

**Before the**  
**MAHARASHTRA ELECTRICITY REGULATORY COMMISSION**  
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**Case No. 65 of 2009**

**In the matter of Petition of M/s. Solapur Bioenergy Systems Pvt. Ltd., under  
Section 62 and 86(1)(e) of Electricity Act, 2003 for determination of Tariff for  
supply of electricity from Municipal Solid Waste Power Project to Distribution  
licensees in Maharashtra**

**Shri V. P. Raja, Chairman**  
**Shri S. B. Kulkarni, Member**  
**Shri V. L. Sonavane, Member**

**ORDER**

**Date: September 3, 2010**

M/s Solapur Bioenergy Systems Pvt. Ltd. (SBSPL) filed a Petition under affidavit before the Commission on 21.10.2009 under Section 62(1) and 86 (1)(e) of the Electricity Act, 2003 (EA 2003) for determination of Tariff for supply of electricity from Municipal Solid Waste Power project to Distribution Licensees in Maharashtra. The Commission, in exercise of the powers vested under Sections 61, 66, and 86 read with Section 181 of the Electricity Act, 2003, and all other powers enabling it in this behalf, and after taking into consideration all the submissions made by Petitioner, all the suggestions and objections of the public, responses of Petitioner, issues raised during the Public Hearing, and all other relevant material, determines the tariff for the MSW based Power Project of SBSPL as under.



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## APPENDIX

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**APPENDIX 2.2 : List of the Persons attended Hearing**

**APPENDIX 3 : List of the Persons attended Public Hearing**



### **List of Abbreviations**

A&G	Administrative and General
AFC	Annual Fixed Charge
Capex	Capital Expenditure
CAGR	Compounded Annual Growth Rate
CO <sub>2</sub>	Carbon dioxide
COD	Commercial Operation Date
CPI	Consumer Price Index
Cu.m	Cubic meter
CUF	Capacity Utilization factor
CV	Calorific Value
DPR	Detailed Project Report
EA 2003	Electricity Act, 2003
FY	Financial Year
GOM	Government of Maharashtra
GoI	Government of India
GTG	Gas Turbine Generator
IDC	Interest During Construction
IEP	Integrated Energy Policy
IWC	Interest on Working Capital
kcal	kilo calories
kcal/kWh	kilo calories per kilowatt hour
kW	kilo Watt
kWh	kilowatt hour
MCM	Million Cubic Meter
MEDA	Maharashtra Energy Development Agency
MNRE	Ministry of New & Renewable Energy
MERC	Maharashtra Electricity Regulatory Commission
MoU	Memorandum of Understanding
MPCB	Maharashtra Pollution Control Board
MSEDCL	Maharashtra State Electricity Distribution Corporation Ltd.
MSW	Municipal Solid Waste
MT	Metric Tonnes
MU	Million Units
MW	MegaWatt



O&M	Operations and Maintenance
PLR	Prime Lending Rate
PPA	Power Purchase Agreement
RE	Renewable Energy
RoE	Return on Equity
R&M	Repair and Maintenance
SBI	State Bank of India
SBSPL	Solapur Bioenergy Systems Pvt. Ltd.
SERC	State Electricity Regulatory Commission
SLDC	State Load Dispatch Centre
SMC	Solapur Municipal Corporation
SPV	Special Purpose Vehicle
TPD	Tonne Per Day
TVS	Technical Validation Session
WTE	Waste to Energy



## 1 BACKGROUND AND BRIEF HISTORY

India is one of the fastest growing economies in the world. Energy is a critical input for socio-economic development. The energy strategy of a country aims at efficiency and security and to provide access to electricity through environment friendly means and achievement of an optimum mix of primary resources for energy generation. Fossil fuels will continue to play a dominant role in the energy scenario in our country in the next few decades. However, conventional or fossil fuel resources are limited, non-renewable, polluting and, therefore, need to be used prudently. On the other hand, renewable energy resources are indigenous, non-polluting and virtually inexhaustible. India is endowed with abundant renewable energy resources. Therefore, their use should be encouraged in every possible way.

With the ever increasing demand for electricity and promoting renewable energy to overcome issues related with environmental pollution, the Central Government has notified Acts and Policies. The Electricity Act 2003 (EA 2003) provides for policy formulation by the Government of India and mandates Electricity Regulatory Commissions (ERCs) to take steps to promote renewable sources of energy within their area of jurisdiction.

In order to achieve the objective of Electricity Act, 2003, National Electricity Policy, 2005 (NEP) and Tariff Policy, 2006, the Maharashtra Electricity Regulatory Commission (MERC or Commission) has notified MERC (Terms and Conditions for Determination of RE Tariff) Regulations, 2010 on June 07, 2010.

Section 86 1 (e) of the EA 2003 lays down that the State Commission shall discharge the following functions: *“promote co-generation and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licence;..”*

Clause 5.12.1 of the NEP lays down that *“Non-conventional sources of energy being the most environment friendly; there is an urgent need to promote generation of electricity based on such sources of energy. For this purpose, efforts need to be made to reduce the capital cost of projects based on nonconventional and renewable*



*sources of energy. Cost of energy can also be reduced by promoting competition within such projects. At the same time, adequate promotional measures would also have to be taken for development of technologies and a sustained growth of these sources.”*

Prior to the notification of MERC (Terms and Conditions for Determination of RE Tariff) Regulations, 2010, the Commission had issued the Order dated April 6, 2004 in Case No. 15 of 2002 to promote waste-to-energy projects and technologies. The Commission had encouraged the concept of procurement of power by Municipal Corporations and Local Authorities based on municipal solid waste on the tariff/terms to be mutually decided amongst the private developers and local authorities subject to ceiling tariff as stipulated by MNRE guidelines. Further, Licensees were directed to facilitate such transactions and provide open access to their distribution systems to enable Local Authorities to procure power from MSW based projects. Subsequently, the Commission vide Order dated August 6, 2006 in Case No. 6 of 2006 allowed the sale and purchase of power from Municipal Solid Waste projects to distribution licensees and other eligible persons including Open Access users. However, the tariff rate for such procurement was to be determined by the Commission through a separate regulatory process based on a Petition, if any, filed before the Commission.

Against this background, the Petitioner, M/s Solapur Bioenergy Systems Pvt. Ltd. (SBSPL), filed the present Petition and requested the Commission to follow the same approach as considered for other RE technologies in the State and to determine the preferential tariff based on cost plus method, for generation and sale of power from its proposed MSW power project to distribution licensees within State.

## **1.1 DETAILS OF THE PROJECT**

1.1.1. SBSPL submitted that the problems of unmanaged waste disposal in India are chronic. In many cities including Solapur, nearly 50% of waste remains unattended to, resulting in unhygienic conditions and potentially, causing diseases. By dealing with unmanaged MSW and transforming a social liability it into an economic opportunity, the project makes a major contribution to sustainable development.

1.1.2. SBSPL is a Special Purpose Vehicle (SPV) project company formed by M/s CICON Environment Technologies Ltd (hereinafter referred to as CICON) in



pursuance of Clause 16 of the Concession Agreement executed between Solapur Municipal Corporation (SMC) and M/s CICON to undertake Waste Management Project in the limit of Solapur city in Maharashtra along with development of proposed Municipal Solid Waste based power project in line with the terms of the Concession Agreement. As per Clause 16 of the said Concession Agreement, SMC has agreed to allow M/s CICON to form Special Purpose Vehicle (SPV), if so desired by CICON. SMC has handed over the required land area admeasuring 9 acres located at Tuljapur Road in Solapur to SBSPL for a period of 29 years on lease basis. The SMC has granted necessary permissions for setting up the 2.83 MW capacity MSW power project and also assured the supply of Municipal Solid Waste in required quantity and quality to SBSPL at the mutually agreed delivery point (Approximately 300 TPD).

- 1.1.3. The proposed project is based on Thermophillic Biomethanation process, i.e., Anaerobic Digestion. This is simply an 'accelerated' version of what nature does to biodegradable waste; here, the waste is degraded with the help of bacteria. "**Anaerobic Digestion**" means a controlled process involving microbial decomposition of organic matter in the absence of oxygen. According to SBSPL, this is a proven technology and ideal for Indian conditions where moisture content in the waste is high, especially in the monsoon.
- 1.1.4. The Municipal Solid Waste received at site for processing will be heterogeneous in nature having a mixture of various materials discarded by human beings and are generally comprising of materials such as food and vegetable wastes, paper and cardboard products, plastic products, leather and rubber products, rags and textile products, glass and ceramics, inert, Bidi Patta (Tendu leaves) etc.
- 1.1.5. SBSPL under its Petition has highlighted the basic steps involved in the process as under:
  - 1.1.5.1. **Pre-treatment:** The incoming Municipal Solid Waste (MSW) is dumped into a bunker after manual segregation and sorting. The metals are removed from these large rejects prior to land filling. The outlet of magnetic separator shall have the compostable matter and shall be sent to digestion section.



- 1.1.5.2. **Anaerobic Digestion:** This intermediate storage facilitates to manage the fluctuations in the input and doses into the feeding pumps. Above each feeding pump, a mixing unit is placed where the fresh organic fraction is mixed with residue. After addition of steam, to raise the temperature of the input to 50-55<sup>0</sup>C for immediate start-up of the thermophilic fermentation and kill-off of pathogens, the material is pumped to the top of each reactor and brought in the reactor. During the digestion process, the material passes through the digester from top to bottom. The digested residue leaves the digester through the conical outlet and is collected and transported by screw conveyors.
- 1.1.5.3. **Bio-gas Generation :** During the fermentation phase, approximately 65% of the volatile solids introduced in the digester are converted to biogas. The remaining organic matter plus ash are removed as the digested residue. The biogas has methane content of 55%, a CO<sub>2</sub> content of nearly 45% and a H<sub>2</sub>S content of about 300 ppm. The gas is temporarily stored in gas holder. In cases of emergency, the biogas can be flared off.
- 1.1.5.4. **Power Generation from Biogas :** The gas stored in the gas holders is compressed to a pressure of 4.1 bar and fed to the inlet of the gas engines where it is transformed into electricity. The electricity generated is evacuated to the electricity grid.
- 1.1.5.5. **Dewatering Of Digested Residue :** The digested residue is brought into a batch mixer, where it is extensively mixed with a polymer solution that has been prepared in flocculent unit. The produce press cake has a total solids content of about 45-50%, ideally suited for post composting. The effluent of the centrifuge can be pumped to a biological water treatment for further treatment.
- 1.1.5.6. **Refining and Post Composting :** The press and centrifuge cake fall into a screw conveyor which crumbles the cake to optimize the efficiency of sieving. The material that passes through the screen falls on an underlying conveyor belt, which brings it into the maturation hall. Here, it is fully automatically, spread out in rows which at the end form a uniform heap with a height of 2 metre. A controllable air flow is blown through the heap via grooves in the bottom plate. After a retention time of +14 days, the compost is stabilized and can be removed out the hall by a front end loader.



1.1.6. The proposed project will process approximately 150 tonnes per day of biodegradable waste and the resultant biogas will supply a 2.83 MW capacity electricity generation unit to generate 19.56 million units of electricity on annual basis. Moreover, the project activity will generate renewable electricity that will displace fossil-fuel based generation and assist in supplying State's pressing and growing electricity demand. SBSPL submitted that necessary debt component required for project funding has been raised from Bank of Baroda (BoB). The details of the financial assumptions considered for tariff determination have been shown in Chapter 5 of this Order.

1.1.7. With an intention to sell the electricity to Maharashtra State Electricity Distribution Company Ltd (MSEDCL), a distribution licensee in the State, SBSPL made the following Prayers in its Petition:

- (i) *“Accept this petition for determination of tariff for supply of electricity from proposed Municipal Solid Waste Power project at Solapur to Distribution licensee in Maharashtra (MSEDCL). It is further requested that Hon'ble Commission may specify the levellised tariff for proposed MSW power plant for 20 year tariff period which is useful life of plant.(CERC has recommended tariff period of 25years for SPV and solar Thermal projects in RE tariff notification dated September,2009). The Hon'ble Commission may direct the distribution licensee to execute PPA with the petitioner for the specified tariff period.*
- (ii) *Approve the levellised tariff of Rs 6.84/ kWh for sale of electricity generated from proposed MSW power project to distribution licensees.*
- (iii) *Issue an interim order at an early date to enable the petitioner to avail the loan from the lender. The actual loan disbursement will take place after producing the PPA executed with DISCOM specifying the tariff approved by Hon'ble Commission.*
- (iv) *Direct the distribution licensee to bear the cost of power transmission line beyond the switchyard point for evacuation of power. The necessary funding for the same may be made available from the Green Energy Fund as per Government of Maharashtra Policy.*
- (v) *To grant an opportunity in person before Hon'ble Commission during the hearing on the above matter.*
- (vi) *Condone any inadvertent omissions/errors/shortcomings and permit the petitioner to add/ change/ modify/ alter this filing and make future submissions as may be required at a future date.”*



## **1.2 ORGANISATION OF THE ORDER**

This Order is organised in the following six Sections:

- Section 1 of the Order provides a Background of the project and the prayers submitted by SBSPL.
- Section 2 of the Order discusses the regulatory process undertaken by the Commission, i.e., Technical Validation Session, Hearing and Public Hearing.
- Section 3 of the Order lists out the various suggestions and objections raised by the objectors in writing as well as during the Public Hearing before the Commission. The various suggestions and objections have been summarised, followed by the response of SBSPL and the rulings of the Commission on each of the issues.
- Section 4 of the Order detail out the tariff philosophy highlighting the approach for tariff determination.
- Section 5 of the Order comprises the submissions with respect to performance parameters and financial parameters and the Commission's analysis on various components and the methodology adopted to determine tariff.
- Section 6 of the order elaborates on the tariff conditions and other conditions associated with the tariff rate and structure, and sets out the Commission's directives.
- Section 7 of the Order addresses applicability of the tariff order.



## 2 REGULATORY PROCESS

Regulation 7.1(a) and Regulation 7.2 of MERC (Terms and Conditions for Determination of RE Tariff) Regulations, 2010 enable determination of project specific tariff in respect of 'Municipal Waste based power plants' within the State, as reproduced below:

*"7.1 Project Specific Tariff, on case to case basis, shall be determined by the Commission for the following types of projects:-*

*(a) Municipal Waste based Projects.*

....

*7.2 Determination of Project Specific tariff for generation of electricity from such renewable energy sources shall be in accordance with such terms and conditions as stipulated under relevant Orders of the Commission:*

*Provided that the financial norms as specified under Chapter-2 of these Regulations, except for Capital Cost and O&M cost, shall be ceiling norms while determining the project specific tariff."*

The regulatory process followed by the Commission is described below:

### 2.1 Technical Validation Session (TVS)

2.1.1 During the Technical Validation Session held on November 16, 2009, SBSPL made a detailed presentation covering the salient features of the Petition such as capacity and configuration of the proposed MSW project, technology adopted, Fuel Supply arrangements, capital cost, cost of generation, and proposed tariff, etc., and also made references to the relevant provisions of EA 2003 and MERC Regulations.

2.1.2 The Commission observed that there were some discrepancies in the Petition as regards parameter assumptions vis-a-vis provisions under the MERC RE Tariff Regulations. One of the issues was regarding assumption on financial parameters. SBSPL had assumed debt:equity of 55:45, however, it clarified that the normative debt:equity can be considered as 70:30 and any excess equity component in excess of 30% may be treated as a notional loan. Further, the Commission directed SBSPL to confirm and modify its Petition, if necessary, to address issues raised during the TVS.

2.1.3 Further, MSEDCL, vide its letter ref. CE(Com)/NCE/SBESPL/MSW-Power sale/29496 dated September 7, 2009 confirmed its willingness to purchase power generated from the proposed MSW based power project of SBSPL. In



addition, Petitioner has also submitted copies of correspondence with BEST (ref. Letter no. RC/PM/942/2009/45473 dated August 17, 2009) and RInfra-D (ref. Email dated August 7, 2009) confirming their willingness to purchase power from proposed MSW power project of the Petitioner.

- 2.1.4 During the TVS, Commission directed the Petitioner to involve Solapur Municipal Corporation (SMC) and distribution licensees such as MSEDCL, BEST Undertaking, TPC-D and RInfra-D as Parties and also directed SBSPL to serve copies of the Petition to the distribution licensees, SMC and authorized Consumer Representatives.
- 2.1.5 Subsequent to the TVS, Commission, vide letter dated February 10, 2010 directed SBSPL to implead SMC as a necessary respondent since the proposed power project is based on Municipal Solid Waste, which is being made available by SMC, and the response of SMC is critical for further regulatory process in the matter.
- 2.1.6 Further, to confirm the technical viability of the project, the Commission, vide letter dated February 15, 2010 requested the MNRE to provide their view on the proposed technology, i.e., thermophilic biogas production. In response, MNRE vide, letter dated March 19, 2010 stated that the project based on biogas production should be taken up only on the segregated/uniform waste, however, technical viability of the same has not been assessed by the MNRE.

## 2.2 Hearing

- 2.2.1 Subsequent to the TVS, two hearings were held on March 31, 2010 and April 17, 2010, respectively, so as to determine the techno-commercial viability of the project and to have a prudence check of the technical and financial parameters submitted by SBSPL in the Petition.
- 2.2.2 During the first hearing, the Commission directed Maharashtra Energy Development Agency (MEDA) to give their views with respect to techno-economic feasibility of the project. Further, the Commission also observed that SMC does not seem to have any stake in the form of equity share or any type of holding in this project. The Commission was of the view that the co-ordination between SBSPL and SMC should be strong, so as to overcome the major risk such as failure of supply of Municipal Solid Waste and failure of pre-treatment operations.



2.2.3 Subsequent to this, the Commission conducted second hearing, which was attended by Shri Ranjit Singh Deol, Commissioner of SMC. During the hearing, he submitted that SMC is extending its full support to the project. Further, the Commission directed SMC to make submission on affidavit with regards to the Fuel Supply Arrangement, i.e., Concession Agreement between the SMC and SBSPL to overcome the risk related with the fuel supply.

### 2.3 Public Hearing

2.3.1 SBSPL, through its additional submissions, responded to all the queries raised during the TVS held on November 16, 2009, and hearings held on March 31, 2010 and April 17, 2010, respectively. In accordance with Section 64 (2) of the EA 2003, the Commission directed SBSPL to publish its Petition in prescribed abridged form and manner to ensure due public participation. The Commission also directed SBSPL to reply expeditiously to all the suggestions and objections received from all the stakeholders on its Petition. The Public Notice was published in 4 Newspapers, i.e., Indian Express (English), LokSatta (Marathi & English), DNA (English) & Kesari (Marathi) by SBSPL.

2.3.2 A summary of the Tariff Proposal under consideration was also made available by making the payment of Rs.50/-. The copy of the Public Notice and Executive Summary of the Petition were also made available on the Commission's website, i.e., [www.mercindia.org.in](http://www.mercindia.org.in) in downloadable format. The Public Notice stipulated that the suggestions and objections, either in English or Marathi, may be filed in the form of affidavit along with proof of service on SBSPL.

2.3.3 The Public Hearing was held on July 19, 2010 at 11:00 hours at the Commission's office. The list of objectors, who participated in the Public Hearing is provided in **Appendix 3**. During the public hearing, a brief presentation was made by SBSPL, covering all the submissions. The public hearing was attended by representatives from SBSPL, TPC, and MSEDCL. The issues raised by the various stakeholders during this public process are summarized in the following Section.



### **3 ISSUES/OBJECTIONS SUMMARY, PETITIONER'S RESPONSE & COMMISSION ANALYSIS & RULINGS**

In this Section, the issues raised by various stakeholders and the Commission on the Petition filed by SBPSL and the Commission's rulings on the issues have been summarised issue-wise.

#### **3.1 FUEL SUPPLY ARRANGEMENT**

3.1.1 During the TVS, the Commission has observed that the stake of Solapur Municipal Corporation in this project seems to be negligible. The Concession Agreement submitted by SBSPL does not speak about the fuel supply agreement between the Solapur Municipal Corporation and SBSPL.

3.1.2 MEDA submitted that there is some uncertainty as regards continuous supply of fuel. The MSW management in the area of Solapur Municipal Corporation seems to be in the nascent stage. MEDA also submitted that few developers involved in bidi making business are planning to install biomass plant based on tendu patta, the raw material used for making bidi, so the contribution of tendu patta would be negligible and therefore, reduce the quantity of MSW available for the proposed MSW project.

#### **Petitioner's Response**

3.1.3 SBSPL submitted that the Concession Agreement has been signed between M/s CICON and SMC. SBSPL stated that under Clause 16 of the Concession Agreement, SMC has agreed to allow CICON to form a SPV, if so desired by CICON, which may be a Limited Company or subsidiary Company or Joint Venture Company or any other business arrangement and /or instrument for the Project, and obtain necessary finance, expertise, technology backup or any other support. Further, SBSPL highlighted that in case of formation of SPV, all the rights and obligations under the Concession Agreement are transferred to the SPV.

3.1.4 SBSPL submitted that CICON has formed SBSPL as the SPV for the Project. Regarding continuous supply of fuel, SBSPL submitted that



the Solapur Municipal Corporation, in the Concession Agreement signed with SBSPL, has confirmed the availability of MSW as 300 TPD. With reference to availability of waste, the Executive Director of All India Institute of Local Self Government has certified the zone-wise waste generation and collection within the SMC limits of the order of 420 TPD and 347 TPD, respectively. The city-wise baseline data for MSW generation and distribution for the 423 cities as published in the "Technical Memorandum on Shelf of Viable Projects" under the "National Master Plan for Development of Waste to Energy in India" indicates the waste generation in Solapur city as 350 TPD.

- 3.1.5 SBSPL further clarified that SMC has understood that the success of the project depends entirely on regular supply of MSW in the stipulated quantity as per Clause 2.6 of the Concession Agreement, and as far as possible, all the waste derived from the vegetable markets along with hotels, restaurants, etc., shall be essentially delivered as MSW by SMC under this arrangement. SMC will always supply all above types (except bio-medical waste) of waste including vegetable market waste with organic matter to SBSPL on priority.
- 3.1.6 In the Concession Agreement, it is also stated that in case SMC fails to supply the desired quantity, SPV will arrange for the deficient quantity at its cost. The expenses incurred by the SPV on the collection, transportation, loading and unloading in such event will be billed to SMC, subject to the condition that such expenses will be calculated at actual or at the rate of SMC's then prevailing average cost of collection, transportation and handling, whichever is higher.
- 3.1.7 During the hearing held on April 17, 2010, the Commissioner of Solapur Municipal Corporation (SMC) submitted that till date, waste segregation arrangement is not available, but they have started the collection of kitchen waste from various hotels/restaurants and waste from bidi making industry. In response to queries by the Commission, SMC responded that at present, there is no scientific landfill site for disposal of waste by SMC. As regards SMC's stake in this project, he informed that SMC has provided land for the project and also SMC shall earn approximately 33% revenue from the sale of manure/compost from the said MSW segregation facility.



### **Commission's Ruling**

3.1.8 The Commission is of the view that the entire project is dependent on continuous and reliable supply of MSW of desired quantity and quality, and the co-ordination between SBSPL and SMC should be strong. In this regard, SMC had submitted on affidavit, addressing all the commitments made between SBSPL and SMC. SMC in its affidavit, dated May 18, 2010, has stated that "As per the clause 5.1 of the Concession Agreement, the Municipal Corporation shall deliver guaranteed MSW everyday subject to variation at the rate of +/-20%. The shortfall in the supply shall be made good on the following days with the average of 300 TPD within the fortnight."

3.1.9 The Commission notes that project capacity and site location should be so chosen that availability and collection of MSW poses least hurdles, thereby minimizing fuel input related risks. Accordingly, it is the responsibility of SBSPL to establish the availability of fuel over the useful life of the Project period, and to establish a fuel management chain with appropriate commercial arrangements with Solapur Municipal Corporation to ensure continuous availability of MSW for the Project. The risk of lack of availability of MSW fuel of desired quantity and quality cannot be passed on to the distribution licensee/consumers at later stage. In this context, the Commission observes that there is a contractual arrangement between SBSPL and SMC for regular supply of MSW, and the same has been considered for the purpose of the Order.

### **3.2 THERMOPHILIC BIOMETHANATION V/S MESOPHILIC BIOMETHANATION**

3.2.1 MEDA submitted that the MoU executed between the technology provider and developer needs to be examined, in order to determine the technical viability of the project. MEDA submitted that SBSPL should justify the advantages of thermophilic biomethanation technology proposed to be deployed vis-a-vis mesophilic biomethanation, which has been deployed extensively across the world.



3.2.2 MNRE submitted that the proposed technology may be undertaken only in case the waste is available in segregated manner.

**Petitioner's Response**

3.2.3 SBSPL submitted that M/s Waste Works, Ireland, is a collaborator/consultant to this project and the technology has been developed jointly, to suit the Indian conditions. The technology known as DRANCO, i.e., dry thermophilic anaerobic digestion process has been proposed and the same technology is intended to be used for the Project.

3.2.4 SBSPL submitted the comparison of merits and demerits of thermophilic biomethanation and mesophilic biomethanation processes based on National Master Plan (NMP) on development of Waste to Energy projects in India prepared for MNRE, which indicates the following –

3.2.5 Water requirement for Thermophilic biomethanation process is only about 20% of the requirement for the mesophilic process, which favours the thermophilic process, since water is a constrained resource in Solapur, which fall in the dry belt in Maharashtra.

3.2.6 The NMP document has also compared power generation on an equal capacity basis from gas based on the two processes. It is approximately 33 % higher in case of thermophilic biomethanation process as compare to the mesophilic process. On an average, the thermophilic process is able to generate 1 MW of power per 100 TPD of waste whereas the mesophilic process is able to generate 0.76 MW per 100 TPD of waste.

3.2.7 The sludge produced after the anaerobic digestion is lower in thermophilic process as compared to mesophilic process; which is a result of greater conversion of the feedstock to gas.

3.2.8 The residence time of the sludge in the digester is about 15 days in the case of thermophilic process as compared to mesophilic process wherein the residence time may be 50-55 days for full digestion of the feedstock. This implies that the digestion process is much faster in the



thermophillic biomethanation case as compared to the mesophillic process and would therefore, result in smaller capacities for digester chamber, gas holder, etc., due to the faster throughput resulting in reduced cost and greater power output.

3.2.9 Thermophillic Biomethanation has a high solid digestion process and has higher biogas productivity. It works between 48-57<sup>0</sup>C temperature. With the digester loading 10-20 kg/m<sup>3</sup> of reactor volume, the biogas generation is 100-200 m<sup>3</sup> of biogas per ton of waste.

3.2.10 As regards MEDA's observation on thermophillic biomethanation, SBSPL submitted that similar MSW project based on DRANCO technology was approved by the MNRE and MEDA earlier for Nagpur Municipal Corporation, for which the subsidy was also sanctioned by MNRE. The proposal/DRANCO technology was thoroughly scrutinized on technical grounds by MNRE/MEDA before sanctioning the subsidy for the Nagpur MSW project. Since, the similar technology is proposed in the Solapur MSW project, SBSPL submitted that the question of technical scrutiny does not arise. SBSPL further submitted that the Nagpur MSW project could not come up because the investor backed out and not because of technology failure.

3.2.11 SBSPL further submitted that power plants based on thermophillic biomethanation technology are already installed at various places and are operating satisfactorily, as summarised under following table:

<b>Plant Location</b>	<b>Capacity (ton per year)</b>	<b>Type of waste</b>
Brecht, Belgium	12000	Biowaste and non-recyclable paper
Salzbaug, Austria	20000	Biowaste
Bassum, Germany	13500	Rest waste and sludge
Asrberg, Switzerland	11000	Biowaste
Kaiserlautem, Germany	20000	Biowaste
Vileneuve	10000	Biowaste and green waste

3.2.12 SBSPL submitted that it agreed with the suggestions made by MNRE on the need for segregation of waste for biomethnation based power projects. SBSPL submitted that in this case too, SBSPL will provide segregated waste for generation of gas but the cost of segregation would be borne by the developers.



3.2.13 Based on the above comparison, SBSPL submitted that it may be safely concluded that the thermophilic process is technologically far more efficient than the mesophilic process and the greater efficiency in turn would imply lower cost per unit of power output.

### **Commission's Ruling**

3.2.14 The Commission observes that as per 'Technical Memoranda for Waste to Energy Technologies' published by MNRE as part of National Master Plan for Waste to Energy Technologies, biomethanation technology has been ranked first amongst various waste to energy technologies upon assessment of various evaluation criteria such as system configuration, system auxiliaries, environmental aspects, resource recovery and commercial aspects. As regards MEDA's contention of thermophilic biomethanation vis-a-vis mesophilic biomethanation, the Commission has also noted that a MSW project based on similar thermophilic biomethanation technology (DRANCO technology) was planned as Nagpur MSW project, for which MNRE/MEDA had earlier sanctioned subsidy as well. However, the Commission has also noted the comment made by MNRE that segregation of municipal solid waste is a pre-requisite condition for successful deployment of such technology. The Commission has dealt with this aspect of segregation and pre-treatment under subsequent paragraph 3.4.

3.2.15 Further, the technology risk in any case is required to be borne by SBSPL. The risk of lower generation or sub-optimal technological performance cannot be passed on to the distribution licensee/consumers at later stage. The Commission has noted the Petitioner's submissions and confirmation in this respect and the same has been considered for the purpose of the Order.

## **3.3 ESTIMATION OF QUANTUM OF GAS GENERATION**

3.3.1 MEDA submitted that as per the DPR, the biogas generation shown is 174 cu.m per tonne of organic waste, which seems to be very high (ref. 6.6 on page 99). Based on MEDA's interaction with some experts in the field, biogas generation of around 100 cu.m per tonne is more



realistic. MEDA further submitted that if the biogas generation is assumed to be 100 cu.m per tonne of organic waste then the maximum power that could be produced is 1.3 MW and not 2.83 MW as proposed by SBSPL. MEDA submitted that as per MNRE guidelines, 12000 cu.m of biogas is needed to generate 1 MW of power.

### **Petitioner's Response**

3.3.2 SBSPL submitted that the level of generation mentioned by MEDA is possible if the mesophilic range of temperature is considered. SBSPL highlighted that the proposed MSW plant at Solapur is based on Thermophilic Biomethanation technology in which the biomethanation process takes place at 55-65<sup>0</sup>C. SBSPL further added that no such plant is in existence in India where the plant is working on thermophilic biomethanation technology. SBSPL submitted that the research studies/operational data indicates that the gas generation by thermophilic biomethanation process would be in the range of 150-200 Cu.m/tonne of waste.

3.3.3 Further, SBSPL submitted data of two reference plants deploying similar technology and biogas generation as summarised below:

<b>Parameter</b>	<b>Brecht Full scale Plant Characteristics</b>	<b>Salzburg Full Scale Plant Characteristics</b>
Total solids	40%	31%
Volatile solids	55%	70%
Loading rate	7-14 kg VS per cum per day	5-8 kg VS per cum per day
Biogas production	90-120 N cum per tonne of input	120-170 N cum per tonne of input
Methane content	50-60%	50-65%

3.3.4 SBSPL submitted that thermophilic anaerobic digestion operates at 55 to 60 deg C, where rate of biomethanation and loading rates are higher, and consequently biogas generation is more, coupled with other advantages such as lower digestion period, pathogens in compost are absent and lower requirement of area. SBSPL further submitted that it has also been reported by MNRE in the National Master Plan for development of Waste to Energy in India (Technical Memoranda for WTE technology) that a typical thermophilic based anaerobic digestion plant of 500 MT capacity generates 52,500 N cum per day of biogas having calorific value of 4800 kcal. This results in biogas



generation of 105 N cum per tonne per day, which is in line with the claim made by SBSPL.

3.3.5 SBSPL further submitted that the gas generation from waste not only depends on quantity but also quality of waste, i.e., the favourable chemical composition of the waste received. Similarly, it cannot be guaranteed that the chemical composition of waste received at MSW site will remain exactly the same over the years.

3.3.6 SBSPL submitted that in case of any variation in the gas generation and the power generation thereof, only SBSPL would be subjected to entire risk of under payment and the subsequent deficit in cash flow, as the revenue of the proposed MSW power project would be entirely dependent on the actual generation in a particular year and payable under the 'single part tariff' mechanism. There will be absolutely no impact on the end consumer or the Government.

### **Commission's Ruling**

3.3.7 The Commission opines that the technology risk of estimation of biogas generation and consequent electricity generation is required to be borne by SBSPL. The Commission has noted the Petitioner's submissions and confirmation in this respect and the same has been considered for the purpose of the Order.

### **3.4 SEGREGATION OF MSW AND ITS IMPACT ON CAPITAL COST & OPERATING COST**

3.4.1 During the hearing, the Commission observed that the capital cost related with collection and segregation, i.e., pre-treatment facility, and operating cost (O&M costs) including the auxiliary consumption is high. Further, the Commission highlighted that collection, segregation and safe disposal of MSW is a statutory responsibility of the Municipal Corporation under MSW (Management & Handling) Rules 2000. However, by virtue of pre-treatment facilities being included as a part of project cost, the cost of the same is being loaded on the electricity consumers in terms of the proposed tariff, i.e., Rs. 6.84 / kWh.



3.4.2 In view of the above, the Commission directed SBSPL to clearly bring out the per unit impact of additional capital cost towards segregation of waste and operating cost considering 17% auxiliary consumption and cost related with O&M on account of pre-treatment facilities in the proposed tariff.

### **Petitioner's Response**

3.4.3 SBSPL submitted that it is true that as per the MSW (Management and Handling) Rules, 2000, the disposal of waste is the primary responsibility of the Municipal bodies. These Rules stipulate that all Urban Local Bodies are responsible for proper collection, storage, transportation, processing and disposal of the municipal waste. Only the residual inerts after due processing of waste are to be disposed off into a sanitary landfill in accordance with these Rules. The Rules advocate the use of composting, Biomethanation, pelletization with or without energy recovery and other thermal processes for adoption as processing techniques for municipal waste. However, despite these Rules, there has not been any material improvement in MSW management practices across India. The compliance rate of Indian Municipal Corporations with the MSW Rule 2000 is very low (< 9%) essentially due to the limited financial and technical and managerial resources with the municipalities. In the case of Solapur also, there is low probability that the SMC can manage the waste on its own and supply the waste of desired technical grade suitable for incorporation as feed stock into the biomethanation digester. The technical requirement of the biochemical digester necessitate that the feed stock needs to have adequate pH value, moisture content and be free of toxic inclusions such as metals, plastics, batteries, e-waste, etc., all of which would tend to reduce the rate of biomethanation, thereby affecting gas yield. The inclusion of foreign matter in the waste would also gradually accumulate in the bio-digester forcing premature closure of bio-digester for maintenance purpose resulting in increased maintenance cost, increased down time and reduced generation.

3.4.4 Hence, from the technical consideration of efficient plant operations, SBSPL has accepted the responsibility of material segregation at the inlet side to ensure that the technical specification of material is



maintained as per process requirement. Hence, pre-treatment may be treated as essential part of the process and cannot be separated. If the quality of feed stock cannot be maintained, the project may not be technically feasible in terms of guaranteed reliability of operations.

- 3.4.5 SBSPL has not considered the cost associated with the last two processes, namely, de-watering of digested residue and refining and post composting, in the capital cost because these processes are not required for power generation. However, the upstream capital cost as mentioned above termed as Pre-treatment processes, which consist of segregation and sorting of the MSW before putting it into the digester chamber are very much a part of power generation facility. The biomethanation process, biogas generation and subsequently power generation directly depends upon the quality of the bio-decomposable waste entered into the digester chamber. SBSPL submitted that if these upstream capital cost are separated from the capital cost and the untreated waste is let into the digester chamber then the power generation from the MSW plant will be adversely affected, which in turn will increase the cost of generation of the MSW plant.
- 3.4.6 In the context of pre-treatment of fuel/feed stock, it may be noted that other technologies are also permitted to include certain costs which are similar to pre-treatment cost. For example, coal is washed and crushed prior to combustion in coal based thermal power projects and such costs (capital and operational) are internalized into the tariff. Similarly, biomass projects have also to perform sizing and chopping operations to ensure appropriate qualities of the feed stock.
- 3.4.7 In the light of these observations, SBSPL requested that the inclusion of pre-treatment cost may be considered entirely reasonable and should be treated as essential part of the project for internalization into the tariff. It may be emphasized that this assumption of responsibility for pre-treatment is critical to the lifelong and trouble free operation of the project.



3.4.8 SBSPL submitted that the Integrated Energy Policy (IEP) of Government of India stipulated the range of capital cost and cost of generation for RE technologies. The higher capital cost and subsequent cost of generation for MSW to Energy is recognized by IEP as follows:

Source	Capital Cost (Rs. Crores/MW)	Estimated CoG(Rs./kWh)
Small Hydro Power (<25 MW)	5.00 – 6.00	2.50-3.50
Wind Power	4.00 – 5.00	3.00-4.00
Bio mass	4.00	3.00-4.00
Bagasse Cogeneration	3.00-3.50	2.00 – 3.00
Bio mass Gasifier	2.50-3.00	3.00-4.00
Energy from Waste	5.00-10.00	4.00 – 7.50
Solar PV	25-30	15.00 – 20.00

3.4.9 SBSPL submitted that the power produced from the project may be considered as despatchable power or available at will, any time during the daily cycle. This power can be accommodated during peak load, which will be very beneficial for grid support. Hence, the tariff to be determined may be viewed favourably keeping this aspect in mind.

3.4.10 SBSPL further presented the per unit tariff impact due to additional capital cost and operating cost on account of pre-treatment facilities, in the proposed tariff in the following table:

Sr No	Tariff computation excluding post treatment process		Tariff computation excluding pre-treatment and excl post treatment process	
	Particular	Value	Particular	Value
1.	Capacity	2.83 MW	Capacity	2.83 MW
2.	Capital cost	3841 lakhs	Capital cost	3366 lakhs
3.	O & M	7.2 % of CC	O & M	6%
4.	Auxiliary consumption	17 %	Auxiliary consumption	12.32%
5.	Tariff	Rs 6.84 / kWh	Tariff	Rs 5.34 / kWh
<b>Per unit impact on account of pre-treatment process</b>			<b>Rs 1.50 / kWh</b>	

### **Commission's Ruling**

3.4.11 The Commission observes that Section 4 of MSW (Management & Handling) Rules 2000 [S.O.908(E)], clearly stipulates the responsibility of Municipal Corporation vis-a-vis segregation and safe



disposal of municipal waste generated in its area of operations. The relevant extract of the Section is given below:

**“4. Responsibility of municipal authority .-**

1. *Every municipal authority shall, within the territorial area of the municipality, be responsible for the implementation of the provisions of these rules, and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.*
2. *The municipal authority or an operator of a facility shall make an application in Form-I, for grant of authorization for setting up waste processing and disposal facility including landfills from the State Board or the Committee in order to comply with the implementation programme laid down in Schedule I.*
3. *The municipal authority shall comply with these rules as per the implementation schedule laid down in Schedule I.*
4. *The municipal authority shall furnish its annual report in Form-II,-*
  - a. *to the Secretary-incharge of the Department of Urban Development of the concerned State or as the case may be of the Union territory, in case of a metropolitan city; or*
  - b. *to the District Magistrate or the Deputy Commissioner concerned in case of all other towns and cities, with a copy to the State Board or the Committee on or before the 30<sup>th</sup> day of June every year.”*

3.4.12 Thus, while the ‘pre-treatment facility’ is an integral part of the proposed MSW power project scheme as proposed by SBSPL, the statutory responsibility entrusted on Solapur Municipal Corporation cannot be ignored. The Commission is of the view that allowing such capital cost and operating cost/performance parameters such as auxiliary consumption, to be included as part of overall capital cost for the purpose of tariff determination would amount to ignoring such statutory duty entrusted on the Solapur Municipal Corporation, also amount to burdening the distribution licensee and consumers of such distribution licensee with the cost of such segregation/pre-treatment of municipal waste, which in the first place, is the statutory responsibility of the Solapur Municipal Corporation. On account of being a statutory responsibility of the Municipal Corporation to undertake segregation/pre-treatment of waste before its disposal, SBSPL's



argument to equate the pre-treatment of biomass power or washed coal, etc., is not tenable. Besides, the Commission also notes the recommendation of MNRE that biomethanation based projects should be encouraged only after ensuring availability of segregated waste.

3.4.13 The Commission notes that SBSPL has based its computation of tariff determination based on Capital Cost assumption of Rs 3841 Lakh including cost of pre-treatment but excluding the cost of post-treatment (i.e., de-watering and composting). SBSPL has furnished detailed break-up of various components of project cost as summarised below:

Sr. No.	Item Description	Units	Pretreatment	Digestion	Power Generation	Composting	Miscellaneous	Total
1	Land & Site Development, Buildings & Civil Works	Rs L	72.04	447.95	49.68	84.46	173.88	828.00
2	Plant & Machinery	Rs L	288.69	1306.32	678.42	132.32	0.00	2405.74
3	Process & Technology Transfer	Rs L	56.00	224.00	0.00	0.00	0.00	280.00
4	Cost of consumables	Rs L	0.00	70.00	0.00	0.00	0.00	70.00
5	Insurance (3% on Civil & Plant)	Rs L	10.82	52.63	21.84	6.50	5.22	97.01
6	Interest During Construction (IDC)	Rs L	26.71	131.31	46.68	13.90	11.15	229.74
7	Pre Operative Costs	Rs L	7.13	35.02	12.45	3.71	2.97	61.28
8	Contingencies	Rs L	5.20	25.55	9.08	2.70	2.17	44.71
9	Working Capital Margin	Rs L	8.51	41.84	14.87	4.43	3.55	73.21
10	<b>Total Capital Cost</b>	<b>Rs L</b>	<b>475.10</b>	<b>2334.62</b>	<b>833.02</b>	<b>248.01</b>	<b>198.94</b>	<b>4089.69</b>
11	% of Total Capital Cost	%	11.6%	57.1%	20.4%	6.1%	4.9%	100.0%
12	<b>Per MW Capital Cost</b>	<b>Rs L/MW</b>	<b>167.88</b>	<b>824.95</b>	<b>294.36</b>	<b>87.64</b>	<b>70.30</b>	<b>1445.12</b>

3.4.14 The Commission notes that as per SBSPL's own submission referring to Integrated Energy Policy Report, the normative Capital Cost for waste to energy projects is stated to range from Rs 5 – 10 Crore per MW, which is too wide a range, whereas the capital cost estimated by petitioner amounts to Rs 14.45 Crore/MW corresponding to total capital cost of Rs 4089 Lakh. In the absence of any similar reference project cost benchmarks in India, it will not possible to compare and comment on whether the proposed capital cost stated by SBSPL is appropriate. It is also not the intention of the Commission to approve each element of the Capital Cost, but to scrutinise reasonableness of various major cost components. Accordingly, the Commission has considered the data of capital cost components under four alternatives as under:



- **Alt-1:** Including Pre-Treatment and incl. Post-treatment  
**(All inclusive)**
- **Alt-2:** Including Pre-treatment but excluding Post-treatment  
**(As per SBSPL)**
- **Alt-3:** Excluding Pre-treatment and excluding Post treatment  
**(To evaluate tariff impact on consumer for non-segregation of MSW)**
- **Alt-4:** Excluding Pre-treatment but including Post-treatment  
**(Considered by Commission for Tariff Purposes)**

3.4.15 A comparison of capital cost under various alternatives is summarised below:

Sr. No.	Item Description	Units	Capital Cost Incl. Pre-Treatment and Incl. Composting	Capital Cost Incl. Pre-Treatment and Excl. Composting	Capital Cost Excl. Pre-Treatment and Excl. Composting	Capital Cost Excl. Pre-Treatment and Incl. Composting
			Alt-1 (all inclusive)	Alt-2 : As proposed by Petitioner	Alt-3 : For evaluation of tariff impact on consumer for non-segregation	Alt-4 : Considered by Commission for Tariff purpose
1	Land & Site Development, Buildings & Civil Works	Rs L	828.00	743.54	671.51	755.96
2	Plant & Machinery	Rs L	2405.74	2273.42	1984.74	2117.05
3	Process & Technology Transfer	Rs L	280.00	280.00	224.00	224.00
4	Cost of consumables	Rs L	70.00	70.00	70.00	70.00
5	Insurance (3% on Civil & Plant)	Rs L	97.01	90.51	79.69	86.19
6	Interest During Construction (IDC)	Rs L	229.74	215.84	189.13	203.03
7	Pre Operative Costs	Rs L	61.28	57.57	50.45	54.15
8	Contingencies	Rs L	44.71	42.01	36.81	39.51
9	Working Capital Margin	Rs L	73.21	68.78	60.27	64.70
10	<b>Total Capital Cost</b>	<b>Rs L</b>	<b>4089.69</b>	<b>3841.68</b>	<b>3366.58</b>	<b>3614.59</b>
11	<b>Per MW Capital Cost</b>	<b>Rs L/MW</b>	<b>1445.12</b>	<b>1357.48</b>	<b>1189.61</b>	<b>1277.24</b>

3.4.16 Thus, overall capital cost estimate for Alt-1 is Rs 4089 Lakh (Rs 1445 Lakh/MW), for Alt-2 is Rs 3841 Lakh (Rs 1357 Lakh/MW), for Alt-3 is Rs 3366 Lakh (Rs 1189 Lakh/MW) and for Alt-4 is Rs 3614 Lakh (Rs 1277 Lakh/MW).

3.4.17 Under earlier paragraphs, the Commission has elaborated the need for exclusion of capital cost components corresponding to pre-treatment facilities for the purpose of tariff determination. As regards capital cost pertaining to post-treatment (i.e., dewatering and composting), the Commission is of the view that revenue from sale of such composts



should be available to the Project Company since compost is a by-product of such biomethanation based power project operation and all associated capital cost, operating cost, etc., may be factored in while determining tariff. This aspect has been further elaborated under Para 3.7 of this Order. **Accordingly, for the purpose of tariff determination for the proposed MSW power project of SBSPL, the Commission has considered capital cost corresponding to Alt-4, i.e., Rs 3614 Lakh (Rs 1277 Lakh/MW).**

### 3.5 DEBT EQUITY RATIO

3.5.1 SBSPL had earlier considered financing plan with debt:equity of 55:45, but it was clarified during TVS, that the normative debt:equity can be considered as 70:30 and any excess equity component in excess 30% may be treated as notional loan.

#### Petitioner's Response

3.5.2 SBSPL submitted that they have strived to avail 70% debt from various lenders and Financial Institutions, but managed to get 55% debt component from Bank of Baroda. The lenders are somewhat hesitant to provide 70% debt to MSW project, which is still at nascent stage of development in India.

3.5.3 SBSPL requested the Commission to consider the debt:equity ratio of 55:45 stating that the project is already approved by Financial Institutions on 55:45 basis. Further, SBSPL stated that the risk component by contributing higher equity will be taken by SBSPL.

3.5.4 SBSPL submitted that the project is beneficial to the Municipal Corporation as the waste is being treated without any investment from SMC. Therefore, SBSPL requested the Commission not to penalize SBSPL by considering lower equity percentage as it results in reduction in tariff.

3.5.5 However, SBSPL furnished the tariff computations based on normative debt:equity of 70:30 and sought approval for computed tariff as directed by the Commission.



### **Commission's Ruling**

3.5.6 As regards assumption of debt:equity for the purpose of project specific tariff determination, the Commission would like to highlight that Regulation 13.2 and Regulation 7.2 of MERC (Terms and Conditions for Determination of RE Tariff) Regulations, 2010 are the relevant Regulations. The relevant extracts of the same are as under:

*"13.2 For project specific tariff, the following provisions shall apply:*

*If the equity actually deployed is more than 30% of the capital cost, equity in excess of 30% shall be treated as normative loan.*

*Provided that where equity actually deployed is less than 30% of the capital cost, the actual equity shall be considered for determination of tariff;*

.....

7.2 *Determination of project specific tariff for generation of electricity from such renewable energy sources shall be in accordance with such terms and conditions as stipulated under relevant Orders of the Commission.*

*Provided that the financial norms as specified under Chapter-2 of these Regulations, except for capital cost and O&M cost, shall be ceiling norms while determining the project specific tariff."*

*(emphasis added)*

3.5.7 Accordingly, the Commission has considered debt:equity of 70:30 for the purpose of project specific tariff determination under this Order.

### **3.6 SUBSIDY FROM MNRE**

3.6.1 The Commission asked SBSPL to clarify and confirm the nature and extent of grant or capital subsidy available for MSW project and whether the same has been availed or proposed to be availed. Further, the Commission asked SBSPL to provide adequate justification if the same has not been availed.

3.6.2 MEDA submitted that during 1999-2000, MNRE, GoI had sanctioned financial support for 520TPD/4 MW demonstration power project based on Biomethanation of MSW at Nagpur Municipal Corporation (NMC) using DRANCO technology, which is same as that proposed by Petitioner for the said MSW power project at Solapur. The first



installment of capital subsidy was already released by MNRE for the MSW project at Nagpur but unfortunately the project could not come up since the promoter of the project backed out and the subsidy had to be returned to MNRE, GoI. Later, objections from NGOs for financially supporting such centralized MSW processing and power generation units with new and unproven technologies instead of promoting composting techniques made the Hon'ble Supreme Court to direct GoI to keep the concerned policy in abeyance till further orders. In the light of this, the proposed DRANCO technology has not yet been proven at field level in India.

3.6.3 MNRE stated that the guidelines for project development framed in accordance with the decision of Hon'ble Supreme Court, indicated in the administrative approval for MNRE's scheme for setting up 5 MSW based projects inter alia stated that projects based on biomethanation should be taken up only on segregated/uniform waste unless it is demonstrated that in Indian conditions, the waste segregation plant/process can separate wastes suitable for biomethanation. Since the said project is based on MSW supplied by Municipal Corporation without source segregation, MNRE has informed the project proponents that no financial support can be extended for this project under MNRE's Scheme.

3.6.4 The technology proposed to be deployed for this project at Solapur is same as that selected for the 4 MW project at Nagpur, for which capital subsidy was sanctioned by MNRE in the year 2000. Since the project was not installed at Nagpur, the performance of the technology could not be demonstrated/ evaluated.

### **Petitioner's Response**

3.6.5 SBSPL submitted that as per MNRE policy, a capital subsidy of Rs 2.00 Cr / MW is available for 5 demonstration projects in India for the year 2009-10. SBSPL has made an application to MNRE through MEDA for availing such capital subsidy. The Hon'ble Supreme Court passed a Judgment on May 15, 2007 stating that the subsidy will be provided only to those biomethanation projects, which procure waste in segregated manner. So, the benefit of subsidy would not be available



to SBSPL. Hence, SBSPL has arranged financing for the project without considering any subsidy or grant.

### **Commission's Ruling**

3.6.6 The Commission observes that as per Regulation 22.1 of MERC (Terms and Conditions for determination of RE tariff) Regulations, 2010, the Commission shall take into consideration any subsidy/grant to be provided by the Central/State Government. The relevant extract of said Regulations is as under:

*"22.1 The Commission shall take into consideration any incentive or subsidy offered by the Central or State Government, including accelerated depreciation benefit if availed by the generating company, for the renewable energy power plants while determining the tariff under these Regulations."*

3.6.7 The Commission notes that in case segregated MSW was made available by SMC to the proposed MSW Power project, it would have been eligible to avail the capital subsidy upto Rs 2 Crore per MW as per MNRE Programme on Energy Recovery from Municipal Solid Waste dated July 9, 2009.

3.6.8 Since, SBSPL has confirmed that no capital subsidy would be available for the project; the Commission has not considered any capital subsidy for the purpose of project specific tariff determination under this Order in accordance with Regulation 22.1 of MERC RE Tariff Regulations, 2010.

### **3.7 REVENUE GENERATED FROM SALE OF COMPOST**

3.7.1 The Commission observed that the cost related with the post-treatment has been excluded by SBSPL. However, the Commission sought further details of the post treatment facility such as quantum of compost production and sale arrangement including assumptions about revenue from the sale of compost thereof.

### **Petitioner's Response**

3.7.2 SBSPL submitted that the total compost generation from the plant would be 45 TPD, out of which 15 TPD would be shared with the Solapur Municipal Corporation (SMC) as per the Concession



Agreement. However, the exact quantity and quality of the manure can vary depending upon the input of the incoming raw material at MSW shed.

3.7.3 SBSPL submitted that at present, there is no arrangement for the sale of manure, but they are planning to enter into long term sale arrangements for sale of compost with various domestic as well as international buyers.

3.7.4 SBSPL further submitted that while computing the tariff, the capital cost associated with the manure production, i.e., dewatering, and post composting processes as well as operation and maintenance costs relating to composting facilities have been excluded from tariff computations, so the revenue generated from the sale of compost has been excluded from the tariff calculations. Therefore, SBSPL requested the Commission to allow it to retain the benefits, if any, from sale of manure.

### **Commission's Ruling**

3.7.5 As elaborated under para 3.4, the Commission is of the view that as compost/manure is the byproduct of the biomethanation based power project operations, the Project Company should be entitled to revenue from sale of such compost. The capital cost and operations costs pertaining to post-treatment (i.e., dewatering and composting) facilities have been accounted for as part of project cost for the purpose of tariff determination, and the revenue from sale of compost/manure should also be accounted for accordingly.

3.7.6 While it is difficult to ascertain quantum of revenue in the absence of organised market information for organic manure/compost, the Commission observes that Clause 3.5 of the Concession Agreement submitted by SBSPL provides that *"SPV shall pay the cost of free compost of 15 TPD to SMC at the rate of Rs.1000/ton i.e. Rs. 49.5 lac per year in advance before the commencement of financial year."*

3.7.7 Thus, the Commission notes that on a conservative estimate, revenue of around Rs 148.5 Lakh per annum (from sale of compost



corresponding to 45 tpd) equivalent to revenue benefit of Rs 0.87/kWh would be available to the Project Company.

3.7.8 While the Commission has not considered 1/3<sup>rd</sup> of the revenue from sale of compost as per concession agreement the Petitioner has committed to make the same available to SMC, however for the purpose of tariff determination, the Commission opines that remaining 2/3<sup>rd</sup> of such revenue from sale of compost needs to be passed onto consumers through reduction in tariff, as and when materialised. Accordingly, for the purpose of tariff computations, the Commission has deducted such 2/3<sup>rd</sup> of revenue from sale of power at the rate of compost sale of Rs 1000/MT as estimated by the Petitioner from the total annual fixed costs computations. The benefit of such 2/3<sup>rd</sup> revenue amounts to equivalent to Rs 0.58 per kWh.

### **3.8 AUXILIARY CONSUMPTION AND OPERATING COST**

3.8.1 The Commission asked SBSPL to clarify and justify its assumption of auxiliary consumption factor of around 17%, which is high. Further, the Commission asked SBSPL to justify its requirement of O&M expense, estimated at 7.2% of Capital Cost.

#### **Petitioner's Response**

3.8.2 SBSPL submitted that the O&M expenses comprise of repair and maintenance expenses, insurance, establishment including employee expenses and administrative and general expenses. In response to Commission's query, the Petitioner further submitted that O&M cost excluding costs pertaining to operations of pre-treatment facilities can be considered as 6% of the capital cost.

3.8.3 As regards the basis for assumption of auxiliary consumption factor, SBSPL submitted that the MSW power plant using the biomethanation technology consists of four distinct processes in the form of pre-treatment, digestion, generation and post-treatment. Significant quantum of electricity is required to run the different mechanical equipments under each of the processes. The electricity is particularly required to run the equipments like inclined rotary conveyer,



homogenizing drum, ballistic separators and magnetic separators in the pre-treatment part. Similarly, electricity is required for biogas cleaning system, mixing unit, vibrating screen during the digestion and power generation process.

3.8.4 The details of auxiliary power consumption requirement on account of various drive loads and utilities is presented below:

Sr. No.	Item Description	Aux. Loads (kW) Incl. Pre-Treatment and Incl. Composting	Aux. Load (kW) Incl. Pre- Treatment and Excl. Composting	Aux. Loads (kW) Excl. Pre- Treatment and Excl. Composting	Aux. Loads (kW) Excl. Pre-Treatment and Incl. Composting
		Alt-1 (all inclusive)	Alt-2 : As proposed by Petitioner	Alt-3 : For evaluation of tariff impact on consumer for non- segregation	Alt-4 : Considered by Commission for Tariff purpose
1	- Receiving Shed	5.9	5.9	5.9	5.9
2	- Pre-treatment section	155.5	155.5		
3	- Control room	2	2	2	2
4	- digester section	137.6	137.6	137.6	137.6
5	- post treatment	57.55			57.55
6	- power island	99.8	99.8	99.8	99.8
7	- Utilities	32	32	32	32
8	- Lighting load	25	25	25	25
9	<b>Total Auxiliary Load (kW)</b>	<b>515.35</b>	<b>457.8</b>	<b>302.3</b>	<b>359.85</b>
10	<b>Gross Plant Capacity (kW)</b>	<b>2830</b>	<b>2830</b>	<b>2830</b>	<b>2830</b>
11	<b>Auxiliary Consumption Factor (%)</b>	<b>18.21%</b>	<b>16.18%</b>	<b>10.68%</b>	<b>12.72%</b>

### Commission's Ruling

3.8.5 The Commission observes that the auxiliary consumption including pre-treatment and post-treatment process is considerably high at around 18% (Alt-1), and excluding post-treatment facility, auxiliary consumption is around 16% (Alt-2). Further, the Commission observes that auxiliary consumption excluding energy consumed by both pre-treatment and post-treatment facility is around 11% (Alt-3), whereas the auxiliary consumption excluding pre-treatment but including post-treatment is estimated to be 12.72%.

3.8.6 In view of the reasoning outlined under Para 3.4, the Commission rules that the operating cost and auxiliary consumption on account of pre-treatment facilities should not be passed on to the consumers through tariff. Accordingly, for the purpose of project specific tariff determination under this Order, the Commission has considered auxiliary consumption factor of 12.72% and O&M cost at 6% of the capital cost.



## **4 PREMISE FOR DETERMINATION OF PROJECT SPECIFIC TARIFF**

### **4.1 Regulatory Framework for Tariff Determination**

- 4.1.1 SBSPL had filed its original Petition on October 21, 2009, when the Commission had initiated the process of comprehensive review of regulatory framework for Renewable Energy projects for the new Control Period, however, RE Tariff Regulations for the new Control Period were yet to be finalised. SBSPL submitted that in the absence of separate RE Tariff Regulations at the State level, the Commission may consider CERC guidelines for determination of tariff for the sale of electricity from MSW power projects after conducting the prudence check of the technical and financial parameters submitted by SBSPL in the Petition.
- 4.1.2 SBSPL submitted that in accordance with the CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2009, the tariff for Waste to Energy projects should consist of single part levellised tariff, namely Annual Fixed Charges, while the Variable cost is zero as the fuel, i.e., waste will be procured from Solapur Municipal Corporation free of cost.
- 4.1.3 SBSPL submitted that the financial parameters, viz., debt:equity ratio, interest on debt and repayment period have been considered as specified in the CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2009. However, the Capital Cost and other operating parameters like O&M cost, Capacity Utilization Factor, and Auxiliary Consumption may be considered in line with the values outlined under Detailed Project Report (DPR) submitted for the proposed project.
- 4.1.4 As per Section 62(1) of EA, 2003, the Appropriate Commission is empowered to determine the tariff in accordance with the provisions of the Act for supply of electricity by a Generating Company to a Distribution Licensee, and for transmission and wheeling of electricity. Further, as per Section 61 (h), the Commission shall be guided by the aspect of promotion of electricity generation from renewable sources of energy.



4.1.5 Further, the Commission notes that one of the prayers is to determine the project specific tariff for supply of electricity from the said MSW power project to MSEDCL. The Commission notes that as per Section 86(1) (b) of EA 2003, the Commission is empowered to regulate electricity purchase and procurement process of distribution licensees, including the price at which electricity shall be procured from the generating company. The relevant extract of the same is as under:

*"S 86(1)(b) The State Commission shall discharge following functions, namely - "regulate electricity purchase and procurement process of distribution licensees including the price at which electricity shall be procured from the generating companies or licensees or from other sources through agreements for purchase of power for distribution and supply within the State."*

4.1.6 In addition, Section 86(1) (e) stipulates that –

*"The State Commission shall discharge following functions, namely - "promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of total consumption of electricity in the area of distribution licensee".*

4.1.7 Further, as per Section 61 of the EA 2003, the Commission is required to specify the terms and conditions for the determination of tariff, in accordance with the provisions of the Act and certain guiding factors. The Commission has notified the MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010 on June 7, 2010.

4.1.8 As per Regulation 7.1.(a) of MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010, project specific tariff shall be determined on case to case basis in case of Municipal Solid Waste based power projects.

4.1.9 As per the proviso to Regulation 7.2 of MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010, the financial principles as specified under Chapter 2 of the said Regulations, except



for capital cost and O&M cost, shall be ceiling norms while determining the project specific tariff. The relevant extract of the said Regulations is as under:

*“7.2 Determination of project specific tariff for generation of electricity from such renewable energy sources shall be in accordance with such terms and conditions as stipulated under relevant Orders of the Commission.*

*Provided that the financial norms as specified under Chapter-2 of these Regulations, except for capital cost and O&M cost, shall be ceiling norms while determining the project specific tariff.”*

4.1.10 The Commission has also issued Orders earlier in respect of determination of tariff and the procurement process for projects based on certain other renewable sources such as wind energy, non-fossil fuel based co-generation, biomass power, small hydel power and solar power. The Commission has kept in view the principles and methodology adopted in those Orders, as were relevant, to ensure consistency and certainty in the regulatory approach.

## **4.2 Premise for Development of Tariff Structure**

4.2.1 The Commission has studied the DPR and the Petition submitted by Petitioner, and critical analysis of the submissions has been carried out taking into consideration the regulatory framework outlined as per MERC RE Tariff Regulations, 2010 and to ensure the objective of promoting generation from said MSW based power project, which is the first of its kind project within Maharashtra and still at nascent stage of development. The tariff has been determined as per Regulation 8.2 of MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010.

4.2.2 The relevant extract of the said Regulation is given below:

*“8.2A petition for determination of project specific tariff shall be accompanied by such fee as may be determined by Regulations and shall be accompanied by;*

*a) Information in Forms 1.1, 1.2, 2.1 and 2.2 as the case may be, and as appended to these Regulations;*



- b) *Detailed project report outlining technical and operational details, site specific aspects, premise for capital cost and financing plan, etc.*
- c) *A Statement of all applicable terms and conditions and expected expenditure for the period for which tariff is to be determined.*
- d) *A statement containing full details of calculation of any subsidy and incentive received, due or assumed to be due from the Central Government and/or State Government. This statement shall also include the proposed tariff calculated without consideration of the subsidy and incentive.*
- e) *Any other information that the Commission requires the Petitioner to submit.”*

4.2.3 **Useful Life:** In accordance with Regulation 2.1 (ff) (f) of MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010, the Commission has considered the useful life of the project as 20 years from the COD.

4.2.4 **Levelling Tariff Design:** In accordance with Regulations 10.2 and 10.3 of MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010, the Commission has determined the levellised tariff for the Representative Case in respect of MSW based Projects. The relevant extract of above Regulation is given below:

*“10.2 For the purpose of levellised tariff computation, the discount factor equivalent to normative weighted average cost of capital shall be considered.*

*10.3 Levellisation shall be carried out for the ‘useful life’ of the Renewable Energy project while tariff shall be specified for the period equivalent to ‘Tariff Period’.* “

4.2.5 The assumptions and their rationale for input values in respect of project specific parameters have been elaborated in the subsequent Section.



## 5 PARAMETERS FOR TARIFF DETERMINATION

In accordance with Regulation 9.1 of MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010, the tariff for renewable energy projects shall be single-part tariff consisting of following fixed cost components:

- a) Return on equity;
- b) Interest on loan capital;
- c) Depreciation;
- d) Interest on working capital;
- e) Operation and maintenance expenses;

The performance parameters and financial parameters are discussed in this section.

### 5.1 INSTALLED PLANT CAPACITY

5.1.1 SBSPL submitted that it has considered installed plant capacity of proposed MSW power project as 2.83 MW.

5.1.2 The Commission is of the view that the technology risk of design, selection of configuration, technology and sizing of capacity is required to be borne by SBSPL. Accordingly, the Commission has considered the installed capacity of 2.83 MW for the purpose of project specific tariff determination under this Order in accordance with the SBSPL's submissions and confirmation in this respect.

### 5.2 FUEL INPUT, BIOGAS GENERATION AND ITS COMPOSITION

5.2.1 SBSPL submitted the fuel related assumptions such as Availability of the fuel and composition of the biogas (feed-in fuel). SBSPL submitted that 300 TPD of MSW would be available for processing, from which 100-200 m<sup>3</sup> of biogas per tonne of waste would be produced. The details of the composition of the fuel, i.e., waste and biogas is given below:

#### a. Composition of Waste

Particulars	Percent	TPD
Total Solids	50% - 55%	82.50
Moisture Content	40% - 45%	67.50
Total Volatile solids	65% - 70%	57.75
Biodegradation Volatile Solids	60 % - 65%	37.54



**b. Composition of Biogas**

<b>Constitute</b>	<b>Content</b>
Methane	55-70% by volume
Carbon dioxide	30-45% by volume
Hydrogen sulphide	200-4000 ppm
Energy content of AD gas product	20-25MJ/standard m <sup>3</sup>
Energy content of CH <sub>4</sub> per ton MSW	167-373MJ/Ton MSW

5.2.2 SBSPL submitted that the Gross Calorific value (GCV) of the Biogas generated from MSW is 5000 kcal/m<sup>3</sup>.

5.2.3 In this context, as ruled under Para 3.3 of this Order, the Commission opines that the technology risk of estimation of biogas generation and consequent electricity generation is required to be borne by SBSPL, and the risk of lower generation or sub-optimal biogas generation cannot be passed on to distribution licensee/consumers at later stage. The Commission has noted SBSPL's submissions and confirmation in this respect and the same has been considered for the purpose of the Order.

**5.3 CAPACITY UTILISATION FACTOR**

5.3.1 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). SBSPL submitted that considering the availability of MSW from Solapur Municipal Corporation, the Capacity Utilization Factor given in the DPR as 78.90 % over the useful life of the project may be considered as reasonable for the purpose of tariff computation.

5.3.2 The Commission is of the view that the operational risk of MSW power plant operations is required to be borne by SBSPL. The risk of lower generation and consequent lower capacity utilisation factor cannot be passed on to the distribution licensee/consumers at later stage. Similarly, benefit of excess generation beyond threshold value of CUF shall be allowed to be retained by SBSPL. Accordingly, the Commission has considered the capacity utilization factor of 78.9% for the purpose of project specific tariff



determination under this Order in accordance with SBSPL's submissions and confirmation in this respect.

#### **5.4 AUXILIARY CONSUMPTION FACTOR**

5.4.1 Auxiliary Consumption is another key performance parameter for any power plant and is dependent on the size of plant and plant configuration. The auxiliary consumption factor in respect of the said Project (as per DPR information) varies from 12.32 % to 17%, with most indicating auxiliary consumption requirement to the extent of 17%.

5.4.2 As highlighted under para 3.8 of this Order, the Commission has considered auxiliary consumption factor of 12.72%, for the purpose of project specific tariff determination under this Order.

#### **5.5 MSW FUEL AVAILABILITY**

5.5.1 It is important to ensure the long term availability of MSW fuel of desired quantity and quality for the sustainable energy generation from MSW. The energy that can be generated using MSW as fuel depends on properties such as moisture content, calorific value and non-combustible and biodegradable materials in the MSW.

5.5.2 The Price of MSW is the key factor influencing the variable Cost of Generation (COG) and thereby the project economics. SBSPL has submitted that as per the Concession Agreement, SMC has to arrange to supply MSW free of cost.

5.5.3 As ruled under Para 3.1 of this Order, it is the responsibility of SBSPL to enter into appropriate commercial arrangement with SMC to ensure availability of reliable supply of MSW on long term basis. The risk of fuel supply availability – in terms of quantity and quality - cannot be passed on to the distribution licensee and consumers at later stage. Further, the Commission notes that such MSW fuel supply is made available free of cost. Accordingly, the Commission has not considered any variable cost towards MSW fuel supply for the purpose of tariff determination under this Order.



## 5.6 CAPITAL COST

5.6.1 SBSPL submitted that the Capital Cost of the project has been considered as per the project cost estimate submitted in the DPR. SBSPL has considered a Capital Cost of Rs 3841 lakh for setting up the 2.83 MW MSW power project. Out of the total cost, approximately Rs 475 lakh is accounted for by pre-treatment of the MSW before passing it to digester chamber. The item-wise detailed break up of Capital Cost submitted by SBSPL is as under:

**Table: Summary of the Capital Cost proposed by SBSPL (Rs. Lakh)**

Sr. No.	Item Description	Units	Pretreatment	Digestion	Power Generation	Miscellaneous	Total
1	Land & Site Development, Buildings & Civil Works	Rs L	72.04	447.95	49.68	173.88	743.54
2	Plant & Machinery	Rs L	288.69	1306.32	678.42	0.00	2273.42
3	Process & Technology Transfer	Rs L	56.00	224.00	0.00	0.00	280.00
4	Cost of consumables	Rs L	0.00	70.00	0.00	0.00	70.00
5	Insurance (3% on Civil & Plant)	Rs L	10.82	52.63	21.84	5.22	90.51
6	Interest During Construction (IDC)	Rs L	26.71	131.31	46.68	11.15	215.84
7	Pre Operative Costs	Rs L	7.13	35.02	12.45	2.97	57.57
8	Contingencies	Rs L	5.20	25.55	9.08	2.17	42.01
9	Working Capital Margin	Rs L	8.51	41.84	14.87	3.55	68.78
10	<b>Total Capital Cost</b>	<b>Rs L</b>	<b>475.10</b>	<b>2334.62</b>	<b>833.02</b>	<b>198.94</b>	<b>3841.68</b>

5.6.2 SBSPL has not considered the cost associated with the last two processes, namely, dewatering of digested residue and refining/post composting, for tariff computations, since these processes do not essentially form a part of power plant components.

5.6.3 SBSPL submitted that the cost of pre-treatment has been included in the Capital Cost, because the success of the project largely depends on the quality of MSW. Hence, a provision has been made for an extensive pre-treatment segment, which would include shredders, magnetic separators, etc., to enable efficient and effective source segregation. This would enhance the quality of input and directly enhance the gas generation. Thus, these costs, are inherently being incurred for the efficiency of power generation, and are included in the calculations.



5.6.4 The Commission notes that the Capital Cost of the Project includes plant and machinery, civil works, erection and commissioning, financing costs, preliminary and pre-operative expenses, interest during construction, and evacuation infrastructure up to inter-connection point. As per the proviso to Regulation 12.1, SBSPL has submitted the detail breakup of the capital cost items as specified in Regulation 8 of the MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010, as reproduced below:

*“12.1 The norms for the Capital Cost as specified in the subsequent technology specific chapters shall be inclusive of all capital work including plant and machinery, civil work, erection and commissioning, financing costs, preliminary and pre-operative expenses, and interest during construction, and evacuation infrastructure up to inter-connection point.”*

*Provided that for project specific tariff determination, the generating company shall submit the break-up of capital cost items along with its petition in the manner specified under Regulation 8.”*

5.6.5 As highlighted under Para 3.4 of this Order, it is not the intention of the Commission to scrutinise and approve each element of Capital Cost under project specific preferential tariff determination route as per MERC RE Tariff Regulations, 2010. Further, while entire technology risk entailing selection of capacity, configuration, technology, etc., is borne by SBSPL, the Commission wishes to only ensure that the Capital Cost is optimal and reasonable so that undue cost burden is not passed on to the consumers through preferential tariff under project specific tariff determination route.

5.6.6 Accordingly, under para 3.4 of this Order, the Commission has extensively dealt with the aspects of exclusion of capital cost components pertaining to pre-treatment facility and inclusion of capital cost components pertaining to post-treatment facilities. Thus, for the purpose of tariff determination for proposed MSW power project of SBSPL, the Commission has considered capital cost of Rs 3614 Lakh (Rs 1277 Lakh/MW).

5.6.7 Further, the Commission directs SBSPL to submit its audited accounts and audited Statement of Capital Cost within three months from achievement of Commercial Operation of the Project. Any deviation in excess of 5% of the



Capital Cost as considered under this Order shall be dealt with in accordance with provisions outlined under MERC RE Tariff Regulations, 2010.

## 5.7 DEBT EQUITY RATIO

5.7.1 SBSPL has considered debt:equity ratio of 70:30 for determination of tariff for MSW power project as specified in RE Tariff Regulations, 2009 notified by CERC.

5.7.2 The Commission has considered the debt equity ratio of 70:30 as specified in Regulation 13 of the MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010. The relevant extract from the regulation is given as follows:

*“13.2 For project specific tariff, the following provisions shall apply: If the equity actually deployed is more than 30% of the capital cost, equity in excess of 30% shall be treated as normative loan. Provided that where equity actually deployed is less than 30% of the capital cost, the actual equity shall be considered for determination of tariff; ....”*

5.7.3 The debt and equity component accordingly works out as under:

**Table: Debt Equity Component**

Sr. No.	Description	At the rate (%) of Capital Cost	As per SBSPL (Rs. Lakh)	Commission (Rs. Lakh)
1.	Debt	70%	2688.70	2530.21
2.	Equity	30%	1152.30	1084.38
	<b>Total</b>	<b>100%</b>	<b>3841.00</b>	<b>3614.59</b>

## 5.8 DEPRECIATION

5.8.1 SBSPL submitted that the depreciation of plant and machinery has been computed at the rate of 7% per annum for the first 10 years of the tariff period and the remaining depreciable amount has been spread over the remaining useful life of the project. SBSPL has considered 20 years as the useful life of the plant and machinery.

5.8.2 The Commission has computed depreciation at the rate of 7% per annum for the first ten years and remaining depreciation has been spread over the



remaining useful life of the project, i.e., for 10 years in accordance with Regulation 15 of the MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010. The relevant extract from the above said Regulation is given as under :

*“15.1 The value base for the purpose of depreciation shall be the Capital Cost of the asset admitted by the Commission. The salvage value of the asset shall be considered as 10% and depreciation shall be allowed up to maximum of 90% of the Capital Cost of the asset.*

*15.2 Annual Depreciation shall be based on ‘Differential Depreciation Approach’ using ‘Straight Line Method’, over two distinct periods comprising loan tenure and period beyond loan tenure over useful life. The depreciation rate for the first 10 years of the Tariff Period shall be 7% per annum and the remaining depreciation shall be spread over the remaining useful life of the project from 11th year onwards.*

*15.3 Depreciation shall be chargeable from the first year of commercial operation.*

*Provided that in case of commercial operation of the asset for part of the year, depreciation shall be charged on pro rata basis.”*

## **5.9 OPERATION & MAINTENANCE EXPENSES**

5.9.1 SBSPL has projected O&M expenses at 7.2% of Capital Cost. In support of its claim for O&M expenses, the Petitioner has referred to the Technical Memorandum on Investment and Funding Strategies prepared under National Master Plan for the development of Waste to Energy, where the comparison of the available technological options in terms of capital cost, O&M cost, and project life was done. The summary of O&M expenses for different types of waste to energy technologies as given in the referred Technical Memorandum are reproduced below:



Financing Option	Unit	Capacity (1000 TPD)			Capacity (500 TPD)			Capacity (150 TPD)		
		Bio-methanation	Gasification	RDF	Bio-methanation	Gasification	RDF	Bio-methanation	Gasification	RDF
Project Life	Yrs	15	15	15	15	15	15	15	15	15
Capital Cost	Rs in lakh	10000	21904	6483	6000	13000	3890	1800	4600	1400
O & M	% of CC	8.5	7.43	13.54	8.33	6.5	13.5	9.44	6.5	13.57

5.9.2 SBSPL further submitted that O&M expenses consist of repair and maintenance expenses, insurance, establishment including employee expenses and administrative and general expenses. The Project will employ around 25 people during operation phase, who will be trained on the technicalities of operating the plant.

5.9.3 SBSPL further submitted that for the efficient operation of the plant, pre-treatment process, i.e., screening and segregating of waste, is necessary. Thus, due to the considerable pre-treatment requirement, the O&M cost is slightly higher than the other fuel based renewable energy project. Therefore, SBSPL has considered O&M expenses as 7.20% of Capital Cost with an annual escalation of 5.72% per annum for the purpose of tariff determination. The estimate of O&M expense as submitted by SBSPL for the first year is given as under:

Sl.	Particulars	Units	Values
1.	O&M Rate for first year	%	7.2
2.	O&M expense per annum	Rs. Lakh	276.55
3.	Normative O & M expenses	Rs. lakh /MW	97.72
4.	Escalation Rate from second year onwards	%	5.72

5.9.4 In accordance with the rationale provided under Para 3.4 and Para 3.8 of this Order for non-inclusion of capital cost and operating costs pertaining to pre-treatment facilities, the Commission has considered O&M expenses of 6% of Capital Cost for the first year of operation with escalation factor of 5.72% per annum for the purpose of tariff determination.



## 5.10 INTEREST ON TERM LOAN

5.10.1 SBSPL submitted that Bank of Baroda has sanctioned loan amount of Rs. 2249.58 lakh at an interest rate of 14.75% per annum. SBSPL added that in the absence of State-specific Tariff Regulations for RE technologies, it has considered interest rate as specified in CERC Order of Petition No.284/2009 (Suo Motu) dated December 3, 2009 which is stated to be 14.29% (average SBI PLR of 12.79% + 150 basis points)

5.10.2 As per Regulation 14 of the MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010, the interest rate shall be equivalent to average State Bank of India Advance Rate (SBAR) prevalent during previous year plus 150 basis points. The relevant extract of the said Regulation is as under:

*“The loans arrived at in the manner indicated above shall be considered as gross normative loan for calculation of 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.*

*For the purpose of computation of tariff, the normative interest rate shall be considered as average of State Bank Advance Rate (SBAR) prevalent during the previous year plus 150 basis points.*

*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.”*

5.10.3 However, the Commission notes that reporting requirements of benchmark interest rates have undergone changes recently, with Banks required to publish Base Rates instated of Prime Lending Rate (PLR) or State Bank Advance Rate (SBAR). Hence, the Commission has considered SBAR prevalent at the time of filing of original petition (Oct 2009), which was 11.75% plus 150 basis points, amounting to 13.25% as interest rate for the purpose of tariff determination under this Order.



5.10.4 Further, in accordance with Regulation 14, the Commission has considered loan repayment tenure of 10 years from first year of commercial operation of the project and annual repayment equivalent to annual depreciation has been considered for the purpose of tariff determination.

## 5.11 INTEREST ON WORKING CAPITAL

5.11.1 SBSPL submitted that it has computed the working capital in accordance with the CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2009 considering the following:

- (i) Operation and maintenance cost for one month ;
- (ii) Receivables equivalent to 2 months of energy charges for the sale of electricity calculated on the normative CUF and ;
- (iii) Maintenance spares @15% of operation and maintenance expense.

5.11.2 SBSPL submitted that it has considered Interest on Working Capital at the rate of 13.79% as mentioned in CERC Order of Petition No.284/2009 (Suo Motu) dated December 03, 2009.

5.11.3 In accordance with Regulation 17.1 of MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010 the Commission has considered the following elements for determining the working capital requirement:

- (i) Operation & Maintenance expenses for one month
- (ii) Receivables equivalent to 2 (Two) months of energy charges for sale of electricity calculated on the normative Capacity Utilisation Factor (CUF);
- (iii) Maintenance spare @ 15% of operation and maintenance expenses.

5.11.4 Further, while computing the interest on working capital for the purpose of tariff determination under this Order, the Commission has considered the interest rate of 12.75%, which is equivalent to the SBI Advance Rate (SBAR) prevalent at the time of filing of Petition (i.e., 11.75%) plus 100 basis points, in accordance with Regulation 17.3, as reproduced below:

*“17.3 Interest on Working Capital shall be at interest rate equivalent to average State Bank Advance Rate (SBAR) during the previous year plus 100 basis points.”*



## 5.12 RETURN ON EQUITY (ROE)

5.12.1 SBSPL submitted that it has computed Return on Equity (RoE) on the base equity, i.e., 30 % of the Capital Cost. SBSPL has considered normative RoE in accordance with Regulation 16 of CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2009, as under:

- (i) Pre-tax 19% per annum for the first 10 years.
- (ii) Pre-tax 24% per annum from 11<sup>th</sup> years onwards.

5.12.2 The Commission has considered normative pre-tax RoE rate of 19% for initial 10 years and pre-tax RoE rate of 24% for the remaining period of useful life in accordance with Regulation 16.2 of the MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010.

## 5.13 DISCOUNT RATE

5.13.1 SBSPL submitted that it has considered the discount rate as per the CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2009 to calculate the levellised tariff, which is equivalent to Weighted Average Cost of Capital.

5.13.2 The Commission notes that as per Regulations 10.2 and 10.3 of MERC RE Tariff Regulations, 2010, the discount rate for the purpose of levellised tariff computation shall be equivalent to normative weighted average cost of capital and further that the levellisation shall be carried out for useful life of the project. The 'useful life' in case of Municipal Waste based power project is 20 years as per Regulation 2.1 (ff) (f) and Tariff of the MERC RE Tariff Regulations, 2010. The relevant extract of the said Regulations is as under:

*“10.2 For the purpose of levellised tariff computation, the discount factor equivalent to normative weighted average cost of capital shall be considered.*

*10.3 Levellisation shall be carried out for the 'useful life' of the Renewable Energy project while tariff shall be specified for the period equivalent to 'Tariff Period.'”*



5.13.3 Accordingly, the Commission has considered discount factor of 15.73% for the purpose of computation of levellised tariff under this Order.

5.13.4 Summary of various parameters and assumptions thereof covering capital cost, financial parameters, operating parameters and performance parameters, as considered for the purpose of Project Specific Tariff determination under this Order is presented in the following table:



**Table : Summary of Parameters and Assumptions**

S. No.	Assumption Head	Sub-Head	Sub-Head (2)	Unit	As per Petitioner	Approved by Commission
					Incl. Pre-Treatment and excl. post-treatment	Excluding Pre-treatment but incl. post treatment
1	<b>Power Generation</b>					
		<u>Capacity</u>				
			Installed Power Generation Capacity	MW	2.83	2.83
			Capacity Utilization Factor	%	78.90%	78.90%
			Auxiliary Consumption		17.00%	12.72%
			Useful Life	Years	20	20
2	<b>Project Cost</b>					
		Capital Cost	Power Plant Cost	Rs Lacs	3,841.00	3,614.59
3	<b>Financial Assumption</b>					
			Tariff Period	Years	20	20
		<u>Debt: Equity</u>				
			Debt	%	70%	70%
			Equity	%	30%	30%
			Total Debt Amount	Rs Lacs	2688.70	2530.21
			Total Equity Amount	Rs Lacs	1152.30	1084.38
		<u>Debt Component</u>				
			Loan Amount	Rs Lacs	2688.70	2530.21
			Repayment Period(incl. Moratorium)	years	10	10
			Interest Rate	%	14.29%	13.25%
		<u>Equity Component</u>				
			Equity amount	Rs Lacs	1,152.30	1,084.38
			Return on Equity for first 10 years	% p.a	19.00%	19.00%
			RoE Period	Year	10	10
			Return on Equity 11th year onwards	% p.a	24.00%	24.00%
			Discount Rate (equiv. to WACC) 11th year onwards		16.45%	15.73%
4	<b>Sale of Compost</b>	Compost				
			Quantum of Generation and sale of Compost	TPD	45.00	45.00
			Operating no. of days per annum	days	330.00	330.00
			Rate for sale of Compost	Rs/tonne	1,000.00	1,000.00
			Share of revenue with Electricity Consumers	%	66.7%	66.7%
5	<b>Depreciation</b>					
		<u>Depreciation</u>				
			Depreciation Rate for first 10 years	%	7.00%	7.00%
			Depreciation Rate 11th year onwards	%	2.00%	2.00%
			Years for 7% rate		10	10
6	<b>Working Capital</b>					
		<u>For Fixed Charges</u>				
			O&M Charges	Months	1	1
			Maintenance Spare (% of O&M expenses)		15%	15%
			Receivables for Debtors	Months	2	2
		<u>For Variable Charges</u>				
			Interest On Working Capital	%	13.79%	12.75%
7	<b>Operation &amp; Maintenance</b>					
			power plant (FY 10-11)		276.55	216.88
			Total O & M Expenses Escalation	%	5.72%	5.72%



## 5.14 TARIFF RATE AND OTHER CONDITIONS

5.14.1 Based on the parameters and assumptions and methodology for project specific tariff determination as outlined under earlier paragraphs, the Commission hereby determines the various Annual Fixed Charge components of tariff over the useful life of the Project as outlined under **Annexure-1** of this Order.

5.14.2 **Further, the Commission hereby determines the Levellised Tariff for the said MSW based power plant of SBSPL as Rs 4.88 per kWh, which shall be applicable over a period of 20 years.**

5.14.3 The above tariff shall be applicable for supply of electricity from the said MSW power project of SBSPL for supply to any distribution licensee within Maharashtra subject to the conditions set out below:

- a) The tariff and structure shall be firm, and will not vary with exchange rate variations or on account of changes in law or in taxes.
- b) As outlined under para 5.6.7, the Commission directs SBSPL to submit its audited accounts and audited Statement of Capital Cost within three months from achievement of Commercial Operation of the Project. Any deviation in excess of 5% of the Capital Cost as considered under this Order shall be dealt with in accordance with provisions outlined under MERC RE Tariff Regulations, 2010.
- c) Similarly, in case any capital subsidy, grant or generation based incentive from Central Government or State Government is available or availed by the said Project in future, the benefit of the same will have to be passed on by way of reduction in tariff in accordance with Regulation 22 of MERC RE Tariff Regulations, 2010.
- d) As ruled under Paras 3.1, 3.2 and 3.3, the technology risk and MSW fuel supply availability risk will have to be borne by SBSPL. Accordingly, the risk of sub-optimal biogas generation and consequent lower electricity generation cannot be passed on to distribution licensee/consumers at later stage. Similarly, benefit of excess generation over and above the normative capacity utilisation factor above 78.90% considered for the purpose of tariff determination under this Order shall be available to SBSPL. The tariff for such excess generation above normative CUF shall be same as determined under this Order.



## **6 GUIDELINES AND PRINCIPLES FOR ENERGY PURCHASE AGREEMENT (EPA)**

The Commission notes that one of the prayers seeks to approve supply of electricity to MSEDCL, and the Petitioner has also enclosed letters from MSEDCL, BEST and RInfra-D confirming their willingness to purchase electricity from the said MSW power project at the tariff rate to be determined by the Commission. Accordingly, the Commission hereby rules that Project Specific Tariff determined under this Order shall be applicable for supply of electricity from the said MSW power project to any of the distribution licensee within Maharashtra.

The following principles/guidelines may be considered by SBSPL and the licensee while entering into Energy Purchase Agreement.

### **6.1 TENURE OF EPA**

- 6.1.1 The tenure of the EPA shall be for a period, which is co-terminus with the period of Agreement entered into by the Municipal Corporation/Local Authority for the supply of waste. In any case, the tenure of the EPA should not be more than useful life of the project, which is stated as 20 years. Accordingly, the obligations to purchase and sell will remain on the respective parties to EPA for the duration of 20 years.

### **6.2 EVACUATION FACILITIES**

- 6.2.1 The Interconnection Point for interfacing the said Power plant with the Grid shall be the line isolator on outgoing feeder on HV side of the generator transformer situated within the power plant premises. Further, the concerned licensee shall be responsible to develop evacuation infrastructure beyond Inter-connection Point and to ensure evacuation of power from said MSW power project in accordance with the Regulation 17.1 for Grid Connectivity Framework for renewable energy projects as outlined under MERC (Renewable Purchase Obligations, its compliance and REC framework Implementation) Regulations, 2010.

### **6.3 APPROVALS, CONSENTS AND COMPLIANCE WITH GUIDELINES OF COMPETANT AUTHORITY / MNRE**

- 6.3.1 It shall be the responsibility of the Licensee to verify and ensure that all required consents, approvals and clearances for setting up of MSW power



project have been obtained by the Petitioner from the competent authorities and all other conditions outlined by Competent Authority/MNRE Guidelines have been adhered to by project developer before entering into EPA with it. The power plant installation should incorporate adequate systems/equipment for power conditioning and ensure grid quality supply, and comply with extant Regulations regarding Grid Connectivity standards, Indian Electricity Grid Code, 2010 (IEGC, 2010) and MERC (State Grid Code) Regulations, 2006 and amendments thereof.

#### **6.4 PURCHASE OF ENERGY UNITS**

6.4.1 The purchase of energy units by the Licensee from the Project under the EPA shall be in the nature of firm purchase. There shall be no restriction on the supply of energy units by the project developer to the Licensee, except for force majeure conditions and despatch instructions issued by SLDC from time to time. Further, the Project must follow grid discipline.

#### **6.5 BILLING AND PAYMENT**

6.5.1 The Project developer shall raise a monthly energy bill based on the joint meter reading taken by the developer and the Licensee (or STU) at the end of each month. The due date for the payment of the bill by the Licensee shall be 60 days from the date of the bill. In case of any delay in payment beyond the due date, the Project developer shall be entitled for the late payment surcharge, i.e., the interest on the amount of payment delayed at the rate of 1.25% per month as addressed in Regulation 20.1 of the MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010.

#### **6.6 PAYMENT THROUGH LETTER OF CREDIT**

6.6.1 In view of Regulation 19 of the MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010, the Parties may mutually discuss and agree to arrange for payment through Letter of Credit mechanism in accordance with following conditions:

*“19.1 For payment of bills of the generating company through letter of credit, a rebate of 2% shall be allowed.*



*19.2 Where payments are made other than through letter of credit within a period of one month of presentation of bills by the generating company, a rebate of 1% shall be allowed”.*

## **6.7 DEFAULT PROVISIONS LEADING TO THIRD PARTY SALE**

- 6.7.1 In case of any default by the Licensee, the Petitioner shall be entitled to sell energy to third party consumers or to any other entity other than defaulting licensee, subject to compliance with the Open Access Regulations as may be applicable from time to time. The STU and Licensees shall facilitate such third party sale and enter into an Energy Transmission/Wheeling Agreement with the Project developer to enable such third party sale.
- 6.7.2 In the case of sale of energy to third party consumers under circumstances as above, subject to the relevant Open Access Regulations, the transmission charges and wheeling charges and transmission loss and wheeling loss as may be determined by the Commission separately from time to time, shall be applicable.

## **6.8 TAXES AND DUTIES**

- 6.8.1 In accordance with Regulation 23.1 of MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010, the tariff shall be exclusive of taxes and duties on generation and sale of electricity from renewable energy project as may be levied by the Appropriate Government. The same shall be allowed as pass through on actual incurred basis.

## **6.9 SHARING OF CDM BENEFITS**

- 6.9.1 As per Regulation 21.1 of the MERC (Terms & Conditions for Determination of RE Tariff) Regulations, 2010, all risks, costs and efforts associated with the availing of carbon credits shall be borne by SBSPL. Further, the entire proceeds of carbon credit from approved CDM project, if any, shall be retained by SBSPL.



## 7 APPLICABILITY OF THIS ORDER

- 7.1.1 This Order is applicable only for the specific project (Case No. 65 of 2009) filed by Petitioner (SBSPL) and project specific tariff has been determined in accordance with Regulations 7 and 8 of MERC RE Tariff Regulations, 2010 and should not be construed to be applicable for any other MSW based power project within Maharashtra.
- 7.1.2 The tariff and structure for other MSW power projects, if any, can be determined on case-to-case basis through a separate regulatory process in accordance with the MERC RE Tariff Regulations, 2010.
- 7.1.3 The Petitioner and Distribution Licensees shall enter into EPA in accordance with the principles set out in Section 6 of this Order and submit the copy of the same to the Commission within four months from date of issuance of this Order.

The Commission hereby acknowledges the contributions made by Maharashtra Energy Development Agency (MEDA), Solapur Municipal Corporation (SMC) and Ministry of New and Renewable Energy (MNRE) for their valuable inputs to the regulatory process.

With this Order, the Commission disposes of SBSPL's Petition in Case No. 65 of 2009.

Sd/-  
(V. L. Sonavane)  
Member

Sd/-  
(S. B. Kulkarni)  
Member

Sd/-  
(V. P. Raja)  
Chairman



(K.N. Khawarey)  
Secretary, MERC



### Annexure-1 : Summary of Annual Fixed Charge and Determination of Levellised Tariff

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		2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83	2.83
Net Generation	MU		17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07	17.07

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		216.88	229.28	242.40	256.26	270.92	286.42	302.80	320.12	338.43	357.79	378.25	399.89	422.76	446.94	472.51	499.54	528.11	558.32	590.25	624.02
Depreciation	Rs Lakh		253.02	253.02	253.02	253.02	253.02	253.02	253.02	253.02	253.02	253.02	72.29	72.29	72.29	72.29	72.29	72.29	72.29	72.29	72.29	72.29
Interest on term loan	Rs Lakh		318.49	284.97	251.44	217.91	184.39	150.86	117.34	83.81	50.29	16.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working Capital	Rs Lakh		28.18	28.10	28.06	28.05	28.09	28.17	28.29	28.47	28.69	28.97	26.93	28.06	29.25	30.51	31.84	33.25	34.74	36.31	37.98	39.74
Return on Equity	Rs Lakh		206.03	206.03	206.03	206.03	206.03	206.03	206.03	206.03	206.03	206.03	260.25	260.25	260.25	260.25	260.25	260.25	260.25	260.25	260.25	260.25
<b>Total Fixed Cost</b>	<b>Rs Lakh</b>		<b>1022.60</b>	<b>1001.40</b>	<b>980.94</b>	<b>961.28</b>	<b>942.45</b>	<b>924.50</b>	<b>907.48</b>	<b>891.45</b>	<b>876.46</b>	<b>862.58</b>	<b>737.72</b>	<b>760.49</b>	<b>784.55</b>	<b>810.00</b>	<b>836.89</b>	<b>865.33</b>	<b>895.39</b>	<b>927.17</b>	<b>960.77</b>	<b>996.29</b>
Quantum of Compost (generation & Sale) @ 45 tpd	tonnes p.a.		14850	14850	14850	14850	14850	14850	14850	14850	14850	14850	14850	14850	14850	14850	14850	14850	14850	14850	14850	14850
Sale price of Compost	Rs/tonne		1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Revenue from sale of Compost	Rs Lakh		148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5	148.5
Sharing of revenue with Electricity Co	Rs Lakh		99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00	99.00
<b>Net Fixed Cost</b>	<b>Rs Lakh</b>		<b>923.60</b>	<b>902.40</b>	<b>881.94</b>	<b>862.28</b>	<b>843.45</b>	<b>825.50</b>	<b>808.48</b>	<b>792.45</b>	<b>777.46</b>	<b>763.58</b>	<b>638.72</b>	<b>661.49</b>	<b>685.55</b>	<b>711.00</b>	<b>737.89</b>	<b>766.33</b>	<b>796.39</b>	<b>828.17</b>	<b>861.77</b>	<b>897.29</b>

Levellised 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
O&M expn	Rs/kWh	<b>1.76</b>	1.27	1.34	1.42	1.50	1.59	1.68	1.77	1.88	1.98	2.10	2.22	2.34	2.48	2.62	2.77	2.93	3.09	3.27	3.46	3.66
Depreciation	Rs/kWh	<b>1.28</b>	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42
Int. on term loan	Rs/kWh	<b>0.98</b>	1.87	1.67	1.47	1.28	1.08	0.88	0.69	0.49	0.29	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Int. on working capital	Rs/kWh	<b>0.17</b>	0.17	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.16	0.16	0.17	0.18	0.19	0.19	0.20	0.21	0.22	0.23
RoE	Rs/kWh	<b>1.27</b>	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52
<b>Total COG</b>	<b>Rs/kWh</b>	<b>5.46</b>	<b>5.99</b>	<b>5.87</b>	<b>5.75</b>	<b>5.63</b>	<b>5.52</b>	<b>5.42</b>	<b>5.32</b>	<b>5.22</b>	<b>5.13</b>	<b>5.05</b>	<b>4.32</b>	<b>4.45</b>	<b>4.60</b>	<b>4.74</b>	<b>4.90</b>	<b>5.07</b>	<b>5.24</b>	<b>5.43</b>	<b>5.63</b>	<b>5.84</b>
Less Share of Compost Sale revenue	Rs/kWh	<b>0.58</b>	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
<b>Net COG</b>	<b>Rs/kWh</b>	<b>4.88</b>	<b>5.41</b>	<b>5.29</b>	<b>5.17</b>	<b>5.05</b>	<b>4.94</b>	<b>4.84</b>	<b>4.74</b>	<b>4.64</b>	<b>4.55</b>	<b>4.47</b>	<b>3.74</b>	<b>3.87</b>	<b>4.02</b>	<b>4.16</b>	<b>4.32</b>	<b>4.49</b>	<b>4.66</b>	<b>4.85</b>	<b>5.05</b>	<b>5.26</b>

Discount Factor			1	0.864	0.747	0.645	0.558	0.482	0.416	0.360	0.311	0.269	0.232	0.201	0.173	0.150	0.129	0.112	0.097	0.084	0.072	0.062
<b>Levellised Tariff</b>	<b>4.88</b>	<b>Rs/Unit</b>																				



## APPENDIX 1

### List of Persons who attended the Technical Validation Session held on November 16, 2009

Sr.No	Name of Person / Official	Designation	Institution
1.	Shri Suhas Bandh	Managing Director	M/s. Solapur Bioenergy Systems Pvt. Ltd.
2.	Shri Sarang Bandh	Director	M/s. Solapur Bioenergy Systems Pvt. Ltd.
3.	Shri Surendra Pimparkhedkar	Asst. Fellow	World Institute of Sustainable Energy (WISE)
4.	Shri Indrapreet Chadda	Manager (Finance & Accounts)	M/s. Solapur Bioenergy Systems Pvt. Ltd.
5.	Aarti Munchandi	Deputy Manager	M/s. Solapur Bioenergy Systems Pvt. Ltd.
6.	Shri Sunil Mayabhate	Head (Business Development)	M/s. Solapur Bioenergy Systems Pvt. Ltd.



## APPENDIX 2.1

### List of attendees for Hearing held on March 31, 2010

Sr.No	Name of Person / Official	Designation	Institution
1.	Riddhi Protim Lahiri	Research Associate	World Institute of Sustainable Energy (WISE)
2.	Shri Ranjeet Singh	Research Associate (Regulatory Affairs)	World Institute of Sustainable Energy (WISE)
3.	Aarti Munchandi	Deputy Manager	M/s. Solapur Bioenergy Systems Pvt. Ltd.
4.	Shri P.K. Bagewadikar	Junior Engineer	Solapur Municipal Corporation
5.	Shri Surendra Pimparkhedkar	Asst. Fellow	World Institute of Sustainable Energy (WISE)
6.	Shri Sunil Mayabhate	Head (Business Development)	M/s. Solapur Bioenergy Systems Pvt. Ltd.
7.	Shri S. A. Patil	Incharge General Manager	Maharashtra Energy Development Agency (MEDA)
8.	Shri N. G. Naru	Chief Engineer (Commercial)	Maharashtra State Electricity Distribution Company Ltd. (MSEDCL)
9.	Shri R. G. Sonawane	Senior Engineer (Commercial)	Maharashtra State Electricity Distribution Company Ltd. (MSEDCL)
10.	Shri M. S. Paradkar	Consultant	S.M.S. Infrastructure Ltd.
11.	Shri Ravi Mankar	Consultant	S.M.S. Infrastructure Ltd.
12.	Shri Rahul Ranade	Assistant Manager (Regulations)	The Tata Power Company
13.	Shri Abhinav Sharma	Executive (Regulations)	The Tata Power Company
14.	Shri Suhas Bandh	Managing Director	M/s. Solapur Bioenergy Systems Pvt. Ltd.
15.	Shri Sarang Bandh	Director	M/s. Solapur Bioenergy Systems Pvt. Ltd.
16.	Shri Indrapreet Chadda	Manager (Finance & Accounts)	M/s. Solapur Bioenergy Systems Pvt. Ltd.
17.	Shri N. V. Bhandari	Div. Engineer (Regulatory Cell)	BrihanMumbai Electric Supply & Transport Undertaking
18.	Shri N. P. Jagaldas	Supt. Engineer	BrihanMumbai Electric Supply & Transport Undertaking
19.	Shri Vinayak Rokde	Supt. Engineer	BrihanMumbai Electric Supply & Transport Undertaking



## APPENDIX 2.2

### List of attendees for Hearing held on April 17, 2010

S.No	Name of Person / Official	Designation	Institution
1.	Aarti Munchandi	Deputy Manager	M/s. Solapur Bioenergy Systems Pvt. Ltd.
2.	Shri R. G. Sonawane	Senior Engineer (Commercial)	Maharashtra State Electricity Distribution Company Ltd. (MSEDCL)
3.	Shri Sunil Mayabhate	Head (Business Development)	M/s. Solapur Bioenergy Systems Pvt. Ltd.
4.	Shri Surendra Pimparkhedkar	Asst. Fellow	World Institute of Sustainable Energy (WISE)
5.	Riddhi Protim Lahiri	Research Associate	World Institute of Sustainable Energy (WISE)
6.	Shri Ranjeet Singh	Research Associate (Regulatory Affairs)	World Institute of Sustainable Energy (WISE)
7.	Shri Sarang Bandh	Director	M/s. Solapur Bioenergy Systems Pvt. Ltd.
8.	Shri Suhas Bandh	Managing Director	M/s. Solapur Bioenergy Systems Pvt. Ltd.
9.	Shri Ranjit Singh Deol	Commissioner	Solapur Municipal Corporation
10.	Shri Indrapreet Chadda	Manager (Finance & Accounts)	M/s. Solapur Bioenergy Systems Pvt. Ltd.
11.	Shri N. V. Bhandari	Div. Engineer (Regulatory Cell)	BrihanMumbai Electric Supply & Transport Undertaking
12.	Shri M. S. Paradkar	Consultant	S.M.S. Infrastructure Ltd.
13.	Shri Ravi Mankar	Consultant	S.M.S. Infrastructure Ltd.
14.	Shri Vinayak Rokde	Supt. Engineer	BrihanMumbai Electric Supply & Transport Undertaking
15.	Shri S. A. Patil	Incharge General Manager	Maharashtra Energy Development Agency (MEDA)
16.	Shri M.S. Paruller		
17.	Shri O.P. Agarwal		
18.	Shri P. Rathod		



### APPENDIX 3

#### List of attendees for Public Hearing held on July 19, 2010

Sr .No	Name of Person / Official	Designation	Institution
1.	Shri Sunil Mayabhate	Head (Business Development)	M/s. Solapur Bioenergy Systems Pvt. Ltd.
2.	Shri Aarti Munchandi	Deputy Manager	M/s. Solapur Bioenergy Systems Pvt. Ltd.
3.	Shri Indrapreet Chadda	Manager (Finance & Accounts)	M/s. Solapur Bioenergy Systems Pvt. Ltd.
4.	Shri Anil Kale		ICRA Mgmt Consulting, Mumbai
5.	Shri Suhas Bandh	Director	M/s. Solapur Bioenergy Systems Pvt. Ltd.
6.	Shri Surendra Pimparkhedkar	Asst. Fellow	World Institute of Sustainable Energy (WISE)
7.	Shri M.P. Wadhe	Executive Engineer	Maharashtra State Electricity Distribution Company Ltd. (MSEDCL)
8.	Shri N. G. Naru	Chief Engineer (Commercial)	Maharashtra State Electricity Distribution Company Ltd. (MSEDCL)
9.	Shri Manish Modi	Director	Samruddhi Equities & Securities Services Ltd.
10.	Shri Abhinav Sharma	Executive (Regulation)	The Tata Power Company

