National Electric Power Regulatory Authority

Islamic Republic of Pakistan

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Registrar

No. NEPRA/R/TRF-93/PSMA-2008/8286-89
June 12, 2008.

Subject: **Decision of the Authority in the Matter of Petition filed by Pakistan Sugar Mills Association (PSMA)**
(Case No. NEPRA/TRF-93/PSMA-2008)

Dear Sir,

Enclosed please find herewith NEPRA Decision on the tariff petition filed by Pakistan Sugar Mills Association (PSMA). The Authority has decided to determine an indicative tariff on the tariff petition filed by PSMA. The indicative tariff is based on the generic feasibility study for a 60 MW plant as submitted by the petitioner. Each sugar mill wishing to install a power plant will submit individual tariff petition along with a generation licence application under NEPRA Act (XL of 1997) and relevant NEPRA Rules and Regulations. The actual tariff given to such sugar mill in response to its individual formal tariff petition will be based on the evidence provided. The tariff given in the attached decision is an indicative tariff only for the purpose of guidance.

Enclosure: As above

12.06.08

(Mahjoob Ahmad Mirza)

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
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Secretary
Cabinet Division
Government of Pakistan
Cabinet Secretariat
Islamabad

CC

1. Secretary, Ministry of Water & Power, Government of Pakistan, Islamabad.
2. Secretary, Ministry of Finance, Government of Pakistan, Islamabad.
3. Secretary, Ministry of Industries, Government of Pakistan, Islamabad.

NATIONAL ELECTRIC POWER REGULATORY AUTHORITY
(NEPRA)

June 12, 2008

DECISION OF THE AUTHORITY

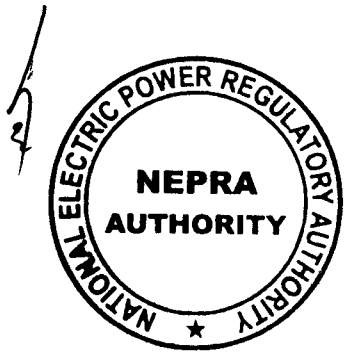
IN THE MATTER OF PETITION

FILED BY

PAKISTAN SUGAR MILLS ASSOCIATION

(PSMA)

Case # NEPRA/TRF-93/PSMA-2008



DETAILS OF THE CASE

1. BACKGROUND

1.1 The National Policy for Power Co-generation by Sugar Industry was announced in January 2008. Subsequently, Pakistan Sugar Mills Association (PSMA) filed a petition for determination of tariff before National Electric Power Regulatory Authority (the "**NEPRA**" or the "**Authority**") pursuant to Rule 3 of the NEPRA (Tariff Standards and Procedure) Rules, 1998. The petition was based on a feasibility report for a notional 60MW power plant based on bagasse-coal as fuel.

1.2 This tariff petition was admitted for consideration by the Authority on February 6, 2008 and was assigned case number NEPRA/TRF-93/PSMA-2008. While admitting tariff petition, the Authority also specified that an application for generation license shall be filed by all willing members of sugar industry/PSMA who were desirous of setting up a cogeneration plant within sugar mills for electricity production pursuant to a decision on the instant petition along with a formal tariff petition specific to a particular industry.

1.3 Salient features of PSMA's petition were advertised in the newspapers on 1st February, 2008 to inform all the interested persons/stakeholders and to invite participation in the tariff-setting proceedings through their comments or by becoming a party to the proceedings as interveners. Invitations were also sent to the concerned Federal & Provincial Government ministries, Chambers of Commerce and Industries, Representatives of Professional bodies and Experts, soliciting their views on the petition.

1.4 A public hearing on the petition was held on March 03, 2008 at NEPRA Main Office, Islamabad. This hearing was attended by the applicant, stakeholders, commentators as well as general public. At the end of the hearing PSMA was given 15 days for closure of evidence so that it could respond to the queries raised during the hearing and the information direction sent to it. Later on, this period for closure of evidence was extended till March 31, 2008 at the request of PSMA.

2. SALIENT FEATURES OF PETITION

FINANCIAL

2.1 PSMA submitted a request for a typical two part tariff structure with an energy charge for the energy actually dispatched and a capacity charge based on contract capacity for a period of 30 years. The following tariff for delivery of electricity to Central Power Purchase Agency (CPPA) was proposed by PSMA.

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REFERENCE TARIFF PROPOSED BY PSMA

Tariff Components	Year 1 to 10	Year 11 to 30
Capacity Charge (Rs./kW/hr)		
Fixed O&M	0.144	0.144
Insurance	0.116	0.116
Working Capital	0.082	0.082
Debt. Service	1.877	---
Return on Equity	0.398	0.398
ROE during construction	0.050	0.050
With holding tax (div)	0.036	0.036
Total Capacity Charge	**2.703**	**0.826**
Total Capacity Charge (Rs/kWh @ 60% PF)	**4.506**	**1.377**
Energy Charge (Rs./kWh)		
Fuel Cost Component	3.003	3.003
Variable O&M – Foreign	0.360	0.360
Total Energy Charge	**3.363**	**3.363**
Total Tariff (Rs/kWh)	**7.869**	**4.740**
Tariff Levelized at 10% per annum interest rate over 30 years control period		
6.78 Rs/kwh		

2.2 PSMA submitted that the total cost of co-generation project (including IDC and taxes) for the entire scope of works is estimated at US $ 96.674 million. PSMA also proposed the following capital structure of the co-generation project:

Equity	19.334 USD Million
Total debt	77.339 USD Million
Total Project Cost	96.674 USD Million
Debt to Equity	4:1

TECHNICAL

2.3 According to PSMA's petition based on generic feasibility study, a Co-Generation power plant of conventional steam turbine technology having a nominal capacity of at least 60MW will be installed along side existing sugar mills. The scheme is based on a duel fuel fired boiler and a turbo-generating set. The boiler will be designed for generation of steam to meet the steam requirement during season and

off-season operations. The boiler will be capable of burning bagasse-coal mix during season and 100% coal during off season. The bagasse will be supplied by sugar mills during season, and the coal used during season and off-season will be either imported or local. The steam turbine will be a condensing type non reheat with controlled/uncontrolled extraction for process steam and regenerative feed water heating system, steam from turbine will exhaust in the condenser at 0.1bar (a). Power will be exported to NTDC electrical network via double circuit 132KV transmission lines.

2.4 The cogeneration power plant will comprise of the following:-

- One condensing type steam turbine with four steam extractions
- One bagasse-coal fired boiler, 270 t/hr steam generating capacity at 87 bar, 535 deg.C.
- One turbo generator, 2 pole type, 50 HZ, 11 KV, 0.8 power factor with a rated capacity of 75 MVA coupled with steam turbine.
- One step-up transformer of 11/132 KV with rated capacity of 75 MVA
- One main auxiliary transformer of 11/6.6 KV with rated capacity of 16 MVA
- 132 KV outdoor sub-station designed for single bus bar arrangement, 1 incoming bay, 2 outgoing bays, with all necessary protection and metering system
- Main cooling water system(Cooling Tower)
- Closed cooling water system
- Water treatment system
- Common control room
- Coal/bagasse handling and storage facility
- Coal preparation and feeding system
- Ash removing system, discharge and storage in the ash yard
- Boiler equipped with electro static precipitators
- RCC stack of 85 meter height

3. PARTICIPATION OF STAKEHOLDERS

Several stakeholders participated in the proceedings in person or through correspondence. These participants include Central Power Purchase Agency (CPPA), Private Power Infrastructure Board (PPIB), Pakistan Council of Science & Technology (PCST) and Pakistan Association of Scientists and Scientific Professions (PASSP).

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4. ISSUES

Following issues have emerged from the proceedings:

- Fuel Mix and Utilization of Existing Sugar Mill Infrastructure
- Plant Capacity
- Thermal Efficiency
- Project Cost
- Tariff Structure
- Length of Crushing Season
- Fixed O&M
- Variable O&M
- Insurance
- Cost of Working Capital
- Return on Equity
- Return on Equity During Construction
- Cost of Debt
- Interest During Construction
- Fuel Cost

These issues and the views of Authority on these are described in the following paragraphs:

5. FUEL MIX AND UTILIZATION OF EXISTING SUGAR MILL INFRASTRUCTURE

5.1 Availability of bagasse and presence of existing power generation infrastructure in sugar mills are always described as two main benefits of allowing sugar mills to expand their cogeneration capacity. However, in this tariff petition, both these benefits have been omitted. The tariff petition is based on coal as primary fuel while bagasse usage has been restricted to only about 25%. Furthermore, the actual cogeneration will take place only during the crushing season that will consist of only 100 days as per the petition. Therefore, as per the definition used in other countries, such project would not qualify to be categorized as a cogeneration project.

5.2 It appears from this petition that the new power plants installed by sugar mills will not have any significant synergistic benefits from the existing available infrastructure and would rather suffer from lower power generation efficiency due to the requirement of using bagasse and supplying process steam to sugar mills during crushing season. A plant using only coal and having no link with the sugar mill would be able to provide electricity at a higher efficiency and lower cost than that estimated by PSMA for a plant linked to a sugar mill.

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5.3 An argument given in favour of bagasse based power co-generation is that it would save some foreign exchange during crushing season but given the extremely low proportion of bagasse in the proposed fuel mix, net savings do not appear to be significant in this case. Furthermore, use of substantial proportion of imported coal also weakens this argument. The low efficiency would also mean that more coal would be imported. Coal transportation is a very expensive exercise. Transporting imported coal from Karachi to interior Pakistan especially to the remote rural areas where most sugar mills are situated will substantially add to the cost. The road infrastructure in these areas is not good enough to absorb the increased load of heavy traffic transporting coal to these sugar mills.

5.4 All over the world, cogeneration by sugar mills using bagasse as fuel is considered as environmentally friendly power generation and is eligible for carbon credits. In countries like India, thermal fuels are allowed in cogeneration plants only if they account for no more than 25% of total fuel used. But in the present petition, coal will account for almost 75% of total fuel used. Therefore, it is unlikely that these new cogeneration plants will be able to get any benefit of carbon credits. In fact, their detrimental environmental impact may be significant.

5.5 Comparison of the proposed power plants under this petition with other similar plants paints an interesting picture. Ex-WAPDA DISCOs have been signing agreements for purchase of power with willing sugar mills that use bagasse for power generation. One recent example is PEPCO's agreement for purchase of power with Al-Moiz Sugar Mills, D.I. Khan. This agreement has been signed at a rate of Rs. 4.88/kWh (about 7.0 cents/kWh on current exchange rate). This rate includes fuel cost of Rs 3.62/kWh and fixed O&M cost of Rs 1.28/kWh. Total installed capacity of this plant will be 27 MW from which it will make 15 MW available to PEPCO. This is a ten year duration "take & pay" contract. Only the fuel cost is indexed.

5.6 To take another example, in the neighbouring India, bagasse based cogeneration tariff varies from state to state but is generally in the range of 2.96 – 3.20 Indian Rs/kWh. In current dollar terms it translates into 7-7.5 cents/kWh. Furthermore, these tariffs do not allow any foreign exchange indexation. Cogeneration plants in India are typically small, generally 15-30 MW, use bagasse as primary fuel and use of secondary fuel (coal) is restricted to 25% of the total. Given this, it seems a bit hard to accept the requested tariff of 11.1 cents at face value.

5.7 In defense of its tariff petition, PSMA has argued that sugar mills are able to install power plants rather quickly due to their previous experience with power generation and the availability of bagasse. The plant size of at least 60 MW was adopted to satisfy the concerns of WAPDA regarding low efficiency.

5.8 Furthermore, PSMA pointed out some other benefits of these cogeneration plants including reduction in emission levels, help in ensuring fuel security, reduction in transmission losses because of proximity of these plants to load centers thus stabilizing the grid voltage, smaller gestation period, foreign exchange saving by avoiding import of diesel and furnace oil, improvement in social conditions in remote areas where many sugar mills are situated etc.

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5.9 All the benefits of cogeneration plants as pointed out by PSMA are valid to an extent, but these can all be achieved by installing 25-30 MW plant using bagasse as primary fuel. Even with lower efficiency, these smaller plants should be able to sell electricity at a price similar to the Al-Moiz Sugar Mills case.

5.10 Therefore, it appears that instead of installing units of 60 MW or higher using imported coal, it would be better for the power sector if sugar mills are allowed to construct only smaller plants of 25-30 MW capacity using primarily bagasse and sell electricity to DISCOs on take-and-pay basis. If the objective is increasing the usage of coal based electricity in the generation mix, a better option would be to construct larger coal based power plants as near to the coast as possible to reduce inland transportation cost and to save the transport infrastructure from heavy load.

5.11 However, in view of the prevailing power shortage in the country, the Authority has decided to issue an indicative tariff on the petition. This indicative tariff is for a 60 MW power plant using bagasse/coal mix as fuel and should be used for guidance purposes. The actual effective tariff will be determined based on the prudence analysis of evidence regarding costs submitted by individual sugar mills in their specific tariff petitions.

6. PLANT CAPACITY

6.1 The petitioner has submitted that the proposed plant will have available gross capacity of 59.816 MW during off-season and 55.353 MW during season. The petitioner has proposed a weighted average net capacity of 51.45 MW based on weighted average of gross output (55.352 MW) during season and gross output (59.816 MW) during off-season less 7.0 MW for auxiliaries during off-season and 11.0 MW of auxiliaries during season.

6.2 Central Power Purchase Agency (CPPA) gave the following opinion:

6.2.1 The capacity payment should be linked with the actual available capacity of the Complex during season and off-season. As the Company will be utilizing steam for processing of the sugar mill and also meeting the power requirement of the sugar mill during crushing season thereby decreasing the gross efficiency of the plant form 36% to 30%, its impact should not be passed on to the power purchaser. The Company should share this benefit with the power purchaser by (i) allocating zero value to Bagasse and (ii) claiming capacity beyond the seasonal net out put of 44.35 MW.

6.2.2 The estimated auxiliary consumption of 11 MW (season) and 7 MW (off-season) is too high for a plant of this size.

6.3 Private Power & Infrastructure Board was of the opinion that the total project cost of USD 96.674 million has been assumed for the capacity of 60 MW. However, only 51.75 MW are proposed for sale to the power purchaser. The capacity price should be reduced to cater for the power to be used by sugar mills internally.

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6.4 The petitioner responded that the power purchaser will only pay for the capacity declared and dispatched to NTDC. The capacity shortfall during cane crushing season would result in less capacity payment to the project sponsor.

6.4.1 The loss of efficiency caused by the use of bagasse in the boiler during cane crushing season shall not be passed on to the power purchaser as the fuel cost component of tariff at 28% net efficiency shall be fixed during the term of the PPA.

6.4.2 The auxiliary consumption of 7.0 MW is normal for coal fired power plants.

6.4.3 PSMA also offered to supply all the net electric output during cane crushing season to the power purchaser instead of supplying 4 MW to the sugar mill.

6.5 A cogeneration plant generates both electricity and useful heat. It is only fair that if a sugar mill is going to be supplied with energy from a power plant, the power purchaser should not be made to pay for this benefit availed by the sugar mill. Even if no electricity from the power plant is supplied to the sugar mill, still the power generation capacity is reduced due to bleeding of steam for use in sugar mill processes. There is a need to assign a monetary value to this steam usage which has been done in the project cost portion.

6.6 The petitioner's estimated auxiliary consumption of 7.0 MW is indeed quite high. For a plant of similar size and nature, the auxiliary consumption in general ranges between 8-10% of generation capacity. Therefore, instead of 7.0 MW, auxiliary consumption of 5.98 MW corresponding to 10% of generation capacity is being allowed.

6.7 With this auxiliary consumption, the gross capacity available during off season of 59.816 MW and the gross capacity available during season of 55.353 MW will result in a weighted average net available capacity of 52.347 MW which has been used for determination of tariff.

6.8 The actual net capacity is estimated to be 53.834 MW during off season and 49.371 MW during crushing season. Actual payments would be made based on this available capacity. This net capacity would be verified through Initial Dependable Capacity (IDC) Test to be carried out at the time of Commercial Operation Date (COD). Adjustment in tariff would be made only if the IDC testing establishes net capacity higher than given above.

7. THERMAL EFFICIENCY

7.1 The tariff petition is based on a net thermal efficiency of 28%. As per the feasibility report, the gross efficiency during off season is estimated to be 36.1% while that during crushing season is estimated to be 30%. The net efficiency (at LCV) will be about 28% and 23.26% during season and off-season respectively.

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Boiler efficiency is estimated to be 84% and 72% during off-season and season respectively as use of bagasse reduces boiler efficiency.

7.2 CPPA in its comments, pointed out that the efficiency of 28% for cogeneration plants of 60 MW size is a benchmark as per ECC decision, which does not mean that a plant of 60 MW cannot have net efficiency more than 28% because with the development of technology double pressure steam turbines giving efficiency of 34 – 36% are available.

7.3 PSMA responded that it is not appropriate to raise any issues at this time after the ECC decision in which 28% net efficiency has been decided as a benchmark for a 60 MW plant. Furthermore, the proposed plant size was increased from 30 MW to 60 MW in order to provide at least 28% net efficiency as desired by the power purchaser and the requested tariff has been based on this efficiency disregarding the lower efficiency on bagasse.

7.4 Citing the reference made to gross efficiencies of 36% and 30% as estimated in the feasibility report, PSMA pointed out that in the feasibility report the efficiency of steam cycle during season and off-season operations is analyzed with extractions from steam turbine. This does not include the heat energy that boiler has to add by burning coal/bagasse. The plant's overall efficiency is the product of boiler efficiency and steam cycle efficiency. Furthermore, the net efficiency of 28% approved by ECC is not on average basis, it is the efficiency at LCV and at 132 kV grid for calculation of fuel cost part of the tariff.

7.5 The net thermal efficiency of the plant using coal has been estimated as about 28% and the petitioner has used this to calculate the proposed tariff. However, thermal efficiency of coal based power plants has been steadily rising in recent years. Utilization of new technologies like super critical, ultra critical and ICGC has resulted in highly efficient coal based power plants.

7.6 As the cogeneration policy has specified a benchmark efficiency of 28% for a 60 MW cogeneration plant, this minimum efficiency is allowed in the tariff. Reference net plant heat rate as estimated by the petitioner at LCV at 132 kV is 12048 Btu/kWh and this has been used in calculation of fuel cost. This heat rate would be adjusted based on heat rate testing at the time of COD. This adjustment will be made only if the actual heat rate is found to be lower than the reference rate in the heat rate testing.

7.7 Minimum net plant heat rate of 12048 Btu/kWh at LCV at 132 kV is being allowed only as a benchmark for plants of 60 MW size. Plants of higher sizes have the benefit of better economies of scale as well as of better efficiency. Therefore, higher capacity plants would be expected to have much lower heat rates.

8. PROJECT COST

8.1 The petitioner has estimated a total project cost of USD 96.674 million. This cost includes both EPC and Non-EPC Costs. The EPC Cost consists of Mechanical,

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Electrical and Civil works. The Non-EPC cost also includes Interest During Construction (IDC) and duties/taxes among other costs. Taking out the estimated IDC Cost (USD 8.398 million) and duties/taxes (USD 4.477 million), the break up of remaining project cost submitted by the petitioner is as follows:

S. No.	Description	(US$ 000)
	EPC Costs	
A	Mechanical Works	50,262
B	Electrical Works	13,500
C	Civil Works	11,915
	Total EPC Cost	75,677
D	Total Non EPC Cost (excl. IDC duties & taxes)	8,122
A+B+C+D	**Total Project Cost**	**83,799**

8.2 CPPA commented that the project cost submitted by the petitioner was extremely high. This cost translated to more than USD 1616/kW for the installed capacity of 60 MW plant, whereas now-a-days project cost varies in the range of US$ 1000-1200 per kW world-wide.

8.3 PPIB opined that the capital cost and tariff for cogeneration projects is generally expected to be lower than conventional generation projects. However, the proposed cost is higher than other projects for which NEPRA has issued determinations including combined cycle and reciprocating engine projects for which the capital cost varies between USD 800-1300/kW. The proposed capital cost also appears to be higher than a comparable new project based on imported coal.

8.4 In response, the petitioner took the position that coal-fired power plants are capital intensive and are built at a higher specific cost ($/kWh) which varies depending on the size of generating unit. Furthermore, many cost elements incurred to satisfy the provision of power policy and PPA requirements are not linked with plant capacity. These costs have a significant impact on $/kW cost in case of a smaller 60 MW plant.

8.5 PSMA mentioned that EPC costs have fast escalated in international markets during the last few years due to substantial increase in raw material price. Today the market is a supplier's market and therefore it would be impossible to secure EPC contract for a coal fired plant utilizing advanced technologies at costs mentioned by CPPA and PPIB. As the coal/bagasse fired power plant infrastructure and the project technical requirement is very broad so it is unreasonable to make comparisons with IPP's based on RFO/Gas.

8.6 The total project cost does appear to be quite high as compared to similar projects undertaken in other countries. In general the project cost for such projects is in the range of USD 900-1100 / kW. Cost of such projects is especially low in countries like India where a large number of sugar mills are using bagasse/coal mix for

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power generation. This too when in most cases the arrangement for power evacuation (transmission line etc) is the responsibility of project developer.

8.7 On query, representatives of the petitioner clarified that in India, power plants use mostly local equipment. Furthermore, in Pakistan due to restrictions imposed by the power purchaser, power plants have to utilize top of the line technology and paraphernalia. This appreciably increases the project cost. There is also a general inflationary trend in the cost of power plant equipment globally. Due to demand outstripping the supply, prices have risen. Other factors like increase in steel prices have also contributed to this price escalation. This trend is likely to continue in the near future.

8.8 It was observed by the Authority that no relevant evidence in support of these cost estimates was provided by the petitioner even on being directed to do so through the information direction. No suppliers' quotations or comparisons with similar projects in other countries were provided. Given that the burden of proof lies with the petitioner, it has not been able to provide such proof even though it was given ample opportunity to do so.

8.9 Therefore, the Authority, after thorough analysis, has rationalized the project cost estimates to bring these more in line with global trends.

8.10 Amount estimated in terms of duties and taxes appears to be quite high. Given that duties have been and are being reduced or even removed on many items due to the power shortage in the country and the fact that many parts of plant equipment will be of indigenous origin, no allocation for duties and taxes is being included in the project cost. The relevant duties and taxes, if incurred would be reimbursed on actual basis with adjustment in tariff at COD.

8.11 If Interest During Construction (IDC) cost is made a part of initial project cost, it would mean that part of IDC which will actually be paid back at the cost of debt is being reimbursed in the tariff at a higher cost of equity. This anomaly can possibly be removed at COD when actual IDC cost and actual equity invested can be determined. But in the meanwhile, inclusion of IDC cost in total project cost artificially shows an inflated tariff. Therefore, IDC cost has been separated from the project cost and has been included in the tariff separately.

8.12 Furthermore, IDC (as well as financial charges and ROEDC) have been calculated at effective interest rates as per the normal banking practice instead of at simple interest rates as has apparently been done in the petition.

8.13 The design & detailed engineering plus erection, commissioning and testing costs of mechanical, electrical and civil works portions of the EPC cost have been estimated on a higher side by the petitioner. In general, these costs are between 7-9% of equipment cost. Therefore, these costs for the respective portions of EPC costs have been estimated at 8.5% of respective equipment cost.

8.14 Costs of Owner's engineer and Independent engineer as well as insurance during construction included in the Non-EPC cost portion have been reduced to bring these in line with other tariff determinations of the Authority.

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8.15 The project cost depends on several factors such as nature and scope of the project (greenfield/expansion), selection of the boiler technology (pressure levels, back pressure type, extraction cum condensing type cogeneration etc.) and nature of contractual agreement (turnkey, non-turnkey etc.). Bagasse based cogeneration projects are supposed to make use of the available infrastructure and also meet energy requirements of sugar mills. To that extent, project cost should be reduced for the purposes of determining generation tariff.

8.16 No benefit from existing infrastructure of the sugar mill has been estimated in the project cost by the petitioner. When actual tariff petition of an individual sugar mill comes before the Authority based on specific costs, such benefit must be taken into account and project cost reduced accordingly. However, at the moment no cost adjustment for existing infrastructure is being recommended in the project cost except for small reduction in civil works cost of handling systems for bagasse and coal and staff colony.

8.17 The Authority has determined prudent EPC and Non-EPC costs (excluding IDC) as USD 54.811 million and USD 6.245 million respectively totaling USD 61.056 million.

8.18 Loss in net plant capacity during crushing season is 4.46 MW. This has been approximated for the initial benefit availed by the sugar mill in the form of process steam. Based on the project cost and the length of crushing season, this benefit can be assigned a monetary value of USD 1.632 million and this would be subtracted from the project cost. The resulting project cost attributable to the power plant, excluding IDC as well as duties and taxes, is estimated to be USD 59.424 million and this has been used for tariff calculations.

8.19 Project cost, if all sourced in foreign currencies is widely exposed to the vagaries of exchange rates. Therefore, in the interest of power consumers and local industry, it is imperative that project sponsors source as much portion of the project works locally as is possible. It is expected that once such work is started being sourced to the local market, it would result in improvement and enhancement of local capabilities to undertake larger portions of project works as has been the case in other countries of the region.

8.20 As is expected to be the case for most companies, Non-EPC cost as well as the entire civil works portion and 30% of electrical works portion of the EPC cost have been deemed to be sourced in local currency.

8.21 Project cost adjustments would be allowed based on variation in US Dollar/Euro – Rupee exchange rate (from the reference rates of 67 Rs/USD and 103.18 Rs/Euro depending on the evidence of source of supply) only to the extent of a maximum of 100% of allowed mechanical works cost and a maximum of 70% of allowed electrical works cost.

The breakdown of project cost allowed is as follows:

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	Description	Cost (USD 000)
	EPC Cost:	
A	Mechanical Works	36,219
B	Electrical Works	9,901
C	Civil Works	8,691
	Total EPC Cost	54,811
D	Total Non EPC Cost	6,245
A+B+C+D	**Total Project Cost (excl. IDC, duties & taxes)**	**61,056**
	Project Cost Attributed to the Power Plant	**59,424**

9. TARIFF STRUCTURE

9.1 The petitioner has requested a two part tariff. In many countries, e.g. in India a single part per kWh tariff is more common. According to the proponents of single part tariff for cogeneration plants, fixed cost of such cogeneration projects may be rewarded as an element of energy rate. If bagasse based power is kept outside the merit order dispatch schedule, single part tariff should offer built in incentives. Ex-WAPDA Discos are also contracting with bagasse based power generators for power purchase at a single tariff without capacity charge on take-and-pay basis.

9.2 However, given that the proposed investment is quite high and it has been expressed in several previous instances that local lenders are not comfortable lending to power sector projects unless their loan pay back is ensured through capacity payments, a two-part tariff is being allowed consisting of a capacity charge part to cater for the fixed cost obligations and an energy charge part to cater for the fuel and variable O&M costs.

10. LENGTH OF CRUSHING SEASON

10.1 The petitioner has proposed a tariff based on a 100 day cane crushing season. The cane crushing season varies all over the world. In some countries, it is up to 240 days. In countries like India, it is generally around 180 days.

10.2 In Pakistan, sugar mills have cane crushing season of varying lengths ranging from 120 to 165 days. For the calculation of tariff, a cane crushing season of at least 120 days has been adopted extending from November 16 to March 15. The specific dates may be adjustable for individual sugar mills but the length of crushing season will not be less than 120 days.

11. FIXED O&M

11.1 Fixed O&M expenditure has been requested as USD 1.064 Million by the petitioner. This would cover administrative costs, salaries & wages, regulatory

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fees, maintenance/overhauling etc. The petitioner has also requested that half of this cost may be treated as foreign cost.

11.2 The petitioner's requested fixed O&M cost translates to 15.55 paisas/kW/hr. Fixed O&M cost allowed by the Authority to other IPPs is around 13 paisas/kW/hr. A fixed O&M cost of 13 paisas/kW/hr is therefore being allowed.

11.3 Furthermore, for these small cogeneration projects all fixed O&M expenses are likely to be and should be payable only to local counter parties. Therefore, the whole of fixed O&M cost would be treated as local cost.

12. VARIABLE O&M

12.1 The petitioner has estimated variable O&M cost at 36 paisas/kWh. This cost includes start up fuel, water usage charges, lubricants and chemicals, consumable spares etc.

12.2 A relevant benchmark for such project can be the variable O&M cost for similar projects. In the absence of any such bagasse based cogeneration projects, a comparison can be made with Lakhra Power plant that uses coal.

12.3 CPPA has also commented that the petitioner should not be allowed a higher cost than the variable O&M cost of 19 paisas/kWh allowed to Lakhra.

12.4 Even though Lakhra is one of the most in-efficient plants with obsolete machinery and therefore its O&M cost is expected to be on a higher side than any comparable plant. Still, in order to give an incentive to the investors, the petitioner will be allowed a variable O&M cost of 19 paisas/kWh.

13. INSURANCE

13.1 The petitioner has requested insurance @ 1.35% of EPC cost. The request being inline with the cases already determined by the Authority is being accepted.

13.2 Therefore 10.81 paisas/kW/hour may be allowed as cost of insurance to PSMA corresponding to 1.35% of EPC Cost excluding IDC. This would be adjusted on the basis of actual premium subject to maximum of assessed at COD.

14. COST OF WORKING CAPITAL

14.1 The petitioner has requested that working capital cost should be included in the tariff. This cost is based on fuel storage of 30 days, spares@ 1.5% of EPC cost, financial charges on receivables etc.

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14.2 CPPA pointed out that the petitioner is planning to run the plant on coal for 230 days while it has estimated working capital cost based on coal requirements for the whole year. It also pointed out that cost of spares has already been accounted for in O&M cost therefore it can not be included for calculation of cost of working capital.

14.3 PSMA in response maintained that even though coal will be used as the only fuel during off-season, even during crushing season the fuel will be a mixture of bagasse and coal. Therefore, coal will be required throughout the year.

14.4 Notwithstanding this response, it must be pointed out that based on 25% consumption of coal during the crushing season, the requirement for fuel storage will be one fourth of that during the off-season and this has to be taken into account. Receivables have been estimated at 100% of monthly energy sales for 30 days (60% load factor). The petitioner's request for inclusion of spares at 1.5% of EPC cost is not tenable because as pointed out by CPPA, spares cost has already been included in O&M cost. Furthermore, even if that were not the case, spares requirement could only be related with the cost of mechanical and electrical equipment, not with the whole EPC cost. Sales tax at 15% should also be included for working capital requirements calculation. The working capital is expected to be financed at a short term rate of 3-months KIBOR.

14.5 Based on the above parameters, the cost of working capital has been calculated as 3.59 paisas per kW per hour.

15. CAPITAL STRUCTURE

15.1 A capital structure consisting of 80% debt and 20% equity has been proposed by the petitioner. Being in line with the normal practice, this capital structure is being allowed.

16. RETURN ON EQUITY

16.1 The petitioner has requested a 15% annual return on its equity investment. As this is in line with the return allowed to other companies, therefore a 15% ROE is being allowed in tariff.

17. RETURN ON EQUITY DURING CONSTRUCTION

17.1 The petitioner has also requested a return on equity during the construction period of 24 months so that the equity investor's IRR becomes 15%. This request is in line with the practice of the Authority and is therefore accepted.

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17.2 As no schedule of proposed equity investment has been provided by the petitioner, equity investment has been estimated at similar time intervals and in similar proportions as the proposed debt investment for now. At the time of COD, this will be adjusted based on actual disbursements.

18. COST OF DEBT

18.1 Debt at a cost of 13 % (KIBOR +3%) has been assumed by the petitioner. As per the practice with other IPPS, cost of debt at 3-month KIBOR plus 300 bps (3%) will be allowed. Furthermore, if foreign loan is taken, then the cost of debt will be LIBOR+3%. For tariff adjustment, effective quarterly interest rate will be used calculated by the following formula:

$$\text{Effective quarterly interest rate} = (1+\text{KIBOR})^{(1/4)} - 1$$

19. INRTEREST DURING CONSTRUCTION

19.1 The petitioner has provided a draw down schedule for debt. Based on this schedule and an effective monthly interest rate, Interest During Construction (IDC) has been estimated.

19.2 IDC is not paid upfront and therefore it should not be made a part of initial project cost as doing this would mean increasing the total investment and making IDC partly equity financed. This anomaly may be removed at the time of COD based on actual debt and equity disbursements but it is much better to estimate it in the right way up front.

19.3 Therefore, the IDC has been detached from the initial project cost and made a separate part of tariff so that this reclassification does not affect the project sponsor who is reimbursed for actual costs. The IDC has been estimated as USD 4.878 million.

20. FUEL COST

20.1 The petitioner has estimated its fuel costs based on coal usage for 230 days and bagasse/coal mix usage for 100 days. The reference coal is estimated to have a gross calorific value of 6500 kCal/kg and a net calorific value of 6196.38 kCal/kg.

20.2 The petitioner has estimated the bagasse price to be used for fuel cost adjustment during the crushing season by linking it with the coal price. The ratio of GCV coal to GCV bagasse has been estimated as 2.8. The conversion factor to convert from GCV to NCV for bagasse has been estimated as 1.232.

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20.3 CPPA commented that the petitioner should be asked to use more efficient turbines thus reducing the fuel cost. Furthermore, bagasse should be assigned zero value as the sugar mill will be getting steam and electricity from a plant paid for by the power purchaser.

20.4 PPIB was of the opinion that the mechanism suggested by PSMA for indexation of both fuels is based on imported coal, whereas it should be different for bagasse. Furthermore, the heat contents/calorific value of bagasse and coal (imported/local) are different; PSMA has proposed the same tariff for both fuels. The adequacy of facilities available at the local ports for handling of imported coal should be analyzed and confirmed.

20.5 Furthermore, PPIB also commented that the proposed tariff and its assumptions are based on imported coal and it is not identified why the use of local coal has not been considered. The use of bituminous coal is likely to require higher start-up costs for the projects. No estimates for these charges have been mentioned. It is not clear that at what stage the environmental studies will be conducted. The environmental issues in such projects are likely to be more significant as compared to other thermal projects.

20.6 Pakistan Association of Scientists and Scientific Professions in its comments proposed that the local coal (Sor-Range Coal) should be used in the sugar mills as such or mixed with bagasse produced in sugar mills for power generation. Imported coal should be discouraged in order to save hard earned foreign exchange. Sugar Mills should be instructed to establish coal testing laboratories particularly for determination of sulphur before feeding coal in the combustion chamber of the boiler to check environmental and operational problems.

20.7 Pakistan Council for Science & Technology in its comments also urged the use of local coal in these projects as the first preference.

20.8 PSMA in its response to these comments maintained that the suggestion of assigning zero value to bagasse is unacceptable. Bagasse, if not used in power generation, can be sold to paper and pulp factories, hardboard/chip board makers etc. Therefore zero value cannot be assigned to something that has a monetary value. A better option is to link bagasse price to the price of coal based on relative calorific value as has been proposed in the petition.

20.9 The petitioner maintained that infrastructure for handling imported coal is available at Port Qasim/Karachi Port and is being further extended to cater for all demands of imported coal. It was also stated that the environmental impact study will be conducted for specific projects by sponsors wishing to set up cogeneration plants alongside sugar mills. Boiler design for burning coal will utilize advanced techniques such as bottom ash collection/removal system, electrostatic precipitator and high stack to control emission level. The cost of these systems is already included in the project cost.

20.10 PSMA clarified that the tariff for sale of electricity will be coal based and even though the efficiency and output will deteriorate on bagasse-coal operation during the crushing season resulting in higher costs, these will not be passed on to the power purchaser.

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20.11 Based on petitioner's estimates of reference net heat rate of 12048 btu/kWh, gross calorific value of 6500 kCal/kg and net calorific value of 6196.38 kCal/kg for coal, the reference fuel cost comes out at Rs 2.9557/kWh and is allowed in the tariff.

20.12 The reference coal price has been taken as USD 90.135/ton which is CIF price at Karachi port. Inland coal transportation cost for specific plants will be additional. For fuel cost adjustment, at the start of and during the off-season operations adjustment would be made based on the CIF price of 6500 kCal/kg coal at Karachi port for plants using imported coal.

20.13 At the start of the crushing season, adjustment in fuel cost would be made based on FOB price of coal of 6500 kCal/kg instead of CIF price. Bagasse price would be calculated using that coal price. The ratio of GCV coal to GCV bagasse and the conversion factor to convert from GCV to NCV for bagasse would be 2.8 and 1.232 respectively as estimated by the petitioner. During the season, no adjustment would be made in the fuel cost as the quantity of coal used is supposed to be no more than 25% which should be catered for by the reserve storage.

20.14 While determining tariff for individual sugar mills, it would be expected that maximum possible utilization of bagasse as fuel would be made based on specific cane crushing capacity of such sugar mill.

21. REVENUE REQUIREMENTS

21.1 Based on the above discussion, the financial parameters have been specified as follows:

Project Cost	USD 59.424 million
Capital Structure	80:20
IDC cost	USD 4.878 million
Reference Exchange Rates for Tariff Adjustment:	Rs 67/USD and Rs 103.18/Euro
Reference WPI:	183.09
Cost of Debt:	KIBOR + 300 bps (13%)
Cost of Equity:	15%
Construction Period:	24 months

21.2 The annual fixed revenue requirements based on the above parameters are as follows:

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	Rs Million
Fixed O&M Cost	59.630
Insurance Cost	49.576
Working Capital Cost	16.441
Return on Equity Cost	119.442
Return on Equity During Construction Cost	14.240
Debt Servicing Cost	560.363
Interest During Construction Cost	57.497
Total Fixed Revenue Requirements	**877.190**

21.3 The reference fuel cost is Rs 2.9557/kWh while the variable O&M cost has been determined as Rs 0.19/kWh.

22. INDICATIVE TARIFF

22.1 The Authority has decided to determine an indicative tariff on the tariff petition filed by Pakistan Sugar Mills Association. The indicative tariff is based on the generic feasibility study for a 60 MW plant as submitted by the petitioner. Each sugar mill wishing to install a power plant will submit individual tariff petition along with a license application under NEPRA Act 1997 and relevant NEPRA Rules and Regulations. The actual tariff given to such sugar mill in response to its individual formal tariff petition will be based on the evidence provided. The tariff given hereunder is an indicative tariff only for the purpose of guidance:

Tariff Component	Year 1-10	Year 11-30	Indexation
Capacity Charge (Rs/kW/hr)			
Fixed O&M Cost	0.1300	0.1300	WPI, biannually
Insurance Cost	0.1081	0.1081	-
Working Capital Cost	0.0359	0.0359	Effective rate based on 3-M KIBOR, quarterly
Return on Equity Cost	0.2605	0.2605	Rs/USD
Return on Equity During Construction Cost	0.0311	0.0311	Rs/USD
Debt Servicing Cost	1.2220	-	Rs/USD, Effective rate based on 3 month KIBOR, quarterly

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Interest During Construction Cost	0.1254	-	Rs/USD
Total Capacity Charge (Rs/kW/hr)	**1.9129**	**0.5655**	
Total Capacity Charge (Rs/kWh @ 60% PF)	**3.1882**	**0.9426**	
Energy Charge (Rs/kWh)			
Fuel Cost	2.9557	2.9557	Fuel Price
Variable O&M Cost	0.1900	0.1900	WPI
Total Energy Charge (Rs/kWh)	3.1457	3.1457	
Total Tariff (Rs/kWh)	**6.3339**	**4.0882**	
Tariff Levelized at 10% per annum interest rate over 30 years control period			
5.5520 Rs/kWh (8.2866 US cents/kWh)			

- All relevant duties and taxes will be paid and accounted for at actual.
- Reference exchange rates are Rs 67/USD and Rs 103.18/Euro.

Authority

Zafar Ali Khan
Member/Vice Chairman

12/6/08

Maqbool Ahmad Khawaja
Member

12/6

Nasiruddin Ahmed
Member

12/6/08

Abdul Rahim Khan
Member

ON LEAVE.

Khalid Saeed
Chairman

12/6/08

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