National Electric Power Regulatory Authority
Islamic Republic of Pakistan

Registrar

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No. NEPRA/UGTBPP-2017/20345-20347
December 15, 2017

Subject: **Determination of the Authority in the matter of Upfront Generation Tariff for Biomass Power Projects**

Dear Sir,

Please find enclosed herewith the subject Determination of the Authority along with Annex-I, II, III & IV (28 pages).

2. The Determination is being intimated to the Federal Government for the purpose of notification in the official gazette pursuant to Section 31(4) of the Regulation of Generation, Transmission and Distribution of Electric Power Act (XL of 1997).

3. The Order along with Annex-I, II, III & IV of the Authority's Determination are to be notified in the official Gazette.

Enclosure: As above

15 12 17

(Syed Safeer Hussain)

Secretary
Ministry of Energy
'A' Block, Pak Secretariat
Islamabad

CC:

1. Secretary, Cabinet Division, Cabinet Secretariat, Islamabad.
2. Secretary, Ministry of Finance, 'Q' Block, Pak Secretariat, Islamabad.

Determination of the Authority

in the matter of

Upfront Generation Tariff

for

Biomass Power Projects

Dated December 2017

Interveners:

- Anwar Kamal Law Associates
- Punajb Bio Energy Company Limited
- EnMass Energy

Commentators:

- Whistle Blower
- Alternative Energy Development Board
- Hyderabad Electric Supply Company (HESCO)
- Central Power Purchasing Agency (CPPA-G)
- Ministry of Petroleum & Natural Resources
- Pakistan Environmental Protection Agency, Ministry of Climate Change

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1. Background

1.1 National Electric Power Regulatory Authority (hereinafter referred to as the "Authority") was established under section 3 of the 'Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997' (hereinafter referred to as the "Act") and its responsibilities under the Act include, inter alia, determination of tariff, rates, charges and other terms and conditions for supply of electric power services by generation, transmission and distribution companies. In performing its functions under the Act, the Authority has to protect, as far as practicable, the interests of consumers and companies providing electric power services in accordance with the guidelines, not inconsistent with the provisions of the Act laid down by the Federal Government.

1.2 Keeping in view the potential of around 1000 MW from biomass, as indicated by the Ministry of Energy, the Authority in exercise of its powers under the Act read with rule 3 (1) of the National Electric Power Regulatory Authority (Tariff Standards and Procedure) Rules, 1998 (hereinafter referred to as the "tariff rules") and regulation 3 of the National Electric Power Regulatory Authority Upfront Tariff (Approval & Procedure) Regulations, 2011 (hereinafter referred to as the "upfront tariff regulations") decided to initiate proceedings for determination of new upfront tariff for generation of electricity from biomass power projects (hereinafter referred to as the "upfront tariff'). Accordingly a draft upfront tariff proposal was developed on the basis of information available with the Authority.

1.3 In line with the tariff setting process envisaged in the tariff rules, and with a view to arrive at a just and informed decision, notice of public hearing and salient features of the draft upfront tariff proposal were published in the national newspapers on 25th March 2017 inviting filing of intervention requests and comments. The Authority also served separate notices to various stakeholders for filing their comments, if any, on the draft upfront tariff proposal and its underlying terms and conditions. The advertised tariff, along with its salient features were as follows;

Tariff Components	Rs./kWh						WACC
	1-10	11-30	Levelized	1-15	16-30	Levelized	Levelized
FCC	4.7186	4.7186	4.7186	4.7186	4.7186	4.7186	4.7186
Variable O&M-Foreign	0.1646	0.1646	0.1646	0.1646	0.1646	0.1646	0.1646
Variable O&M – Local	0.1646	0.1646	0.1646	0.1646	0.1646	0.1646	0.1646
Fixed O&M – Local	0.2195	0.2195	0.2195	0.2195	0.2195	0.2195	0.2195
Insurance	0.1096	0.1096	0.1096	0.1096	0.1096	0.1096	0.1096
Cost of working Capital	0.0968	0.0968	0.0968	0.0968	0.0968	0.0968	0.0968
ROE / WACC	0.5614	0.5614	0.5614	0.5614	0.5614	0.5614	1.0701
Debt Servicing	1.6070	-	1.0474	1.2959	-	1.0456	0.4572
Total Tariff	**7.6420**	**6.0351**	**7.0825**	**7.3310**	**6.0351**	**7.0807**	**7.0011**

1.4 The assumptions are as under:

- The project cost has been assumed as US$ 0.8 million per MW.
- The annual plant factor has been assumed as 80%.
- Insurance has been assumed as 1% of EPC cost.
- The debt equity structure of 75:25.
- IRR of 15%.

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- KIBOR of 6.53%.
- Spread over KIBOR as 3%
- Exchange rate parity of PKR 105/US$.
- Debt repayment period of 10 years, 15 years and WACC (11.24%) for 30 years.
- Efficiency of 29.24% (flat)
- Calorific Value of 12364.74 btu/kg average of all biomass agricultural residue.
- Fuel price of Rs. 5,000/ton including freight. The power projects can use agricultural residue i.e. cotton stalk, wheat stalk, rice straw, rice husk, maize straw, maize husk, maize cob, wood etc for electricity generation.

2. Proceedings

2.1 The advertisement in this regard for information / views / comments of the stakeholders was published on 23rd February 2017 & 8th March 2017. In response three intervention requests from Anwar Kamal Law Associates, Punjab Bio Energy Company Limited and EnMass Energy has been received. Whistle Blower submitted intervention request after stipulated time however the Authority decided to consider the same as commentator. AEDB, Lahore Waste Management Company, Hyderabad Electric Supply Company (HESCO), Pakistan Environmental Agency, Ministry of Petroleum & Natural Resources and CPPA-G also submitted the comments. Notice of hearing was published on 14.4.2017 in the national newspapers. Hearing was held on 9.5.2017 which was attended by the representatives of CPPA-G, Punjab Bio Energy, EnMass, Media and other stakeholders.

3. Intervention Requests

3.1 The following intervention requests has been received:

- Anwar Kamal Law Associates
- Punajb Bio Energy Company Limited
- EnMass Energy

3.2 **AKLA Concerns**

3.2.1 AKLA concerns are as under:

- Under which law NEPRA has developed the NEPRA Upfront Tariff (Approval and Procedure) Regulations – 2011?
- The Upfront determination is mismatched with the least cost generation plan.
- In Upfront tariff there is no provision of stakeholder participation.
- A large number of comparatively cheaper, conventional coal and gas (RLNG) based power plants are in the pipeline and a large number of these power plants will be commissioned by the end of the year 2018.
- Efficiencies of the new technology are very low and due to non-availability of the fuel the power plants may not be able to achieve the desired plant factor.
- The proposed new technology would probably be on must run power plants and will supply electricity irrespective of Economic Merit Order.
- Due to available generation capacity and by operating these power plants the capacity component will be paid for the idle capacity.
- Why low efficiency, low plant factor and costlier power plant if the efficient plants are available in the market.
- What would be the fuel used in this technology.

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- Whether any agency carried out any study about the availability of fuel, regions-wise for the proposed technology
- Due to higher electricity cost in Pakistan the industries especially the exports goods manufacturing industries are losing their global market share.
- Non-use of already commissioned and readily available IPPs i.e. Japan, Saba, SEPCOL, Reshma and Gulf Power (700 MW) are the obvious examples of mismanagement.
- The generation addition in future will create surplus power situation and the consumer will pay capacity charges.
- There is available generation capacity which is not fully utilized due to which the end-consumers are paying capacity charges.
- Keeping in view the available generation capacity the addition of further generation is a matter of concern to the electricity consumers.

3.3 **Punjab Bio Energy Company (Pvt.) Limited**

3.3.1 The Punjab Bio Energy Company Limited (PBECL) has been incorporated by Govt. of Punjab. The primary function of the Company is to establish biomass supply chain to set up bio energy projects for power generation for the national grid. According to PBECL this is first of its own kind venture in public sector to produce electricity from biomass fuel. The model will attract private investment in the energy sector. Resultantly, it will reduce energy crises in the country. Following comments has been submitted by the Punjab Bio Energy Company (Pvt.) Limited:

- The determination by NEPRA as advertised in the Suo Moto notices will lead to a certain purchase rate of biomass on the lower side and will make it extremely difficult for the Company (PBECL) to perform its functions of supplying the required quantity of biomass to the power plant.
- Being a fresh initiative by the Government of Punjab, it would prove to be a discouraging factor and also lead to waste of allocated resources.
- The determination is bound to change the biomass marketing scenario. The current figures do not truly portray the facts on ground.
- The investment shy private sector is bound to stay away from this prospective business opportunity, thus leading to a wastage of 1000 MW worth of annual energy production capacity in Punjab only, which lies unaddressed due to lack of investment in this area.
- The incentives being put in place by the Company will not reap the desired results and whatever little encouragement is forthcoming in the new area of biomass collection and sale, will be defeated.
- The fuel price of Rs. 5,000/M.Ton is on lower side.
- In the case of Rice Straw there is a very short span of time of its availability at harvesting. Being of high moisture at 25% plus it has to be dried before it is collected for baling & stacking. The harvesting is also during the relatively cooler months of October & November. Losses tend to increase if there are faults in collection.
- Wheat Straw has in recent years been converted into Toori, animal fodder, by machines and once this conversion takes place the wheat straw option is beyond the reach of the power plant. The price becomes a limiting factor which increases from Rs. 200 to Rs 250 and even upto Rs. 4001- per 40 kg at time.
- Maize Stalks are the only dependable source, and that too is available in the two months of June & July. Harvesting is mostly manual. The cost incurred in the Processing of maize stalks

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increases its cost & with mounting pressures of procurement by upcoming biomass Energy Plants, its price is bound to escalate.

- Sugar Cane Trash has yet to be considered as a possible source of fuel. The stubs of sugar cane left standing in the fields of sugar cane for next year crop are a great hindrance for the collecting machinery.
- Calorific value taken at average is also questionable
- Recognition of efficient Project cost, which would also include the establishment of 6-8 procurement centers within a 50 KM radius for a 20 MW plant.

3.3.2 The PBECL Government of Punjab further submitted the following:

- The Govt. of Punjab has planned to setup a biomass fueled power plant in Dist. Faisalabad with a capacity of 20 MW. The proposed site at Tehsil Jhumra Dist. Faisalabad is to be developed for a possible biomass power generation plant. PBECL has been given the mandate to collect the biomass from the vicinity for onward supplies to the power plant.
- PBECL has to guarantee 140,000 ton biomass annually to the power plant. The major types of biomass are wheat straw, rice straw, maize stalks, sugarcane trash etc. In order to ensure the availability of biomass to the power plant, PBECL has approved different incentive schemes for the farmers/suppliers of the biomass. PBECL will enter into contract agreements with each supplier of biomass for continuous supply of biomass to the power plant.
- It is pertinent to mention that this is a first of its own kind venture in public sector to produce electricity from biomass fuel. The proposed initiative is planned in a manner so as to trigger the process of biomass harvesting, baling and transportation with the involvement of the private sector. The baled biomass would be purchased and stored by PBECL at collection centers and supplied to the power plant according to an agreed plan.
- The cost of loading/unloading, baling, shredding and storage has not been included in the proposed cost of NEPRA.

3.3.3 The price of different types of biomass as per PBECL (based on market survey) are as under:

Description	Maize Straw	Rice Straw/Sugar Can Trash	Wheat Straw
Avg. Price of Biomass	120	120	200
Loading / Unloading	20	20	20
Transportation (Field to Centre Radius: 50 km)	40	40	40
Baling Cost	50	50	50
Shredding Cost	25	-	-
Storage Cost	55	55	55
Transportation (Centre to Plant)	40	40	40
Total	350	325	405
Total Cost per ton	8,750	8,125	10,125
Cost of Incentives	280	280	280
Total Cost per ton	**9,030**	**8,405**	**10,405**

3.3.4 According to PBECL a feasibility study is being conducted by the Energy Department Govt. of Punjab. The biomass power project is model project in the Public sector which will be replicated to other potential sites of the province. Therefore incentives should be given for attracting the investment in the energy sector. The Authority is requested to keep all these factors while issuing the determination of generation tariff for biomass power projects.

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3.4 **EnMass Energy**

3.4.1 EnMass Energy has following concerns:

- The Project cost does not fully account for the capital expenditure associated with establishing biomass power projects.
- The project cost is lower as compared to the cost determined by the Authority in case of SSJD Bioenergy.
- The efficiency taken is on higher side.
- The Calorific Value of 12364.74 btu/kWh needs to be reviewed keeping in view the limited number of agricultural biomass resources.
- Pricing of biomass needs to be reviewed.
- The higher IRR for encouragement of the biomass and keeping in view the risk associated with the project may be given.

4. Comments

4.1 The following comments were submitted:

- Whistle Blower
- Alternative Energy Development Board
- Hyderabad Electric Supply Company (HESCO)
- Central Power Purchasing Agency (CPPA-G)
- Ministry of Petroleum & Natural Resources
- Pakistan Environmental Protection Agency, Ministry of Climate Change

4.2 **Whistle Blower**

4.2.1 Whistle blower has the same comments as of AKLA.

4.3 **Alternative Energy Development Board**

4.3.1 AEDB submitted that the UNIDO is partnership with AEDB is implementing a project on *"Promoting Sustainable Energy Production and Use from Biomass in Pakistan"*. The project aims to promote market-based adoption of modem biomass conversion technologies particularly in the industrial sector as a means for power and process heat applications and under the project UNIDO has carried out several studies /analysis and formulated recommendations i.e. (i) 'Policy on Biomass Energy Technology', (ii) 'Minimum Quality Standard for Biomass Gasification Plants' and (iii) 'Biomass Management and Pricing for Power Generation' through their consultant engaged for the activity. The UNIDO comments are as under:

4.3.2 The tariff setting methodology adopted by NEPRA, follows the international best practices. Our recommendations are more in the context of the assumptions which are used for tariff setting, a few of which need to be re-considered, as detailed below:

ISSUE-1: APPLICABLE TECHNOLOGIES	
As is	MODIFICATION RECOMMENDED
Biomass power projects	independent power producing projects based on biomass combustion technology (Minimum 45 bar and 410'C) • Independent power producing projects based on biomass gasification technology, using husks/stalks and woody biomass as fuel • Industrial power generation/cogeneration projects (other than bagasse exporting surplus power)

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ISSUE-2: BIOMASS CHARACTERISTICS & THEIR IMPACT	
As is	**MODIFICATION RECOMMENDED**
Types of Biomass — cotton stalk, wheat stalk, rice straw, rice husk, maize straw, maize husk, maize cob, wood	Distinguish between biomasses based on characteristics.
Biomass with gross calorific value 12364.74 kJ/kg	
Annual plant factor: 80%	
Efficiency 29.24%	

4.3.3 Characteristics of biomass vary widely. From the perspective energy conversion, biomasses should be classified under two categories:

Parameter	Unit	Husk	Straw / Stalks
Bulk Density	Kg/cum	100-120	25-40
Alkali Content	%	<10-15	35-37
Ash Content	%	15-20%	15-20%
Chloride Content	%	0.01	0.1
Chloride Content	%	0.01	0.1
Size		Uniform distributed	To be sized
Other physical		Hydrophilic	Hygroscopic

4.3.4 The differences in characteristics have impact on cost of generation due to the following parameters:

Parameter	Technical Impact	Tariff parameter impact
Low bulk density	More handling volume	High capital cost on storage and fuel system
	Low flue gas velocity	High capital cost on boiler
High alkali content	Low ash fusion temperature steam temperature	High heat rate
High chloride content	Higher corrosion	Higher maintenance cost
Non-uniform fuel size	Use of TG technology	Higher capital cost
	Lower combustion efficiency	Higher heat rate
	Fuel preparation	Higher auxiliary power
Hygroscopic	Storage degradation	Lower CV on annual basis

4.3.5 In view of the above differences in characteristics, the impact on key assumptions are:

Parameter	Husk	Straw / Stalks
Technology	Suitable for biomass combustion and biomass gasification	Present technology supports only biomass combustion
Gross Calorific Value	Produced at mills, relatively clean, can be marketed by millers regularly over the year, hence GCV can be ensured	Have to be produced during harvesting and stored for use during the year causing variation in moisture and impurity level

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		and loss in heating value due to natural process of degradation.
Plant load factor	Benign fuel, not much impact on fouling / deposition, can achieve high PLF of 80% and above.	Very adversely impact both deposition and corrosion of metal, particularly in the super heater area leading to one shut down per month for cleaning of heating surfaces PLF of about 70% achievable.
Station heat rate	Biomass combustion: More efficient fluidized bed technology (thermal efficiency >83%) and high pressure and temperature (105 bar / 540 C resulting in lower station heat rate. Biomass gasification: Updraft and d owndraft gasification system for systems.	Limitations in use of high efficiency technology due to high level of alkali and chlorides.

ISSUE-3: Capital Cost	
As is	MODIFICATION RECOMMENDED
Project cost: US$ 0.8 million / MW	For husk / wood chips based project – US$ 0.8 million / MW
	For other biomasses – US$ 1.0 million / MW

4.3.6 The capital cost of straw based plants would be higher due to:

- Additional equipment for fuel handling, preparation and feeding systems
- Deployment of travelling grate/vibrating grate technologies
- Tall boiler design with low gas velocities to protect the super heater /convection zone from adverse impact of fouling/choking and corrosion
- Use of much larger number of retractable soot blowers for keeping the heating surfaces clean.

4.3.7 Accordingly, recommended for straw and stalk based (combustion) projects:

- Investment cost-120% of the normative cost for husk based projects • Specific fuel consumption-15% higher to take care of lower efficiency and storage degradation
- Auxiliary power consumption-20% higher required for preparatory devices

4.3.8 Recommendations for biomass gasification projects:

- Investment cost-200% of the normative cost
- Specific fuel consumption-15% higher
- Auxiliary power consumption-10%
- Station heat rate of 4,600 kCal/kWh for updraft gasifier and 5,280 kCal/kWh for downdraft gasifier

4.3.9 **ISSUE-4: FUEL COST**

4.3.9.1 AEDB submitted that the fuel price should be subject to verification based on periodic biomass resource survey. The tariff guidelines provided in the notification may work for husk based projects subject to validation of the current market price of rice husk. As per a field survey carried out in 2015, the procurement price was Rs 6,000 / MT for rice husk during season and Rs 8,000/MT during off-season.

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4.4 **Hyderabad Electric Supply Company (HESCO)**

4.4.1 HESCO submitted the following comments:

- HESCO appreciate and support the NEPRA initiative for the upfront generation tariff for bagasse power project, which will not only pay its vital role in mitigating the demand supply gap but will also enable to achieve the socio-economic objectives of the GOP.
- Return on Equity / WACC and debt servicing / depreciation for both Solid Wastes are different and should be only one component for it and the project should consider for the 0.8 million US$ / MW and component should be equally divided on 30 years of project life i.e. 1.4 /kWh for ten years on the 75% of the project cost.
- Internal Rate of Return (IRR) also divided equally into 30 years of project life i.e. 3.33% @ 0.02/kWh on 25% of the project cost.

4.5 **Central Power Purchasing Agency Guarantee Limited (CPPA-G)**

4.5.1 CPPA-G submitted that the power purchaser is aligned with the vision to diversify power generation portfolio, earmarked with substantial quantum of renewables in the overall mix. This will not only help utilizing indigenous resources, but also assist in ensuring security and sustainability in the power equation of the country. The comments are as under:

- **Policy, Regulatory and Legal Framework:**
  - The power procurement by the Power Purchaser, keeping in view the current / planned commitments with prospective translation into positive differential of generation and demand gap, should be restricted to the Take & Pay, which in turn entails amendments in the Policy Framework for Power Co-Generation 2013 (Bagasse / Biomass). This will prevent swelling of fixed cost component of the end-consumer's tariff.
  - The quantum of renewables (technology specific) to be inducted into National Grid, pursuant to the demand projections for each year, should be determined as percentage of the total generation to be added in the each year and the same percentage needs to be assured by the Distribution Companies in their submission of Power Acquisition Program to the Authority for approval.
  - Draft Energy Purchase Agreement needs to be developed to depict take and pay framework as proposed above.
  - Section 32 of NEPRA Act entails development of prescribed procedures and standards for Authority's prior approval of Power Acquisition Program for Distribution Companies.
- **Determination of Uniform Feed in Tariff:**
  - CPPA-G is of the view that a uniform feed-in tariff without any front loading, be considered by the Authority for the term of the project, keeping in view the prevailing parameters, as already proposed by the same in its Suo Moto hearing for Upfront Tariff Generation from Waste Heat Recovery System. Further it is suggested that:
    - Minimum / Maximum capacity of plant by the power producer should be determined based on the analysis of availability of the fuel while ensuring the lower limit of annual plant factor.
    - Only variable cost component of the tariff be allowed to be charged by the power purchaser after achieving the annual plant factor during any month of the prevailing year.
    - Allowance of 15% Internal Rate of Return, especially in the context of power market witnessing transition to buyer's regime in the near future entails revisiting by the esteemed Authority.

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- Authority may consider placing limit on the quantum of power to be procured under the proposed tariff regime, in consonance with the aforementioned comments above.
- Permissible limit of auxiliary consumption may also be mentioned in the assumptions set.
- Detailed study of availability of the fuel in various regions to be consumed in the framework of subject regime, needs to be carried out in order to arrive at inform figures.
- Mechanism to determine the fuel price including freight needs to be evolved for different region without any indexation to the coal price.
- Assumption of annual plant capacity factor of 80% as proposed by the Authority bears prudence and can be managed on account of enhanced efficiency as well by designing the capacity of the plant in accordance with the fair estimate of the availability of the fuel.

4.6 **Ministry of Petroleum & Natural Resources**

4.6.1 Ministry of Petroleum and Natural Resources stated that the proposal of generation of electricity through biomass is supported since it will not only reduce the reliance on gas for generation of electricity but also help in bridging the gap between demand and supply of electricity in the country. Further, the determination of upfront tariff for such projects may be made in a way that it can attract the project sponsors / developers to undertake and deliver such projects.

4.7 **Pakistan Environmental Protection Agency, Ministry of Climate Change**

4.7.1 Ministry of Climate Change provided the following comments:

- All potential power projects including those based on solid waste or biomass for consideration of generation license by NEPRA may be subjected to comply with the mandatory requirement of seeking environmental approval from respective environmental protection agency as per their territorial jurisdiction and in accordance with the provisions of the relevant environmental protection acts and rules / regulation made thereunder.

5. Issues

5.1 The Authority considered the matter and approved the notice of hearing for publication in the national newspapers. Similarly following issues were approved which was published in the national newspapers. Hearing in the matter was held on 9th May 2017. The issues are as under:

- Whether the proposed project cost for biomass power projects (incineration & gasification) is reasonable?
- Whether the Debt Equity ratio of 75:25 is reasonable?
- Whether the proposed O&M cost is reasonable?
- Whether the proposed IRR of 15% is reasonable?
- Whether the insurance cost at 1% of EPC cost is reasonable?
- Whether the proposed efficiency of 29.24% is justified?
- What should be the pricing mechanism for biomass power projects?
- Whether the proposed Calorific Value is reasonable?
- Whether the proposed generation tariff on 10 years, 15 years financing and Weighted Average Cost of Capital is reasonable?
- What should be the mode of evacuation i.e. Take and Pay or take or Pay?
- Whether indexation mechanism is justified?

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- Whether the concerns of the interveners and commentators are reasonable & justified?

6. DISCUSSION, ANALYSIS AND DETERMINATION OF THE AUTHORITY

7. Whether the proposed project cost for biomass power projects (incineration & gasification) is reasonable?

7.1 The proposed project cost on the basis of available information was US$ 0.8 million per MW. There are two main components of a combustion based biomass plant: 1) the biomass-fired boiler that produces steam; and 2) the steam turbine, which is then used to generate electricity. Following are three indicators of the cost:

i. Equipment cost (factory gate FOB and delivered at site CIF);
ii. Total installed project cost, including financing costs; and
iii. The levelized cost of electricity LCOE.

7.2 During the hearing, Punjab Bio Energy and other representatives of PPDB stated that the project cost is on lower side as compared to cost allowed in the cases of SSJD and Lumen Energia. The representatives of Punjab Bio Energy submitted that the efficiency is directly linked with the project cost. Punjab Bio Energy submitted that the project cost should be US$ 1.86 million instead of proposed US$ 0.8 million. The feasibility study for the PPDB has been conducted by AF Consultant. According to the representative of the AF Consultant the project cost in the feasibility study based on European technology is US$ 1.53 /MW. The representative of AF Consultant submitted that this is comparable with the other technologies and the project cost for reliable technology needs to be allowed for operational period.

7.3 AEDB submitted that the project cost for husk / rice should be around US$ 0.8 million per MW. For others it should be around US$ 1 million per MW and for gasifier power projects the same should be double of the reference cost.

7.4 The intervener EnMass Energy submitted that the project cost is on lower side which needs to be enhanced keeping in view the project cost in the neighboring country. According to the EnMass representative, per MW cost is around US$ 1.2 million in the Indian Punjab.

7.5 The Authority considered the submission of the interveners, commentators, AEDB, Power Purchaser and analyzed the information available in record. The Authority considers that the project cost of US$ 1 million recommended by the AEDB for incineration projects is reasonable. Accordingly the same is approved in the instant case.

8. Whether the Debt Equity ratio of 75:25 is reasonable?

8.1 In the instant case debt:equity ratio of 75:25 was proposed which was recommended by the different stakeholders. The Authority considers that the biomass power projects are at nascent stage therefore needs to be treated in same manner as in case of Independent Power Producers. Accordingly the tariff has been calculated on basis of debt:equity ratio of 75:25.

9. KIBOR Spread

9.1 The Upfront Tariff for Biomass Energy Projects proposal was based on KIBOR plus 3% Spread. Accordingly the tariff was calculated on the same basis.

9.2 The Authority noted that State Bank of Pakistan ("SBP") in June, 2016 had approved financing scheme for renewable power projects. Under that scheme, SBP is providing loan at a flat rate of

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6% for a debt servicing term of ten years. In view of the favourable terms being offered under the SBP scheme, the Authority has decided that biomass power projects opting this upfront tariff shall secure financing under the said SBP scheme. Accordingly the reference tariff has been approved on the same basis. This upfront tariff shall be approved/adjusted for the projects on commercial financing terms only after the option of financing under SBP scheme is exhausted which shall be substantiated with submission of relevant documentary evidences at the time of application for this upfront tariff. The commercial financing for local financing after exercising the SBP scheme shall be KIBOR + 3% and in case of foreign financing LIBOR + 4.5%. The savings in the spread, if any, shall be shared between power purchaser and power producer in the ratio of 60:40.

10. Construction Period

10.1 According to the IRENA and REN21 the maximum construction period of biomass power plant construction period is from 18 to 24 months. NEPRA in bagasse based power generation projects allowed 24 months construction period from the date of acceptance. From date of financial close the construction period is 18 month. In the light of the available research on the issue and already precedence available in other countries, the 24 month construction period is sufficient for the biomass power projects.

10.2 The Authority has further decided to allow financial close time of six months from the date of acceptance of tariff and construction period of eighteen months from the date of financial close for this upfront tariff. The applicability period of this tariff shall be two years from the date of issuance of this tariff.

11. Minimum Size of the Power Plant

11.1 The project size depends on the fuel (biomass) availability near the project location. The collection and storage of biomass is *the critical* activity for any biomass project to succeed. Keeping in view the aforesaid, the Authority has decided that the investor shall decide about the size of the plant keeping in view all aspects.

12. Auxiliary Consumption

12.1 In our neighboring country allowed auxiliary consumption for the biomass power projects is around 10% - 12.5%. The Authority in case of SSJD and Lumen Energia biomass projects allowed 12.5% of the auxiliary consumption. The Authority considers that the auxiliary consumption is dependent upon the conveyer belts of the transporting / handling multi-fuels, smaller size of the plant and pre-processing of the fuel before combustion. Accordingly keeping in view the proposed 12% auxiliary consumption being reasonable, the Authority has decided to approve the same.

13. Plant Availability

13.1 In our neighboring country plant availability is 80%. According to the REN21 reports the plant factor ranges between 80-90%. The representatives of Bulleh Shah Packages has also stated that the plant availability of their power plant envisaged is around 90%. The Authority in the case of SSJD and Lumen Energia allowed 80% plant factor.

13.2 The representatives of Punjab Bio Energy submitted that in feasibility study carried out by the Department, 70% plant factor has been proposed / suggested. The same was requested by the Punjab Bio Energy department.

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13.3 The Authority considered the submissions of the interveners, commentators, AEDB and Power purchaser and is of the view that Punjab Bio Energy department is in process of developing of the collection centers wherein they will collect and transport the biomass product to the Power plant for the purpose of power generation. Since huge setup has been formed under the Umbrella of the Government of Punjab to provide backup supply chain therefore 80% plant factor can be maintained. Furthermore, the captive power plants operating in self generation mode are operating with more than 80% plant factor. Keeping in view the aforesaid, the Authority considers that 80% plant factor is achievable. In view thereof the same has been adopted.

14. Whether the proposed O&M cost is reasonable?

14.1 O&M costs of biomass energy systems are predominately the costs of fuel processing and labor. In other respects, these systems are similar to other boiler-based electricity production systems. Operation is continual, so costs for operation and for the purchase and storage of fuel need to be assessed with the overall project costs. The operating expense ranges between 2-6% of the capital cost. NEPRA also determined the biomass tariff for SSJD and Lumen Energy on 28.6.2012 and 15.11.2012. Subsequently NEPRA in its determination dated 29.5.2013 allowed annual O&M cost of US$ 0.0264 million on the basis of 3.25% of EPC cost (45% plant factor).

14.2 The fixed and variable O&M for power plants available in system comprises of salaries and wages, plant admin costs, rents, security, transportation, overheads, office costs, environment monitoring, contract fees, utilities, professional fee (audit tax and legal fee), spare parts (imported/local), lube oil, consumables etc.

14.3 Punjab Bio Energy representatives during the hearing stated that the O&M cost should be allowed keeping in view the operational expense required in the matter. The representatives of the Punjab Bio Energy proposed Rs. 1.45/kWh on account of O&M cost.

14.4 The collection of biomass, shredding, balling etc requires higher O&M cost. Keeping in view the above, the Authority has decided to allow 4% of the EPC cost as O&M cost in the instant case. Accordingly the following O&M has been approved:

Description	Rs./kWh
Variable O&M – Foreign	0.0736
Variable O&M – Local	0.1104
Fixed O&M – Local	0.2759
Total	**0.4598**

15. Working Capital

15.1 In bagasse based Upfront Tariff Cost of working capital based on KIBOR plus 2% spread for 45 days fuel invoice receivables was allowed in line with other projects. In the instant case 45 days fuel inventory and 30 days receivables was proposed. No comments received regarding the working capital. Accordingly based on 45 days inventory and 30 days invoice receivables cost of working capital has been assessed as Rs. 1255/kWh. The working capital component of tariff will be adjusted quarterly based on variation in three months KIBOR.

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16. **Biomass pricing Mechanism & Fuel cost**

16.1 Biomass products i.e. Wheat Straw, Husk Rice, Rice Straw, Cotton Sticks, Maiz etc have different time period due to natural process, different classification and availability. The collection of biomass products is difficult as compared to the bagasse which is by product of the sugar cane. Similarly there is no transportation involved in the bagasse since the sugar mill uses its waste for generation of electricity. The biomass can be purchased:

i. Directly through farmers
ii. Through intermediaries

16.2 Punjab Energy Department provided the following information:

PUNJAB BIO ENERGY COMPANY			
Bio Mass	**Cost per ton**	**Mix Ratio**	**Weighted Average Cost**
Wheat Straw	8,875	20%	1,775
Rice Straw	5,375	45%	2,418.75
Maize Straw	4,375	35%	1,531.25
Cost of Bio Mass per Ton			**5,725**

AF CONSULTS FEASIBILITY REPORT	
Cost of Bio Mass per Ton	**6,424**

BULLESHAH PACKAGING	
Wheat Straw	8,500
Rice Straw	3,500
Maize Straw	9,000
Cotton Sticks	7,000
Suger Cane Trush	2,000
Cost of Bio Mass per Ton	**6,000**

16.3 In addition, following information was also provided:

PARTICULARS	PUNJAB BIO ENERGY COMPANY	AF CONSULT FEASIBILITY REPORT	BULLEHSHAH PACKAGING
		.....Rs. Per Ton.....	
COST OF BIOMASS	5,725	6,424	6,000
PROCESSING AND ADMIN COST	1,867	2,375	-
TOTAL COST	**7,592**	**8,799**	**6,000**
Add: TRANSPORTATION COST	800	800	800
TOTAL COST AT PLANT	**8,392**	**9,599**	**6,800**
BIOMASS COLLECTION MECHANISM	**THIRD PARTY SUPPLIER**	**THIRD PARTY SUPPLIER**	**CONTROL OF SUPPLY CHAIN AND COLCENS BY PLANT OPERATOR**

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16.4 There biomass prices varies from place to place depending upon the requirement of the purchaser. Although the Pakistan Bureau of Statistics provide the monthly indices of the agricultural crops however agricultural waste prices cannot be determined through these indices. There are three type of pricing mechanisms that can be opted for the pricing of the biomass based power plants. Firstly, the mechanism as approved by the Authority in its determination in case of SSJD Bioenergy Limited where the Authority decided to link the price of biomass with the price of coal and formulated a formula for working out the transportation cost of biomass fuel. Secondly, representative of AEDB suggested Rs. 6,000/ton for season and Rs. 8,000/ton for off-season. Thirdly, the mechanism as proposed by the PPDB wherein the actual biomass prices have been conveyed.

16.5 As a matter of fairness, equity and justice the actual prices need to be considered instead of linking the same with some indices which are used in the absence of actual prices prevailing in the market. The Authority also noticed that these prices are indicated by the government agency specially created / constituted with the purpose to procure biomass for the generation power plant. The Authority is also of the view that the weighted average percentage indicated by the PPDB may varies depending upon the quantity and availability of the crops. However, the same can be managed through affective pricing and management techniques.

16.6 The Authority considers that the Punjab Bio Energy department has been established for the collection of the biomass. Similarly the other provinces / or third party may adopt this approach. Since the Punjab Bio Energy indicated the actual prices on which the biomass has been procured therefore these prices can be used as reference / benchmarks for future indexation instead of linking the same with the coal price.

16.7 The Authority keeping in view the above issues, decided to opt for the actual prices indicated by the PPDB for biomass prices. Accordingly based on the actual weighted average biomass price of Rs. 5,725 per ton and transportation cost of Rs. 800 per ton, efficiency of 27.5% and calorific value of 12364.74 btu/kg, the fuel cost component has been worked out as Rs. 6.55/kWh. The fuel price shall be subject to indexation maximum 2% after every two years. However, first adjustment on account of fuel price variation shall be made after two years of COD.

17. <u>Whether the proposed efficiency of 29.24% is justified?</u>

17.1 The assumed net electrical efficiency (after accounting for feedstock handling) of the prime mover (generator) averages around 30%, but varies from a low of 25% to a high of around 36%. Many technologies are available with higher efficiencies, with 31% for wood gasifies to a high of 36% for modern well-maintained stoker, circulating fluidized bed (CFB), bubbling fluidized bed (BFB) and anaerobic digestion systems. The biomass power projects installed in Pakistan are Captive Power Plants. The efficiency in our neighboring country is around 21%-26.43%. NEPRA in the case of bagasse based generation projects determined 24.5% efficiency which has recently been revised to 28.37%.

17.2 According to the representative of Punjab Bio Energy, the efficiency is 26.2% as per feasibility study conducted by AF consultant. The intervener EnMass energy submitted that the efficiency

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should be in the range of 24-26% instead of 29.24% published by NEPRA. The representative of AEDB submitted that for up draft gasifier the efficiency is 4600 kilocalories.

17.3 The Authority has considered the above submissions and noted that the efficiency of the dedicated power plants ranges between 26-30% of the steam turbines. Accordingly based on the available information, benchmarks with NEPRA, the Authority has decided to allow 27.5% net efficiency throughout life of the project in the case of biomass power projects.

18. Calorific Value

18.1 As per the information available with NEPRA, the Calorific Value (CV) of the different biomass products are as under:

Type of Crop	Type of Crop Residue	Moisture Content of Residue (%)	LHV (MJ/Kg)
Cotton	Cotton Stalk	12.5	15.0
Wheat	Wheat Straw	10.0	14.4
Rice	Rice Straw	10.5	12.5
Rice	Rice husk	11.5	13.5
Sugarcane	Sugarcane trash	24.0	12.6
Sugarcane	Bagasse	50.0	7.5
Maize	Maize stalk	16.0	13.0
Maize	Maize husk	11.9	11.6
Maize	Maize cob	17.6	14.0
Gawar	Gawar Straw	11.3	15
Gram	Gram stalk	12	14.4
Wood	Wood waste & agricultural residues	12	16.5

18.2 The calorific value of the biomass agriculture is different in different places. The power plant may use the mixed biomass which can have different results. In response to the above proposal, the AEDB and PPDB recommended the average CV of 12364.74 btu/kg announced by NEPRA. Accordingly the same has been adopted for the purpose of calculating the fuel cost component. However, the power producers shall maintain the lab test reports of the CV of the biomass product on monthly basis. The same will be subject to adjustment on annual basis based on the monthly average and actual lab test results. The adjustment on this account will be made only if the CV is established higher than the minimum benchmarks for which the power producer shall submit the documentary evidence on yearly basis.

19. Whether the proposed IRR of 15% is reasonable?

19.1 The Authority in case of Upfront Tariff of Biomass Power Projects indicated an IRR of 15%. This IRR was in line with the return allowed in case of Wind Upfront Tariff.

19.2 Punjab Bio Energy stated that the IRR needs to be reviewed keeping in view the huge investment require in the field of Biomass Power Projects. According to the Company the investor needs higher return. AEDB also supported the same. The representative of Punjab Bio Energy stated that 17% IRR needs to be allowed instead of 15% IRR. The first project will attract the investment in the biomass sector once the higher IRR is allowed to the particular project. The intervener EnMass

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Energy suggested that 20% IRR allowed in the case of Thar Coal projects be allowed in the instant case.

19.3 The Authority considered the submission of the interveners and commentators. The Authority is of the view that due to the level playing field and provision of equal opportunity / incentives, the associated risks to the renewable projects over the period of time anticipated has been diluted. The same has been reflected in the recent cases wherein the renewable projects offered IRR around 12%. In competition market the investors are now willing to accept the return even less than 12%. Furthermore, the renewable projects are more important keeping in view the energy security which needs to be encouraged. In view thereof the Authority considers that the same IRR of 15% allowed in case of Wind Power plants is reasonable and therefore is approved in the instant case.

20. Whether the proposed insurance cost at 1% of the EPC cost is reasonable?

20.1 Currently 1% of EPC is allowed by the Authority as cost for insurance during construction and operations. Previously, the Authority had allowed as high as 1.35% of EPC. The essence of insurance cost is that in the event of a disaster, the insurance coverage should exist to cover for replacement of the damaged machinery/ equipment. Insurance cost typically covers events such as earthquake, flooding, technology specific risk, cyber security, terrorism, marine, delay in construction and location specific risks.

20.2 In the instant case 1% of the EPC cost was published for the input of the stakeholders. The representative of Punjab Bio Energy submitted that the insurance should be around 1.5%. While justifying the 1.5% of the insurance cost representative of Punjab Bio Energy department submitted that biomass has higher risk therefore higher insurance cost needs to be allowed.

20.3 The Authority keeping in view the actual benchmarks available in different projects considers 1% of EPC cost as insurance cost is reasonable. Accordingly the same has been approved on account of insurance component for the project construction and operational period.

21. Tariff Control Period

21.1 The Authority in case of bagasse based power generation approved tariff control period of 30 years. In the instant case the same was proposed. Accordingly the same control period has been approved in the instant case which is in line with the bagasse based power projects.

22. Whether the concerns of the Intervener are reasonable and justified?

22.1 **Response to AKLA Queries**

22.1.1 In accordance with the provision of Section 47 and sub-clause (a) of the Sub-Section 7 of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997 the Upfront Tariff Regulations are issued. Energy is fundamental input to economic activity, and thus to human welfare and progress. The importance of electricity in the development of the economy of any country is beyond any doubt. The economic growth of any country is directly linked with the availability of safe, secure, reliable and cheaper supply of electricity. In view of the said reasons, the Authority is of the considered opinion that for sustainable development all indigenous resources of power generation must be developed on priority basis in the public and private sector, including Coal, Hydel, Wind, Solar and RE.

22.1.2 The concerns of the AKLA with respect to least cost generation plan are valid. The Authority is cognizant of the least cost generation plan and the while determining generation tariff all these

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factor are kept in mind. The Authority considers that the bagasse / biomass based power projects are in accordance with the RE policy which is formulated by the Federal Government. The existing demand supply gap also requires induction of new generation plant and especially the renewable power projects for enhancement of the energy security.

22.1.3 The existing energy mix of the country is heavily skewed towards the thermal power plants, mainly operating on imported fuel. The import of fuel for electric power generation not only creates a pressure on the precious foreign exchange reserves of the country but is also an environmental concern. Therefore, in order to achieve sustainable development it is imperative that indigenous RE resources are given priority for power generation and their development is encouraged. The renewable projects will help in diversifying the energy portfolio of the country. Further, the project will not only enhance the energy security of the country by reducing the dependence on imported oil but will also help in reducing carbon emission by generating clean electricity, thus improving the environment. Similarly the biomass to Energy Projects will not only provide electricity to the national grid, attract investment but also provide great support to protect the environment issue and economic growth of the country.

22.1.4 Upfront tariff are always determined in accordance with the provision of law and through consultative process wherein input of all stakeholders is solicited.

22.1.5 So far as under-utilization of the existing plants is concerned, demand phenomenon needs to be understood. Demand is not constant; rather it changes round the clock from peak to minimum. Load Shedding has to be carried out during the peak demand-supply gap. Similarly during the period of less demand, generation has to be curtailed. The available generation capacity is not sufficient to meet the peak demand and efforts are being made to build new power generation capacity. Non utilization of plants during the minimum demand time doesn't mean that plants are underutilized as all the plants cannot be operated when there is not enough demand. Regarding take or pay arrangement, it is observed that this arrangement is in accordance with the applicable Power Policy and unless there is a competitive power market in the country this regime will be hard to change. The biomass power projects will further strengthen the economy and economic welfare of the farmers of this country.

22.1.6 The availability of fuel is the responsibility of the power producers and in case of non-availability of fuel the Liquidated Damages will be imposed to the power projects therefore no effect on this account will be passed on to the end-consumers.

22.1.7 The Saba, SEPCOL, and Japan power have their contractual obligations with WPPO which do not fall under the domain of NEPRA. As regards the Reshma and Gulf Power, both are in operation.

22.1.8 As regards the underutilization of the power plants, the proceedings in this regard has been initiated.

22.1.9 As regards the CPPA-G concerns, the policy framework is the prerogative of GOP therefore the query of the CPPA-G in this regard is not relevant in the instant case.

23. ORDER

23.1 The Authority hereby determines and approves the following upfront tariff for biomass power projects for delivery of electricity to the power purchaser:

Tariff Components	Incineration			Indexation
	1-10	11-30	Levelized	
FCC Rs./kWh	6.5474	6.5474	6.5474	2% escalation in fuel price after two years

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Rs./kW/hr				
Variable O&M-Foreign	0.0736	0.0736	0.0736	US CPI & PKR / USD
Variable O&M – Local	0.1104	0.1104	0.1104	CPI General
Fixed O&M – Local	0.2759	0.2759	0.2759	CPI General
Insurance	0.1150	0.1150	0.1150	PKR / USD
Cost of working Capital	0.1255	0.1255	0.1255	KIBOR
ROE /ROEDC	0.5575	0.5575	0.5575	PKR/USD
Debt Servicing	1.3661	-	0.8904	LIBOR / KIBOR & PKR/USD (If applicable)
Total Tariff – Rs/kWh	**9.1713**	**7.8053**	**8.6957**	

i. *The above tariff is applicable for 30 years from COD.*

ii. *The above tariff is applicable for biomass power projects.*

iii. *Dispatch criterion will be energy charge.*

iv. *The reference component wise Upfront Tariff table is attached herewith as Annex-I*

v. *The reference Debt Service schedule is attached herewith as Annex-II.*

vi. This upfront tariff has been worked out on the basis of the interest rate of 6% being offered under SBP scheme. In case of commercial local financing, the tariff shall be computed using applicable KIBOR plus a premium of 300 basis points. In case of commercial foreign financing, the tariff shall be computed using applicable LIBOR plus a premium of 450 basis points. In case negotiated rates/spread is less than the said limits, the savings shall be shared by the power purchaser and the power producer in the ratio of 60:40 respectively. The power producer shall submit relevant authentic documentary evidence to the Authority, for the aforesaid adjustment within 15 days of COD of the relevant company. In case the premium on LIBOR/KIBOR is higher than that mentioned above, no adjustment on the basis of actual higher premium will be allowed.

vii. The interest during construction shall be adjusted at the time of COD on account of actual project financing mix and variation in quarterly LIBOR/KIBOR (where applicable) over the approved reference rates. The interest during construction shall be reassessed for the allowed construction period of eighteen months, starting from the date of financial close of the relevant company, on the same computation basis as already adopted, by applying 3 months KIBOR/LIBOR of last day of the preceding quarter (plus allowed spread thereon), on the basis of phasing for debt injection considered in the computation of upfront tariff. The power producer shall submit relevant authentic documentary evidence to the Authority, for the aforesaid adjustment within fifteen days of the COD of the relevant company.

24. Pass through items

24.1 If the company is obligated to pay any tax on its income from generation of electricity, or any duties and/or taxes, not being of refundable nature, are imposed on the company up to the commencement of its commercial operations for import of its plant, machinery and equipment, the exact amount paid by the company on these accounts shall be reimbursed by the power purchaser on production of original receipts. This payment should be considered as a pass-through payment spread over a twelve months period. Furthermore, in such a scenario, the company shall also submit to the power purchaser details of any tax savings and the power purchaser shall deduct the amount of these savings from its payment to the company on account of taxation.

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24.2 The adjustment for duties and/ or taxes will be restricted only to the extent of duties and/or taxes directly imposed on the company. No adjustment for duties and/or taxes imposed on third parties such as contractors, suppliers, consultants, etc. excluding adjustment for taxes imposed on dividend as stated below, will be allowed. Withholding tax on dividends will not be allowed as a pass through item.

25. Adjustments & Indexations

25.1 Following indexation shall be applicable to the reference tariff after one-time adjustment:

a) Fuel Cost Component: The fuel cost component of tariff will be adjusted on account of variation in price of fuel (biomass) after every two years in advance (w.e.f. 1st of July of each applicable year) as per the formula given hereunder:

$FCC_{(REV)}$	=	$FCC_{(REF)} * BP_{(REV)} / BP_{(REF)}$
Where:		
$FCC_{(REV)}$	=	Revised fuel cost component of tariff for the applicable period.
$FCC_{(REF)}$	=	Reference fuel cost component of tariff.
$BP_{(REF)}$	=	Reference weighted average price of Biomass, i.e. the price in Rs./ton for the period immediately preceding the applicable period .
$BP_{(REV)}$	=	Revised price of weighted average biomass in Rs/ton shall be worked out as $BP_{(REV)} = BP_{(Ref)} + 2\% * BP_{(Ref)}$

Note: For the 1st applicable period of two years after COD, the reference price shall be the biomass base price

b) Fixed O&M: The fixed O&M component will be adjusted on account of local Inflation. Quarterly adjustments for inflation will be made on 1st July, 1st October, 1st January & 1st April respectively on the basis of the latest available information with respect to Pakistan CPI (General). The formula of indexation will be as under:

$F.O\&M_{(REV)}$	=	$F.O\&M_{(REF)} * CPI_{(REV)} / CPI_{(REF)}$
Where:		
$F.O\&M_{(REV)}$	=	The revised Fixed O&M component of tariff
$L\ F.O\&M_{(REF)}$	=	The reference Fixed O&M component of tariff
$CPI_{(REV)}$	=	The applicable revised CPI (General)
$CPI_{(REF)}$	=	The reference CPI (General) of 216.61 for the month of August, 2017

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c) Variable O&M-Local: The local variable O&M component will be adjusted on account of local Inflation. Quarterly adjustments for inflation will be made on 1st July, 1st October, 1st January & 1st April respectively on the basis of the latest available information with respect to Pakistan CPI (general). The formula of indexation will be as under:

L V. O&M$_{(REV)}$	=	L V. O&M $_{(REF)}$ * CPI $_{(REV)}$ / CPI $_{(REF)}$
Where:		
L V. O&M$_{(REV)}$	=	The revised local variable O&M component of tariff
L V. O&M$_{(REF)}$	=	The reference local variable O&M component of tariff
CPI$_{(REV)}$	=	The applicable revised CPI (General)
CPI$_{(REF)}$	=	The reference CPI (General) of 216.61 for the month of August 2017

d) Variable O&M-Foreign: The foreign variable O&M component will be adjusted on account of variation in Rupee/Dollar exchange rate and US CPI. Quarterly adjustments for inflation and exchange rate variation will be made on 1st July, 1st October, 1st January & 1st April respectively on the basis of the latest available information with respect to US CPI (notified by US bureau of labor statistics) and revised TT&OD Selling rate of US Dollar (notified by the National Bank of Pakistan). The formula of indexation will be as under:

F V. O&M$_{(REV)}$	=	F V. O&M $_{(REF)}$ * US CPI $_{(REV)}$ / US CPI $_{(REF)}$ *ER $_{(REV)}$/ER$_{(REF)}$
Where:		
F V. O&M$_{(REV)}$	=	The revised foreign variable O&M component of tariff
F V. O&M$_{(REF)}$	=	The revised foreign variable O&M component of tariff
US CPI$_{(REV)}$	=	The revised US CPI (All Urban Consumers)
US CPI$_{(REF)}$	=	The reference US CPI (All Urban Consumers) of 245.519 for the month of August, 2017
ER$_{(REV)}$	=	The revised TT & OD selling rate of US dollar
ER$_{(REF)}$	=	The reference TT & OD selling rate of RS. 105/USD

e) Adjustment of debt servicing component: This fixed charge component after one-time adjustment will remain unchanged throughout the tariff control period except for the adjustment due to variation in LIBOR/KIBOR in case of commercial financing. The debt servicing component of tariff will be adjusted accordingly on quarterly basis.

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f) Return on Equity: Return on equity (ROE) as well as Return on Equity during Construction (ROEDC) component of tariff shall be adjusted for variation in PKR/US$ exchange rate according to the following formula:

$ROE_{(Rev)}$	=	$ROE_{(Ref)} * ER_{(Rev)} / ER_{(Ref)}$
Where;		
$ROE_{(Rev)}$	=	Revised ROE Component of Tariff
$ROE_{(Ref)}$	=	Reference ROE Component of Tariff
$ER_{(Rev)}$	=	The revised TT & OD selling rate of US dollar as notified by the National Bank of Pakistan
$ER_{(Ref)}$	=	The reference TT & OD selling rate of Rs. 105/USD

g) Insurance during Operation: The actual insurance cost for the minimum cover required under contractual obligations with the Power Purchaser, not exceeding 1% of the EPC cost, will be treated as pass through. Insurance component of reference tariff shall be adjusted annually as per actual upon production of authentic documentary evidence according to the following formula;

AIC	=	$Ins_{(Ref)} / P_{(Ref)} * P_{(Act)}$
Where		
AIC	=	Adjusted insurance component of tariff
$Ins_{(Ref)}$	=	Reference insurance component of tariff
$P_{(Ref)}$	=	Reference premium @ 1% of EPC Cost at Rs. 105
$P_{(Act)}$	=	Actual premium or 1% of the EPC Cost converted into Pak Rupees on exchange rate prevailing on the 1st day of the insurance coverage period whichever is lower

26. Terms and condition of Upfront Tariff

26.1 The proposed terms and conditions are as under:

i. Upfront tariff will be applicable for all new power projects using biomass i.e. Cotton Stalk, Wheat Straw, Rice Straw, Rice husk, Sugarcane trash, Maize stalk, Maize husk, Maize cob, Gawar Straw, Wood wastes and forestry residues include wood chips, sawdust, timber slash etc and other agricultural residues as primary fuel under the GoP approved Frame Work for Power Co-generation 2013 (Bagasse/Biomass as per GoP Renewable Energy Policy 2006 (as amended).

ii. Following are eligible for Upfront tariff:

a. Companies recommended by the AEDB / relevant agencies for the grant of Upfront tariff.

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b. Companies which certify that all the plant and machinery to be installed will be new and international standards in the form attached as Annex-.III.
c. Companies who have consent of the power purchaser for procurement of the electricity as per format attached as Annex-IV.

iii. The option for accepting Upfront tariff by power projects will be applicable for two year from the date of approval of Upfront Tariff by the Authority with maximum cap of 100 MW.

iv. The Upfront Tariff will be applicable and become effective after Commercial Operation Date (COD).

v. The decision to opt for upfront tariff once exercised will be irrevocable.

vi. The project sponsors will be required to achieve COD within 24 months from date of approval of Upfront tariff by the Authority. No extension will be allowed.

vii. The sponsors interested in availing Upfront tariff will submit unconditional formal application to NEPRA for approval by the Authority in accordance with the NEPRA Upfront Tariff (Approval and Procedure) Regulations 2011 and GoP Policy for Renewable Energy 2006 (approved Frame work for Power Co-generation 2013(Bagasse/Biomass).

viii. The mode of transaction will be on take or pay basis. No allowance / adjustment shall be given other than NEPRA allowed tariff. No fuel and variable component will be allowed in case of non-evacuation of the electricity from the power project. The power producers will only be entitled for capacity charge in this case.

ix. The companies opting for this tariff will have to achieve financial close within six months from the date of decision of the Authority awarding upfront tariff to them. The upfront tariff granted to any company will no longer remain applicable/valid, if financial close is not achieved by the relevant company in the abovementioned timeline or a generation license is declined to that company.

x. The targeted maximum construction period after financial close is 18 months. No adjustment will be allowed in this tariff to account for financial impact of any delay in project construction. However, the failure of a project to complete construction within 18 months of financial close will not invalidate the tariff granted to it.

xi. The projects opting this tariff shall secure debt under the concessionary financing scheme of State Bank of Pakistan. This tariff shall be allowed on the approved terms of commercial financing only after availing the option of financing under SBP scheme.

xii. Power Producers shall have the option to offer energy to the respective Distribution Company (DISCO) at 11 KV or 132 KV, or to the CPPAG at 132 KV, provided that the cost of interconnection, grid station upgrades etc for power evacuation shall be incurred by the respective DISCO/CPPAG.

xiii. In the Upfront Tariff no adjustment for certified emission reductions has been accounted for. However, upon actual realization of carbon credits, the same shall be distributed between the power purchaser and the power producer in accordance with the Policy for Development of Renewable Energy for Power Generation 2006, as amended from time to time.

xiv. The use of coal imported or local is not allowed.

xv. Pre-COD sale of electricity to the power purchaser, if any, will be allowed subject to the terms and conditions of PPA, at the applicable tariff excluding principal repayment of debt component and interest component.

xvi. The adjustment/indexation of upfront tariff will be made on the basis of benchmarks assumed by the Authority for Upfront Tariff in accordance with the indexation mechanism stipulated hereinabove. No project specific adjustments shall be taken in account.

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xvii. The PPA executed shall be consistent with all applicable documents including Generation License and NEPRA's Tariff determination for the power producer. Any provisions of PPA/ EPA which is inconsistent with NEPRA's Tariff Determination shall be void to that extent and its financial impact shall not be passed on to the end consumer.

xviii. The terms and conditions specified herein form an integral part of this tariff.

27. The above order of the Authority, along with attached annexures (I to IV), are recommended for notification by the Federal Government, in the Official Gazette, in accordance with Section 31(4) of the Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997.

AUTHORITY

(Syed Masood-ul-Hassan Naqvi)
Member

(Himayat Ullah Khan)
Member

(Saif Ullah Chattah)
Vice Chairman

(Brig (R) Tariq Saddozai)
Chairman

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Reference Upfront Tariff for New Biomass (Incineration) Power Projects

Year	Fuel cost component	Variable O&M Local	Variable O&M Foreign	Total EPP	Fixed O&M Local	Insurance	Working capital cost	Return on Equity	ROE During Construction	Loan Repayment	Interest Charges	Total Tariff	Total Tariff
	Rs./kWh	Rs./kWh	Rs./kWh	Rs./kWh	Rs./kW/hr							Rs. / kWh	US¢ / kWh
1	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467	0.7702	0.5959	9.1713	8.7346
2	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467	0.8174	0.5486	9.1713	8.7346
3	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467	0.8676	0.4985	9.1713	8.7346
4	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467	0.9208	0.4452	9.1713	8.7346
5	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467	0.9773	0.3887	9.1713	8.7346
6	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467	1.0373	0.3287	9.1713	8.7346
7	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467	1.1010	0.2651	9.1713	8.7346
8	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467	1.1685	0.1975	9.1713	8.7346
9	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467	1.2402	0.1258	9.1713	8.7346
10	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467	1.3163	0.0497	9.1713	8.7346
11	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
12	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
13	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
14	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
15	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
16	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
17	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
18	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
19	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
20	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
21	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
22	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
23	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
24	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
25	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
26	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
27	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
28	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
29	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
30	6.5474	0.1104	0.0736	6.7314	0.2759	0.1150	0.1255	0.5108	0.0467			7.8053	7.4336
Levelized Tariff	**6.5474**	**0.1104**	**0.0736**	**6.7314**	**0.2759**	**0.1150**	**0.1255**	**0.5108**	**0.0467**	**0.6357**	**0.2547**	**8.6957**	**8.2816**

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
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Reference Upfront Tariff for New Biomass (Incineration) Power Projects
Debt Servicing Schedule

Period	Local Debt					Annual Principal Repayment Rs./kWh	Annual Interest Rs./kWh	Annual Debt Service Rs./kWh
	Principal Million Rupees	Repayment Million Rupees	Mark-Up Million Rupees	Balance Million Rupees	Debt Service Million Rupees			
	78.7582	1.4513	1.1814	77.3070	2.6327			
	77.3070	1.4731	1.1596	75.8339	2.6327			
	75.8339	1.4952	1.1375	74.3387	2.6327			
	74.3387	1.5176	1.1151	72.8212	2.6327			
1	78.7582	5.9371	4.5936	72.8212	10.5306	0.7702	0.5959	1.3661
	72.8212	1.5403	1.0923	71.2808	2.6327			
	71.2808	1.5634	1.0692	69.7174	2.6327			
	69.7174	1.5869	1.0458	68.1305	2.6327			
	68.1305	1.6107	1.0220	66.5198	2.6327			
2	72.8212	6.3014	4.2292	66.5198	10.5306	0.8174	0.5486	1.3661
	66.5198	1.6349	0.9978	64.8849	2.6327			
	64.8849	1.6594	0.9733	63.2255	2.6327			
	63.2255	1.6843	0.9484	61.5413	2.6327			
	61.5413	1.7095	0.9231	59.8317	2.6327			
3	66.5198	6.6881	3.8426	59.8317	10.5306	0.8676	0.4985	1.3661
	59.8317	1.7352	0.8975	58.0965	2.6327			
	58.0965	1.7612	0.8714	56.3353	2.6327			
	56.3353	1.7876	0.8450	54.5477	2.6327			
	54.5477	1.8144	0.8182	52.7332	2.6327			
4	59.8317	7.0985	3.4322	52.7332	10.5306	0.9208	0.4452	1.3661
	52.7332	1.8417	0.7910	50.8916	2.6327			
	50.8916	1.8693	0.7634	49.0223	2.6327			
	49.0223	1.8973	0.7353	47.1250	2.6327			
	47.1250	1.9258	0.7069	45.1992	2.6327			
5	52.7332	7.5341	2.9966	45.1992	10.5306	0.9773	0.3887	1.3661
	45.1992	1.9547	0.6780	43.2445	2.6327			
	43.2445	1.9840	0.6487	41.2605	2.6327			
	41.2605	2.0138	0.6189	39.2468	2.6327			
	39.2468	2.0440	0.5887	37.2028	2.6327			
6	45.1992	7.9964	2.5343	37.2028	10.5306	1.0373	0.3287	1.3661
	37.2028	2.0746	0.5580	35.1282	2.6327			
	35.1282	2.1057	0.5269	33.0225	2.6327			
	33.0225	2.1373	0.4953	30.8851	2.6327			
	30.8851	2.1694	0.4633	28.7157	2.6327			
7	37.2028	8.4871	2.0436	28.7157	10.5306	1.1010	0.2651	1.3661
	28.7157	2.2019	0.4307	26.5138	2.6327			
	26.5138	2.2350	0.3977	24.2789	2.6327			
	24.2789	2.2685	0.3642	22.0104	2.6327			
	22.0104	2.3025	0.3302	19.7079	2.6327			
8	28.7157	9.0079	1.5228	19.7079	10.5306	1.1685	0.1975	1.3661
	19.7079	2.3370	0.2956	17.3709	2.6327			
	17.3709	2.3721	0.2606	14.9988	2.6327			
	14.9988	2.4077	0.2250	12.5911	2.6327			
	12.5911	2.4438	0.1889	10.1473	2.6327			
9	19.7079	9.5606	0.9700	10.1473	10.5306	1.2402	0.1258	1.3661
	10.1473	2.4805	0.1522	7.6668	2.6327			
	7.6668	2.5177	0.1150	5.1492	2.6327			
	5.1492	2.5554	0.0772	2.5938	2.6327			
	2.5938	2.5938	0.0389	(0.0000)	2.6327			
10	10.1473	10.1473	0.3834	(0.0000)	10.5306	1.3163	0.0497	1.3661

Gross Capacity	1 MW	US$/PKR parity	105
Net Capacity	0.88 MW	Debt	0.75 US$
Plant Factor	80%	Debt Service Period	10 years

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
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Annexure - III

Date: _____

The Registrar,
National Electric Power Regulatory Authority,
Islamabad

Subject:- **Certifications in respect of application approval of tariff for Biomass Power Projects**

I, [NAME, DESIGNATION], being the duly Authorized representative of [NAME OF APPLICANT COMPANY] by virtue of [BOARD RESOLUTION/POWER OF ATTORNEY DATED], hereby confirm that for our project of [CAPACITY OF THE PROJECT] MW installed capacity to be located at [ADDRESS OF THE PROJECT SITE]:

2. All the plant and machinery to be installed will be brand new and of international standards.

Signature: _____

Name: _____

Designation: _____

Company Stamp

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
NEPRA
AUTHORITY

[On letter head of power purchaser]

Annexure - IV

Date: _____

The Registrar,
National Electric Power Regulatory Authority,
Islamabad

Subject:- **Consent of the Power Purchaser**

We hereby confirm that necessary arrangements will be in place, to evacuate and absorb power in the national grid, supplied by biomass power project of [NAME OF THE COMPANY], having [CAPACITY OF THE PROJECT] MW gross installed capacity to be located at [ADDRESS OF THE PROJECT SITE]. The Authority may accordingly grant upfront tariff to [NAME OF THE COMPANY] for the aforesaid project.

Signature: _____

Name: _____

Designation: _____

Company Stamp

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