CENTRAL ELECTRICITY REGULATORY COMMISSION
NEW DELHI

Date : 07th October , 2015

Coram: Shri Gireesh B. Pradhan, Chairperson

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STATEMENT OF REASONS

The Central Electricity Regulatory Commission (Terms and Conditions for Tariff determination from Renewable Energy Sources) (Fourth Amendment) Regulations, 2015(Norms for determination of generic tariff for Municipal Solid Waste/Waste to Energy projects and indicative tariff for 2015-16)

1. Introduction

1.1 The Commission received references from the Ministry of Urban Development (MoUD) informing the non operation of many WtE plants in the past due to issues such as non-purchase of power by DISCOMs at preferred tariff and, sought the intervention of CERC to determine generic tariff for Waste to Electricity. MoUD also referred to the key objective of Swachh Bharat Mission of processing 100% solid waste generated in cities/towns by 2nd October 2019. MoUD also requested the Commission for determination of generic tariff for waste to electricity to bring about substantial improvement in solid waste management sector. To aid this objective, the Ministry of Power (MoP) was also in the process of amending the tariff policy to include a provision for State DISCOMs to ***"mandatorily purchase all power generated from municipal solid waste".***

1.2 Taking cognizance of the fact that management of waste is a serious issue in India as also to promote stakeholders to play their role in contributing to a cleaner environment by setting up WtE plants, Central Electricity Regulatory Commission notified draft amendment to Central Electricity Regulatory Commission (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations , 2012 vide public notice No. L-1/94/CERC/2011 on 10TH August 2015 . Comments were invited from all stakeholders till 10th September 2015. Written comments were received from the following stakeholders :

a) JITF Urban Infrastructure Ltd , New Delhi (JITF)

b) The Tata Power Co. Ltd, Noida, U.P. (Tata Power)

c) Waste Management Association, New Delhi (WMA)

d) Abellon Clean Energy Ltd, Ahmedabad (Abellon)

e) Essel Infraprojects Ltd, Mumbai. (Essel Infra)

f) NN Back Office Services Pvt. Ltd. (Nexus Novus), Benguluru

g) IL &FS Environment Infrastructure & Services Ltd, New Delhi. (ILFS)

h) Power Exchange India Ltd , Mumbai

i) A2Z Infrastructure Ltd, New Delhi (A2Z)

1.3 Subsequently, a public hearing was held on 18th Sept, 2015, where presentations and oral submissions were made by following stakeholders:-

a) A2Z Infrastructure Ltd.

b) Essel Infraprojects Ltd.

c) IL &FS Environment Infrastructure & Services Ltd

d) JITF Urban Infrastructure Ltd

e) KPMG Advisory Services (KPMG)

f) Ramky

1.4 The important issues raised by the stakeholders and Commission's analysis and decisions thereon are presented in the subsequent sections

A. AMENDMENTS TO REGULATIONS

1. Amendment to Regulation 2 - Definitions and Interpretation

1.1 Commission's Proposal in Draft Regulation

a) After sub-clause (o) under clause (1) of Regulation 2 of the Principal Regulations, a new clause (oa) shall be added as under:-

"Municipal solid waste' means and includes commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes"

b) After sub-clause (s) under clause (1) of Regulation 2 of the Principal Regulations, a new clause (sa) shall be added as under:-

''Refuse Derived Fuel' means segregated combustible fraction of solid waste other than chlorinated plastics in the form of pellets or fluff produced by drying, shredding, dehydrating and compacting combustible components of solid waste that can be used as fuel;"

c) After sub-clause (g) under clause (1)(aa) of Regulation 2 of the Principal Regulations, a new sub-clause (h) shall be added as under:-

"Municipal solid waste (MSW) and Refuse derived fuel (RDF) based power projects - 20 years"

1.2 Comments Received

As regards definition for RDF, A2Z Infrastructure Ltd suggested De-Stoning operation to be included in RDF preparation as removal of stones from MSW for production of RDF is an important operation before shredding.

1.3 Analysis & Commission's view

On the definition of RDF , the Commission appreciates the contention of the stakeholder that de-stoning is necessary to pre-process the RDF as this would ease the further processing of waste . This has accordingly been suitably incorporated as under :

"Refuse Derived Fuel' means segregated combustible fraction of solid waste other than chlorinated plastics in the form of pellets or fluff produced by drying, de-stoning , shredding, dehydrating and compacting combustible components of solid waste that can be used as fuel;"

2. Amendment to Regulation 4 –Eligibility Criteria

2.1 Commission's Proposal in Draft Regulation

a) **After clause (g) of Regulation 4 of the Principal Regulations, a new clause (h) shall be added as under:-**

"Municipal solid waste (MSW) based power projects – The project shall qualify to be termed as a Municipal solid waste (MSW) based power project, if it is using new plant and machinery based on Rankine cycle technology and using Municipal solid waste (MSW) as fuel sources"

b) **After clause (h) of Regulation 4 of the Principal Regulations, a new clause (i) shall be added as under:-**

"Refuse derived fuel (RDF) based power projects – The project shall qualify to be termed as a Refuse derived fuel (RDF) based power project, if it is using new plant and machinery based on Rankine cycle technology and using Refuse derived fuel (RDF) as fuel sources"

2.2 Comments Received

2.2.1 A2Z Infrastructure Ltd suggested to include use of Fossil fuel upto 15 % and biomass as support fuel limited to the extent of 25 % of total Fuel Consumption on Annual basis in the eligibility criteria of MSW/RDF based power plants . This is because both MSW and RDF have low bulk energy and high percentage of moisture. Therefore, fossil fuel is required to support efficient combustion.

2.2.2. They support their claim on the following basis :

a) The Commission in its principal RE Regulation in Para 4 (c) has classified a project as a Biomass power project if it uses Biomass Fuel Sources and also restricted use of Fossil Fuel upto 15 % of total fuel consumption on annual basis

b) Ministry of Environment & Forest by way of Gazette Notification 2002 dated 1st December 2009 also mentioned that "Power Plants upto 15 MW based on non- hazardous municipal waste and using auxiliary fuel such as coal/Lignite/ Petroleum upto 15 % are exempt" from Environmental Impact Assessment.

c) Ministry of New & Renewable Energy in their Order of September 2013 has stated that in MSW projects, any waste of RE/ Biomass can be mixed to the extent of 25% based on GCV

2.3. Analysis & Commission's view

2.3.1 On the issue of usage of fossil fuel in WtE plants, the Commission would like to emphasize that the prime objective of the amendment to regulations are to promote usage of RDF/MSW for energy generation. Therefore, by allowing usage of fossil fuel , the very objective of using alternate fuel is defeated.

2.3.2. The Orders issued by GERC since 2010 till 2015 for the WtE projects also make no mention of permitting usage of fossil fuel.

2.3.3 Thus, considering the necessity to promote the usage of Waste material as fuel in WtE plants, the proposed amendment to the Regulations is retained while not permitting usage of either fossil fuel or biomass fuel.

3. Amendment to Regulation 11 – Despatch principles for electricity generated from Renewable Energy Sources

3.1 Commission's Proposal in Draft Regulation

a) After clause (1) of Regulation 11 of the Principal Regulations, a new clause (1a) shall be added as under:-

" The Municipal Solid Waste and Refuse Derived Fuel based power projects shall be treated as 'MUST RUN' power plants and shall not be subjected to 'merit order despatch' principles."

b) Clause (2) of Regulation 11 of the Principal Regulations shall be substituted as under:-

"The biomass power generating station with an installed capacity of 10 MW and above, non-fossil fuel based co-generation projects, municipal solid waste and refuse derived fuel shall be subjected to scheduling and despatch code as specified under CERC (Indian Electricity Grid Code) Regulations, 2010 and Central Electricity Regulatory Commission (Unscheduled Interchange and related matters) Regulations, 2009 including amendments thereto."

3.2 Comments Received

3.2.1 On the issue of WtE plants being subject to **Scheduling and Despatch code**, A2Z Infrastructure Ltd suggested that the scheduling and dispatch code as specified under Indian Electricity Grid Code (IEGC) and Central Electricity Regulatory Commission (Unscheduled Interchange and related matters) Regulations, 2009 including amendments thereto should not be applicable to MSW and RDF plants as WtE sector is in a nascent stage in India. Moreover as MSW and RDF fuel is highly corrosive, abrasive and heterogeneous, they lead to uncertain choking of boiler tubes and increased wear and tear. Therefore, accurate forecasting of power generation from MSW and RDF is difficult. Accordingly, applicability of Scheduling may be considered at a later stage.

3.2.2 Waste Management Association & ILFS Environmental Infrastructure Pvt Ltd also suggested that WtE projects should be outside the purview of scheduling as the calorific value of MSW fuel is highly variable and hence complying with scheduling of input power to the grid is very difficult.

3.2.3 Essel Infraprojects Ltd sought exemption from Inter-State Scheduling in case of Energy Sale to DISCOM and 3rd party as it is difficult to control the

instantaneous heat input on account of heterogeneous and bulky fuel and therefore not possible to predict the instantaneous power generation in advance.

3.3. Analysis & Commission's view

3.3.1. The status of must run for the WtE plants is necessary as it aids in disposal of wastes thus protecting the environment and avoiding higher landfills. Generation of power from waste thus serves to keep the environment clean and also cater to the requirements for grid support

3.3.2. On the views of the stakeholders seeking exemption from Scheduling and compliance to dispatch code ,it is reiterated that generation from WtE projects carries certain degree of conformity. This is so as the generators have a fixed schedule of feeding in tonnage of waste. Even though the quality of waste differs in seasons, there is always a fixed pattern . Therefore, it is not difficult to prepare a schedule of generation of power.

3.3.3. Importantly, MSW power unlike wind and solar which are not affected by the vagaries of nature. Also, keeping WtE plants out of the purview of scheduling may hamper the grid discipline. Hence, the above regulation remains unchanged as following:-

Clause (2) of Regulation 11 of the Principal Regulations shall be substituted as under:-

"The biomass power generating station with an installed capacity of 10 MW and above, non-fossil fuel based co-generation projects, municipal solid waste and refuse derived fuel shall be **subjected to** scheduling and despatch code as specified under CERC (Indian Electricity Grid Code) Regulations, 2010 and Central Electricity Regulatory Commission (Unscheduled Interchange and related matters) Regulations, 2009 including amendments thereto."

4. Insertion of new Regulation 33 A : Technology aspect

4.1 Commission's Proposal in Draft Regulation

The norms for tariff determination specified hereunder are for power projects which use municipal solid waste (MSW) and refuse derived fuel (RDF) and are based on Rankine cycle technology application

4.2 Comments Received

JITF Integrated Waste Management, New Delhi opined that apart from the suggested technologies by Commission, Pyrolysis and High End Gasifier technologies could be used with same tariff norms . The same is also recommended in the "Report of the Task Force on Waste to Energy" by the Planning Commission in May 2014 . Alternatively, norms could be technology free based on fuel selection as of RDF/MSW.

4.3 Analysis & Commission's view

The Commission opines that the selection of technology is left to the discretion of the developer so as to arrive at a reasonable tariff. Therefore, Pyrolysis and High End Gasifier can also be selected by the developer in addition to Combustion or incineration, Bio-methanation (which can be used for smaller capacity and wet garbage handling)

5. Insertion of new Regulation 33 B : Capital cost

5.1 Commission's Proposal in Draft Regulation

The normative capital costs for FY 2015-16, for power projects which use municipal solid waste (MSW) and refuse derived fuel (RDF) and are based on Rankine cycle technology application shall be as under:

i. **Rs 1500 lakh/MW for the power projects which use municipal solid waste (MSW) and are based on Rankine cycle technology application.**

ii. **Rs 900 lakh/MW the power projects which use refuse derived fuel (RDF) and are based on Rankine cycle technology application.**

Provided that the Capital Cost norms for the remaining years of the control period, for municipal solid waste (MSW) and refuse derived fuel (RDF) based power projects shall be reviewed on annual basis.

5.2 Comments Received

5.2.1 A2Z Infrastructure Ltd has proposed capital cost of Rs. 12 Cr/MW for RDF based power plant and Rs 18Cr/MW for MSW based power plant (The same is inclusive of Rs 2 Cr/MW for land and site development) . They also refer to the

Planning Commission Report of Task Force of Waste to Energy of May 2014 which recommended capital cost (excluding land cost) between Rs 5 Crs to Rs 10 Cr / MW depending on the quantum of composition of MSW and RDF and technological options

5.2.2 JITF suggested separate capital cost for Air Cooled Condenser and Water Cooled Condenser as done in Biomass based power plant.

For RDF

- Water Cooled Condenser - Rs 900 lakh/MW
- Air Cooled Condenser - Rs 1000 lakh/MW

For MSW

- Water Cooled Condenser - Rs 1500 lakh/MW
- Air Cooled Condenser - Rs 1600 lakh/MW

5.2.3 Tata Power opined that the capital cost for RDF and MSW project is without considering cost of land. As Municipality offers land for WtE plant and Waste processing to developer on nominal rental basis i.e. at Rs 1 / sq.m, it should be clarified that nominal rental for land would be considered for cost of land.

5.2.4 IL & FS Environmental Infrastructure & Services Ltd and Waste Management Association suggested that the capital cost of RDF based WtE plant amounts to Rs. 12 Crore / MW . Similarly Waste Management Association suggests that the capital cost of MSW based WtE plant should be revised to Rs. 18 Cr/ MW . This is to consider all additional costs such as steel being used in the boilers, type of grate, furnace design, higher quantum of refractory, usage of air-cooled grates, heterogeneous and corrosive fuel, flue gas treatment systems using activated carbon, lime and urea, flue gas emission monitoring system and disposal of fly ash .

5.2.5 Essel Infrastructure stated that the capital cost for various projects under execution is about 30% higher than that proposed by the Commission . As such projects are in the nascent stage, the cost of technology and other equipment have yet to reach economies of scale and thus capital cost is on a higher side vis-a-vis other conventional sources of energy. Other components of capital cost should include cost of imported equipment. The recent depreciation of Indian rupee has also affected the landed cost of equipment in India. Therefore, norms should be individually considered for plant & machinery, civil and construction cost, cost of scientific landfill sites, evacuation infrastructure, soft costs, etc.

5.2.6 Representative from Ramky Group stated that due to technology being imported, grates being made of special material, expensive bag filters and refractors and other high operating costs, Commission may consider capital costs at Rs 18 Cr/MW

5.3 Analysis & Commission's view

5.3.1. The Commission has noted the views of the stakeholders that MSW (which is the input for WtE plant) is abrasive containing combustible chloride material due to which the equipment needs to be specially designed to burn MSW in designed boilers. As the flue gases are also corrosive in nature, world-wide, such plants are far more expensive than coal based thermal and biomass based power plants due to the emphasis on sophisticated emission reduction processes.

5.3.2. While CERC had fixed the capital cost of a biomass power at Rs 445 lakh per MW for the FY 2012-13 , the same was increased for the FY 2015-16 to Rs 558.705 lakh/MW for Project [other than rice straw and juliflora (plantation) based project] with water cooled condenser.

5.3.3. Similarly, MoUD forwarded data which had been provided by the developers of MSW projects where the capital cost ranged from Rs 8.88 Crore to Rs 26.33 Crore/MW. The average of all data provided by MoUD for Capital Cost / MW is 16.72 Cr per MW.

5.3.4. The Madhya Pradesh Electricity Regulatory Commission (MPERC) determined generic Tariff for MSW projects in 2013 and considered Capital Cost at Rs 6 Cr per MW (excluding land cost) when the stakeholders claimed capital cost in the range of 6 Crs to Rs 12.5 Crs per MW.

5.3.5. The Gujarat Electricity Regulatory Commission (GERC) determined project specific tariff for RDF based project and MSW based projects in 2010, 2014 and 2015. In its Order for Hanjer Green Power (P) Ltd, the capital cost for the RDF plant was determined at Rs 6.90 Cr/MW (inclusive of land cost), the capital cost for an exclusive MSW based project (excluding land cost) was fixed at Rs 17.78 Crs / MW and Rs 14 Cr/MW for a plant whose fuel consisted of 10% RDF and 90% MSW . However, while approving the capital cost, GERC did not factor the incentives

5.3.6. The Commission has considered all the parameters and has been liberal in acknowledging the constraints expressed by stakeholders in arriving at a reasonable capital cost. Therefore, considering the comparable nature of technology of biomass and waste to energy plants, the normative capital cost for the Rankine Cycle Combustion based Power Plants utilizing MSW as input shall be in accordance with Biomass Power plant with additional cost consideration for the

requirement of a larger boiler and more sophisticated equipments to control flue gas emissions .

5.3.7. Therefore, in line with the Commission's proposal, the benchmark capital cost for **RDF based WtE plant is fixed at Rs 900 lakh/MW(Rupees Nine Crore per MW) and Rs 1500 lakh/MW (Rupees Fifteen Crore per MW) for MSW power projects.** As the capital cost for preprocessing comes to around 35-40% of entire capital cost, 40% of the capital cost has been considered as capital cost of preprocessing facility for MSW.

5.3.8. With due regard to the fact that waste to energy is an emerging technology, the Commission has decided that the Capital Cost norms for the remaining years of the control period, for municipal solid waste (MSW) and refuse derived fuel (RDF) based power projects shall be reviewed on annual basis.

6. Insertion of new Regulation 33 C : Plant Load Factor

6.1 Commission's Proposal in Draft Regulation

(1) Threshold Plant Load Factor for determining fixed charge component of tariff for the power projects which use municipal solid waste (MSW) and refuse derived fuel (RDF) shall be:

a) During Stabilisation	**:**	**65%**
b) During the remaining period of the first year (after stabilization)	**:**	**65%**
c) From 2nd Year onwards	**:**	**70 %**

(2) The stabilisation period shall not be more than 6 months from the date of commissioning of the project.

6.2 Comments Received

No Comments were received

6.3 Analysis and Commission's decision

6.3.1 The Commission had proposed PLF for MSW and RDF plants at 65% for the first year and 70% from the second year onwards. No comments were received in this context. However, the Commission reviewed the feasibility of the PLF of MSW and RDF projects based

on the available information, eg. in the orders of some of the State Commissions it was found that the PLF of MSW based projects could be different from the RDF based projects because of the independent nature of fuel source. PLF is dependent on factors like availability of fuel supply, number of operating hours, moisture content of fuel etc.

6.3.2 In Maharashtra Electricity Regulatory Commission (MERC) Order of 2014 for Rochem Green Energy Pvt. Ltd, "*RGEPL submitted that the Capacity Utilisation Factor (CUF) is an important performance parameter for any power plant, and is dependent on factors such as continuous availability of reliable quality fuel supply, plant availability and un-constrained off-take (high load factor). RGEPL further submitted that considering the availability of MSW from PMC, variation in the quality of MSW across the seasons, the Capacity Utilization Factor as 65 % during stabilization period (first year of operation) and 75 % over the remaining useful life of the project may be considered as reasonable for the purpose of tariff computation"*

GERC in its Orders of 2014 and 2015 for Abellon Clean and RGE Surat (which are primarly MSW plants), permitted PLF of 60% for 1st year and 80% / 85.6% from 2nd year onwards.

The Commission has taken note of the above.

6.3.3 RDF is basically processed from MSW and is capable of higher heat content and higher PLF. GERC in its Order of 2011 for Hanjer Green Power have permitted higher PLF of 80% in this regard.

6.3.4 Therefore, in view of the above, the threshold Plant Load Factor for determining fixed charge component of tariff for the power projects which use municipal solid waste (MSW) and refuse derived fuel (RDF) shall be:

	PLF	MSW	RDF
a)	**During Stabilisation**	**65%**	**65%**
b)	**During the remaining period of the first year (after stabilization)**	**65%**	**65%**
c)	**From 2nd Year onwards**	**75%**	**80%**

7. Insertion of new Regulation 33 D : Auxiliary consumption

7.1 Commission's Proposal in Draft Regulation

The auxiliary power consumption for the power projects which use municipal solid waste (MSW) and refuse derived fuel (RDF) shall be 12.5%

7.2 Comments Received

7.2.1. Abellon Clean Energy Ltd., opined that Auxiliary consumption for MSW based WtE plants operating on air-cooled condenser to be 15 % as it is technically incorrect to assume that a 13.85 MW plant running on MSW where the fuel requirement is 748 TPD will have the same equipment capacity sizing as a 13.85 MW biomass based power plant where the fuel requirement is only 262 TPD. Therefore, the following may be studied before fixing the auxiliary consumption:-

- Global operational data
- Usage of air cooled and water cooled condensers
- Higher usage of MSW in MSW plants vis-a-vis biomass plants
- Biomass and WtE plants cannot be compared due to design of plant, combustion technologies
- Requirement of larger ash handling in WtE plants.

7.2.3 Essel Infraprojects suggested that auxiliary consumption for MSW based plant is normally in excess of 15% due to continuous working and additional auxiliaries in various stages of MSW processing. This is due to difference in auxiliary system for MSW and biomass projects in the feeding system, combustion grate, hydraulic station, consumption of air for firing requiring 40 & bigger fans in MSW plant, requirement of start up burners etc. They also refered to MERC and GERC Orders specifying auxiliary consumption to be 15 % and 16 % respectively.

7.3 Analysis and Commission's decision

7.3.1 For biomass projects, auxiliary consumption is fixed at 10% after stabilization. However, unlike any other power station, the Rankine Cycle Combustion Based Power Plants utilizing MSW as input requires to install MSW handling facilities that consume higher electricity

7.3.2 While MPERC considered 11.5% as auxiliary consumption, GERC has considered 11.5% as auxiliary consumption for RDF based projects in its Order of 2010 for Hanjer Power for the reason that auxiliary consumption of the plant depends on the consumption of the auxiliary units associated with the main plant and machineries.

7.3.3 In its Order in 2013 for Abellon Clean Ahmedabad Ltd (based on 10% RDF and 90% MSW), GERC allowed auxiliary consumption of 12% for the MSW plant which used air cooled condenser

7.3.4. Maharashtra Electricity Regulatory Commission (MERC) in its Order of 2014 for the MSW plant for Rochem Green Energy (P) Ltd had approved auxiliary consumption of 15% based on various technical parameters of other componants of the plant

7.3.5 In 2014, GERC in the Order for RGE Surat for MSW plants, raised the auxiliary consumption to 16% as it was noted that , in comparison to conventional coal/ biomass and bagasse plant, consumption of energy in MSW plants takes place in various auxiliary equipments (which differ in size, quantities, capacities)

7.3.6 The Commission has noted the comments received and the views of other Commissions in their Orders for MSW and RDF based WtE plants and is of the view that the auxiliary consumption for both MSW plants and RDF plants may be increased to 15% in view of the fact that the equipment for processing the Waste material is of higher capacity with changed design, combustion technologies vis-à-vis conventional plants

7.3.7 Accordingly, while the normative Auxiliary Consumption for Rankine Cycle Combustion based Power Plants utilizing **RDF** as input **and MSW plants** for determining fixed charge component of tariff **is fixed at 15 %.**

7.3.8 The Regulations are modified as hereunder :

The auxiliary power consumption for the power projects which use municipal solid waste (MSW) and refuse derived fuel (RDF) shall be 15%

8. Insertion of new Regulation 33 E : Station Heat Rate

8.1 Commission's Proposal on in draft regulation:

The Station Heat Rate for power projects which use municipal solid waste (MSW) and refuse derived fuel (RDF) shall be 4200 kcal/kWh.

8.2 Comments Received

JITF opined that similar to biomass projects , Vibrating Grate/ Reciprocating Grate type Boiler are advisable to be used in WtE project. As the chlorine content in fuel differs, the SHR also differs. Thus SHR of 4500/kcal/kwh may be considered for WtE projects.

8.3 Analysis and Commission's decision

8.3.1 In biomass power plants, CERC has taken design SHR and provided 10%-12% operating margin. MSW fuel is abrasive and having heterogeneous characteristics. It has poor physical and chemical characteristics and is an inferior fuel even when compared with Paddy straw. The Boiler has low thermal efficiency and the efficiency of the boiler will further decrease due to corrosion in furnace by the chloride content deposited on furnace, super heater & boiler tubes.

8.3.2. MPERC has considered SHR of 4000 kCal/kWh for the purpose of determination of tariff

8.3.3 While GERC in its Orders of 2010 for Hanjer and 2014 for Abellon Clean has considered SHR of 4100 kCal/kWh, the same was reduced to 3587 kCal/kwh with conversion efficiency of 24% for RGE Surat in 2015.

8.3.4. As per data provided by MoUD, SHR of MSW projects ranges from 3500 Kcal/Kwh to 4200 kcal/Kwh

8.3.5. The Commission opines that it has been reasonable in proposing SHR after all technical considerations.

8.3.6. Accordingly, the proposed Regulations of **SHR for RDF and MSW power projects to be 4200 Kcal/kWh is retained .**

9. Insertion of new Regulation 33 F : Operation and Maintenance Expenses

9.1 Commission's Proposal on in draft regulation:

(1) Normative O&M expenses for FY 2015-16 for the power projects which use municipal solid waste (MSW) or refuse derived fuel (RDF) shall be 5% of normative capital cost.

(2) Normative O&M expenses allowed for FY 2015-16 for the power projects which use municipal solid waste (MSW) and refuse derived fuel (RDF) respectively under these Regulations shall be escalated @ 5.72% per annum.

9.2 Comments Received

9.2.1. Essel Infra have stated that as per the Technical Memorandum on Investment and Funding Strategies prepared under the National Master Plan for development of Waste to Energy by National Bio-Energy Board under the MNRE, 2006, the O&M cost for MSW based WtE project is in range of 6.5 - 9.44% for MSW (using Bio-methanation and Gasification technology) and 13.5% for RDF based WtE projects. Accordingly, they have suggested the O&M norms to be in the range of 6-7.5% for MSW based WtE plants

9.2.2. JITF proposed to fix the O&M cost at 8 % of the capital cost for 2015-16 with an escalation of 5.72% thereafter. This is being suggested in view of additional costs being incurred to treat the flue gases by using activated carbon, hydrated lime, bag filters and separate lechate treatment.

9.2.3. Tata Power commented (based on budgetary quotes received for technology providers for complete O&M Charges) that the proposed norms need to be revised upwards to Rs 1 Cr/MW for MSW power plants.

9.2.4. IL &FS suggested that the O&M Cost for RDF based plant should be considered at least at 7.7% of capital cost , keeping in view additional costs at Rs. 10 lakh / MW incurred for installing Bag Filters to remove the Suspended Particulate Matters, costs on lime injection and disposal of Fly Ash either in landfill or by way of blocks.

9.3 Analysis and Commission's decision

9.3.1. The Operation and Maintenance Expenses comprise manpower expenses, insurance expenses, spares and repairs, consumables and other expenses (statutory fees etc.).

9.3.2 While GERC has considered 5% and 4.78% of capital cost as the O&M expenses in its Order for Hanjer Green Power in 2010 and for Abellon Clean in 2014 respectively, it had considered 7.58% of capital cost for RGE Surat based on project specific design.

9.3.3. MPERC has considered 5% of capital cost as the O&M Expenses with 5.72% escalation factor.

9.3.4. In view of the above and considering the fact that higher expenses are involved in treating the wastes (being heterogeneous in nature), the normative O&M expenses for the first year of the Control Period (i.e, FY 2015- 16) for the Rankine Cycle Combustion Based Power Plants utilizing MSW / RDF as input for determining fixed charge component of Tariff is considered at **6 % of normative capital** cost determined and approved, which would be **escalated at the rate of 5.72%** per annum.

9.3.5. Hence, on the normative capital cost of Rs. 9 Crores/MW for RDF based MSW power projects and Rs 15 Crore/MW for MSW power projects, the normative O&M expenses for 2015-16 works out to Rs. 0.54 Crores / MW and Rs. 0.90 Crore/MW respectively.

9.3.6 Accordingly, the proposed Regulation is amended as following:-

(1) Normative O&M expenses for FY 2015-16 for the power projects which use municipal solid waste (MSW) or refuse derived fuel (RDF) shall be 6% of normative capital cost.

(2) Normative O&M expenses allowed for FY 2015-16 for the power projects which use municipal solid waste (MSW) and refuse derived fuel (RDF) respectively under these Regulations shall be escalated @ 5.72% per annum.

10. Insertion of new Regulation 33 G : Calorific Value

10.1 Commission's Proposal in draft regulation:

The calorific value of the refuse derived fuel (RDF) used for the purpose of determination of tariff shall be 2500 kcal/kg.

10.2 Comments Received

10.2.1. JITF and A2Z commented that GCV of RDF should be adopted as 2250 kcal/kg as the same has been considered by other SERCs too. Moreover, while the GCV of raw MSW varies between 800-1000 kcal/kg, after processing of MSW , the resultant GCV is in the range of 2000 to 2400 Kcal/kg

10.2.2. Tata Power commented that calorific value of RDF based WtE projects should be 2500 Kcal/Kg and the GCV for MSW should be separately specified, as there is no variable cost factor for power from MSW.

10.2.3. Abellon Energy and KPMG suggested that same GCV cannot be considered for Raw MSW and RDF

10.3 Analysis and Commission's decision

10.3.1 The history of waste to energy plants in India suggests that the major reason of failure of waste to energy plants is variable calorific value of Indian wastes. Indian wastes are low in organic contents therefore its waste has low calorific value

10.3.2 GERC in its Order for Abellon Clean in 2014 has considered 1820 kcal/kg for MSW and 2250 kcal/kg for RDF. In its Order for MSW plant for RGE Surat in 2015, GERC fixed a GCV of 1650 kCal/kg.

10.3.3. MPERC has considered calorific value of 2250 kCal/kg for the purpose of determination of tariff

10.3.4. As per data provided by MoUD, calorific value for RDF of MSW projects ranges from 1650 Kcal/Kg to 2500 kcal/Kg.

10.3.5. Therefore, the Commission feels it is reasonable in allowing the Calorific Value at **2500 kcal/kg for RDF based waste to energy power projects** and accordingly, the proposed Regulation is retained. GCV for MSW projects is not relevant in the present context as no fuel charge is applicable for such plants.

11. Insertion of new Regulation 33 H : Fuel cost

11.1 Commission's Proposal in draft regulation:

Refuse derived fuel (RDF) price during FY 2015-16 shall be Rs1,800 per MT. For each subsequent year of the Tariff Period, the normative escalation factor of 5% per annum shall be applicable at the option of the refuse derived fuel (RDF) project developer.

No fuel cost shall be considered for determination of tariff for the power projects using municipal solid waste (MSW).”

11 .2 Comments Received

Tata Power Co. Ltd. suggested that the fuel cost too need to be escalated at 5.72%, in view of the impact of inflation rate on fuel processing cost.

11.3 Analysis and Commission's decision

11.3.1 MoUD has provided for a rate of Rs 1800/MT through A2Z Company for RDF.

11.3.2 While MPERC has considered Rs 1320 per MT for RDF, GERC in its Order in 2010 for Hanjer Power has considered a cost of Rs 1320/MT, being the cost of avoided coal with 5% escalation.

11.3.3 In 2014, GERC in its Order for Abellon Clean ordered a fuel cost of Rs 1750/MT for RDF and no costs for MSW plants. Similarly, in its Order for RGE Surat, no fuel cost was considered for MSW plants

11.3.4. Therefore, Commission considers **Rs 1800 Per MT with an escalation at the rate of 5% per annum for fuel of RDF based MSW projects**. This fuel may be RDF or preprocessed MSW. **No Fuel cost is considered for MSW** based projects

11.3.5. Therefore, the proposed amendment to the Regulations is retained

B. OTHER COMMENTS RECEIVED FROM STAKEHOLDERS

1. Para 2.3.3 in Explanatory Memorandum : Interest on Loan

1.1. Commission's Proposal on Interest on Loan :

The computations of interest on loan carried out for determination of tariff in respect of the RE projects treating the value base of loan as 70% of the capital cost and the weighted average of Base rate prevalent during the first six months (i.e. 10.00%) plus 300 basis points is equivalent to interest rate of 13.00%.

1.2. Comments Received

JITF stated that due to non provenness of technology , banks other than SBI are lending at higher rates. Hence, interest on loan to be considered at 14.5%.

1.3. Analysis and Commission's decision

1.3.1 GERC in its Order of 2010 for Hanjer Green Power (P) Ltd capped the interest at 11.75% . In its subsequent Orders of 2014 and 2015 of Abellon Clean and RGE Surat(P) Ltd, the rate was fixed at 12.75% and 12.96% respectively

1.3.2 However, Sub-Regulation (1) of Regulation 14 of the CERC RE Regulations provides that the loan tenure of 12 years is to be considered for the purpose of determination of tariff for RE projects.

a) Sub-Regulation (2) of the said Regulation provides for computation of the rate of interest on loan as under:

(i) *"The loans arrived at in the manner indicated in the Regulation 13 shall be considered as gross normative loan for calculation for interest on loan. The normative loan outstanding as on April 1st of every year shall be worked out by deducting the cumulative repayment up to March 31st of previous year from the gross normative loan.*

(ii) *For the purpose of computation of tariff, the normative interest rate shall be considered as average State Bank of*

India (SBI) Base rate prevalent during the first six months of the previous year plus 300 basis points.

(iii) *Notwithstanding any moratorium period availed by the generating company, the repayment of loan shall be considered from the first year of commercial operation of the project and shall be equal to the annual depreciation allowed".*

1.3.3 The weighted average State Bank of India (SBI) Base rate prevalent during the first six months has been considered for the determination of tariff, as shown in the table below:

Period from	**Period to**	**Base rate**
1/4/2015	30/9/2015	10.00%
Average Base rate for first six months of FY 15-16		**10.00%**

Source: State Bank of India (www.statebankofindia.com)

1.3.4 In terms of the above, the computations of interest on loan carried out for determination of tariff in respect of the RE projects treating the value base of loan as 70% of the capital cost and the weighted average of Base rate prevalent during the first six months of the (i.e. 10.00%) plus 300 basis points is equivalent to **interest rate of 13.00%.**

2. Para 2.3.4 in Explanatory Memorandum : Interest on working capital

2.1 Commission's Proposal :

Interest rate is considered as weighted average of State Bank of India Base Rate prevalent during the first six months of the previous year plus 350 basis points which is equivalent to interest rate of 13.50%.

2.2 Comments Received

JITF stated that due to non provenness of technology , banks other than SBI are lending at higher rates. Hence, interest on loan / interest on working capital to be considered at 14.5%.

2.3 Analysis and Commission's decision

2.3.1 GERC in its Order of 2010 for Hanjer Green Power (P) Ltd fixed the rate of interest at 11.75% and that for Abellon Clean and RGE Surat(P) Ltd in 2014 and 2015 respectively fixed the rate at 12.75% and 12.96% respectively

2.3.2 Regulation 17 (iii) of the RE Tariff Regulations provides for interest on Working capital as

Interest on Working Capital shall be at interest rate equivalent to the average State Bank of India Base Rate prevalent during the first six months of the previous year plus 350 basis points".

2.3.3 Therefore, in accordance to the Regulations, interest rate is considered as weighted average of State Bank of India Base Rate prevalent during the first six months of the previous year plus 350 basis points which is equivalent to **interest rate of 13.50%**

3. Para 3.2 in Explanatory Memorandum : Power Purchase Agreements

3.1 Commission's Explanation

The plants need to sign long term PPAs with beneficiaries for the **entire life of the plant for 20 years**. Beneficiaries of the PPAs should release payments for procurement of power from such plants on priority basis in a timely manner.

3.2 Comments Received

3.2.1 Abellon Clean Energy Ltd sought to allow signing of part-PPA for the quantum of power generated from WtE Projects while allowing sale under third-party or to Urban Local Bodies as well. This would enable obligated entities (DISCOM) to fulfill their RPO partly by procurement of power from waste-to-energy projects.

3.2.2 Nexus Novas requested if slabs of CAPEX support could be considered with corresponding PPA regulations as a blanket approach to allocating PPA will limit technology providers from offering quality solutions due to financial constraints .

3.3 Analysis and Commission's View

3.3.1 The Commission's proposal of tying up the entire power produced for the life of the plant is to ensure that power sourced from such plants are not left unsold for any reason.

However, the plants may sign part PPAs with beneficiaries while allowing third party sale for the entire life of the plant for 20 years. No power generated from such WtE plants should remain unsold . Beneficiaries of the PPAs / third party sale should release payments for procurement of power from such plants on priority basis in a timely manner.

4. Para 3.3 in Explanatory Memorandum : Disposal of non combustible waste

4.1 Commission's Explanation

The non combustible waste released from these power plants should be handled/disposed by the power project developers, the contracting agencies in accordance with the norms of MoUD/MoEF/MNRE and Appropriate Pollution Control Boards.

4.2 Comments Received

Tata Power and KPMG seek more clarity regarding treatment of costs to be incurred in disposal of rejects / ash from the plants. Therefore, norms with regard to cost of disposal and handling of rejects from WtE plants need to be clarified upfront

4.3 Analysis and Commission's View

The Commission opines that disposal of waste after generation of power is to be equally paid attention too and therefore lays the mandate on the generator to follow the norms of MoUD/MoEF/MNRE and Appropriate Pollution Control Boards. The costs associated with this process would not form part of tariff

5. Miscellaneous Comments

5.1 Comments Received

a) Incentive fees from Municipal bodies :

i) Tata Power Co. Ltd commented that there are no guidelines on Tipping Fees paid by Municipality to WtE .

b) Mandatory procurement of Waste to Energy tariff :

i) A2Z Infrastructure Ltd suggested to make it obligatory on the part of DISCOMS to purchase 100 % of the power produced by MSW/RDF plants at tariff determined by respective SERCs.

c) Applicability of Regulations :

i) A2Z Infrastructure Ltd suggested that biomass power projects which have or intend to carry out modification in future to use RDF as main fuel should be covered under the RE Regulation (Fourth Amendment), 2015 to promote Waste to Energy Power Generation;

d) Relaxation of other norms :

i) Essel Infraprojects Ltd suggested

- As a promotional measure, relax transmission charges and losses (similar to usage of ISTS network by Solar Power generating Stations) to be granted for MSW based Waste to Energy projects
- Waiver in Cross Subsidy Surcharge even for 3rd party sale as a promotional measure

e) RPO Compliance :

i) Tata Power commented that RPO specific to waste to energy project should be specified by CERC and SERCs which need to be met by Discoms. It is also suggested that in the event that, procurement of energy from RDF/MSW power plant by Discom exceeds the RPO target set, then SERCs should approve such excess power procured at the feed-in-tariff and not reduce the tariff to APPC.

ii) Abellon Clean Energy Ltd sought to create seperate RPPO category especially for Waste to Energy above and beyond "Others" in RPPO.

f) Others

i) Abellon Clean Energy Ltd. suggested that Urban Local Bodies (ULB) should be able to set-off its aggregate consumption (for consumer points above 415v) for power consumed by ULB from DISCOM by the power injected from waste-to-energy if the project and ULB are in the same DISCOM area.

ii) Waste Management Association & IL&FS Environmental Infrastructure Pvt Ltd commented that as the CDM benefit is very low and highly uncertain and considerable costs are incurred by the generating companies in the process of obtaining CER., net revenue be allowed to be retained by the generating company only in order to incentivize carbon mitigation.

iii) Essel Infraprojects Ltd suggested

- that as a promotional measure, Net metering to be resorted to during shut down and start up instead of charging the consumer as plant is subject to frequent shut downs and maintenance.
- sought allowance of sale of power to the Local Municipal Corporation as a "single consumer/pooled account" with suitable mechanism
- Commission to only notify the Tariff Regulations indicating the principles on which tariff parameters and norms shall be derived while determining project specific tariff for MSW based WtE projects. This is because lack of inadequate data may be an hindrance in actual reflection of scenarios in the generic Tariff Order

5.2 Analysis and Commission's View

The Commission has noted the above comments. However, they are outside the purview of these regulations.

6. All other elements not specifically covered above would be based on the principles stipulated for Biomass power projects on Rankine cycle by this Commission in the CERC RE Tariff Regulations.

7. Accordingly, Tariff for RDF based MSW Projects and MSW Projects as per the regulations is as below:

Technology	Levellised Fixed Cost	Variable Cost	Applicable Tariff Rate	Benefit of Accelerated Depreciation	Net Levellised Tariff
		(FY 2015-16)	(FY 2015-16)	(if availed)	(upon adjusting for Accelerated Depreciation benefit) (if availed)
	(Rs/kWh)	(Rs/kWh)	(Rs/kWh)	(Rs/kWh)	(Rs/kWh)
MSW	7.04	0.00	7.04	0.54	6.50
RDF based MSW	4.34	3.56	7.90	0.31	7.59

The above tariff will be applicable for entire useful life of 20 years for the MSW / RDF based MSW projects commissioned during FY 2015-16. However, in case of RDF based MSW projects, the variable component of tariff will change each year based on the escalation factor of 5%.

Sd/-	**Sd/-**	**Sd/-**	**Sd/-**
(M.K.Iyer)	**(A.S. Bakshi)**	**(A.K. Singhal)**	**(Gireesh B. Pradhan)**
Member	**Member**	**Member**	**Chairperson**

Date : 07.10.2015

Municipal Solid Waste Project

S. No.	Assumption Head	Sub-Head	Sub-Head (2)	Unit	Assumptions
1	**Power Generation**				
		Capacity			
			Installed Power Generation Capacity	MW	1
			Auxillary Consumption during stablisatio	%	15.00%
			Auxillary Consumption after stabilisation	%	15.00%
			PLF(Stablization for 6 months)	%	65%
			PLF(during first year after Stablization)	%	65%
			PLF(second year onwards)	%	75%
			Useful Life	Years	20
2	**Project Cost**				
		Capital Cost/MW	Power Plant Cost	Rs Lacs/MW	1,500.000
3	**Financial Assumptions**				
		Debt: Equity			
			Debt	%	70%
			Equity	%	30%
			Total Debt Amount	Rs Lacs	1050.000
			Total Equity Amout	Rs Lacs	450.000
		Debt Component			
			Loan Amount	Rs Lacs	1050.00
			Moratorium Period	years	0
			Repayment Period(incld Moratorium)	years	12
			Interest Rate	%	13.00%
		Equity Component			
			Equity amount	Rs Lacs	450.00
			Return on Equity for first 10 years	% p.a	20.00%
			Return on Equity after 10 years	%	24.00%
			Weighted average of ROE	%	22.00%
			Discount Rate (equiv. to WACC)	%	10.81%
4	**Financial Assumptions**				
		Fiscal Assumptions			
			Income Tax	%	33.990%
		Depreciation			
			Depreciation Rate(power plant)	%	5.83%
			Depreciation Rate 13th year onwards	%	2.51%
5	**Working Capital**				
		For Fixed Charges			
		O&M Charges		Months	1
		Maintenance Spare	(% of O&M exepenses)		15%
		Receivables for Debtors		Months	2
		For Variable Charges			
		MSW Stock		Months	4
		Interest On Working Capital		%	13.50%
6	**Fuel Related Assumptions**				
		Heat Rate	After Stabilisation period	Kcal/kwh	4200
			During Stablization Period	Kcal/kwh	4200
		MSW			
			MSW Price	Rs/T	0.00
			GCV	Kcal/kg	0.00
			MSW Price Escalation Factor		0.00%
	Operation & Maintenance				
		O&M Expenses (2015-16)		Rs. Lacs	90.00
		O & M Expenses Escalation		%	5.72%
7		O&M Expenses (2015-16)		Rs. Lacs	90.00

Determination of Tariff for MSW Projects

Units Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Installed Capacity	MW		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gross Generation	MU		5.69	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57
Auxiliary Consumption	MU		0.85	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Net Generation	MU		4.84	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58

Fixed Cost	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
O&M Expenses	Rs Lakh		90.00	95.15	100.59	106.34	112.43	118.86	125.66	132.84	140.44	148.48	156.97	165.95	175.44	185.48	196.08	207.30	219.16	231.69	244.95	258.96
Depreciation	Rs Lakh		87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	37.58	37.58	37.58	37.58	37.58	37.58	37.58	37.58
Interest on term loan	Rs Lakh		130.81	119.44	108.06	96.69	85.31	73.94	62.56	51.19	39.81	28.44	17.06	5.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capita	Rs Lakh		12.07	12.09	12.13	12.18	12.26	12.35	12.47	12.60	12.76	12.94	13.56	13.80	13.04	13.60	14.18	14.80	15.46	16.15	16.88	17.66
Return on Equity	Rs Lakh		90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00
Total Fixed Cost	**Rs Lakh**		**410.33**	**404.13**	**398.23**	**392.67**	**387.45**	**382.60**	**378.14**	**374.08**	**370.46**	**367.31**	**383.04**	**380.88**	**334.06**	**344.65**	**355.84**	**367.68**	**380.19**	**393.42**	**407.40**	**422.19**

Levallised tariff corresponding to Useful life

Per Unit Cost of Generation	Unit	Levellised	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Variable COG	Rs/kWh	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O&M expn	Rs/kWh	**2.42**	1.86	1.70	1.80	1.90	2.01	2.13	2.25	2.38	2.51	2.66	2.81	2.97	3.14	3.32	3.51	3.71	3.92	4.15	4.39	4.64
Depreciation	Rs/kWh	**1.43**	1.81	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	1.57	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Int. on term loan	Rs/kWh	**1.23**	2.70	2.14	1.94	1.73	1.53	1.32	1.12	0.92	0.71	0.51	0.31	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Int. on working capita	Rs/kWh	**0.23**	0.25	0.22	0.22	0.22	0.22	0.22	0.22	0.23	0.23	0.23	0.24	0.25	0.23	0.24	0.25	0.27	0.28	0.29	0.30	0.32
RoE	Rs/kWh	**1.72**	1.86	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93
Total COG	**Rs/kWh**	**7.04**	**8.48**	**7.24**	**7.13**	**7.03**	**6.94**	**6.85**	**6.77**	**6.70**	**6.63**	**6.58**	**6.86**	**6.82**	**5.98**	**6.17**	**6.37**	**6.58**	**6.81**	**7.04**	**7.30**	**7.56**

Levellised Tariff	Unit	Year -->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Discount Factor			1	0.902	0.814	0.735	0.663	0.599	0.540	0.488	0.440	0.397	0.358	0.323	0.292	0.263	0.238	0.215	0.194	0.175	0.158	0.142

Variable Cost (FY2015-16)	0.00	Rs/Kwh
Levellised Tariff (Fixed	7.04	Rs/Kwh
Applicable Tariff (FY2015-16)	**7.04**	**Rs/Kwh**

Determination of Accelerated Depreciation for MSW Projects

Depreciation amount	90%
Book Depreciation rate	5.28%
Tax Depreciation rate	80%
Additional Depreciation	20.00%
Income Tax (Normal Rates)	33.990%
Capital Cost Rs. Lakh	1500.000

Years ----------->	**Unit**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Book Depreciation	%	2.64%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	2.88%	0.00%	0.00%
Book Depreciation	Rs Lakh	39.60	79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20	79.20	43.20	0.00	0.00
Accelerated Depreciation																					
Opening	%	100.00%	50.00%	5.00%	1.00%	0.20%	0.04%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Allowed during the year	%	50%	45.00%	4.00%	0.80%	0.16%	0.03%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Closing	%	50%	5%	1.00%	0.20%	0.04%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Accelrated Deprn.	Rs Lakh	750.00	675.00	60.00	12.00	2.40	0.48	0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Depreciation Benefit	Rs Lakh	710.40	595.80	-19.20	-67.20	-76.80	-78.72	-79.10	-79.18	-79.20	-79.20	-79.20	-79.20	-79.20	-79.20	-79.20	-79.20	-79.20	-43.20	0.00	0.00
Tax Benefit	Rs Lakh	241.46	202.51	-6.53	-22.84	-26.10	-26.76	-26.89	-26.91	-26.92	-26.92	-26.92	-26.92	-26.92	-26.92	-26.92	-26.92	-26.92	-14.68	0.00	0.00
Net Energy generation	MU	2.42	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58
Per unit benefit	Rs/Unit	9.98	3.63	-0.12	-0.41	-0.47	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	-0.26	0.00	0.00
Discounting Factor		1.00	0.95	0.86	0.77	0.70	0.63	0.57	0.51	0.46	0.42	0.38	0.34	0.31	0.28	0.25	0.23	0.20	0.18	0.17	0.15

Variable Cost

S. No.	Particulars	Unit	Stabilisation Period (First 6 Month)	Remain. 6 month	1	2	3	4	5	6	7
1	Installed Capacity	MW	1	1	1	1	1	1	1	1	1
2	Plant load factor	%	65%	65%		75%	75%	75%	75%	75%	75%
3	Gross energy generation	MU	2.85	2.85	5.69	6.57	6.57	6.57	6.57	6.57	6.57
4	Auxiliary Consumption	%	15.0%	15.0%		15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
5	Auxiliary Consumption	MU	0.43	0.43	0.85	0.99	0.99	0.99	0.99	0.99	0.99
6	Net Energy generation	MU	2.42	2.42	4.84	5.58	5.58	5.58	5.58	5.58	5.58
7	Station Heat Rate	Kcal/kWh	4200	4200		4200	4200	4200	4200	4200	4200
8	Energy Input required	Million Kcal	11957.4	11957.4	0.0	27594.0	27594.0	27594.0	27594.0	27594.0	27594.0
9	Calorific Value	Kcal/kg	2500	2500		2500	2500	2500	2500	2500	2500
10	MSW Required	Million Kg	4.783	4.783	9.57	11.038	11.038	11.038	11.038	11.038	11.038
11	MSW Price	Rs/ MT			0	0	0	0	0	0	0
12	MSW Cost	Rs Lakh			0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	**Cost of Generation**	**Rs/kWh**			**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	1	1	1	1	1	1	1	1	1	1	1
75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58	5.58
4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
27594.0	27594.0	27594.0	27594.0	27594.0	27594.0	27594.0	27594.0	27594.0	27594.0	27594.0	27594.0	27594.0
2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
11.038	11.038	11.038	11.038	11.038	11.038	11.038	11.038	11.038	11.038	11.038	11.038	11.038
0	0	0	0	0	0	0	0	0	0	0	0	0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Particular	Unit	Description
Power Plant Cost	Rs Lakh	1500.00
Life of Plant	Years	20

Years ---------->	Unit	1	2	3	4	5	6	7	8	9	10
Depreciation for power plant	Rs Lakh	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45
Total Depreciation	**Rs Lakh**	**87.45**	**87.45**	**87.45**	**87.45**	**87.45**	**87.45**	**87.45**	**87.45**	**87.45**	**87.45**

11	12	13	14	15	16	17	18	19	20
87.45	87.45	37.58	37.58	37.58	37.58	37.58	37.58	37.58	37.58
87.45	**87.45**	**37.58**	**37.58**	**37.58**	**37.58**	**37.58**	**37.58**	**37.58**	**37.58**

Return on Equity

Praticular		Unit	Year--->	1	2	3	4	5	6	7	8
Pre-tax ROE		Rs Lakh		90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
ROE		**Rs Lakh**		**90.00**	**90.00**	**90.00**	**90.00**	**90.00**	**90.00**	**90.00**	**90.00**

9	10	11	12	13	14	15	16	17	18	19	20
90.00	90.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00	108.00
90.00	**90.00**	**108.00**	**108.00**	**108.00**	**108.00**	**108.00**	**108.00**	**108.00**	**108.00**	**108.00**	**108.00**

Long-Term Debt Schedule

Particular	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11
Opening Balance	Rs Lakh		1050	963	875	788	700	613	525	438	350	263	175
Repayment	Rs Lakh		87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50
Closing Balance	Rs Lakh		963	875	788	700	613	525	438	350	263	175.0	88
Interest	**Rs Lakh**		**130.81**	**119.44**	**108.06**	**96.69**	**85.31**	**73.94**	**62.56**	**51.19**	**39.81**	**28.44**	**17.06**

12	13
88	0
87.50	0.00
0	0
5.69	**0.00**

Working Captial Requirement

Particular	Unit	Year--->	1	2	3	4	5	6	7	8	9
O&M expense for power plant	Rs Lakh		7.50	7.93	8.38	8.86	9.37	9.90	10.47	11.07	11.70
Receivables	Rs Lakh										
Fixed Charges	Rs Lakh		68.39	67.35	66.37	65.44	64.57	63.77	63.02	62.35	61.74
Variable Charges	Rs Lakh		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance Spare	Rs Lakh		13.50	14.27	15.09	15.95	16.86	17.83	18.85	19.93	21.07
Fuel Stock	Rs Lakh		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Working Capital	**Rs Lakh**		**89.39**	**89.56**	**89.84**	**90.26**	**90.81**	**91.50**	**92.34**	**93.34**	**94.51**
Interest Rate	%	13.50%									
Interest on Working Capital	**Rs Lakh**		**12.07**	**12.09**	**12.13**	**12.18**	**12.26**	**12.35**	**12.47**	**12.60**	**12.76**

10	11	12	13	14	15	16	17	18	19	20
12.37	13.08	13.83	14.62	15.46	16.34	17.28	18.26	19.31	20.41	21.58
61.22	63.84	63.48	55.68	57.44	59.31	61.28	63.37	65.57	67.90	70.36
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.27	23.55	24.89	26.32	27.82	29.41	31.10	32.87	34.75	36.74	38.84
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
95.86	**100.47**	**102.20**	**96.61**	**100.72**	**105.06**	**109.65**	**114.50**	**119.63**	**125.05**	**130.79**
12.94	**13.56**	**13.80**	**13.04**	**13.60**	**14.18**	**14.80**	**15.46**	**16.15**	**16.88**	**17.66**

Operation and Maintenance Expenses

Particular	Unit	Year--->	1	2	3	4	5	6	7	8	9
O&M expense for power plant	Rs Lakh		90.00	95.15	100.59	106.34	112.43	118.86	125.66	132.84	140.44
Total O&M expense	**Rs Lakh**		**90.00**	**95.15**	**100.59**	**106.34**	**112.43**	**118.86**	**125.66**	**132.84**	**140.44**

10	11	12	13	14	15	16	17	18	19	20
148.48	156.97	165.95	175.44	185.48	196.08	207.30	219.16	231.69	244.95	258.96
148.48	**156.97**	**165.95**	**175.44**	**185.48**	**196.08**	**207.30**	**219.16**	**231.69**	**244.95**	**258.96**

RDF Waste Project

S. No.	Assumption Head	Sub-Head	Sub-Head (2)	Unit	Assumptions
1	**Power Generation**				
		Capacity			
			Installed Power Generation Capacity	MW	1
			Auxillary Consumption during stablisatio	%	15.00%
			Auxillary Consumption after stabilisation	%	15.00%
			PLF(Stablization for 6 months)	%	65%
			PLF(during first year after Stablization)	%	65%
			PLF(second year onwards)	%	80%
			Useful Life	Years	20
2	**Project Cost**				
		Capital Cost/MW	Power Plant Cost	Rs Lacs/MW	900.000
3	**Financial Assumptions**				
		Debt: Equity			
			Debt	%	70%
			Equity	%	30%
			Total Debt Amount	Rs Lacs	630.000
			Total Equity Amout	Rs Lacs	270.000
		Debt Component			
			Loan Amount	Rs Lacs	630.00
			Moratorium Period	years	0
			Repayment Period(incld Moratorium)	years	12
			Interest Rate	%	13.00%
		Equity Component			
			Equity amount	Rs Lacs	270.00
			Return on Equity for first 10 years	% p.a	20.00%
			Return on Equity after 10 years	%	24.00%
			Weighted average of ROE	%	22.00%
			Discount Rate (equiv. to WACC)	%	10.81%
4	**Financial Assumptions**				
		Fiscal Assumptions			
			Income Tax	%	33.990%
		Depreciation			
			Depreciation Rate(power plant)	%	5.83%
			Depreciation Rate 13th year onwards	%	2.51%
5	**Working Capital**				
		For Fixed Charges			
		O&M Charges		Months	1
		Maintenance Spare	(% of O&M exepenses)		15%
		Receivables for Debtors		Months	2
		For Variable Charges			
		RDF Stock		Months	4
		Interest On Working Capital		%	13.50%
6	**Fuel Related Assumptions**				
		Heat Rate	After Stabilisation period	Kcal/kwh	4200
			During Stablization Period	Kcal/kwh	4200
		RDF			
			RDF Price	Rs/T	1800.00
			GCV	Kcal/kg	2500
			RDF Price Escalation Factor		5.00%
	Operation & Maintenance				
		O&M Expenses (2015-16)		Rs. Lacs	54.00
		O & M Expenses Escalation		%	5.72%
7		O&M Expenses (2015-16)		Rs. Lacs	54.00
		Total No. of Hours		Hrs	8760

Determination of Tariff for RDF Projects

Units Generation	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Installed Capacity	MW		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gross Generation	MU		5.69	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01
Auxiliary Consumption	MU		0.85	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
Net Generation	MU		4.84	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96
RDF Cost	Rs Lakh		172.19	222.52	233.64	245.33	257.59	270.47	284.00	298.20	313.11	328.76	345.20	362.46	380.58	399.61	419.59	440.57	462.60	485.73	510.02	535.52
Fixed Cost	**Unit**	**Year--->**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
O&M Expenses	Rs Lakh		54.00	57.09	60.35	63.81	67.46	71.31	75.39	79.71	84.27	89.09	94.18	99.57	105.26	111.29	117.65	124.38	131.49	139.02	146.97	155.37
Depreciation	Rs Lakh		52.47	52.47	52.47	52.47	52.47	52.47	52.47	52.47	52.47	52.47	52.47	52.47	22.55	22.55	22.55	22.55	22.55	22.55	22.55	22.55
Interest on term loan	Rs Lakh		78.49	71.66	64.84	58.01	51.19	44.36	37.54	30.71	23.89	17.06	10.24	3.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capital	Rs Lakh		19.13	22.62	23.41	24.25	25.14	26.09	27.09	28.15	29.28	30.47	31.98	33.31	34.11	35.75	37.48	39.30	41.22	43.23	45.35	47.57
Return on Equity	Rs Lakh		54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	64.80	64.80	64.80	64.80	64.80	64.80	64.80	64.80	64.80	64.80
Total Fixed Cost	**Rs Lakh**		**258.09**	**257.84**	**255.07**	**252.54**	**250.26**	**248.24**	**246.49**	**245.04**	**243.90**	**243.09**	**253.66**	**253.56**	**226.72**	**234.38**	**242.48**	**251.03**	**260.06**	**269.59**	**279.66**	**290.29**
Levallised tariff corresponding to Useful life																						
Per Unit Cost of Generation	**Unit**	**Levellised**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Variable COG	Rs/kWh	**5.01**	3.56	3.74	3.92	4.12	4.32	4.54	4.77	5.01	5.26	5.52	5.80	6.08	6.39	6.71	7.04	7.40	7.77	8.15	8.56	8.99
O&M expn	Rs/kWh	**1.37**	1.12	0.96	1.01	1.07	1.13	1.20	1.27	1.34	1.41	1.50	1.58	1.67	1.77	1.87	1.98	2.09	2.21	2.33	2.47	2.61
Depreciation	Rs/kWh	**0.81**	1.08	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Int. on term loan	Rs/kWh	**0.70**	1.62	1.20	1.09	0.97	0.86	0.74	0.63	0.52	0.40	0.29	0.17	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Int. on working capital	Rs/kWh	**0.48**	0.40	0.38	0.39	0.41	0.42	0.44	0.45	0.47	0.49	0.51	0.54	0.56	0.57	0.60	0.63	0.66	0.69	0.73	0.76	0.80
RoE	Rs/kWh	**0.98**	1.12	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
Total COG	**Rs/kWh**	**9.35**	**8.89**	**8.06**	**8.20**	**8.36**	**8.53**	**8.71**	**8.91**	**9.12**	**9.35**	**9.60**	**10.05**	**10.34**	**10.20**	**10.64**	**11.11**	**11.61**	**12.13**	**12.68**	**13.26**	**13.86**
Levellised Tariff	**Unit**	**Year -->**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Discount Factor			1	0.902	0.814	0.735	0.663	0.599	0.540	0.488	0.440	0.397	0.358	0.323	0.292	0.263	0.238	0.215	0.194	0.175	0.158	0.142

Variable Cost (FY2015-16)	3.56	Rs/Kwh
Levellised Tariff (Fixed	4.34	Rs/Kwh
Applicable Tariff (FY2015-16)	**7.90**	**Rs/Kwh**

Determination of Accelerated Depreciation for RDF based MSW Projects

Depreciation amount	90%
Book Depreciation rate	5.28%
Tax Depreciation rate	80%
Additional Depreciation	20.00%
Income Tax (Normal Rates)	33.990%
Capital Cost Rs. Lakh	900.000

Years ----------->	**Unit**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Book Depreciation	%	2.64%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	2.88%	0.00%	0.00%
Book Depreciation	Rs Lakh	23.76	47.52	47.52	47.52	47.52	47.52	47.52	47.52	47.52	47.52	47.52	47.52	47.52	47.52	47.52	47.52	47.52	25.92	0.00	0.00
Accelerated Depreciation																					
Opening	%	100.00%	50.00%	5.00%	1.00%	0.20%	0.04%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Allowed during the year	%	50%	45.00%	4.00%	0.80%	0.16%	0.03%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Closing	%	50%	5%	1.00%	0.20%	0.04%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Accelrated Deprn.	Rs Lakh	450.00	405.00	36.00	7.20	1.44	0.29	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Depreciation Benefit	Rs Lakh	426.24	357.48	-11.52	-40.32	-46.08	-47.23	-47.46	-47.51	-47.52	-47.52	-47.52	-47.52	-47.52	-47.52	-47.52	-47.52	-47.52	-25.92	0.00	0.00
Tax Benefit	Rs Lakh	144.88	121.51	-3.92	-13.70	-15.66	-16.05	-16.13	-16.15	-16.15	-16.15	-16.15	-16.15	-16.15	-16.15	-16.15	-16.15	-16.15	-8.81	0.00	0.00
Net Energy generation	MU	2.42	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96
Per unit benefit	Rs/Unit	5.99	2.04	-0.07	-0.23	-0.26	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.15	0.00	0.00
Discounting Factor		1.00	0.95	0.86	0.77	0.70	0.63	0.57	0.51	0.46	0.42	0.38	0.34	0.31	0.28	0.25	0.23	0.20	0.18	0.17	0.15

Variable Cost

S. No.	Particulars	Unit	Stabilisation Period (First 6 Month)	Remain. 6 month	1	2	3	4	5	6	7
1	Installed Capacity	MW	1	1	1	1	1	1	1	1	1
2	Plant load factor	%	65%	65%		80%	80%	80%	80%	80%	80%
3	Gross energy generation	MU	2.85	2.85	5.69	7.01	7.01	7.01	7.01	7.01	7.01
4	Auxiliary Consumption	%	15.0%	15.0%		15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
5	Auxiliary Consumption	MU	0.43	0.43	0.85	1.05	1.05	1.05	1.05	1.05	1.05
6	Net Energy generation	MU	2.42	2.42	4.84	5.96	5.96	5.96	5.96	5.96	5.96
7	Station Heat Rate	Kcal/kWh	4200	4200		4200	4200	4200	4200	4200	4200
8	Energy Input required	Million Kcal	11957.4	11957.4	0.0	29433.6	29433.6	29433.6	29433.6	29433.6	29433.6
9	Calorific Value	Kcal/kg	2500	2500		2500	2500	2500	2500	2500	2500
10	RDF Required	Million Kg	4.783	4.783	9.57	11.773	11.773	11.773	11.773	11.773	11.773
11	RDF Price	Rs/ MT			1800	1890	1985	2084	2188	2297	2412
12	RDF Cost	Rs Lakh			172.2	222.5	233.6	245.3	257.6	270.5	284.0
13	**Cost of Generation**	**Rs/kWh**			**3.56**	**3.74**	**3.92**	**4.12**	**4.32**	**4.54**	**4.77**

8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	1	1	1	1	1	1	1	1	1	1	1
80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01	7.01
15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%	15.0%
1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05
5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96
4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200
29433.6	29433.6	29433.6	29433.6	29433.6	29433.6	29433.6	29433.6	29433.6	29433.6	29433.6	29433.6	29433.6
2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
11.773	11.773	11.773	11.773	11.773	11.773	11.773	11.773	11.773	11.773	11.773	11.773	11.773
2533	2659	2792	2932	3079	3233	3394	3564	3742	3929	4126	4332	4549
298.2	313.1	328.8	345.2	362.5	380.6	399.6	419.6	440.6	462.6	485.7	510.0	535.5
5.01	**5.26**	**5.52**	**5.80**	**6.08**	**6.39**	**6.71**	**7.04**	**7.40**	**7.77**	**8.15**	**8.56**	**8.99**

Particular	Unit	Description
Power Plant Cost	Rs Lakh	900.00
Life of Plant	Years	20

Years ---------->	Unit	1	2	3	4	5	6	7	8	9	10
Depreciation for power plant	Rs Lakh	52.47	52.47	52.47	52.47	52.47	52.47	52.47	52.47	52.47	52.47
Total Depreciation	**Rs Lakh**	**52.47**	**52.47**	**52.47**	**52.47**	**52.47**	**52.47**	**52.47**	**52.47**	**52.47**	**52.47**

11	12	13	14	15	16	17	18	19	20
52.47	52.47	22.55	22.55	22.55	22.55	22.55	22.55	22.55	22.55
52.47	**52.47**	**22.55**	**22.55**	**22.55**	**22.55**	**22.55**	**22.55**	**22.55**	**22.55**

Return on Equity

Praticular		Unit	Year--->	1	2	3	4	5	6	7	8
Pre-tax ROE		Rs Lakh		54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00
ROE		**Rs Lakh**		**54.00**	**54.00**	**54.00**	**54.00**	**54.00**	**54.00**	**54.00**	**54.00**

9	10	11	12	13	14	15	16	17	18	19	20
54.00	54.00	64.80	64.80	64.80	64.80	64.80	64.80	64.80	64.80	64.80	64.80
54.00	**54.00**	**64.80**	**64.80**	**64.80**	**64.80**	**64.80**	**64.80**	**64.80**	**64.80**	**64.80**	**64.80**

Long-Term Debt Schedule

Particular	Unit	Year--->	1	2	3	4	5	6	7	8	9	10	11
Opening Balance	Rs Lakh		630	578	525	473	420	368	315	263	210	158	105
Repayment	Rs Lakh		52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50	52.50
Closing Balance	Rs Lakh		578	525	473	420	368	315	263	210	158	105.0	53
Interest	**Rs Lakh**		**78.49**	**71.66**	**64.84**	**58.01**	**51.19**	**44.36**	**37.54**	**30.71**	**23.89**	**17.06**	**10.24**

12	13
53	0
52.50	0.00
0	0
3.41	**0.00**

Working Captial Requirement

Particular	Unit	Year--->	1	2	3	4	5	6	7	8	9
O&M expense for power plant	Rs Lakh		4.50	4.76	5.03	5.32	5.62	5.94	6.28	6.64	7.02
Receivables	Rs Lakh										
Fixed Charges	Rs Lakh		43.01	42.97	42.51	42.09	41.71	41.37	41.08	40.84	40.65
Variable Charges	Rs Lakh		28.70	37.09	38.94	40.89	42.93	45.08	47.33	49.70	52.18
Maintenance Spare	Rs Lakh		8.10	8.56	9.05	9.57	10.12	10.70	11.31	11.96	12.64
Fuel Stock	Rs Lakh		57.40	74.17	77.88	81.78	85.86	90.16	94.67	99.40	104.37
Total Working Capital	**Rs Lakh**		**141.71**	**167.55**	**173.42**	**179.64**	**186.25**	**193.25**	**200.67**	**208.54**	**216.86**
Interest Rate	%	13.50%									
Interest on Working Capital	**Rs Lakh**		**19.13**	**22.62**	**23.41**	**24.25**	**25.14**	**26.09**	**27.09**	**28.15**	**29.28**

10	11	12	13	14	15	16	17	18	19	20
7.42	7.85	8.30	8.77	9.27	9.80	10.37	10.96	11.58	12.25	12.95
40.51	42.28	42.26	37.79	39.06	40.41	41.84	43.34	44.93	46.61	48.38
54.79	57.53	60.41	63.43	66.60	69.93	73.43	77.10	80.95	85.00	89.25
13.36	14.13	14.94	15.79	16.69	17.65	18.66	19.72	20.85	22.05	23.31
109.59	115.07	120.82	126.86	133.20	139.86	146.86	154.20	161.91	170.01	178.51
225.68	**236.85**	**246.72**	**252.64**	**264.84**	**277.66**	**291.15**	**305.32**	**320.23**	**335.91**	**352.39**
30.47	**31.98**	**33.31**	**34.11**	**35.75**	**37.48**	**39.30**	**41.22**	**43.23**	**45.35**	**47.57**

Operation and Maintenance Expenses

Particular	Unit	Year--->	1	2	3	4	5	6	7	8	9
O&M expense for power plant	Rs Lakh		54.00	57.09	60.35	63.81	67.46	71.31	75.39	79.71	84.27
Total O&M expense	**Rs Lakh**		**54.00**	**57.09**	**60.35**	**63.81**	**67.46**	**71.31**	**75.39**	**79.71**	**84.27**

10	11	12	13	14	15	16	17	18	19	20
89.09	94.18	99.57	105.26	111.29	117.65	124.38	131.49	139.02	146.97	155.37
89.09	**94.18**	**99.57**	**105.26**	**111.29**	**117.65**	**124.38**	**131.49**	**139.02**	**146.97**	**155.37**