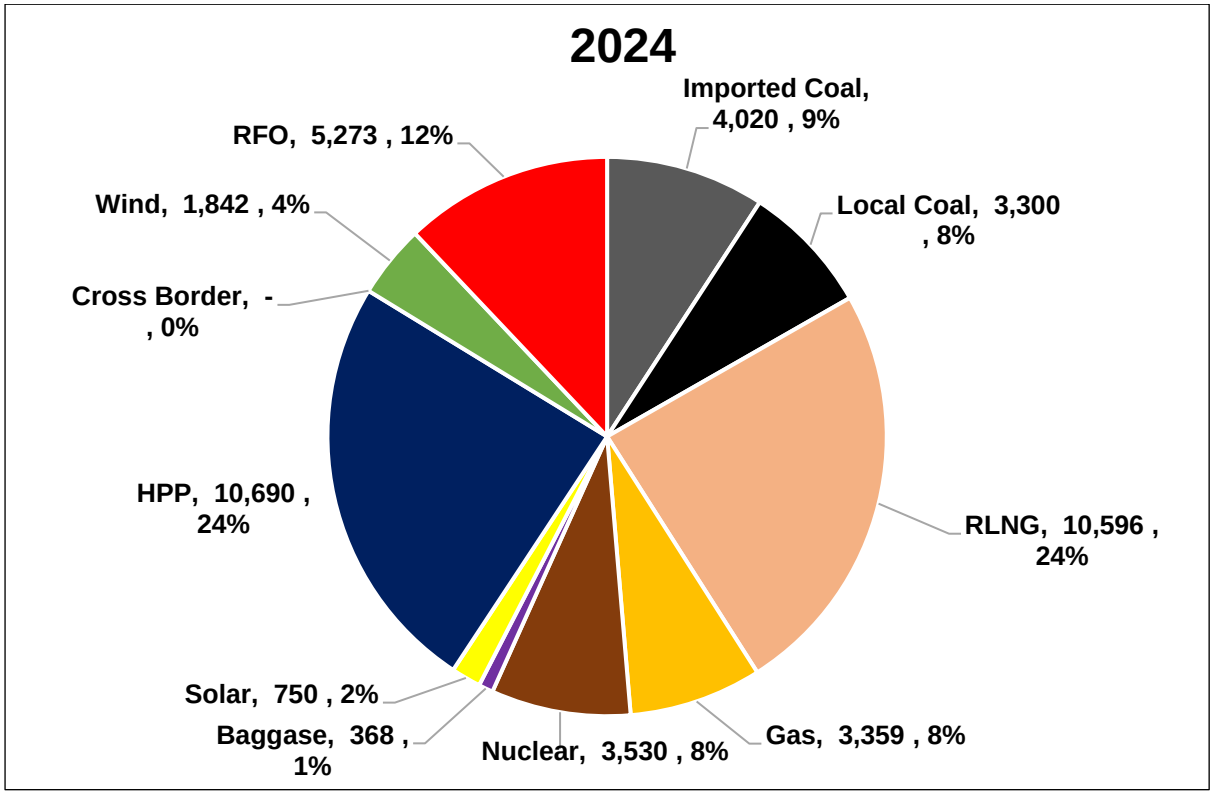


Chart D-4: IGCEP Generation Mix 2024 (MW)

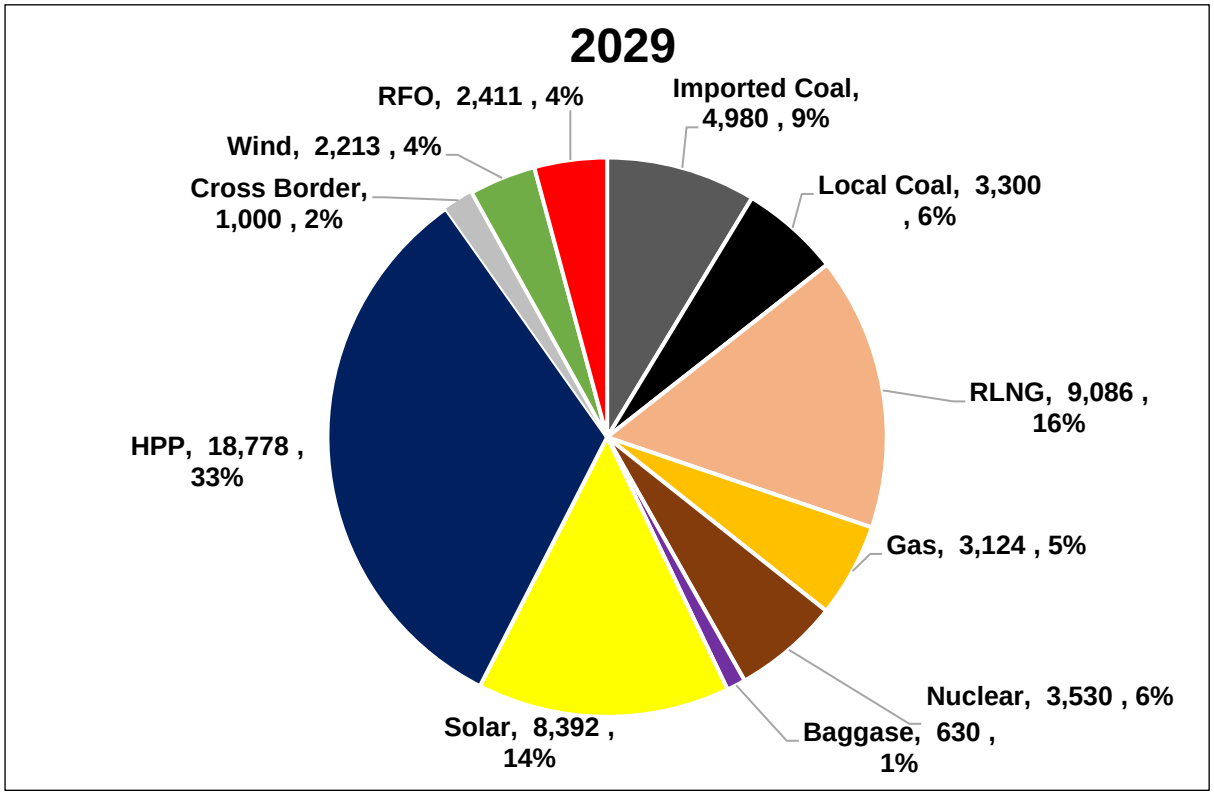


Chart D-5: IGCEP Generation Mix 2029 (MW)

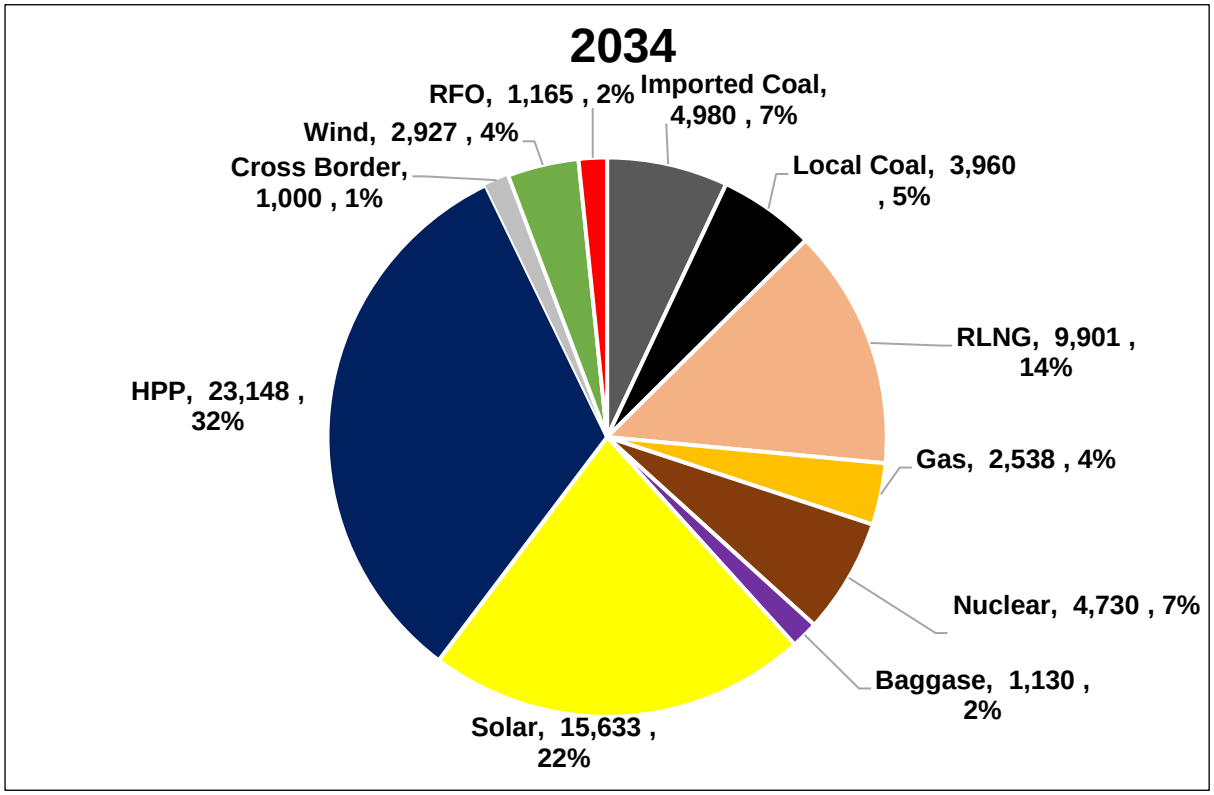
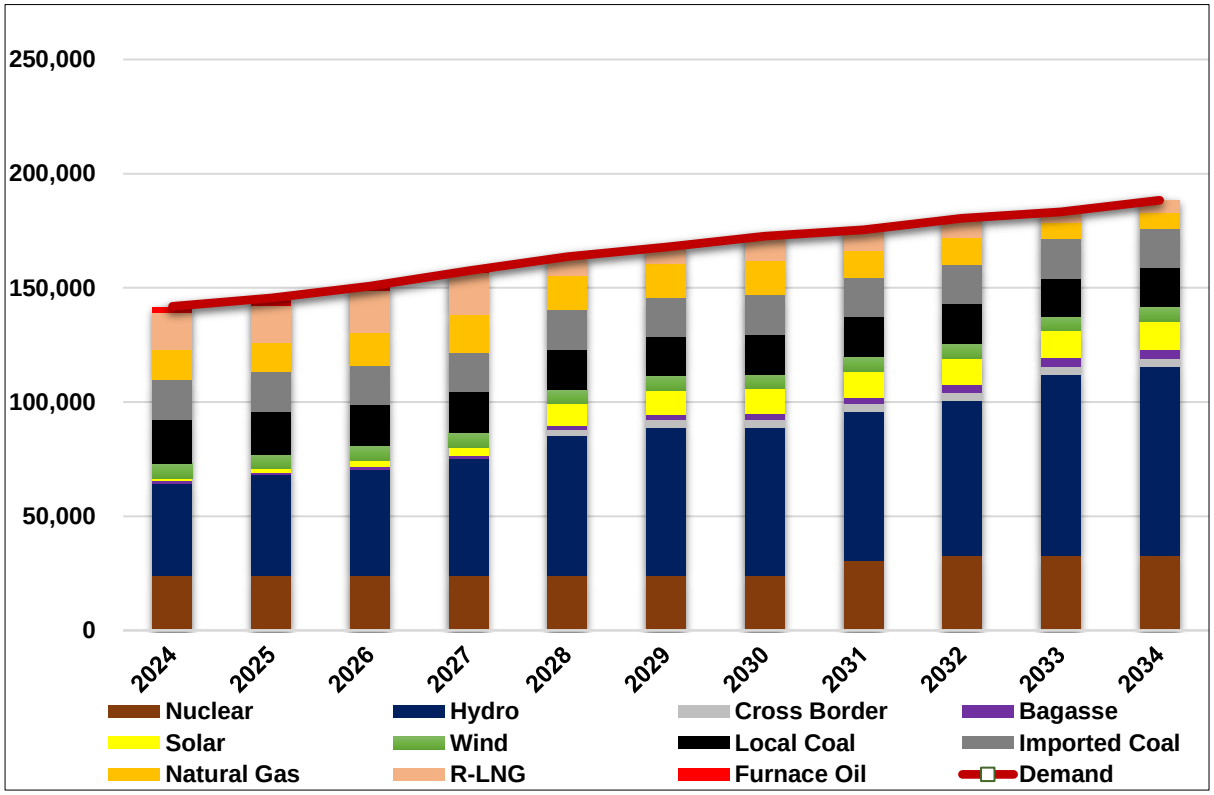


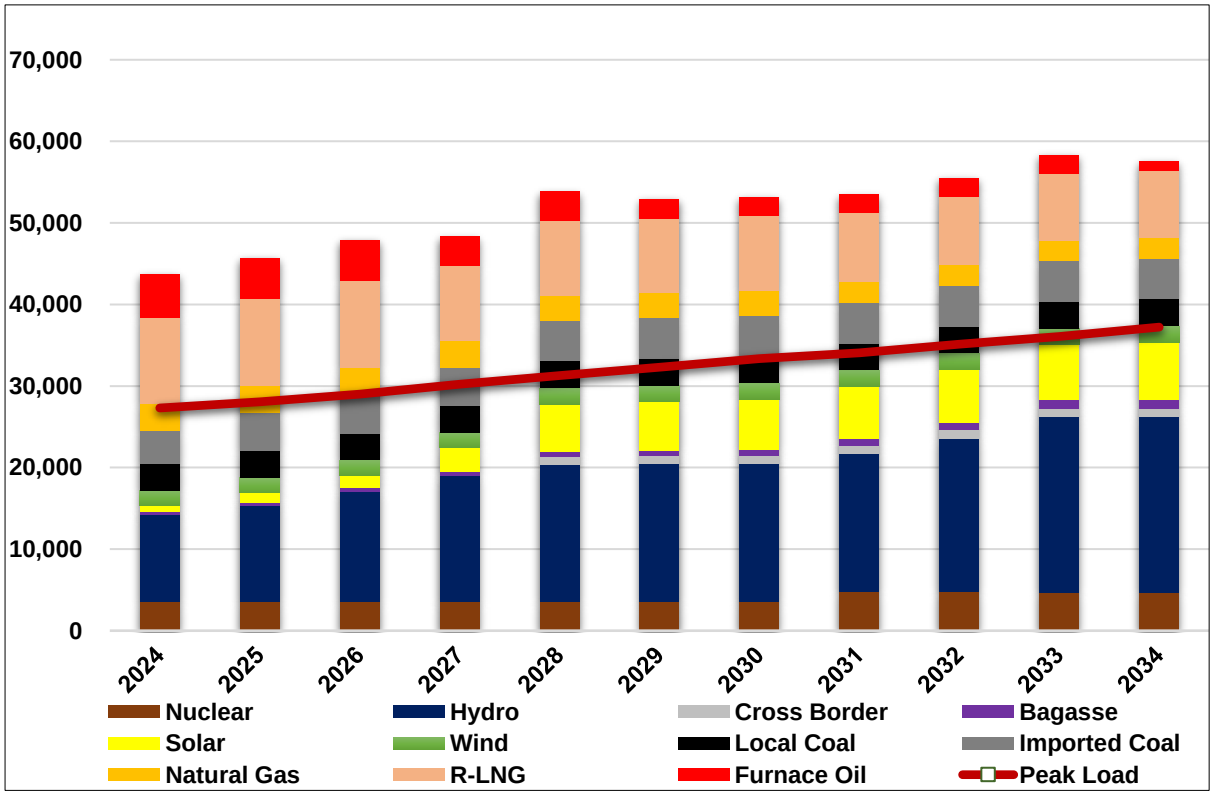
Chart D-6: IGCEP Generation Mix 2034 (MW)

Annexure E. Delay of Diamer Bhasha HPP

E-1. Annual Energy Generation Vs Annual Energy Demand (GWh) - Country



E-2. Installed Capacity Vs Peak Demand (MW) - Country



E-3. Optimized Generation Capacity Additions (MW)

Fiscal Year	Coal Fired Steam Local Coal	Coal Fired Steam Local Coal KE	Combined Cycle on RLNG	Combustion Turbine on RLNG	Nuclear	HPP	Solar Utility MW_p	Net Meter MW_p	Solar KE MW_p	Wind NTDC	Wind KE	Bagasse	Per Year Capacity Addition	Cumulative Capacity Addition
2024	-	-	-	-	-	-	-	-	-	-	-	-	0	0
2025	-	-	-	-	-	-	-	240	-	-	-	-	0	0
2026	-	-	-	-	-	-	-	241	209	-	-	-	209	209
2027	-	-	-	-	-	-	-	215	-	-	-	-	0	209
2028	-	-	-	-	-	-	1,300	223	-	-	-	-	1,300	1,509
2029	-	-	-	-	-	5	-	186	-	-	-	-	5	1,514
2030	-	-	-	-	-	-	-	191	-	-	-	-	0	1,514
2031	-	-	-	-	-	82	-	205	-	-	-	-	82	1,596
2032	-	-	-	-	-	-	-	92	-	-	-	-	0	1,596
2033	-	-	-	-	-	-	-	303	-	-	-	-	0	1,596
2034	-	-	-	-	-	-	-	211	-	-	-	-	0	1,596
Total	**-**	**-**	**-**	**-**	**-**	**87**	**1,300**	**2,107**	**209**	**-**	**-**	**-**	**1,596**	

*Does not include 2,107 MWP of Net Metering, being committed

E-4. List of Projects uptill 2031 (Committed + Optimized)

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
2023-24							
1	Helios	PV	50	50	PPIB	Category-II Project	Dec-23
2	HNDS	PV	50	50	PPIB	Category-II Project	Dec-23
3	Meridian	PV	50	50	PPIB	Category-II Project	Dec-23
4	Jabori	Hydro	10.2	10.2	GoKPK	PC-1 Approved	May-24
Generation Additions in 2023-24 (MW)			**160**	**160**			
Cumulative Addition up till 2023-24 (MW)			**160**	**160**			
2024-25							
1	Suki Kinari (U#1)	Hydro	221	221	PPIB	Financial Close	Aug-24
2	Suki Kinari (U#2)	Hydro	221	221	PPIB	Financial Close	Sep-24
3	Suki Kinari (U#3)	Hydro	221	221	PPIB	Financial Close	Oct-24
4	Suki Kinari (U#4)	Hydro	221	221	PPIB	Financial Close	Nov-24
5	Jamshoro Coal	Imported Coal	660	629	GENCO Holding	PC-1 Approved	Jun-24
6	Zorlu	PV	100	100	PPDB	Category-II Project	Oct-24
7	Lawi	Hydro	69	69	GoKPK	PC-1 Approved	Dec-24
8	Jagran-II	Hydro	48	48	AJK-HEB	PC-1 Approved	Dec-24
9	Koto	Hydro	40.8	40.8	GoKPK	PC-1 Approved	Jun-24
10	Shahtaj	Bagasse	32	32	PPIB	Category-I Project	Jun-24
11	Access_Solar	PV	11.52	11.52	PPIB	Category-I Project	Sep-24
12	Access_Electric	PV	10	10	PPIB	Category-I Project	Sep-24
13	Safe	PV	10	10	PPIB	Category-I Project	Nov-24
14	Chamfall	Hydro	3.22	3.22	AJK-HEB	PC-1 Approved	Jun-24
15	Kurram Tangi	Hydro	18	18	C&M-WAPDA	PC-1 Approved	Jun-24
16	Karora	Hydro	11.8	11.8	GoKPK	PC-1 Approved	Jul-24

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
17	Mangla Refurbishment U#3,4	Hydro	70	70	WAPDA	Committed	Jul-24
18	Net Meter	PV	240	240	DISCOs	Committed	Jul-24
Generation Additions in 2024-25 (MW)			**2,208**	**2,177**			
Cumulative Addition up till 2025 (MW)			**2,369**	**2,338**			
2025-26							
1	Tarbela_Ext_5 (U#1)	Hydro	510	510	WAPDA	PC-1 Approved	Nov-25
2	Tarbela_Ext_5 (U#2)	Hydro	510	510	WAPDA	PC-1 Approved	Dec-25
3	Tarbela_Ext_5 (U#3)	Hydro	510	510	WAPDA	PC-1 Approved	Jan-26
4	Gorkin Matiltan	Hydro	84	84	GoKPK	PC-1 Approved	Aug-25
5	TAY	Bagasse	30	30	PPIB	Category-II Project	Aug-25
6	Riali-II (U#1)	Hydro	3.5	3.5	PPIB	LOS (Issued)	Jun-25
7	Riali-II (U#2)	Hydro	3.5	3.5	PPIB	LOS (Issued)	Jun-25
8	Nardagian	Hydro	3.3	3.3	AJK-HEB	PC-1 Approved	Dec-25
9	Mangla Refurbishment U#1,2	Hydro	70	70	WAPDA	Committed	Dec-25
10	Net Meter	PV	241	241	DISCOs	Committed	Jul-25
11	KE_New_Solar	PV	209	300	K.E	Optimized	Jul-25
Generation Additions in 2025-26 (MW)			**2,174**	**2,265**			
Cumulative Addition up till 2026 (MW)			**4,543**	**4,603**			
2026-27							
1	Dasu (U#1)	Hydro	360	360	WAPDA	PC-1 Approved	Mar-27
2	Dasu (U#2)	Hydro	360	360	WAPDA	PC-1 Approved	Apr-27
3	Dasu (U#3)	Hydro	360	360	WAPDA	PC-1 Approved	May-27
4	Mohmand Dam (U#1)	Hydro	200	200	WAPDA	PC-1 Approved	Dec-26
5	Mohmand Dam (U#2)	Hydro	200	200	WAPDA	PC-1 Approved	Jan-27
6	Mohmand Dam (U#3)	Hydro	200	200	WAPDA	PC-1 Approved	Mar-27

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
7	Mohmand Dam (U#4)	Hydro	200	200	WAPDA	PC-1 Approved	Apr-27
8	PV_Committed_A	PV	600	600	PPIB	Committed	Jan-27
9	PV_Committed_B	PV	600	600	PPIB	Committed	Apr-27
10	Kathai-II (U#1)	Hydro	4	4	PPIB	LOS (Issued)	Jul-26
11	Kathai-II (U#2)	Hydro	4	4	PPIB	LOS (Issued)	Jul-26
12	Mangla Refurbishment U#9,10	Hydro	70	70	WAPDA	Committed	Apr-27
13	Net Meter	PV	215	215	DISCOs	Committed	Jul-26
Generation Additions in 2026-27 (MW)			**3,373**	**3,373**			
Cumulative Addition up till 2027 (MW)			**7,916**	**7,976**			
2027-28							
1	Dasu (U#4)	Hydro	360	360	WAPDA	PC-1 Approved	Oct-27
2	Dasu (U#5)	Hydro	360	360	WAPDA	PC-1 Approved	Nov-27
3	Dasu (U#6)	Hydro	360	360	WAPDA	PC-1 Approved	Dec-27
4	PV_Committed_C	PV	1200	1200	PPIB	Committed	Nov-27
5	CASA	Hydro	1000	1000	GoP	G2G	Aug-27
6	Gwadar	Imported Coal	300	273	PPIB	G2G/CPEC	Dec-27
7	Balakot	Hydro	300	300	GoKPK	PC-1 Approved	Dec-27
8	Siachen	PV	100	100	GoS	Category-II Project	Jun-28
9	Manjhand	PV	50	50	PPIB/GoS	PC-1 Approved	Jun-28
10	Trans_Atlantic	Wind	50	50	PPIB	Category-II Project	Jun-28
11	Western	Wind	50	50	PPIB	Category-II Project	Jun-28
12	Net Meter	PV	223	223	DISCOs	Committed	Jul-27
13	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-27
14	New Solar NTDC	PV	1300	1300	PPIB	Optimized	Jul-27
Generation Additions in 2027-28 (MW)			**5,753**	**5,726**			

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
Cumulative Addition up till 2028 (MW)			**13,669**	**13,702**			
2028-29							
1	Mangla Refurbishment U#7,8	Hydro	30	30	WAPDA	Committed	Sep-28
2	Net Meter	PV	186	186	DISCOs	Committed	Jul-28
3	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-28
4	Batdara	Hydel	5.2	5.2	AJK-HEB	Optimized	Jul-28
Generation Additions in 2028-29 (MW)			**321.2**	**321.2**			
Cumulative Addition up till 2029 (MW)			**13,990**	**14,023**			
2029-30							
1	Net Meter	PV	191	191	DISCOs	Committed	Jul-29
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-29
Generation Additions in 2029-30 (MW)			**291**	**291**			
Cumulative Addition up till 2030 (MW)			**14,281**	**14,314**			
2030-31							
1	C-5	Nuclear	1200	1117	PAEC	PC-1 Approved	Sep-30
2	Net Meter	PV	205	205	DISCOs	Committed	Jul-30
3	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-30
4	Turtonas Uzghor	Hydel	82.25	82.25	K.E	Optimized	Jul-30
Generation Additions in 2030-31 (MW)			**1,587**	**1,504**			
Cumulative Addition up till 2031 (MW)			**15,868**	**15,818**			
2031-32							
1	Diamer Bhasha (U#1)	Hydro	375	375	WAPDA	PC-1 Approved	Jan-32
2	Diamer Bhasha (U#2)	Hydro	375	375	WAPDA	PC-1 Approved	Feb-32
3	Diamer Bhasha (U#3)	Hydro	375	375	WAPDA	PC-1 Approved	Apr-32
4	Diamer Bhasha (U#4)	Hydro	375	375	WAPDA	PC-1 Approved	May-32

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
5	Diamer Bhasha (U#5)	Hydro	375	375	WAPDA	PC-1 Approved	Jun-32
6	Net Meter	PV	92	92	DISCOs	Committed	Jul-31
7	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-31
Generation Additions in 2031-32 (MW)			**2,067**	**2,067**			
Cumulative Addition up till 2032 (MW)			**17,935**	**17,885**			
2032-33							
1	Diamer Bhasha (U#6)	Hydro	375	375	WAPDA	PC-1 Approved	Jul-32
2	Diamer Bhasha (U#7)	Hydro	375	375	WAPDA	PC-1 Approved	Aug-32
3	Diamer Bhasha (U#8)	Hydro	375	375	WAPDA	PC-1 Approved	Sep-32
4	Diamer Bhasha (U#9)	Hydro	375	375	WAPDA	PC-1 Approved	Oct-32
5	Diamer Bhasha (U#10)	Hydro	375	375	WAPDA	PC-1 Approved	Nov-32
6	Diamer Bhasha (U#11)	Hydro	375	375	WAPDA	PC-1 Approved	Jan-32
7	Diamer Bhasha (U#12)	Hydro	375	375	WAPDA	PC-1 Approved	Feb-32
8	Net Meter	PV	303	303	DISCOs	Committed	Jul-32
9	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-32
Generation Additions in 2032-33 (MW)			**3,028**	**3,028**			
Cumulative Addition up till 2033 (MW)			**20,963**	**20,913**			
2033-34							
1	Net Meter	PV	211	211	DISCOs	Committed	Jul-33
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-33
Generation Additions in 2033-34 (MW)			**311**	**311**			
Cumulative Addition up till 2034 (MW)			**21,274**	**21,224**			

E-5. Annual Capacity Factors (%age)

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
1	Almoiz	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
2	Chanar	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
3	Chiniot	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
4	CSP	Bagasse	0.00	0.00	44.50	44.49	44.49	44.49	44.50	44.49	44.49
5	Fatima	Bagasse	6.53	6.53	6.55	6.53	6.53	2.51	5.96	2.75	2.75
6	Hamza	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
7	JDW-II	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
8	JDW-III	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
9	New_Bagasse	Bagasse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Ryk_Mills	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
11	Shahtaj	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
12	TAY	Bagasse	65.87	54.68	54.81	54.68	54.68	54.68	54.81	54.68	54.68
13	Thal_Layyah	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
14	Access_Electric	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
15	Access_Solar	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
16	Appolo	PV	18.86	18.86	18.86	18.86	18.92	18.92	18.92	18.92	18.92
17	Atlas_Solar(Zhenfa)	PV	16.43	16.43	16.42	16.43	16.33	16.33	16.31	16.33	16.33
18	Best	PV	18.40	18.40	18.40	18.40	18.48	18.48	18.48	18.48	18.48
19	Crest	PV	19.08	19.08	19.09	19.08	19.24	19.24	19.24	19.24	19.24
20	Helios	PV	20.35	20.35	20.33	20.35	20.22	20.22	20.20	20.22	20.22
21	HNDS	PV	20.35	20.35	20.33	20.35	20.22	20.22	20.20	20.22	20.22
22	Manjhand	PV	0.00	0.00	26.69	20.35	20.22	20.22	20.20	20.22	20.22
23	Meridian	PV	20.35	20.35	20.33	20.35	20.22	20.22	20.20	20.22	20.22
24	Net_Meter	PV	17.79	17.79	17.78	17.79	17.89	17.89	17.88	17.89	17.89
25	New_Solar_North/Center	PV	0.00	0.00	25.22	25.22	25.39	25.39	25.38	25.39	25.39
26	New_Solar_South	PV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	PV_Committed_A	PV	0.00	17.33	19.21	19.23	19.11	19.11	19.09	19.11	19.11
28	PV_Committed_B	PV	0.00	23.90	19.21	19.23	19.11	19.11	19.09	19.11	19.11
29	PV_Committed_C	PV	0.00	0.00	17.41	19.23	19.11	19.11	19.09	19.11	19.11
30	QA_Solar	PV	17.36	17.36	17.37	17.36	17.46	17.46	17.47	17.46	17.46
31	Safe	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
32	Siachen	PV	0.00	0.00	26.69	20.35	20.22	20.22	20.20	20.22	20.22
33	Zorlu	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
34	Gharo	KE_PV	26.36	26.36	26.35	26.36	26.08	26.08	26.08	26.08	26.08
35	KE_New_Solar	KE_PV	22.87	22.87	22.87	22.87	22.96	22.96	22.96	22.96	22.96
36	Oursun	KE_PV	22.17	22.17	22.17	22.17	21.89	21.89	21.90	21.89	21.89
37	Act	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
38	Act_2	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
39	Artistic_wind	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
40	Artistic_Wind_2	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
41	Dawood	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
42	Din	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
43	FFC	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
44	FWEL-I	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
45	FWEL-II	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
46	Gul Ahmed	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
47	Gul_Electric	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
48	Hawa	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
49	Indus_Energy	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
50	Jhimpir	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
51	Lakeside	Wind	43.96	43.96	43.89	43.96	41.56	41.56	41.49	41.56	41.56
52	Liberty_Wind_1	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
53	Liberty_Wind_2	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
54	Master	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
55	Master_Green	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
56	Metro_Power	Wind	38.06	38.06	37.99	38.06	36.60	36.60	36.54	36.60	36.60
57	Metro_Wind	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
58	NASDA	Wind	43.96	43.96	43.89	43.96	41.56	41.56	41.49	41.56	41.56
59	New_Wind	Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	Sachal	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
61	Sapphire_Wind	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
62	Tenaga	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
63	Three_Gorges_I	Wind	38.06	38.06	37.99	38.06	36.60	36.60	36.54	36.60	36.60
64	Three_Gorges_II	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
65	Three_Gorges_III	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
66	Trans_Atlantic	Wind	0.00	0.00	34.42	38.97	38.48	38.48	38.41	38.48	38.48
67	Tricom	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
68	Tricon_A	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
69	Tricon_B	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
70	Tricon_C	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
71	UEP	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
72	Western	Wind	0.00	0.00	34.54	42.84	40.49	40.49	40.42	40.49	40.49
73	Yunus	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
74	Zephyr	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
75	Zorlu_Wind	Wind	38.06	38.06	37.99	38.06	36.60	36.60	36.54	36.60	36.60
76	KE_New_Wind	KE_Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
77	CASA	Interconnection	0.00	0.00	36.42	41.92	41.92	41.92	41.80	41.92	41.92
78	Balkani	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
79	Batdara	HPP Candidate <=20	0.00	0.00	0.00	47.66	47.66	47.66	47.53	47.66	47.66

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
80	Daral Khwar-II	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81	Deg Outfall	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
82	Ghail	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
83	Jhing-II	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
84	Nandihar	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
85	Arkari Gol	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
86	Artistic-I	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
87	Artistic-II	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
88	Ashkot	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
89	Asrit Kedam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90	Athmuqam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
91	Azad Pattan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
92	Bankhwar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93	Bata Kundi	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
94	Chakoti Hatian	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95	CJ	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
96	Dowarian	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
97	Gabral Kalam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
98	Gabral Utror	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
99	Gumat Nar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	Harigehl-Majeedgala	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101	Jagran-III	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102	Jagran-IV	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
103	Kaigah	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
104	Kalam Asrit	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	Keyal Khwar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
106	Kohala	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
107	Lower Spat Gah	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
108	Luat	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
109	Madyan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110	Mahl	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
111	Mastuj	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112	Nagdar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
113	Naran	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
114	Nila Da Katha	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115	Qadirabad	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
116	Rajdhani	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117	Shalfalam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
118	Sharmai	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
119	Shigo Kas	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
120	Shounter	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
121	Soan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122	Taunsa	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
123	Turtonas Uzghor	HPP Candidate	0.00	0.00	0.00	0.00	0.00	51.90	51.76	51.90	51.90
124	Allai Khwar	HPP Existing	44.43	44.43	44.31	44.43	44.43	44.43	44.31	44.43	44.43
125	Chashma	HPP Existing	48.91	48.91	48.78	48.91	48.91	48.91	48.78	48.91	48.91
126	Daral Khwar	HPP Existing	38.77	38.77	38.66	38.77	38.77	38.77	38.66	38.77	38.77
127	Dubair Khwar	HPP Existing	54.57	54.57	54.42	54.57	54.57	54.57	54.42	54.57	54.57
128	Ghazi Brotha	HPP Existing	52.78	52.78	52.63	52.78	52.78	52.78	52.63	52.78	52.78
129	Golen Gol	HPP Existing	9.15	9.15	9.12	9.15	9.15	9.15	9.12	9.15	9.15
130	Gulpur	HPP Existing	28.92	28.92	28.84	28.92	28.92	28.92	28.84	28.92	28.92
131	Jagran-I	HPP Existing	49.49	49.49	49.35	49.49	49.49	49.49	49.35	49.49	49.49
132	Jinnah	HPP Existing	25.74	25.74	25.67	25.74	25.74	25.74	25.67	25.74	25.74
133	Karot	HPP Existing	45.48	45.48	45.36	45.48	45.48	45.48	45.36	45.48	45.48
134	Khan Khwar	HPP Existing	40.22	40.22	40.11	40.22	40.22	40.22	40.11	40.22	40.22
135	Malakand-III	HPP Existing	54.04	54.04	53.89	54.04	54.04	54.04	53.89	54.04	54.04
136	Mangla	HPP Existing	53.10	53.55	52.91	54.46	54.60	54.60	54.45	54.60	54.60
137	Neelum Jehlum	HPP Existing	53.48	53.48	53.33	53.48	53.48	53.48	53.33	53.48	53.48
138	New Bong	HPP Existing	55.49	55.49	55.34	55.49	55.49	55.49	55.34	55.49	55.49
139	Patrind	HPP Existing	43.76	43.76	43.64	43.76	43.76	43.76	43.64	43.76	43.76
140	Small Hydel	HPP Existing	45.59	45.59	45.46	45.59	45.59	45.59	45.46	45.59	45.59
141	Tarbela 1-14	HPP Existing	38.23	38.23	38.13	38.23	38.23	38.23	38.13	38.23	38.23
142	Tarbela_Ext_4	HPP Existing	30.33	30.33	30.25	30.33	30.33	30.33	30.25	30.33	30.33
143	Warsak	HPP Existing	50.63	50.63	50.49	50.63	50.63	50.63	50.49	50.63	50.63
144	Engro 90MW	CCGT_Gas	29.32	48.52	45.68	31.30	37.17	19.56	17.86	11.51	8.09
145	Foundation	CCGT_Gas	61.33	76.83	73.60	73.69	74.71	75.57	76.02	53.85	53.85
146	Guddu-I	CCGT_Gas	69.84	70.58	74.64	74.43	74.43	74.43	74.64	47.45	49.03
147	Guddu-II	CCGT_Gas	48.52	60.99	58.18	58.18	58.42	48.86	59.75	23.58	20.40
148	Guddu-V (747)	CCGT_Gas	56.88	68.11	65.75	75.56	75.40	65.38	65.37	27.96	22.72
149	Liberty	CCGT_Gas	40.17	40.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150	Uch	CCGT_Gas	63.34	70.75	50.92	38.92	38.92	0.00	0.00	0.00	0.00
151	Uch-II	CCGT_Gas	58.77	67.88	70.45	66.86	71.54	56.67	60.25	56.67	56.67
152	SNPC-I	KE_CCGT_Gas	62.29	68.99	65.61	56.73	65.56	53.29	53.29	53.29	53.29
153	SNPC-II	KE_CCGT_Gas	62.88	70.08	66.14	57.46	70.00	53.31	53.31	53.31	53.31
154	AES Lalpir	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
155	AES Pakgen	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
156	HUBCO	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
157	Jamshoro-I U1	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
158	Jamshoro-II U4	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
159	Muzaffargarh-I U1	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
160	Muzaffargarh-I U2	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
161	Muzaffargarh-I U3	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
162	Muzaffargarh-II U4	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
163	Saba	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
164	AGL	DG_RFO	36.81	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
165	Atlas	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
166	Engro 127MW	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
167	HuB N	DG_RFO	36.81	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
168	Kohinoor	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
169	Liberty Tech	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
170	Nishat C	DG_RFO	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
171	Nishat P	DG_RFO	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
172	GAEL	KE_DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
173	TPL	KE_DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
174	NEW OCGT_North/Center	OCGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
175	NEW OCGT_South	OCGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
176	C-1	Nuclear	81.11	81.11	81.33	81.11	81.11	81.11	81.33	81.11	81.11
177	C-2	Nuclear	79.61	79.61	79.83	79.61	79.61	79.61	79.83	79.61	79.61
178	C-3	Nuclear	81.01	81.01	81.23	81.01	81.01	81.01	81.23	81.01	81.01
179	C-4	Nuclear	81.01	81.01	81.23	81.01	81.01	81.01	81.23	81.01	81.01
180	C-5	Nuclear	0.00	0.00	0.00	0.00	0.00	67.29	90.21	89.96	89.96
181	K-2	Nuclear	85.07	85.07	85.30	85.07	85.07	85.07	85.30	85.07	85.07
182	K-3	Nuclear	85.07	85.07	85.30	85.07	85.07	85.07	85.30	85.07	85.07
183	NEW_Nuclear_North/Center	Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
184	NEW_Nuclear_South	Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
185	Engro Thar	Local Coal	82.51	82.51	82.74	82.18	82.51	82.47	82.44	73.33	73.64
186	Lucky	Local Coal	2.32	0.76	0.00	0.00	0.29	0.79	0.70	0.28	1.10
187	NEW_L.Coal 330	Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
188	NEW_L.Coal 660	Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
189	Thal Nova	Local Coal	84.98	84.98	85.21	84.98	84.98	84.98	85.21	84.98	84.98
190	Thar TEL	Local Coal	84.98	84.98	85.21	84.98	84.98	84.98	85.21	84.98	84.98
191	Thar-I (SSRL)	Local Coal	84.07	84.30	81.28	75.46	79.86	79.79	81.06	77.88	80.14
192	K.E_NEW_L.Coal 330	KE_Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
193	K.E_NEW_L.Coal 660	KE_Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
194	China HUBCO	Imported Coal	56.16	56.16	56.16	56.16	56.16	56.16	56.16	56.16	56.16
195	Gwadar	Imported Coal	0.00	0.00	0.20	0.32	1.16	1.48	1.61	0.29	1.49
196	Jamshoro Coal	Imported Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
197	Jamshoro Coal 2	Imported Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
198	Port Qasim	Imported Coal	56.72	56.72	56.72	56.72	56.72	56.72	56.72	56.72	56.72
199	Sahiwal Coal	Imported Coal	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
200	FPCL	KE_Imported Coal	7.12	17.42	2.31	2.31	1.19	1.15	0.96	0.87	0.87
201	Altern	Gas Engine_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
202	Davis	DG_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
203	Balloki	CCGT_RLNG	6.32	25.81	22.89	18.45	30.18	26.47	22.85	10.04	13.52
204	Bhikki	CCGT_RLNG	1.54	4.86	0.58	0.98	2.39	2.45	2.39	1.07	2.16
205	FKPCL	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
206	Halmore	CCGT_RLNG	0.00	0.00	0.00	0.00	0.30	0.24	0.00	0.00	0.00
207	Haveli	CCGT_RLNG	37.82	73.38	47.60	40.11	57.04	45.59	44.01	25.78	29.22
208	KAPCO 1	CCGT_RLNG	35.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
209	KAPCO 2	CCGT_RLNG	11.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	Nandipur	CCGT_RLNG	36.38	21.87	0.00	0.16	0.62	0.29	0.29	0.00	0.17
211	NEW_CCGT_North/Center	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
212	NEW_CCGT_South	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
213	Orient	CCGT_RLNG	37.73	22.99	0.00	0.62	1.04	1.04	1.22	0.00	0.34
214	Rousch	CCGT_RLNG	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
215	Saif	CCGT_RLNG	37.73	22.86	0.00	0.30	0.91	0.30	0.30	0.00	0.30
216	Saphire	CCGT_RLNG	37.73	22.99	0.00	0.30	0.91	0.30	0.30	0.00	0.30
217	Trimmu	CCGT_RLNG	15.64	10.87	4.14	5.69	10.09	6.05	7.73	4.05	6.95
218	BQPS2	KE_CCGT_RLNG	12.68	42.43	13.19	13.84	13.30	11.25	10.36	7.04	5.82
219	BQPS3	KE_CCGT_RLNG	77.79	13.98	1.03	1.00	1.21	1.22	1.29	1.71	1.66
220	KCCPP	KE_CCGT_RLNG	5.45	30.28	6.62	7.29	6.98	5.19	3.91	1.84	1.78
221	KTGTPS	KE_CCGT_RLNG	3.43	21.25	4.33	4.20	3.27	2.93	2.43	1.03	0.92
222	SGTPS	KE_CCGT_RLNG	2.41	12.76	3.15	3.39	2.50	1.44	1.38	0.50	0.87
223	BQPS1-U1	KE_ST_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
224	BQPS1-U5	KE_ST_RLNG	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
225	BQPS1-U6	KE_ST_RLNG	1.24	3.00	0.33	0.84	0.88	0.72	0.70	0.00	0.00
226	BQPS1-U2	KE_GT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
227	Balakot	UC Hydro_Committed	0.00	0.00	41.63	41.96	41.96	41.96	41.85	41.96	41.96
228	Chamfall	UC Hydro_Committed	48.01	48.01	47.88	48.01	48.01	48.01	47.88	48.01	48.01
229	Dasu	UC Hydro_Committed	0.00	99.00	61.91	64.52	64.52	64.52	64.34	64.52	64.52
230	Diamer Bhasha	UC Hydro_Committed	0.00	0.00	0.00	0.00	0.00	0.00	56.95	42.74	44.40
231	Gorkin Matiltan	UC Hydro_Committed	40.11	44.77	44.65	44.77	44.77	44.77	44.65	44.77	44.77
232	Jabori	UC Hydro_Committed	82.38	82.38	82.23	82.38	82.38	82.38	82.23	82.38	82.38
233	Jagran-II	UC Hydro_Committed	51.22	51.22	51.08	51.22	51.22	51.22	51.08	51.22	51.22
234	Karora	UC Hydro_Committed	72.12	72.12	71.99	72.12	72.12	72.12	71.99	72.12	72.12
235	Kathai-II	UC Hydro_Committed	0.00	60.14	61.57	61.74	61.74	61.74	61.57	61.74	61.74
236	Koto	UC Hydro_Committed	59.06	59.06	58.90	59.06	59.06	59.06	58.90	59.06	59.06
237	Kurram Tangi	UC Hydro_Committed	17.05	17.05	17.01	17.05	17.05	17.05	17.01	17.05	17.05
238	Lawi	UC Hydro_Committed	48.96	48.96	48.84	48.96	48.96	48.96	48.84	48.96	48.96
239	Mohmand Dam	UC Hydro_Committed	0.00	72.83	43.14	43.26	43.26	43.26	43.14	43.26	43.26

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
240	Nardagian	UC Hydro_Committed	43.81	48.50	48.37	48.50	48.50	48.50	48.37	48.50	48.50
241	Riali-II	UC Hydro_Committed	54.79	54.79	54.64	54.79	54.79	54.79	54.64	54.79	54.79
242	Suki Kinari	UC Hydro_Committed	51.16	51.16	51.02	51.16	51.16	51.16	51.02	51.16	51.16
243	Tarbela_Ext_5	UC Hydro_Committed	6.49	10.05	10.02	10.05	10.05	10.05	10.02	10.05	10.05

E-6. Year-wise Installed Capacity Addition (MW)

Year	Net Capacity Addition Over the Plan Period (2023-34)											
	Local Coal	Hydro	RLNG	Nuclear	Imported Coal	RE	New Tech.	Natural Gas	Furnace Oil	Cross Border	Net Yearly Addition	Cumulative Total
	MW											
Jun-23	3,300	10,663	10,185	3,530	4,020	2,810	-	2,964	5,273	-	-	42,745
2024	-	27	411	-	-	150	-	395	-	-	983	43,728
2025	-	1,145	-	-	660	404	-	-	-262	-	1,946	45,674
2026	-	1,694	-	-	-	480	-	-	-	-	2,174	47,849
2027	-	1,958	-1,510	-	-	1,415	-	-	-1,423	-	440	48,289
2028	-	1,380	-	-	300	2,973	100	-235	-	1,000	5,518	53,807
2029	-	35	-	-	-	186	100	-	-1,177	-	-856	52,951
2030	-	-	-	-	-	191	100	-	-136	-	155	53,106
2031	-	82	-638	1,200	-	205	100	-586	-	-	363	53,469
2032	-	1,875	-	-	-	92	100	-	-	-	2,067	55,536
2033	-	2,625	-210	-	-	303	100	-	-	-	2,818	58,354
2034	-	-	-	-	-	211	100	-	-1,110	-	-799	57,555
Total	**3,300**	**21,485**	**8,238**	**4,730**	**4,980**	**9,419**	**700**	**2,538**	**1,165**	**1,000**	**57,555**	

E-7. IGCEP Generation Mix 2024-2034 (GWh)

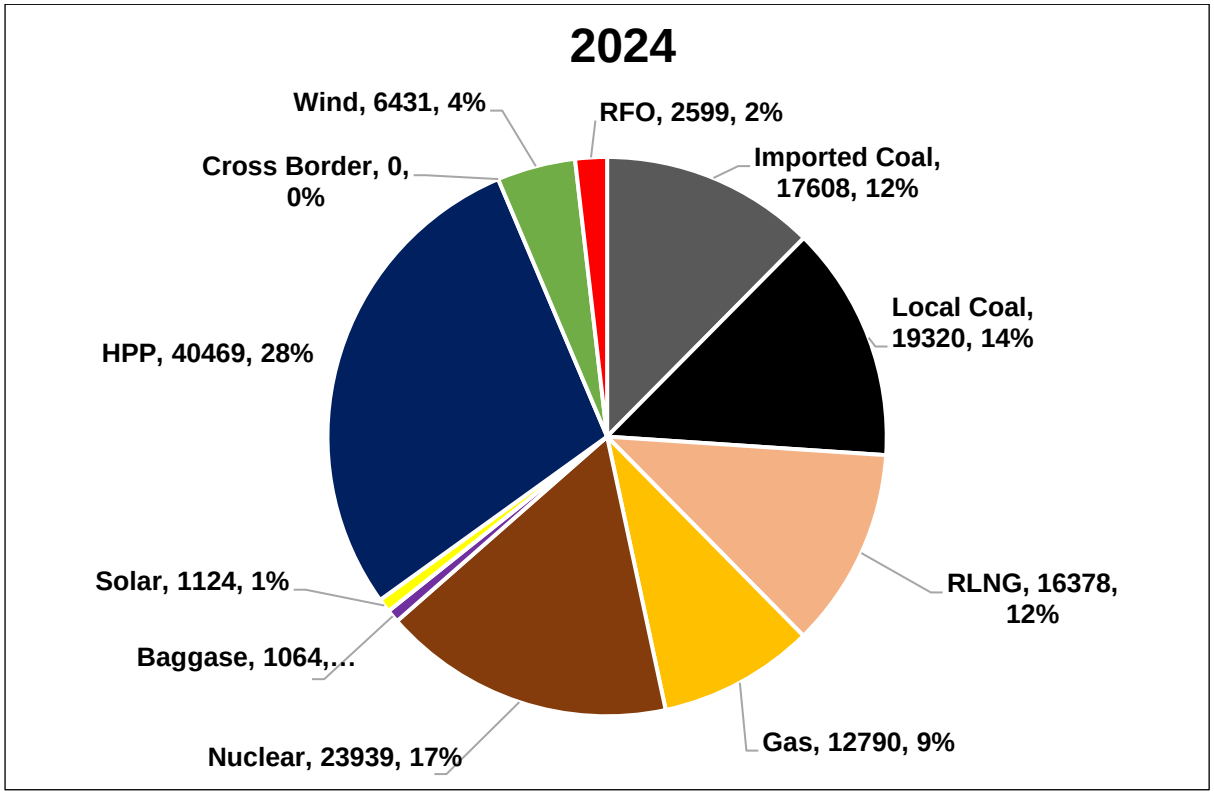


Chart E-1: IGCEP Generation Mix 2024 (GWh)

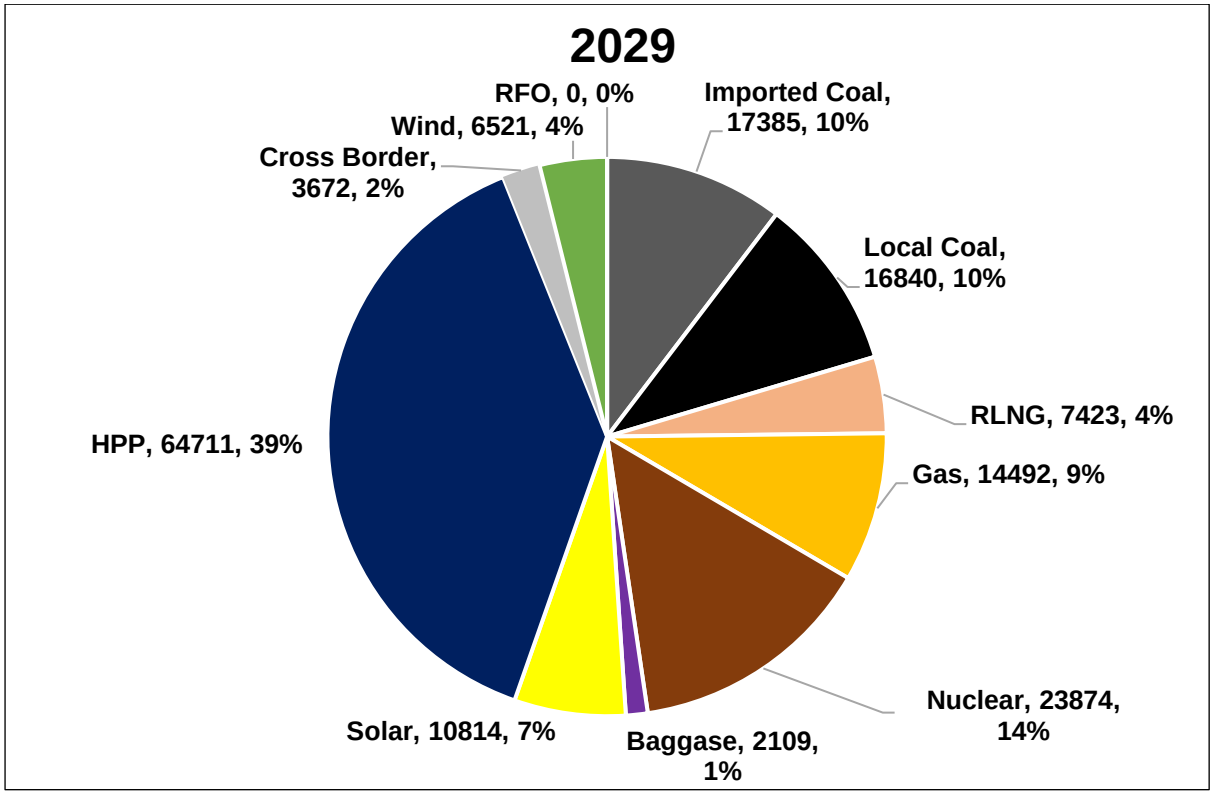


Chart E-2: IGCEP Generation Mix 2029 (GWh)

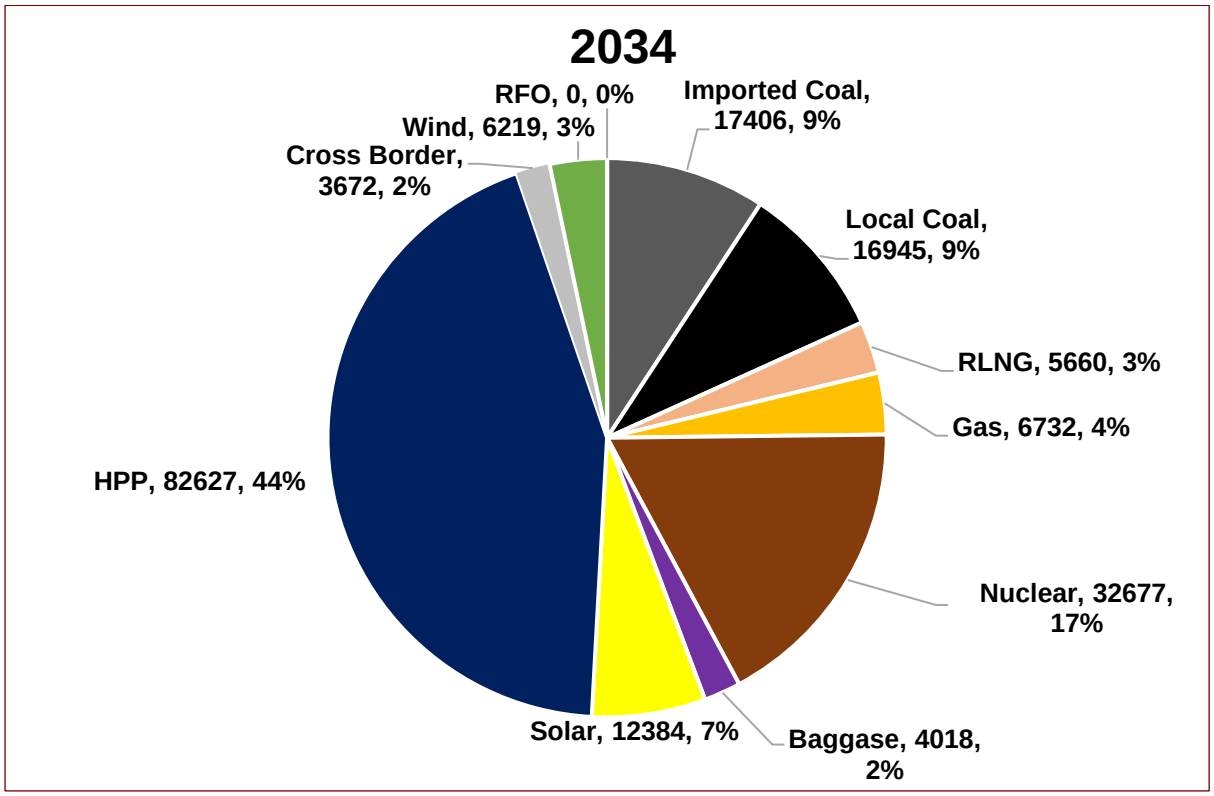


Chart E-3: IGCEP Generation Mix 2034 (GWh)

E-8. IGCEP Generation Mix 2024-34 (MW)

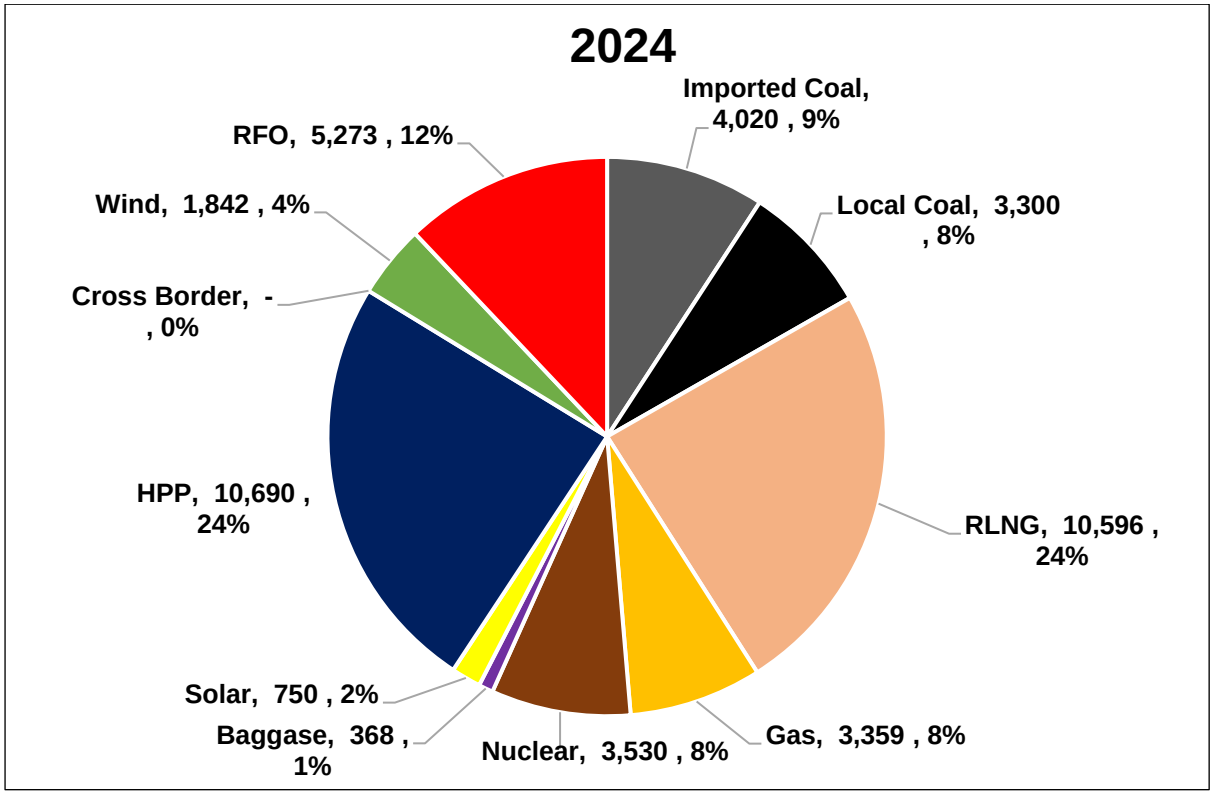


Chart E-4: IGCEP Generation Mix 2024 (MW)

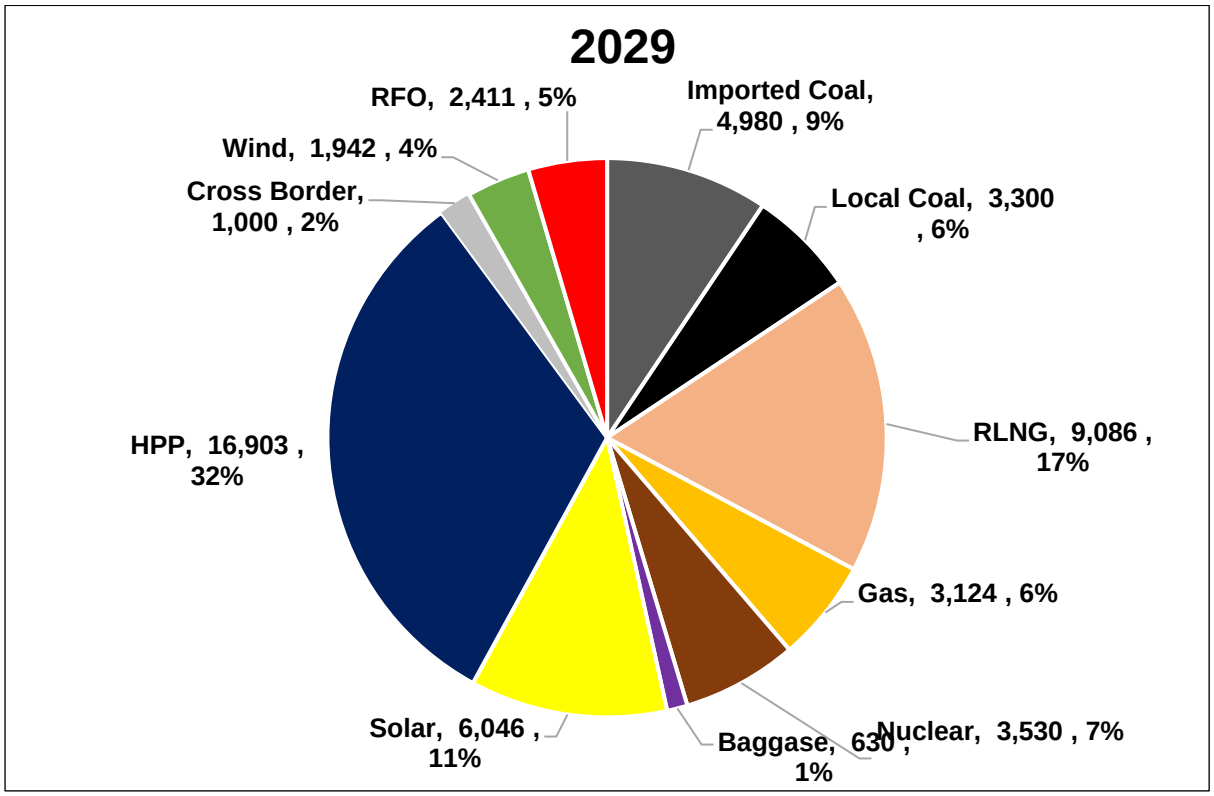


Chart E-5: IGCEP Generation Mix 2029 (MW)

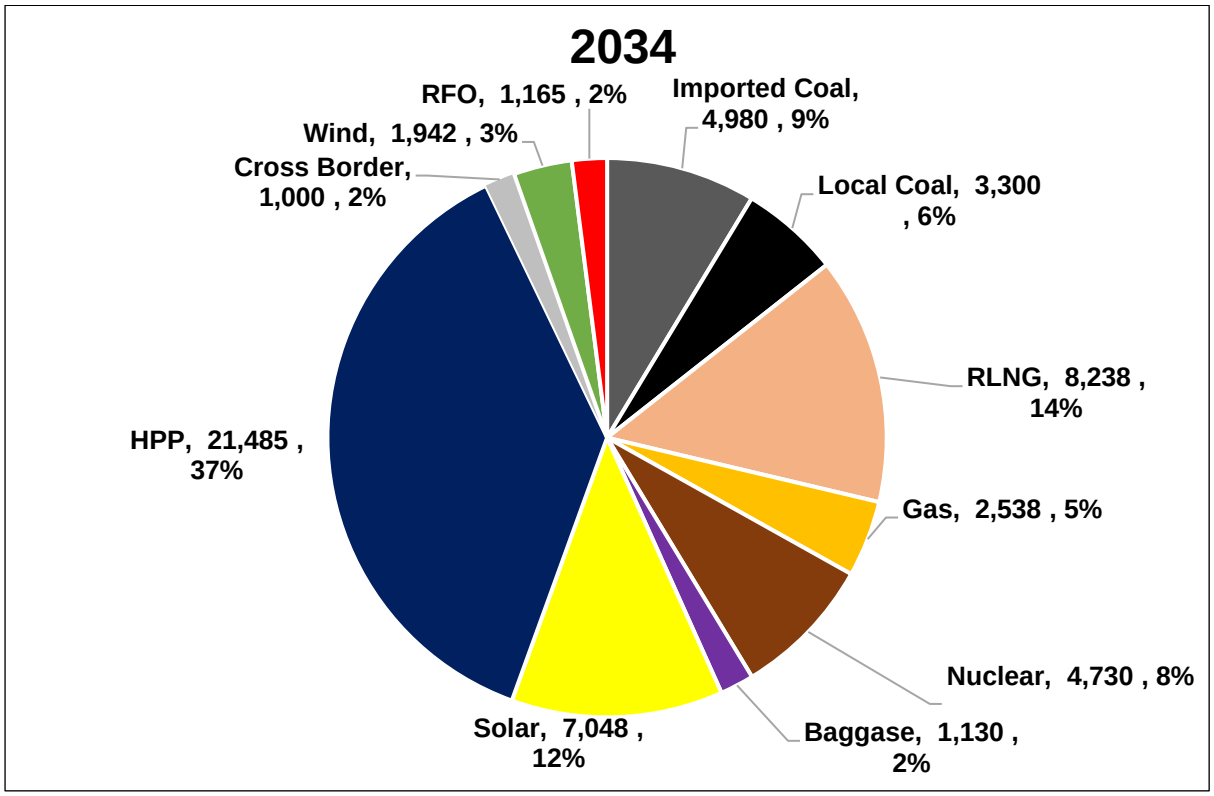
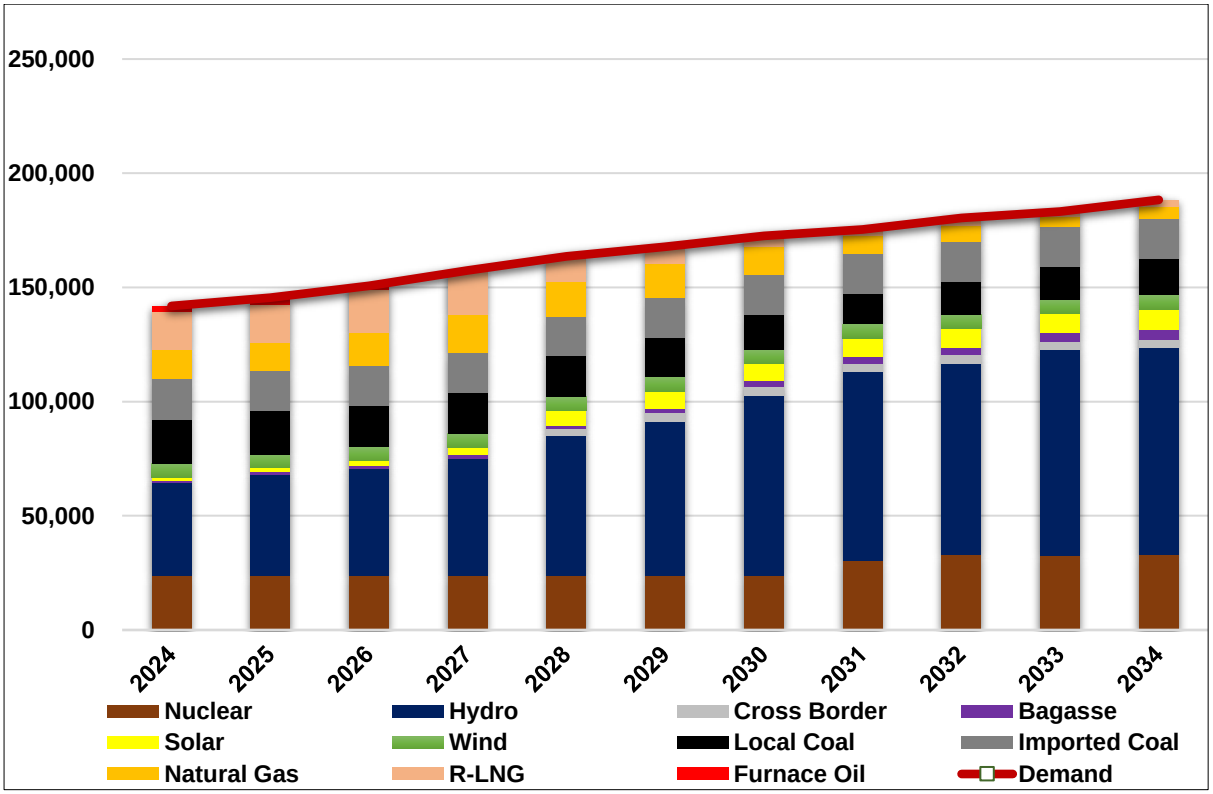


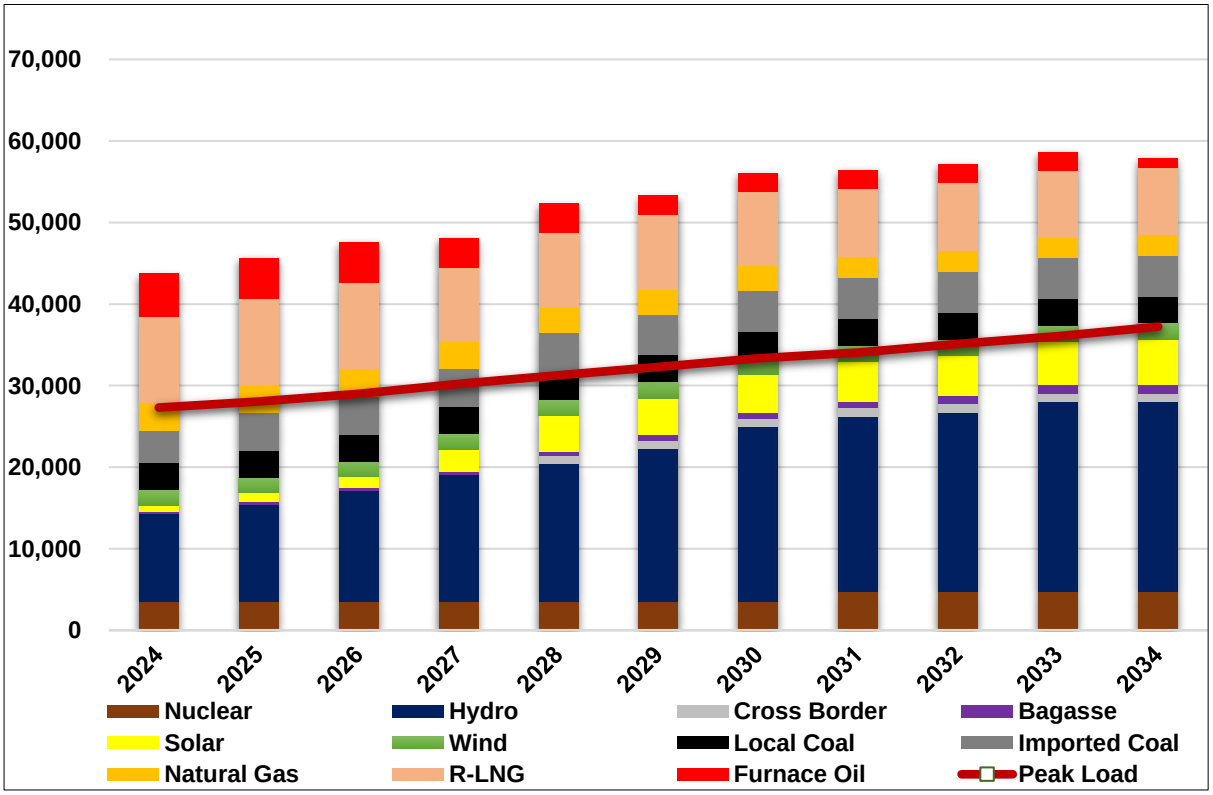
Chart E-6: IGCEP Generation Mix 2034 (MW)

Annexure F. Azad Patan and Kohala HPP as Committed

F-1. Annual Energy Generation Vs Annual Energy Demand (GWh) - Country



F-2. Installed Capacity Vs Peak Demand (MW) - Country



F-3. Optimized Generation Capacity Additions (MW)

Fiscal Year	Coal Fired Steam Local Coal	Coal Fired Steam Local Coal KE	Combined Cycle on RLNG	Combustion Turbine on RLNG	Nuclear	HPP	Solar Utility MW_p	Net Meter MW_p	Solar KE MW_p	Wind NTDC	Wind KE	Bagasse	Per Year Capacity Addition*	Cumulative Capacity Addition
2024	-	-	-	-	-	-	-	-	-	-	-	-	0	0
2025	-	-	-	-	-	-	-	240	-	-	-	-	0	0
2026	-	-	-	-	-	-	-	241	-	-	-	-	0	0
2027	-	-	-	-	-	-	-	215	-	-	-	-	0	0
2028	-	-	-	-	-	-	-	223	-	-	-	-	0	0
2029	-	-	-	-	-	5	-	186	-	-	-	-	5	5
2030	-	-	-	-	-	-	-	191	-	-	-	-	0	5
2031	-	-	-	-	-	82	-	205	-	-	-	-	82	87
2032	-	-	-	-	-	-	-	92	-	-	-	-	0	87
2033	-	-	-	-	-	-	-	303	-	-	-	-	0	87
2034	-	-	-	-	-	-	-	211	-	-	-	-	0	87
Total	**-**	**-**	**-**	**-**	**-**	**87**	**-**	**2,107**	**-**	**-**	**-**	**-**	**87**	

*Does not include 2,107 MWP of net metering, being committed

F-4. List of Projects uptill 2031 (Committed + Optimized)

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
2023-24							
1	Helios	PV	50	50	PPIB	Category-II Project	Dec-23
2	HNDS	PV	50	50	PPIB	Category-II Project	Dec-23
3	Meridian	PV	50	50	PPIB	Category-II Project	Dec-23
4	Jabori	Hydro	10.2	10.2	GoKPK	PC-1 Approved	May-24
Generation Additions in 2023-24 (MW)			**160**	**160**			
Cumulative Addition up till 2023-24 (MW)			**160**	**160**			
2024-25							
1	Suki Kinari (U#1)	Hydro	221	221	PPIB	Financial Close	Aug-24
2	Suki Kinari (U#2)	Hydro	221	221	PPIB	Financial Close	Sep-24
3	Suki Kinari (U#3)	Hydro	221	221	PPIB	Financial Close	Oct-24
4	Suki Kinari (U#4)	Hydro	221	221	PPIB	Financial Close	Nov-24
5	Jamshoro Coal	Imported Coal	660	629	GENCO Holding	PC-1 Approved	Jun-24
6	Zorlu	PV	100	100	PPDB	Category-II Project	Oct-24
7	Lawi	Hydro	69	69	GoKPK	PC-1 Approved	Dec-24
8	Jagran-II	Hydro	48	48	AJK-HEB	PC-1 Approved	Dec-24
9	Koto	Hydro	40.8	40.8	GoKPK	PC-1 Approved	Jun-24
10	Shahtaj	Bagasse	32	32	PPIB	Category-I Project	Jun-24
11	Access_Solar	PV	11.52	11.52	PPIB	Category-I Project	Sep-24
12	Access_Electric	PV	10	10	PPIB	Category-I Project	Sep-24
13	Safe	PV	10	10	PPIB	Category-I Project	Nov-24
14	Chamfall	Hydro	3.22	3.22	AJK-HEB	PC-1 Approved	Jun-24
15	Kurram Tangi	Hydro	18	18	C&M-WAPDA	PC-1 Approved	Jun-24
16	Karora	Hydro	11.8	11.8	GoKPK	PC-1 Approved	Jul-24

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
17	Mangla Refurbishment U#3,4	Hydro	70	70	WAPDA	Committed	Jul-24
18	Net Meter	PV	240	240	DISCOs	Committed	Jul-24
Generation Additions in 2024-25 (MW)			**2,208**	**2,177**			
Cumulative Addition up till 2025 (MW)			**2,369**	**2,338**			
2025-26							
1	Tarbela_Ext_5 (U#1)	Hydro	510	510	WAPDA	PC-1 Approved	Nov-25
2	Tarbela_Ext_5 (U#2)	Hydro	510	510	WAPDA	PC-1 Approved	Dec-25
3	Tarbela_Ext_5 (U#3)	Hydro	510	510	WAPDA	PC-1 Approved	Jan-26
4	Gorkin Matiltan	Hydro	84	84	GoKPK	PC-1 Approved	Aug-25
5	TAY	Bagasse	30	30	PPIB	Category-II Project	Aug-25
6	Riali-II (U#1)	Hydro	3.5	3.5	PPIB	LOS (Issued)	Jun-25
7	Riali-II (U#2)	Hydro	3.5	3.5	PPIB	LOS (Issued)	Jun-25
8	Nardagian	Hydro	3.3	3.3	AJK-HEB	PC-1 Approved	Dec-25
9	Mangla Refurbishment U#1,2	Hydro	70	70	WAPDA	Committed	Dec-25
10	Net Meter	PV	241	241	DISCOs	Committed	Jul-25
Generation Additions in 2025-26 (MW)			**1,965**	**1,965**			
Cumulative Addition up till 2026 (MW)			**4,334**	**4,303**			
2026-27							
1	Dasu (U#1)	Hydro	360	360	WAPDA	PC-1 Approved	Mar-27
2	Dasu (U#2)	Hydro	360	360	WAPDA	PC-1 Approved	Apr-27
3	Dasu (U#3)	Hydro	360	360	WAPDA	PC-1 Approved	May-27
4	Mohmand Dam (U#1)	Hydro	200	200	WAPDA	PC-1 Approved	Dec-26
5	Mohmand Dam (U#2)	Hydro	200	200	WAPDA	PC-1 Approved	Jan-27
6	Mohmand Dam (U#3)	Hydro	200	200	WAPDA	PC-1 Approved	Mar-27
7	Mohmand Dam (U#4)	Hydro	200	200	WAPDA	PC-1 Approved	Apr-27

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
8	PV_Committed_A	PV	600	600	PPIB	Committed	Jan-27
9	PV_Committed_B	PV	600	600	PPIB	Committed	Apr-27
10	Kathai-II (U#1)	Hydro	4	4	PPIB	LOS (Issued)	Jul-26
11	Kathai-II (U#2)	Hydro	4	4	PPIB	LOS (Issued)	Jul-26
12	Mangla Refurbishment U#9,10	Hydro	70	70	WAPDA	Committed	Apr-27
13	Net Meter	PV	215	215	DISCOs	Committed	Jul-26
Generation Additions in 2026-27 (MW)			**3,373**	**3,373**			
Cumulative Addition up till 2027 (MW)			**7,707**	**7,676**			
2027-28							
1	Dasu (U#4)	Hydro	360	360	WAPDA	PC-1 Approved	Oct-27
2	Dasu (U#5)	Hydro	360	360	WAPDA	PC-1 Approved	Nov-27
3	Dasu (U#6)	Hydro	360	360	WAPDA	PC-1 Approved	Dec-27
4	PV_Committed_C	PV	1200	1200	PPIB	Committed	Nov-27
5	CASA	Hydro	1000	1000	GoP	G2G	Aug-27
6	Gwadar	Imported Coal	300	273	PPIB	G2G/CPEC	Dec-27
7	Balakot	Hydro	300	300	GoKPK	PC-1 Approved	Dec-27
8	Siachen	PV	100	100	GoS	Category-II Project	Jun-28
9	Manjhand	PV	50	50	PPIB/GoS	PC-1 Approved	Jun-28
10	Trans_Atlantic	Wind	50	50	PPIB	Category-II Project	Jun-28
11	Western	Wind	50	50	PPIB	Category-II Project	Jun-28
12	Net Meter	PV	223	223	DISCOs	Committed	Jul-27
13	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-27
Generation Additions in 2027-28 (MW)			**4,453**	**4,426**			
Cumulative Addition up till 2028 (MW)			**12,160**	**12,102**			
2028-29							

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
1	Diamer Bhasha (U#1)	Hydro	375	375	WAPDA	PC-1 Approved	Jan-29
2	Diamer Bhasha (U#2)	Hydro	375	375	WAPDA	PC-1 Approved	Feb-29
3	Diamer Bhasha (U#3)	Hydro	375	375	WAPDA	PC-1 Approved	Apr-29
4	Diamer Bhasha (U#4)	Hydro	375	375	WAPDA	PC-1 Approved	May-29
5	Diamer Bhasha (U#5)	Hydro	375	375	WAPDA	PC-1 Approved	Jun-29
6	Mangla Refurbishment U#7,8	Hydro	30	30	WAPDA	Committed	Sep-28
7	Net Meter	PV	186	186	DISCOs	Committed	Jul-28
8	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-28
9	Batdara	Hydel	5.2	5.2	AJK-HEB	Optimized	Jul-28
Generation Additions in 2028-29 (MW)			**2196.2**	**2196.2**			
Cumulative Addition up till 2029 (MW)			**14,356**	**14,298**			
2029-30							
1	Diamer Bhasha (U#6)	Hydro	375	375	WAPDA	PC-1 Approved	Jul-29
2	Diamer Bhasha (U#7)	Hydro	375	375	WAPDA	PC-1 Approved	Aug-29
3	Diamer Bhasha (U#8)	Hydro	375	375	WAPDA	PC-1 Approved	Sep-29
4	Diamer Bhasha (U#9)	Hydro	375	375	WAPDA	PC-1 Approved	Oct-29
5	Diamer Bhasha (U#10)	Hydro	375	375	WAPDA	PC-1 Approved	Nov-29
6	Diamer Bhasha (U#11)	Hydro	375	375	WAPDA	PC-1 Approved	Jan-30
7	Diamer Bhasha (U#12)	Hydro	375	375	WAPDA	PC-1 Approved	Feb-30
8	Net Meter	PV	191	191	DISCOs	Committed	Jul-29
9	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-29
Generation Additions in 2029-30 (MW)			**2,916**	**2,916**			
Cumulative Addition up till 2030 (MW)			**17,272**	**17,214**			
2030-31							
1	C-5	Nuclear	1200	1117	PAEC	PC-1 Approved	Sep-30

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
2	Net Meter	PV	205	205	DISCOs	Committed	Jul-30
3	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-30
4	Turtonas Uzghor	Hydel	82.25	82.25	K.E	Optimized	Jul-30
Generation Additions in 2030-31 (MW)			**1,587**	**1,504**			
Cumulative Addition up till 2031 (MW)			**18,859**	**18,718**			
2031-32							
1	Net Meter	PV	92	92	DISCOs	Committed	Jul-31
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-31
3	Azad Pattan (U#1)	Hydro	175.2	175.2	PPIB	LOS (Issued)	Dec-31
4	Azad Pattan (U#2)	Hydro	175.2	175.2	PPIB	LOS (Issued)	Mar-32
5	Kohala (U#1)	Hydro	187.3	187.3	PPIB	LOS (Issued)	Mar-32
Generation Additions in 2031-32 (MW)			**730**	**730**			
Cumulative Addition up till 2032 (MW)			**19,589**	**19,448**			
2032-33							
1	Net Meter	PV	303	303	DISCOs	Committed	Jul-32
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-32
3	Azad Pattan (U#3)	Hydro	175.2	175.2	PPIB	LOS (Issued)	Jun-32
4	Azad Pattan (U#4)	Hydro	175.2	175.2	PPIB	LOS (Issued)	Sep-32
5	Kohala (U#2)	Hydro	187.3	187.3	PPIB	LOS (Issued)	Jun-32
6	Kohala (U#3)	Hydro	187.3	187.3	PPIB	LOS (Issued)	Sep-32
7	Kohala (U#4)	Hydro	187.3	187.3	PPIB	LOS (Issued)	Dec-32
8	Kohala (U#5)	Hydro	187.3	187.3	PPIB	LOS (Issued)	Dec-32
9	Kohala (U#6)	Hydro	187.3	187.3	PPIB	LOS (Issued)	Dec-32
Generation Additions in 2032-33 (MW)			**1,690**	**1,690**			
Cumulative Addition up till 2033 (MW)			**21,279**	**21,138**			

#	Name of Project	Fuel Type	Installed Capacity	Dependable Capacity	Agency	Status	Schedule of Commissioning
2033-34							
1	Net Meter	PV	211	211	DISCOs	Committed	Jul-33
2	New Technology	-	100	100	PPIB/PPDB	Committed	Jul-33
Generation Additions in 2033-34 (MW)			**311**	**311**			
Cumulative Addition up till 2034 (MW)			**21,590**	**21,449**			

F-5. Annual Capacity Factors (%age)

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
1	Almoiz	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
2	Chanar	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
3	Chiniot	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
4	CSP	Bagasse	0.00	0.00	44.50	44.49	44.49	44.49	44.50	44.49	44.49
5	Fatima	Bagasse	6.53	6.53	6.55	6.53	2.80	2.75	2.74	2.15	2.75
6	Hamza	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
7	JDW-II	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
8	JDW-III	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
9	New_Bagasse	Bagasse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Ryk_Mills	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
11	Shahtaj	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
12	TAY	Bagasse	65.87	54.68	54.81	54.68	54.68	54.68	54.81	54.68	54.68
13	Thal_Layyah	Bagasse	45.62	45.62	45.77	45.62	45.62	45.62	45.77	45.62	45.62
14	Access_Electric	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
15	Access_Solar	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
16	Appolo	PV	18.86	18.86	18.86	18.86	18.92	18.92	18.92	18.92	18.92
17	Atlas_Solar(Zhenfa)	PV	16.43	16.43	16.42	16.43	16.33	16.33	16.31	16.33	16.33
18	Best	PV	18.40	18.40	18.40	18.40	18.48	18.48	18.48	18.48	18.48
19	Crest	PV	19.08	19.08	19.09	19.08	19.24	19.24	19.24	19.24	19.24
20	Helios	PV	20.35	20.35	20.33	20.35	20.22	20.22	20.20	20.22	20.22
21	HNDS	PV	20.35	20.35	20.33	20.35	20.22	20.22	20.20	20.22	20.22
22	Manjhand	PV	0.00	0.00	26.69	20.35	20.22	20.22	20.20	20.22	20.22
23	Meridian	PV	20.35	20.35	20.33	20.35	20.22	20.22	20.20	20.22	20.22
24	Net_Meter	PV	17.79	17.79	17.78	17.79	17.89	17.89	17.88	17.89	17.89
25	New_Solar_North/Center	PV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	New_Solar_South	PV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	PV_Committed_A	PV	0.00	17.33	19.21	19.23	19.11	19.11	19.09	19.11	19.11
28	PV_Committed_B	PV	0.00	23.90	19.21	19.23	19.11	19.11	19.09	19.11	19.11
29	PV_Committed_C	PV	0.00	0.00	17.41	19.23	19.11	19.11	19.09	19.11	19.11
30	QA_Solar	PV	17.36	17.36	17.37	17.36	17.46	17.46	17.47	17.46	17.46
31	Safe	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
32	Siachen	PV	0.00	0.00	26.69	20.35	20.22	20.22	20.20	20.22	20.22
33	Zorlu	PV	19.23	19.23	19.21	19.23	19.11	19.11	19.09	19.11	19.11
34	Gharo	KE_PV	26.36	26.36	26.35	26.36	26.08	26.08	26.08	26.08	26.08
35	KE_New_Solar	KE_PV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36	Oursun	KE_PV	22.17	22.17	22.17	22.17	21.89	21.89	21.90	21.89	21.89
37	Act	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
38	Act_2	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
39	Artistic_wind	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
40	Artistic_Wind_2	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
41	Dawood	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
42	Din	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
43	FFC	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
44	FWEL-I	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
45	FWEL-II	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
46	Gul Ahmed	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
47	Gul_Electric	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
48	Hawa	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
49	Indus_Energy	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
50	Jhimpir	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
51	Lakeside	Wind	43.96	43.96	43.89	43.96	41.56	41.56	41.49	41.56	41.56
52	Liberty_Wind_1	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
53	Liberty_Wind_2	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
54	Master	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
55	Master_Green	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
56	Metro_Power	Wind	38.06	38.06	37.99	38.06	36.60	36.60	36.54	36.60	36.60
57	Metro_Wind	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
58	NASDA	Wind	43.96	43.96	43.89	43.96	41.56	41.56	41.49	41.56	41.56
59	New_Wind	Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	Sachal	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
61	Sapphire_Wind	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
62	Tenaga	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
63	Three_Gorges_I	Wind	38.06	38.06	37.99	38.06	36.60	36.60	36.54	36.60	36.60
64	Three_Gorges_II	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
65	Three_Gorges_III	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
66	Trans_Atlantic	Wind	0.00	0.00	34.42	38.97	38.48	38.48	38.41	38.48	38.48
67	Tricom	Wind	42.84	42.84	42.76	42.84	40.49	40.49	40.42	40.49	40.49
68	Tricon_A	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
69	Tricon_B	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
70	Tricon_C	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
71	UEP	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
72	Western	Wind	0.00	0.00	34.54	42.84	40.49	40.49	40.42	40.49	40.49
73	Yunus	Wind	36.87	36.87	36.80	36.87	35.45	35.45	35.39	35.45	35.45
74	Zephyr	Wind	34.34	34.34	34.29	34.34	32.73	32.73	32.69	32.73	32.73
75	Zorlu_Wind	Wind	38.06	38.06	37.99	38.06	36.60	36.60	36.54	36.60	36.60
76	KE_New_Wind	KE_Wind	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
77	CASA	Interconnection	0.00	0.00	36.42	41.92	41.92	41.92	41.80	41.92	41.92
78	Balkani	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
79	Batdara	HPP Candidate <=20	0.00	0.00	0.00	47.66	47.66	47.66	47.53	47.66	47.66
80	Daral Khwar-II	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81	Deg Outfall	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
82	Ghail	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
83	Jhing-II	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
84	Nandihar	HPP Candidate <=20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
85	Arkari Gol	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
86	Artistic-I	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
87	Artistic-II	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
88	Ashkot	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
89	Asrit Kedam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90	Athmuqam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
91	Azad Pattan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	82.40	55.25	53.16
92	Bankhwar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93	Bata Kundi	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
94	Chakoti Hatian	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95	CJ	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
96	Dowarian	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
97	Gabral Kalam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
98	Gabral Utror	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
99	Gumat Nar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
100	Harigehl-Majeedgala	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
101	Jagran-III	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102	Jagran-IV	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
103	Kaigah	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
104	Kalam Asrit	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	Keyal Khwar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
106	Kohala	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	98.44	59.98	52.14
107	Lower Spat Gah	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
108	Luat	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
109	Madyan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
110	Mahl	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
111	Mastuj	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112	Nagdar	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
113	Naran	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
114	Nila Da Katha	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
115	Qadirabad	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
116	Rajdhani	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117	Shalfalam	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
118	Sharmai	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
119	Shigo Kas	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	Shounter	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
121	Soan	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122	Taunsa	HPP Candidate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
123	Turtonas Uzghor	HPP Candidate	0.00	0.00	0.00	0.00	0.00	51.90	51.76	51.90	51.90
124	Allai Khwar	HPP Existing	44.43	44.43	44.31	44.43	44.43	44.43	44.31	44.43	44.43
125	Chashma	HPP Existing	48.91	48.91	48.78	48.91	48.91	48.91	48.78	48.91	48.91
126	Daral Khwar	HPP Existing	38.77	38.77	38.66	38.77	38.77	38.77	38.66	38.77	38.77
127	Dubair Khwar	HPP Existing	54.57	54.57	54.42	54.57	54.57	54.57	54.42	54.57	54.57
128	Ghazi Brotha	HPP Existing	52.78	52.78	52.63	52.78	52.78	52.78	52.63	52.78	52.78
129	Golen Gol	HPP Existing	9.15	9.15	9.12	9.15	9.15	9.15	9.12	9.15	9.15
130	Gulpur	HPP Existing	28.92	28.92	28.84	28.92	28.92	28.92	28.84	28.92	28.92
131	Jagran-I	HPP Existing	49.49	49.49	49.35	49.49	49.49	49.49	49.35	49.49	49.49

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
132	Jinnah	HPP Existing	25.74	25.74	25.67	25.74	25.74	25.74	25.67	25.74	25.74
133	Karot	HPP Existing	45.48	45.48	45.36	45.48	45.48	45.48	45.36	45.48	45.48
134	Khan Khwar	HPP Existing	40.22	40.22	40.11	40.22	40.22	40.22	40.11	40.22	40.22
135	Malakand-III	HPP Existing	54.04	54.04	53.89	54.04	54.04	54.04	53.89	54.04	54.04
136	Mangla	HPP Existing	53.10	53.55	52.91	54.46	54.60	54.60	54.45	54.60	54.60
137	Neelum Jehlum	HPP Existing	53.48	53.48	53.33	53.48	53.48	53.48	53.33	53.48	53.48
138	New Bong	HPP Existing	55.49	55.49	55.34	55.49	55.49	55.49	55.34	55.49	55.49
139	Patrind	HPP Existing	43.76	43.76	43.64	43.76	43.76	43.76	43.64	43.76	43.76
140	Small Hydel	HPP Existing	45.59	45.59	45.46	45.59	45.59	45.59	45.46	45.59	45.59
141	Tarbela 1-14	HPP Existing	38.23	38.23	38.13	38.23	38.23	38.23	38.13	38.23	38.23
142	Tarbela_Ext_4	HPP Existing	30.33	30.33	30.25	30.33	30.33	30.33	30.25	30.33	30.33
143	Warsak	HPP Existing	50.63	50.63	50.49	50.63	50.63	50.63	50.49	50.63	50.63
144	Engro 90MW	CCGT_Gas	29.32	48.52	48.57	43.11	13.17	9.65	8.43	5.22	6.32
145	Foundation	CCGT_Gas	61.49	76.84	74.17	74.33	53.85	53.85	53.85	53.85	53.85
146	Guddu-I	CCGT_Gas	69.90	70.63	74.64	74.43	74.43	74.43	74.64	19.80	20.01
147	Guddu-II	CCGT_Gas	48.55	61.20	58.25	58.27	20.53	15.12	15.12	9.60	17.98
148	Guddu-V (747)	CCGT_Gas	58.71	68.58	66.16	75.56	71.74	17.61	19.00	12.90	19.41
149	Liberty	CCGT_Gas	40.17	40.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150	Uch	CCGT_Gas	64.06	70.75	55.89	38.92	38.92	0.00	0.00	0.00	0.00
151	Uch-II	CCGT_Gas	59.94	69.88	71.14	71.20	56.67	56.67	56.67	56.67	56.67
152	SNPC-I	KE_CCGT_Gas	62.62	69.53	66.29	66.89	53.29	53.29	53.29	53.29	53.29
153	SNPC-II	KE_CCGT_Gas	63.19	70.47	68.57	70.01	53.31	53.31	53.31	53.31	53.31
154	AES Lalpir	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
155	AES Pakgen	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
156	HUBCO	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
157	Jamshoro-I U1	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
158	Jamshoro-II U4	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
159	Muzaffargarh-I U1	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
160	Muzaffargarh-I U2	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
161	Muzaffargarh-I U3	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
162	Muzaffargarh-II U4	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
163	Saba	ST_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
164	AGL	DG_RFO	36.81	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
165	Atlas	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
166	Engro 127MW	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
167	HuB N	DG_RFO	36.81	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
168	Kohinoor	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
169	Liberty Tech	DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
170	Nishat C	DG_RFO	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
171	Nishat P	DG_RFO	22.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
172	GAEL	KE_DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
173	TPL	KE_DG_RFO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
174	NEW OCGT_North/Center	OCGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
175	NEW OCGT_South	OCGT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
176	C-1	Nuclear	81.11	81.11	81.33	81.11	81.11	81.11	81.33	81.11	81.11
177	C-2	Nuclear	79.61	79.61	79.83	79.61	79.61	79.61	79.83	79.61	79.61
178	C-3	Nuclear	81.01	81.01	81.23	81.01	81.01	81.01	81.23	81.01	81.01
179	C-4	Nuclear	81.01	81.01	81.23	81.01	81.01	81.01	81.23	81.01	81.01
180	C-5	Nuclear	0.00	0.00	0.00	0.00	0.00	67.29	90.21	89.96	89.96
181	K-2	Nuclear	85.07	85.07	85.30	85.07	85.07	85.07	85.30	85.07	85.07
182	K-3	Nuclear	85.07	85.07	85.30	85.07	85.07	85.07	85.30	85.07	85.07
183	NEW_Nuclear_North/Center	Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
184	NEW_Nuclear_South	Nuclear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
185	Engro Thar	Local Coal	82.51	82.51	82.74	82.18	82.51	75.15	77.66	25.37	53.67
186	Lucky	Local Coal	2.56	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00
187	NEW_L.Coal 330	Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
188	NEW_L.Coal 660	Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
189	Thal Nova	Local Coal	84.98	84.98	85.21	84.98	84.98	83.74	85.18	84.98	84.98
190	Thar TEL	Local Coal	84.98	84.98	85.21	84.98	84.98	84.98	85.21	84.98	84.98
191	Thar-I (SSRL)	Local Coal	84.10	84.31	83.53	77.94	59.11	45.47	53.61	77.30	80.37
192	K.E_NEW_L.Coal 330	KE_Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
193	K.E_NEW_L.Coal 660	KE_Local Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
194	China HUBCO	Imported Coal	56.16	56.16	56.16	56.16	56.16	56.16	56.16	56.16	56.16
195	Gwadar	Imported Coal	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00
196	Jamshoro Coal	Imported Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
197	Jamshoro Coal 2	Imported Coal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
198	Port Qasim	Imported Coal	56.72	56.72	56.72	56.72	56.72	56.72	56.72	56.72	56.72
199	Sahiwal Coal	Imported Coal	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47
200	FPCL	KE_Imported Coal	7.12	18.82	2.33	2.13	1.46	1.45	1.52	0.88	0.87
201	Altern	Gas Engine_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
202	Davis	DG_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
203	Balloki	CCGT_RLNG	6.38	25.83	31.59	18.65	15.13	6.47	7.60	1.81	6.40
204	Bhikki	CCGT_RLNG	1.57	4.86	0.68	0.27	0.07	0.05	0.18	0.00	0.30
205	FKPCL	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
206	Halmore	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
207	Haveli	CCGT_RLNG	39.00	74.21	61.94	42.30	22.59	16.62	17.83	14.71	17.50
208	KAPCO 1	CCGT_RLNG	35.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
209	KAPCO 2	CCGT_RLNG	11.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
210	Nandipur	CCGT_RLNG	36.38	21.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00
211	NEW_CCGT_North/Center	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
212	NEW_CCGT_South	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
213	Orient	CCGT_RLNG	37.73	22.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
214	Rousch	CCGT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
215	Saif	CCGT_RLNG	37.73	22.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00
216	Saphire	CCGT_RLNG	37.73	22.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00
217	Trimmu	CCGT_RLNG	16.28	10.97	8.39	5.08	1.61	0.67	1.21	0.65	1.84
218	BQPS2	KE_CCGT_RLNG	12.89	45.26	12.85	14.00	10.73	9.59	9.46	6.32	5.97
219	BQPS3	KE_CCGT_RLNG	77.79	14.97	0.98	0.98	0.89	0.91	0.95	1.18	1.69

#	Plant Name	Fuel	26	27	28	29	30	31	32	33	34
			%								
220	KCCPP	KE_CCGT_RLNG	5.50	31.21	6.10	7.00	4.18	3.79	3.73	1.91	1.93
221	KTGTPS	KE_CCGT_RLNG	3.52	21.86	3.95	4.11	2.39	2.32	2.32	1.23	0.92
222	SGTPS	KE_CCGT_RLNG	2.60	13.12	2.98	3.20	1.99	1.75	1.93	0.50	0.65
223	BQPS1-U1	KE_ST_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
224	BQPS1-U5	KE_ST_RLNG	1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
225	BQPS1-U6	KE_ST_RLNG	1.24	2.89	0.16	0.79	0.38	0.45	0.58	0.00	0.00
226	BQPS1-U2	KE_GT_RLNG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
227	Balakot	UC Hydro_Committed	0.00	0.00	41.63	41.96	41.96	41.96	41.85	41.96	41.96
228	Chamfall	UC Hydro_Committed	48.01	48.01	47.88	48.01	48.01	48.01	47.88	48.01	48.01
229	Dasu	UC Hydro_Committed	0.00	99.00	61.91	64.52	64.52	64.52	64.34	64.52	64.52
230	Diamer Bhasha	UC Hydro_Committed	0.00	0.00	0.00	56.86	42.74	44.40	44.28	44.40	44.40
231	Gorkin Matiltan	UC Hydro_Committed	40.11	44.77	44.65	44.77	44.77	44.77	44.65	44.77	44.77
232	Jabori	UC Hydro_Committed	82.38	82.38	82.23	82.38	82.38	82.38	82.23	82.38	82.38
233	Jagran-II	UC Hydro_Committed	51.22	51.22	51.08	51.22	51.22	51.22	51.08	51.22	51.22
234	Karora	UC Hydro_Committed	72.12	72.12	71.99	72.12	72.12	72.12	71.99	72.12	72.12
235	Kathai-II	UC Hydro_Committed	0.00	60.14	61.57	61.74	61.74	61.74	61.57	61.74	61.74
236	Koto	UC Hydro_Committed	59.06	59.06	58.90	59.06	59.06	59.06	58.90	59.06	59.06
237	Kurram Tangi	UC Hydro_Committed	17.05	17.05	17.01	17.05	17.05	17.05	17.01	17.05	17.05
238	Lawi	UC Hydro_Committed	48.96	48.96	48.84	48.96	48.96	48.96	48.84	48.96	48.96
239	Mohmand Dam	UC Hydro_Committed	0.00	72.83	43.14	43.26	43.26	43.26	43.14	43.26	43.26
240	Nardagian	UC Hydro_Committed	43.81	48.50	48.37	48.50	48.50	48.50	48.37	48.50	48.50
241	Riali-II	UC Hydro_Committed	54.79	54.79	54.64	54.79	54.79	54.79	54.64	54.79	54.79
242	Suki Kinari	UC Hydro_Committed	51.16	51.16	51.02	51.16	51.16	51.16	51.02	51.16	51.16
243	Tarbela_Ext_5	UC Hydro_Committed	6.49	10.05	10.02	10.05	10.05	10.05	10.02	10.05	10.05

F-6. Year-wise Installed Capacity Addition (MW)

Year	Net Capacity Addition Over the Plan Period (2023-34)											
	Local Coal	Hydro	RLNG	Nuclear	Imported Coal	RE	New Tech.	Natural Gas	Furnace Oil	Cross Border	Net Yearly Addition	Cumulative Total
	MW											
Jun-23	3,300	10,663	10,185	3,530	4,020	2,810	-	2,964	5,273	-	-	42,745
2024	-	27	411	-	-	150	-	395	-	-	983	43,728
2025	-	1,145	-	-	660	404	-	-	-262	-	1,946	45,674
2026	-	1,694	-	-	-	271	-	-	-	-	1,965	47,640
2027	-	1,958	-1,510	-	-	1,415	-	-	-1,423	-	440	48,080
2028	-	1,380	-	-	300	1,673	100	-235	-	1,000	4,218	52,298
2029	-	1,910	-	-	-	186	100	-	-1,177	-	1,019	53,317
2030	-	2,625	-	-	-	191	100	-	-136	-	2,780	56,097
2031	-	82	-638	1,200	-	205	100	-586	-	-	363	56,460
2032	-	538	-	-	-	92	100	-	-	-	730	57,190
2033	-	1,287	-210	-	-	303	100	-	-	-	1,480	58,670
2034	-	-	-	-	-	211	100	-	-1,110	-	-799	57,871
Total	**3,300**	**23,309**	**8,238**	**4,730**	**4,980**	**7,910**	**700**	**2,538**	**1,165**	**1,000**	**57,871**	

F-7. IGCEP Generation Mix 2024-2034 (GWh)

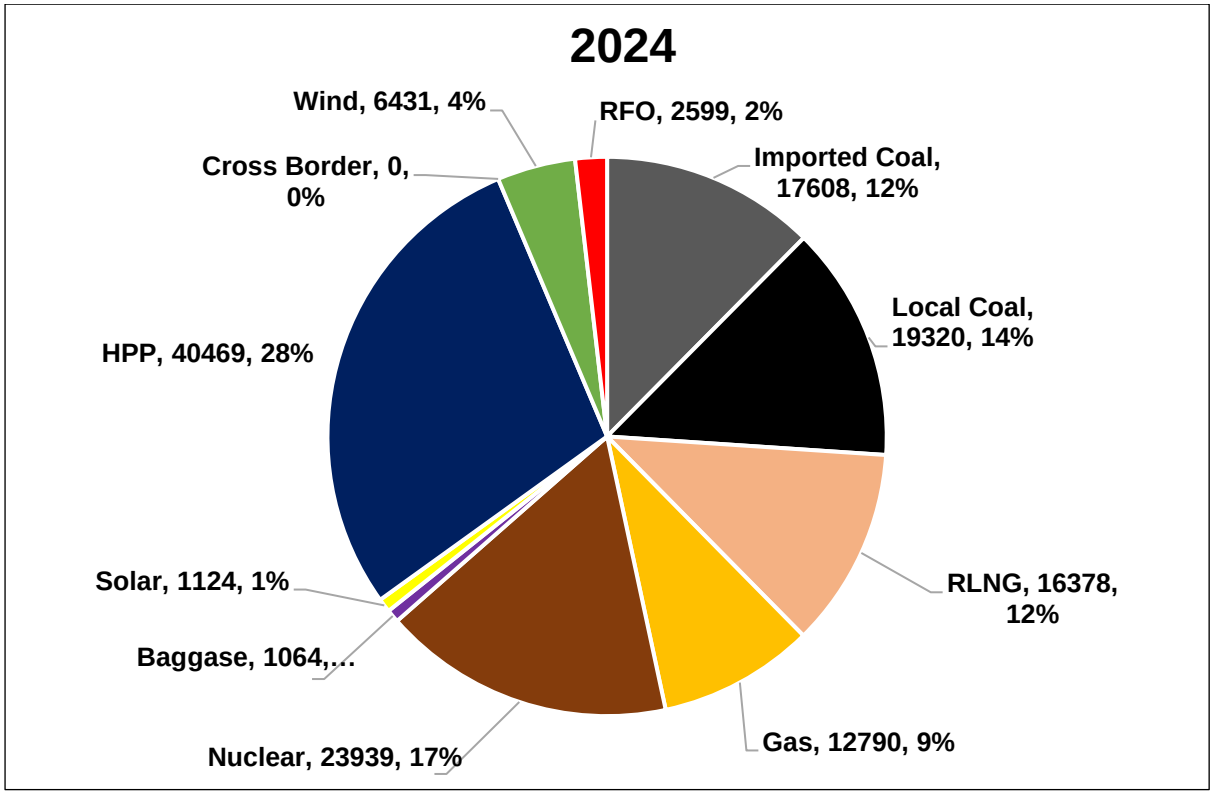


Chart F-1: IGCEP Generation Mix 2024 (GWh)

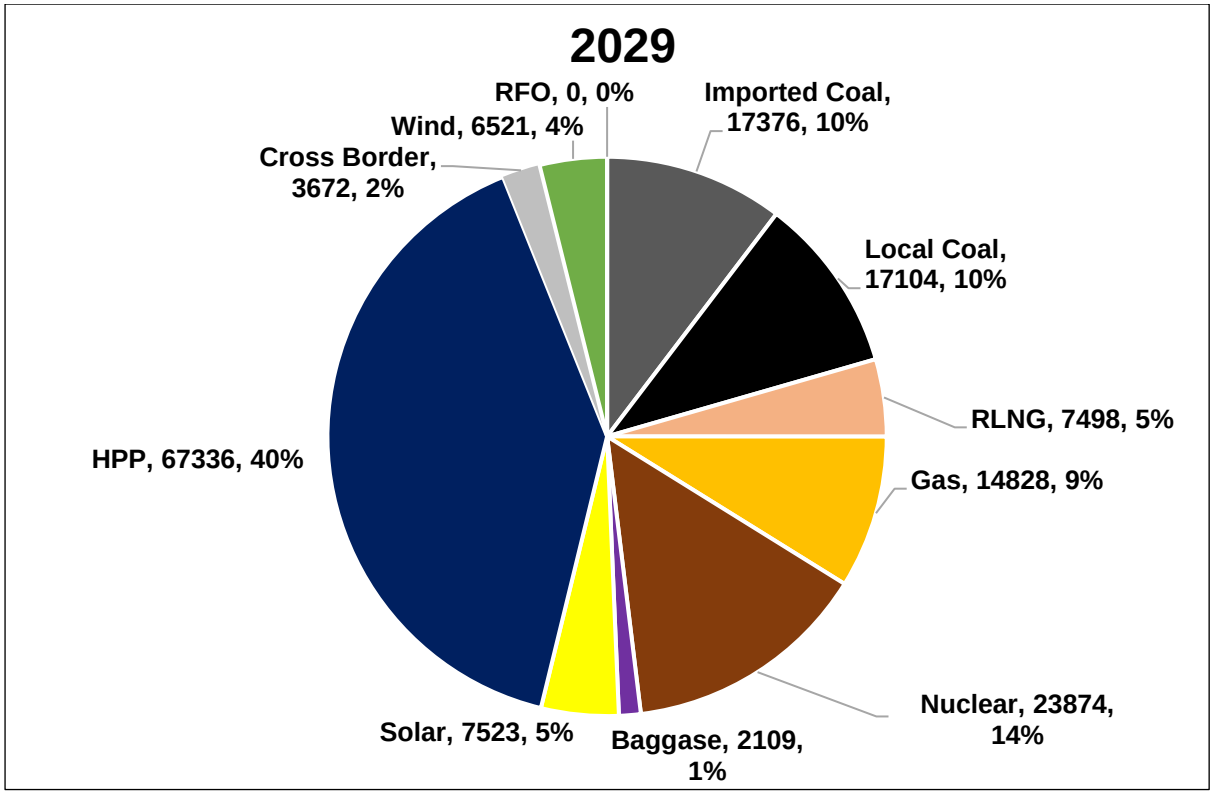


Chart F-2: IGCEP Generation Mix 2029 (GWh)

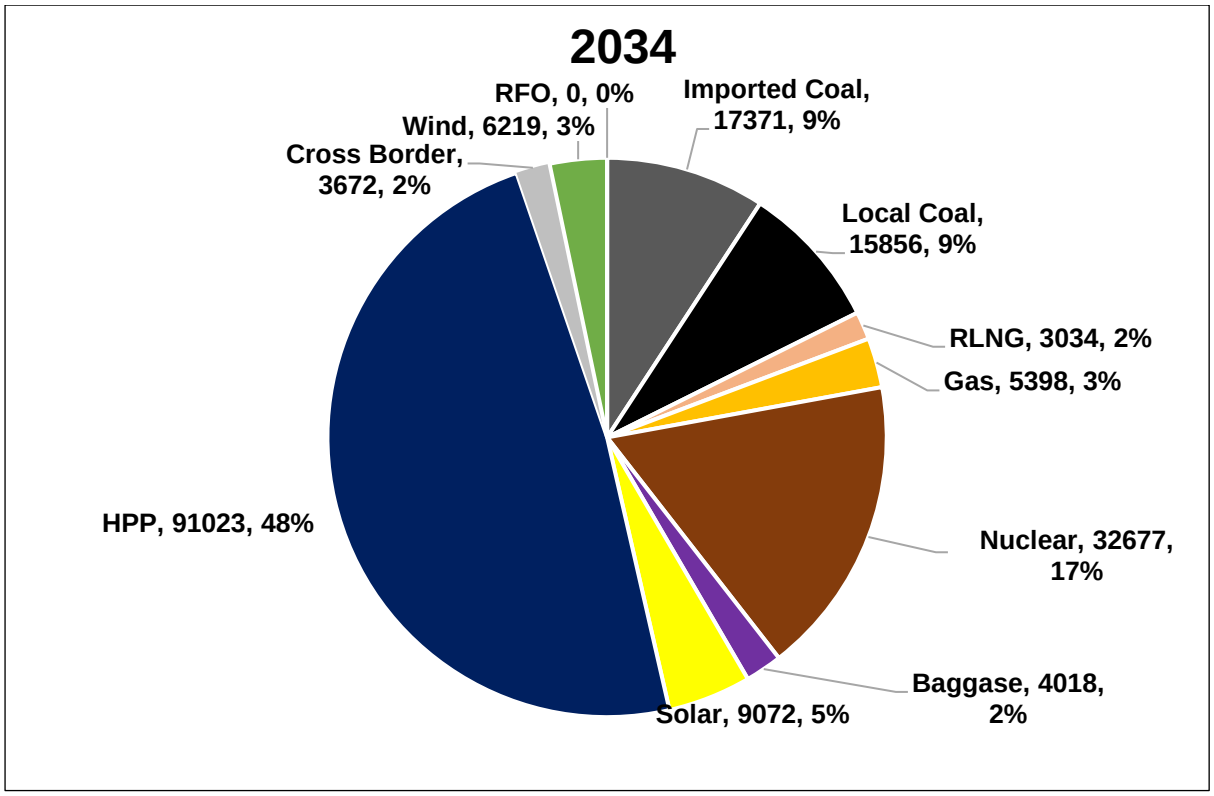


Chart F-3: IGCEP Generation Mix 2034 (GWh)

F-8. IGCEP Generation Mix 2024-34 (MW)

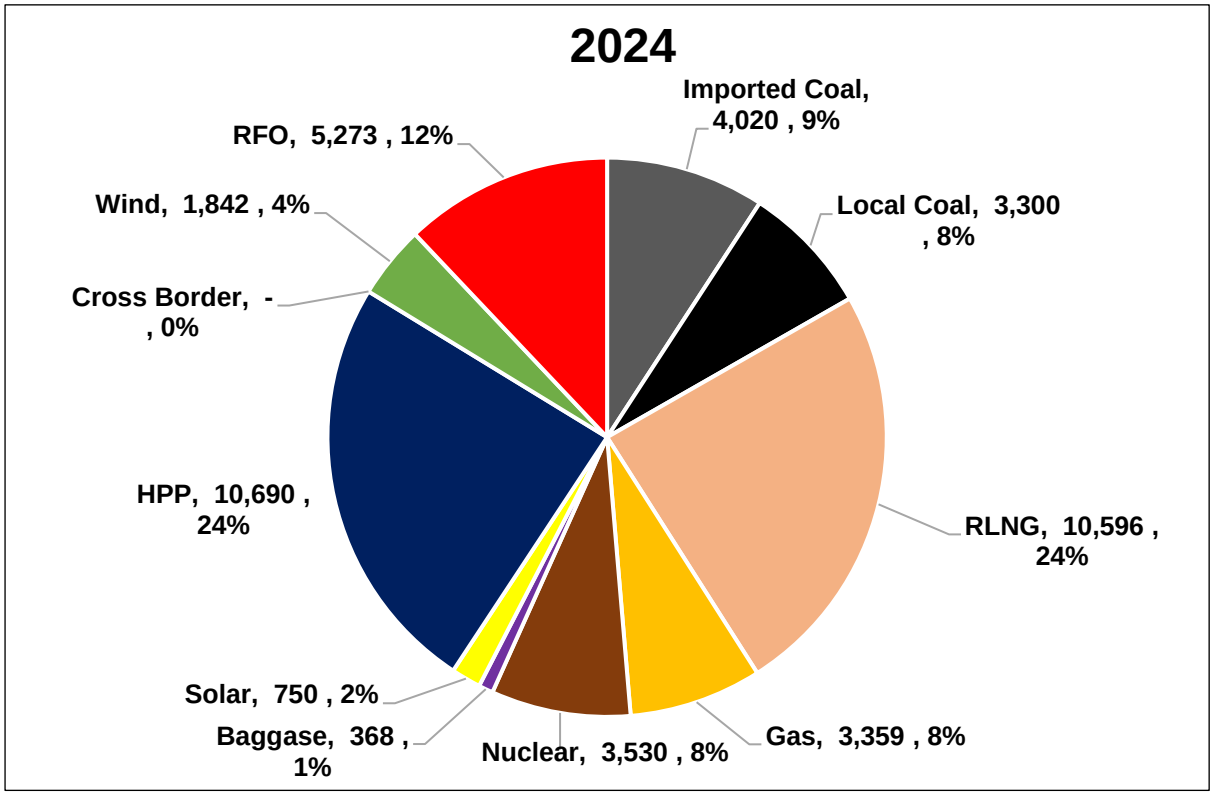


Chart F-4: IGCEP Generation Mix 2024 (MW)

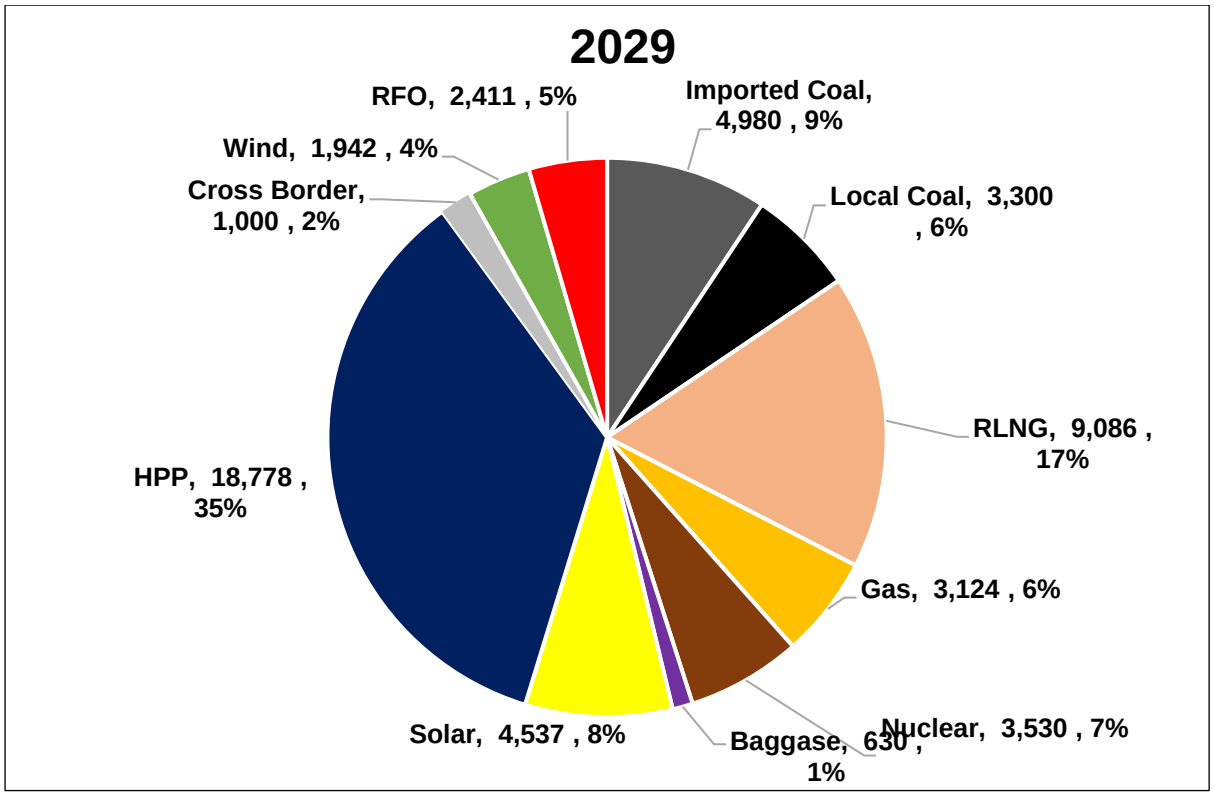


Chart F-5: IGCEP Generation Mix 2029 (MW)

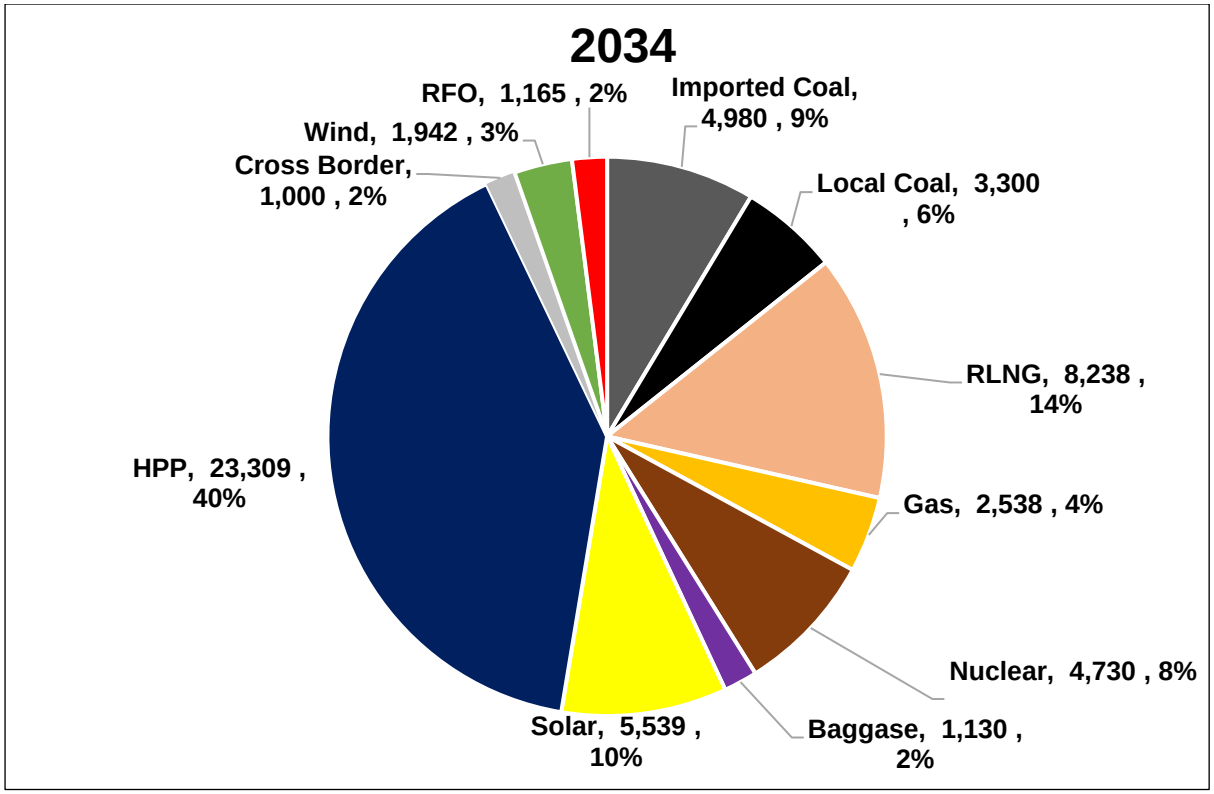


Chart F-6: IGCEP Generation Mix 2034 (MW)

System Operator NTDC