

MSW Discussion Paper 2023

# "DETERMINATION OF GENERIC TARIFF AND OTHER TERMS AND CONDITIONS FOR PROCUREMENT OF POWER BY DISTRIBUTION LICENSEES FROM MUNICIPAL SOLID WASTE TO ENERGY PROJECTS IN THE STATE OF GUJARAT"



# **GUJARAT ELECTRICITY REGULATORY COMMISSION**

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#### **INTRODUCTION**

The Gujarat Electricity Regulatory Commission (GERC or Commission) vide Order No. 4 of 2016 dated 10<sup>th</sup> November, 2016 had issued Generic Tariff Order for procurement of power by Distribution Licensees from Municipal Solid Waste (MSW) to Energy projects applicable for the Control Period up to March 31, 2019, the validity of which was extended up to March 31, 2021 vide *Suo-motu* Order dated October 23, 2017 in Petition 1654/2017.

The Commission intends to initiate the process for determination of generic tariff for the Control Period from the date of Order up to 31<sup>st</sup> March 2028, for procurement of power generated by the MSW Projects in the State of Gujarat by Distribution Licensees, under the powers conferred to it under Sections 61(h), 62(1)(a), and 86(1)(e) of the Electricity Act, 2003, and National Electricity Policy, 2005, and Tariff Policy, 2016.



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# List of Abbreviations

ABT	Availability Based Tariff
APPC	Average Power Purchase Cost
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
GEDA	Gujarat Energy Development Agency
GERC	Gujarat Electricity Regulatory Commission
GETCO	Gujarat Energy Transmission Corporation Limited
GUVNL	Gujarat Urja Vikas Nigam Limited
IoWC	Interest on Working Capital
KERC	Karnataka Electricity Regulatory Commission
KSERC	Kerala State Electricity Regulatory Commission
LOA	Letter of Award
MERC	Maharashtra Electricity Regulatory Commission
MNRE	Ministry of New and Renewable Energy
MoUD	Ministry of Urban Development
MPERC	Madhya Pradesh Electricity Regulatory Commission
MSW	Municipal Solid Waste
MYT Regulations	Multi-Year Tariff Regulations
PLF	Plant Load Factor
PPA	Power Purchase Agreement
REC	Renewable Energy Certificates
RPO	Renewable Purchase Obligation
RTU	Remote Terminal Unit
SERC	State Electricity Regulatory Commission
SLDC	State Load Despatch Centre
STU	State Transmission Utility
SWM	Solid Waste Management
TNERC	Tamil Nadu Electricity Regulatory Commission
TSERC	Telangana State Electricity Regulatory Commission
TITD	
ULB	Urban Local Body
WACC	Urban Local Body Weighted Average Cost of Capital
WACC WPD	Urban Local Body Weighted Average Cost of Capital Wind Project Developer



# **1 INTRODUCTION**

# 1.1 Background

In exercise of the powers conferred under Sections 3 (1), 61 (h), 62 (1) (a), and 86 (1) (e) of the Electricity Act, 2003 (Act), National Electricity Policy, 2005, and Tariff Policy, 2016 and all other powers enabling it in this behalf, the Gujarat Electricity Regulatory Commission (GERC or Commission) presents this Discussion Paper for determination of Generic Tariff and Other Terms and Conditions for procurement of power by Distribution Licensees from Municipal Solid Waste (MSW) to Energy Projects to be commissioned in the Control Period from to FY 2026-27. The Waste to Energy tariff proposed under this Discussion Paper is based on the broad principles contained under the (i) GERC (Multi Year Tariff) Regulations, 2016, ii) GERC (Procurement of Energy from Renewable Sources) Regulations, 2010, (Second amendment) Regulations, 2018 readwith GERC RPO (third amendment) Regulations 2022, and (iii) CERC (Terms and Conditions for Tariff Determination from Renewable Energy Sources) Regulations, 2020. While preparing this Discussion Paper, the GERC Municipal Solid Waste to Energy Tariff Order No. 4 of 2016 dated 10<sup>th</sup> November, 2016 has also been considered:

The Gujarat Waste to Energy Policy-2022 released by the State Government of Gujarat has also been considered while preparing this Discussion Paper. The Commission had issued the previous generic Tariff Order on 10<sup>th</sup> November, 2016, for procurement of power by Distribution Licensees from Waste to Energy projects in Gujarat. The Control Period of GERC Waste to Energy Tariff Order 2016 was originally till 31<sup>st</sup> March, 2019. The validity of the generic tariff for MSW projects was extended up to March 31, 2021 vide *Suo-motu* Order dated October 23, 2017 in Petition 1654/2017. The Commission has decided to initiate the determination of Generic Tariff and Other Terms and Conditions for procurement of power by Distribution Licensees from Municipal Waste to Energy Projects to be commissioned during the new Control Period through the MSW Tariff Order.

# 1.2 The Electricity Act, 2003

The following provisions of the Act provide the enabling legal framework for promotion of Renewable Sources of energy by the State Electricity Regulatory Commissions (SERCs):



**Section 61 (h)** of the Act provides that, while specifying the terms and conditions of determination of tariff, the Commission shall be guided by the objective of promotion of co-generation and generation of electricity from renewable sources of energy.

**Section 62 (1) (a)** of the Act provides for determination of tariff for supply of electricity by a Generating Company to a Distribution Licensee.

**Section 86 (1) (e)** of the Act mandates promotion of co-generation and generation of electricity from renewable sources of energy:

"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 licensee."

**Section 3 (1)** of the Act requires the Central Government to formulate, inter alia, the National Electricity Policy in consultation with the Central Electricity Authority (CEA) and State Governments for inter-alia, development of the renewable sources of energy. The provision is quoted below:

"The Central Government shall, from time to time, prepare the National Electricity Policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilisation of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy."

# 1.3 National Electricity Policy (NEP)

Clause 5.2.20 of the NEP stipulates the need for fully exploiting the feasible potential of non-conventional energy sources, as reproduced below:

"5.2.20 Feasible potential of non-conventional energy resources, mainly small hydro, wind and bio-mass would also need to be exploited fully to create additional power generation capacity. With a view to increase the overall share of non-conventional energy sources in the electricity mix, efforts will be made to encourage private sector participation through suitable promotional measures."

Clause 5.6.1 stipulates about the need for Technology Development and R&D on nonconventional energy systems, as reproduced below:

"Special efforts would be made for research, development demonstration and commercialisation of non-conventional energy systems. Such systems would need to meet international standards, specifications and performance parameters."



Clause 5.12 stipulates several conditions for promotion and harnessing of renewable energy sources. The salient features of the said provisions of NEP are reproduced below.

**5.12.1**: 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 non-conventional 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.

**5.12.2**: The Electricity Act, 2003, provides that co-generation and generation of electricity from non- conventional sources would be promoted by the SERCs by providing suitable measures for connectivity with the grid and sale of electricity to any person and also by specifying, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution licensee. Such percentage for purchase of power from non-conventional sources should be made applicable for the tariffs to be determined by the SERCs at the earliest. Progressively, the share of electricity Regulatory Commissions. Such purchase by distribution companies shall be through competitive bidding process. Considering the fact that it will take some time before non-conventional technologies compete, in terms of cost, with conventional sources, the Commission may determine an appropriate differential in prices to promote these technologies.

## 1.4 Tariff Policy (TP), 2016

In compliance with the Section (3) of the Act, the Central Government has notified the revised Tariff Policy on 28 January, 2016. The Tariff Policy elaborates the role of Regulatory Commissions, the mechanism for promoting renewable energy, the time-frame for implementation, etc. Clause 5.2 of the Tariff Policy provides as under:

"Provided also that the State Government can notify a policy to encourage investment in the State by allowing setting up of generating plants, including from renewable energy sources out of which a maximum of 35% of the installed capacity can be procured by the Distribution Licensees of that State for which the tariff may be determined under Section 62 of the Electricity Act, 2003."



Clause 6.4 of the Tariff Policy addresses various aspects associated with promoting and harnessing renewable sources of energy generation including co-generation from renewable energy sources, as reproduced below:

1) "Pursuant to provisions of Section 86(1)(e) of the Act, the Appropriate Commission shall fix a minimum percentage of the total consumption of electricity in the area of a distribution licensee for purchase of energy from renewable energy sources, taking into account availability of such resources and its impact on retail tariffs. Cost of purchase of renewable energy shall be taken into account while determining tariff by SERCs. Long term growth trajectory of Renewable Purchase Obligations (RPOs) will be prescribed by the Ministry of Power in consultation with MNRE.

*Provided that cogeneration from sources other than renewable sources shall not be excluded from the applicability of RPOs.* 

- (i) Within the percentage so made applicable, to start with, the SERCs shall also reserve a minimum percentage for purchase of solar energy from the date of notification of this policy which shall be such that it reaches 8% of total consumption of energy, excluding Hydro Power, by March 2022 or as notified by the Central Government from time to time.
- (ii) Distribution Licensee(s) shall compulsorily procure 100% power produced from all the Wasteto-Energy plants in the State, in the ratio of their procurement of power from all sources including their own, at the tariff determined by the Appropriate Commission under Section 62 of the Act.
- (iii) It is desirable that purchase of energy from renewable sources of energy takes place more or less in the same proportion in different States. To achieve this objective in the current scenario of large availability of such resources only in certain parts of the country, an appropriate mechanism such as Renewable Energy Certificate (REC) would need to be promoted. Through such a mechanism, the renewable energy based generation companies can sell the electricity to local distribution licensee at the rates for conventional power and can recover the balance cost by selling certificates to other distribution companies and obligated entities enabling the latter to meet their renewable power purchase obligations. The REC mechanism should also have a solar specific REC.
- (iv) Appropriate Commission may also provide for a suitable regulatory framework for encouraging such other emerging renewable energy technologies by prescribing separate technology based REC multiplier (i.e. granting higher or lower number of RECs to such emerging technologies for the same level of generation). Similarly, considering the change in prices of renewable energy



technologies with passage of time, the Appropriate Commission may prescribe vintage based REC multiplier (i.e. granting higher or lower number of RECs for the same level of generation based on year of commissioning of plant).

2) States shall endeavour to procure power from renewable energy sources through competitive bidding to keep the tariff low, except from the waste to energy plants. Procurement of power by Distribution Licensee from renewable energy sources from projects above the notified capacity, shall be done through competitive bidding process, from the date to be notified by the Central Government.

However, till such notification, any such procurement of power from renewable energy sources projects, may be done under Section 62 of the Electricity Act, 2003. While determining the tariff from such sources, the Appropriate Commission shall take into account the solar radiation and wind intensity which may differ from area to area to ensure that the benefits are passed on to the consumers.

- 3) The Central Commission should lay down guidelines for pricing intermittent power, especially from renewable energy sources, where such procurement is not through competitive bidding. The tariff stipulated by CERC shall act as a ceiling for that category.
- 4) In order to incentivize the Distribution Companies to procure power from renewable sources of energy, the Central Government may notify, from time to time, an appropriate bid-based tariff framework for renewable energy, allowing the tariff to be increased progressively in a back-loaded or any other manner in the public interest during the period of PPA, over the life cycle of such a generating plant. Correspondingly, the procurer of such bid-based renewable energy shall comply with the obligations for payment of tariff so determined.
- 5) In order to promote renewable energy sources, any generating company proposing to establish a coal/lignite based thermal generating station after a specified date shall be required to establish such renewable energy generating capacity or procure and supply renewable energy equivalent to such capacity, as may be prescribed by the Central Government from time to time after due consultation with stakeholders. The renewable energy produced by each generator may be bundled with its thermal generation for the purpose of sale. In case an obligated entity procures this renewable power, then the SERCs will consider the obligated entity to have met the Renewable Purchase Obligation (RPO) to the extent of power bought from such renewable energy generating stations.

Provided further that in case any existing coal and lignite based thermal power generating station, with the concurrence of power procurers under the existing Power Purchase



Agreements, chooses to set up additional renewable energy generating capacity, the power from such plant shall be allowed to be bundled and tariff of such renewable energy shall be allowed to be pass through by the Appropriate Commission. The Obligated Entities who finally buy such power shall account towards their renewable purchase obligations.

Provided also that scheduling and despatch of such conventional and renewable generating plants shall be done separately.

- 6) In order to further encourage renewable sources of energy, no inter-State transmission charges and losses may be levied till such period as may be notified by the Central Government on transmission of the electricity generated from solar and wind sources of energy through the inter-State transmission system for sale.
- 7) Appropriate Commission may provide regulatory framework to facilitate generation and sale of electricity from renewable energy sources particularly from roof-top solar system by any entity including local authority, Panchayat Institution, user institution, cooperative society, Non-Governmental Organization, franchisee or by Renewable Energy Service Company. The Appropriate Government may also provide complementary policy support for this purpose."

# 1.5 Government of Gujarat Waste to Energy Policy 2022

The Government of Gujarat notified the 'Waste to Energy Policy-2022' on 2<sup>nd</sup> November, 2022 for development of such projects in the State. Some important provisions of this Policy are listed below:

- This Policy came into force with effect from 2<sup>nd</sup> November, 2022 and will remain in operation for a period of five years, i.e., up to 1<sup>st</sup> November, 2027.
- The Policy is intended to facilitate and promote utilization of MSW for generation of electricity at affordable cost in a sustainable manner, and in the process contribute to Swachh Bharat Abhiyan.
- Gujarat has 8 Municipal Corporations and 162 Municipalities and the solid waste generated in these urban areas could support power plant of 100 MW capacity.
- The Developers may set up Power Plant utilizing MSW for their captive use, for sale of electricity to third party or to obligated entities to meet their Renewable Purchase Obligation (RPO) as specified by the GERC from time to time.
- The Developers of Power Projects, based on MSW, may select eligible site in proximity to the landfill sites or any other suitable land, in consultation with the concerned Authorities like Urban Development and Urban Housing Department, Gujarat Urban Development



Company, Municipal Corporations, Urban Development Authorities, Municipalities, etc., as the case may be. For this purpose, concerned authorities shall provide land at token lease rent of Re. 1 (rupee one) per annum for setting up the power project for a period of 25 years of life of the project or term of power purchase/wheeling agreement, whichever is earlier.

- The developer may prepare and submit the Pre-feasibility reports / Detailed Project Report (DPR) to concerned Urban Body for its techno-commercial appraisals / approvals. Alternatively, UDD / ULB may have the DPR prepared for a particular MSW power project. Based on such DPR, UDD / ULB may have Request for Proposal (RFP) prepared for the purpose of inviting competitive bids for selection of developer by following relevant provisions of Gujarat Infrastructure Development (GID) Act, 1999.
- The urban local body (ULB) shall not charge any tax, cess, royalty, levies or any other charges on the MSW based power project.
- ULBs shall provide MSW to the power plant developer at power plant site without charging any cost.
- Since the management and handling of MSW is to be as per the provisions of the Solid Waste Management Rules, 2016, the WTE Projects shall comply with the MSW Rules and relevant provisions of Environment related Acts, Rules & Regulations as amended from time to time.
- GEDA shall be the nodal agency for facilitation and implementation of the policy for Waste to Energy utilising MSW. The nodal agency shall facilitate and assist the Project Developers to undertake the activities like registration of projects; responding to the queries and problems of Developers of Power Projects; accreditation and recommending WTE Projects for registering with Central Agency under REC mechanism and certifying commissioning of projects.
- Urban Development Department (UDD)/Swachh Bharat Mission Department shall be the Key Nodal Agency for project implementation. To enable smooth functioning and faster implementation, UDD shall prescribe Standard Operating Procedure (SOP) / Guidelines, web-portal service helpdesk, etc. to ensure procedural uniformity amongst the concerned UDCs / ULBs / Municipal Corporations for undertaking various activities viz. identification of potential eligible sites, preparation of DPRs, tendering, preparation of RfP document, concession agreement, land lease agreement, etc
- UDD / SBM Dept. will facilitate and assist the project developers to undertake the activities in achieving the objectives of the Policy like Responding to queries and problems of Project



Developers; Certification of stock of MSW along with Gross Calorific Value (GCV) thereof; Co-ordinating applications for Grant / Capital Subsidy from Centre and/or State Govt. or any such Authority.

- Gujarat Urja Vikas Nigam Ltd (GUVNL) shall formulate a dedicated 'Project Monitoring Cell' consisting of one representative of GEDA and one representative of UDD for reviewing and monitoring the progress of project implementation. The Project Developer shall be required to furnish quarterly progress reports and the Project Monitoring Cell in close co-ordination with concerned Civic Authority shall monitor the projects' progress, address issues (if any) & provide necessary guidance/ clarifications, conduct inspection (if required), etc. and thereby endeavour to assist the Project Developers in fast-tracking implementation of Projects.
- A Committee constituted under the Chairmanship of Principal Secretary (Energy & Petrochemicals Dept.) shall facilitate resolution of policy level issues, grievances / concerns (if any) of existing Projects / Projects under Intervening Period of two Policies / New Projects, removing difficulties, etc. to ensure smooth implementation of the Policy.
- The Projects in pipeline: The projects which are under-construction / implementation but are not commissioned as on date of notification of said Policy will be termed as 'Pipeline Projects'. Such projects, if commissioned by March-2024 shall be eligible for benefits under the WTE Policy 2016 and Amendments thereto.
- The primary contribution of WTE Projects being disposal of MSW and its environmentfriendly management, the cost implication, i.e., tariff payable for purchase of power from the WTE Projects shall be shared amongst the Distribution Licensees and the concerned Civic Authorities viz. UDD / ULB / Municipal Corporations, as the case may be.
- The UDD / ULBs shall develop a robust 'Monitoring Mechanism' and undertake the activities like:
  - a. Monitoring of quantum of MSW stock viz. MSW delivered, processed and consumed by the Project Developer;
  - b. Certification of quantum of stock of MSW along with GCV thereof;
  - c. Certification of quantum of usage of fossil-fuel and its conformity to the permissible ceiling prescribed by MNRE/ GERC;
  - d. Certification of quantum of usage of any other waste of RE nature or biomass with total MSW and its conformity to the permissible ceiling prescribed by GERC from time to time;



- e. Creation and maintenance of Information System / Monthly Database for keeping track of MSW stock, fuel usage, operational parameters, etc.;
- f. Undertake periodic and/or random inspection of the Plant for fulfilment of plant performance, compliance of standards as per Solid Waste Management Rules 2016, Environment Protection Act 1986, norms / rules & regulations framed by MoEF, CPCB, GPCB, NGT, etc.;
- The UDD / ULBs shall install a robust 'CCTV Surveillance System'/any other latest Surveillance System at the Project Site / in the premises of the Project for the purpose of monitoring.
- Grid integration shall be in accordance with the Central Electricity Authority, (Technical Standards for Connectivity to the Grid), Regulations, 2019, as amended from time to time .
- The appropriate voltage for injection of power by Power Projects shall be as per the GERC Supply Code 2013 and amendments thereof. The evacuation facility shall be approved by GETCO/DISCOM after carrying out System Studies. The developer of Power Projects based on Urban Solid Waste (USW) shall establish dedicated evacuation lines for evacuation of power up to nearest GETCO Substation/ Distribution Licensee's network, install RTUs (Remote Terminal Units), other equipment as may be determined by GETCO/Distribution Licensees at their own cost.
- The WTE Project Developers shall provide energy metering and communication facility in accordance with the CEA (Installation and Operation of meters) (Amendment) Regulations 2014 and its subsequent amendments; Gujarat Electricity Grid Code 2013 and its subsequent amendments; GERC (Terms and Conditions of Intra-State Open Access) Regulations, 2011 and its subsequent amendments and GERC Distribution Code 2004 and its subsequent amendments. For the purpose of energy accounting, such projects shall provide ABT-compliant meters at the interface points and the interface metering shall conform to the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2014 and amendments thereto.
- The electricity generated shall be metered and readings taken jointly by WTE Project developer with a representative of DISCOM and GETCO at the metering point, on monthly basis.
- The WTE Project Developers shall also install Remote Terminal Unit (RTU) at their own cost for transferring the real time date to SLDC for its monitoring purpose, and in accordance with the GERC orders from time to time.



- State Load Dispatch Centre shall certify actual injected energy and energy drawn (if any) from local DISCOM on monthly basis.
- The WTE Project Developer may sell power to Distribution Licensee on long term basis. The tariff and its modalities shall be as follows:
  - a. The Concerned Civic Authority UDD / ULB shall undertake Competitive bidding for selection of Developer/s for WTE Projects. The UDD/ULB shall approach GERC for approval of the "discovered tariff" under such Competitive Bidding. The tariff finally approved by the GERC shall be termed the "approved tariff";
  - b. The Concerned Civic Authority shall bear 20% of such "approved tariff". The balance 80% of the "approved tariff" shall be termed as the "PPA Tariff" payable by GUVNL;
  - c. The concerned Civic authorities may avail grant from State Government towards tariff implication equal to 20% of the "approved tariff ";
  - d. A Tripartite Agreement shall be executed amongst the WTE Project Developer, the Nominated Agency GUVNL, and the concerned Civic Authority;
  - e. The WTE Project Developer shall raise monthly energy invoices to GUVNL at tariff approved by GERC as per the terms and conditions of the PPA, along with copy of duly certified State Energy Account (SEA) published by SLDC;
  - f. GUVNL will pay to the WTE Project Developers the cost of energy supplied as per the PPA tariff (80% of the approved tariff by GERC). It will also pay the amount towards the 20% payable by the concerned civic authority from the grant made available to it by CCD/ UDD / ULB. Such 20% of the "approved tariff" shall be made available to GUVNL by CCD / UDD / ULB on quarterly advance basis;
  - g. Every quarter, GUVNL will send payment/generation status report to the CCD & EPD in respect of energy and amount paid to the WTE Project Developer;
  - h. The electrical component of power shall be utilized by local distribution company where the WTE Project is located. Such power shall be charged to Local DISCOM at Average Power Purchase Pooled Cost (APPC) of GUVNL for the year of commissioning of the WTE Project. The APPC once fixed shall remain constant or the life of the project. APPC shall mean power purchased at generator bus excluding renewable power purchase, transmission cost and power purchased for sale to other than consumers;



- The dispensation under Green Open Access Rules, 2022 shall be applicable for all Projects from the date of applicability of the same as may be decided by the Commission;
- j. The difference between the "PPA Tariff" and APPC charged to Local DISCOM shall be considered as cost of Renewable Attribute. On payment of this cost, the Distribution Company shall be eligible for allotment of equivalent number of units of Renewable Attribute. On monthly basis such Renewable Attribute units and their cost shall be apportioned by Nominated Agency – GUVNL to all Distribution companies (including Private Distribution Licensees, Distribution Licensees/ Deemed Distribution Licensees supplying power in SEZs area etc.) in proportion to their power consumption of previous year;
- k. GUVNL will raise two separate bills to Distribution Companies (i) for supply of electrical component of power as mentioned above, & (ii) for renewable attributes as mentioned above. Distribution Companies shall be required to make payment to GUVNL within 7 days from issuance of bill failing which they shall be liable to pay delayed payment charges as per terms of the PPA;
- Such apportioned Renewable Attribute units shall be considered for meeting RPO for the respective DISCOM;
- m. Transmission charges and losses, wheeling Charges and losses shall be borne by the concerned local distribution company which uses the electrical component.
- For entering into PPA with Distribution Licensee, the developer of Power Projects based on MSW shall be required to provide Bank Guarantee at Rs. 5 lakh per MW or part thereof. If the developer achieves commercial operation within the time period mentioned in the PPA, then the Bank Guarantee shall be refunded and if he fails to achieve commercial operation within the stipulated time frame, the Bank Guarantee shall be forfeited.
- The wheeling of electricity for captive consumption at 66 kV within the State shall be allowed on the payment of transmission charges and losses applicable to normal Open Access consumers while captive consumption below 66 kV voltage level within the State shall be allowed on the payment of Transmission Charges and Transmission Losses as applicable to normal Open Access consumers and 50% of Wheeling Charges and 50% of Distribution Losses of the energy fed to the grid as applicable to the normal Open Access consumers.



## Injection at 11 kV and drawal at 11 kV and below voltage level:

- a) When the point of injection and drawal at 11 kV or below voltage level lies within the same Distribution Company, the user shall pay 50% of Wheeling Charges and 50% of Losses of the energy fed to the grid as applicable to normal Open Access consumers.
- b) In case the point of injection and drawal at 11 kV or below voltage level lies in different distribution area, the user shall pay 50% of Wheeling Charges and 50% of Losses of the energy fed to the grid as applicable to normal Open Access consumers for each Distribution Company. Moreover, transmission charges and transmission losses as applicable to normal Open Access Consumer shall also be levied.
- Waste to energy Project Developers who desire to wheel electricity to two or more locations, shall pay 5 paise per unit on energy fed in the grid to the Distribution Company concerned in whose area power is consumed in addition to above mentioned transmission charges and losses, as applicable.

#### **Cross Subsidy Surcharge:**

Cross Subsidy Surcharge and Additional Surcharge shall not be applicable for WTE Projects under Captive Route;

Cross Subsidy Surcharge and Additional Surcharge shall be exempted for WTE Projects under Third Party Sale.

#### Energy Accounting and Surplus Power Injection shall be done as described below:

- The energy accounting for all WTE Projects shall be in accordance with the MOP's Green Energy Open Access Rules 2022 and applicable Regulations framed by Forum Of Regulators / GERC from time to time.
- Banking of energy shall be allowed upon payment of applicable banking charges as determined by GERC from time to time.
- For net import of power, Distribution Company will charge applicable tariff of respective category to the consumer including fixed / demand charge, energy charges, peak charge, other charges / penalty etc. as applicable to other consumers.
- Surplus power (if any), after giving set off, shall be purchased by Distribution Company at rates specified in table hereinbelow. Fixed / demand charge, peak charge, other charges / penalty etc. shall be as applicable to other consumers.



Particulars	Rates of surplus	Treatment of RPO
	Power	
Case1- Consumer not taking RE	Rs. 1.75 / unit	Entire generation to be
Attribute for fulfilling its RPO		considered towards DISCOMs' RPO
Case 2- Consumer taking RE	Rs. 1.75 / unit	Surplus energy to be
Attribute for fulfilling its RPO		considered towards DISCOMs' RPO
Case 3- Consumer registered under	Rs. 1.50 / unit	Surplus energy to be considered
REC Mechanism		towards DISCOMs' RPO

#### Table 1-1: Rate of Surplus power, purchase by DISCOM

- The rate of surplus power (if any), after giving set off to be purchased by DISCOM in case
  of MSMEs setting up Projects for captive consumption (and not registered under REC
  Mechanism) shall be Rs. 2.25 /kwh for first 5 years and thereafter those mentioned at table
  above.
- Electricity Duty on energy generation and consumption shall be in accordance with the provisions of the Gujarat Electricity Duty Act 1958 and its amendments from time to time.
- Exemption from demand cut to the extent of 50% of installed capacity of the Power Project based on MSW in case of captive consumption and third-party sale within the State.
- Power Projects based on MSW availing Open Access for captive/third-party sale under REC mechanism shall be governed by the CERC REC Regulations. Such projects shall be allowed to wheel the electricity on payment of applicable Transmission Charges/Losses, Wheeling Charges/Losses, and other charges as applicable to other normal Open Access consumers.
- Obligated Entities have to abide by the RPO Regulations framed by GERC from time to time for deciding the overall RPO and sub-category wise procurement of Renewable energy power from each Renewable energy source.

# 1.6 Renewable Purchase Obligation in Gujarat

The GERC (Procurement of Energy from Renewable Sources), (Third Amendment) Regulations, 2022, specify the Renewable Purchase Obligation ("*RPO*") targets till FY 2024-25 and beyond as below:



Year	Minimum Quantum of Purchase (in %) from Renewable Energy Sources (in					
	terms of energy in kWh)					
	Wind	Solar (%)	Hydro Power	Others (Biomass,	Total (%)	
	(%)		Purchase	Bagasse, Hydro and		
			Obligation	MSW) (%)		
			(HPO) (%)			
2017-18	7.75	1.75		0.50	10.00	
2018-19	7.95	4.25		0.50	12.70	
2019-20	8.05	5.50		0.75	14.30	
2020-21	8.15	6.75		0.75	15.65	
2021-22	8.25	<b>8.0</b> 0		0.75	17.00	
2022-23	8.25	8.00		0.75	17.00	
2023-24	8.40	9.50	0.05	0.75	18.70	
2024-25	8.55	11.25	0.10	0.80	20.70	

Table 1-2: Renewable Purchase Obligations up to FY 2024-25

If the above-mentioned minimum quantum of power purchase either from Solar or Wind or Hydro or Others (including Biomass, Bagasse & Bio-fuel based cogeneration, MSW and Small/Mini/Micro Hydro) is not available in a particular year, then in such cases, additional renewable energy available either from Solar or Wind or Hydro or Others shall be utilised for fulfilment of RPO. Provided further that the target specified for Obligated Entities for FY 2024-25 shall be continued beyond for FY 2025-26 and onwards unless specified by the Commission separately.

GERC (Procurement of Energy from Renewable Sources) Regulations, 2010 specifies that the obligated entities have the obligation to purchase electricity (in kWh) from specified RE sources. The said purchase shall be at a defined minimum percentage of the total consumption of its consumers including T&D losses during a year.

This Renewable Purchase Obligation (RPO) applies to:

- Distribution Licensees; and
- any other captive and Open Access users consuming electricity (i) generated from conventional captive generating plant having capacity of 5 MW and above for their own use and/or (ii) procured from conventional generation through Open Access and thirdparty sale.



# 1.7 MSW Tariffs in Other States

Central Electricity Regulatory Commission (CERC) under its RE Tariff Regulations, 2020 has adopted project-specific tariff approach for MSW projects. Similar methodology has been considered by Maharashtra Electricity Regulatory Commission (MERC) in its Tariff Order dated 22.03.2021. However, most of the other SERCs like TNERC have adopted Generic Tariff for all the technologies under MSW, while GERC has adopted Generic Tariff for mass incineration and RDF technology, TSERC has adopted Generic Tariff for RDF technology, and KERC has adopted Generic Tariff.

<b>S1</b> .	State	Tariff (Rs./kWh)	Technology	Project	Remark
No.				type	
1	Gujarat	Mass Incineration - 7.03 (without AD benefit); 6.31 (with AD benefit); RDF - 7.07 (without AD benefit); 6.67 (with AD benefit);	Mass Incineration RDF Incineration	Generic	Order dated 10.11.2016
2	Karnataka	7.08	For all type projects	Generic	MSW plant Order issued on 19.09.2016 and validity extended (3 times) up to 31.03.2021
3	Maharashtra	6.53 (with CFA) 7.45 (without CFA)	Mass Combustion	Project Specific	Levelised Tariff (with CFA) Order issued on 22.03.2021
4	Tamil Nadu	6.28	For all type projects	Generic	Comprehensive Tariff Order for MSW plant dated 28.03.2019
5	Telangana	7.84	Mass Incineration	Generic	Order dated 18-04- 2020 in O.P. NO. of 14 of 2020
7	Madhya Pradesh	<u>Without Subsidy</u> 6.69 (without AD) 6.17 (with AD) <u>With Subsidy</u> 5.54 (without AD) 5.16 (with AD)	For all type of Incineration projects	Generic	Order dated 21.09.2021

### Table 1-3: Tariff in other SERCs

# 1.8 GERC Tariff Order 2016 for MSW

GERC, in its Order No. 4 of 2016 dated 10 November, 2016 determined the tariff for procurement of power by the Distribution Licensees from Municipal Solid Waste to Energy



Projects in the State of Gujarat. After due public consultation and regulatory process, GERC determined generic tariff for the municipal solid waste to energy project based on mass incineration technology as well as RDF technology, which is as follows:

### Table 1-4: GERC Tariff for MSW

Tariff (Rs./kWh)	Mass Incineration (Rs./kWh)	RDF based Incineration (Rs./kWh)
With Accelerated Depreciation	6.31	6.67
Without Accelerated Depreciation	7.03	7.07

While allowing the aforesaid tariff to the MSW projects, the Commission also decided that the project developer shall be required to confirm that the project is complying with the environmental norms specified in the Solid Waste Management Rules, 2016 and subsequent amendments made in it as well as the emission norms stipulated by CPCB/GPCB during the life of the projects. In case of failure of the project developer to comply with the stipulated norms, he is liable to pay the compensation to the Licensee for shortfall of RPO if any, occurring due to non-generation of contracted power.



# 2 MSW RESOURCE ASSESSMENT AND MSW TECHNOLOGIES

# 2.1 MSW Resource Assessment for Gujarat

As per CEA data, installed capacity of Renewable Energy sources in India is 94433.79 MW, out of which MSW capacity is 168.64 MW, as on 31.03.2021.



# Figure 1: Installed Capacity of Renewables in India

Source: CEA Annual Report 2021

# 2.2 Status of Solid Waste

The total quantity of Solid waste generated in the country is 1,60,038.9 TPD of which 1,52,749.5 TPD of waste is collected at a collection efficiency of 95.4%, out of which, 79,956.3 TPD (50 %) of waste is treated and 29,427.2 TPD (18.4%) is landfilled. Balance 50655.4 TPD, which is 31.7% of the total waste generated, remains un-accounted. State-wise details of solid waste management is given in the Table below:

S1. No.	State	Solid waste Generated (TPD)	Collected (TPD)	Treated (TPD)	Landfilled(TPD)
1.	Andhra Pradesh	6898	6829	1133	205
2.	Arunachal Pradesh	237	202	Not provided	28



S1. No.	State	Solid waste Generated (TPD)	Collected (TPD)	Treated (TPD)	Landfilled(TPD)
•					
3.	Assam	1199	1091	41	0
4.	Bihar	4281	4014	Not provided	Not provided
5.	Chhattisgarh	1650	1650	1650	0
6.	Goa	227	219	197	22
7.	Gujarat	10374	10332	6946	3386
8.	Haryana	5352	5291	3124	2168
9.	Himachal Pradesh	346	332	221	111
10.	Jammu & Kashmir	1463	1437	548	376
11.	Jharkhand	2226	1852	758	1086
12.	Karnataka	11085	10198	6817	1250
13.	Kerala	3543	965	2550	Not Provided
14.	Madhya Pradesh	8023	7236	6472	764
15.	Maharashtra	22633	22584	15056	1355 (Unscientifically disposed=6221.5)
16.	Manipur	282	190	109	82
17.	Meghalaya	107	93	10	83
18.	Mizoram	345	276	270	0
19.	Nagaland	331	286	122	7
20.	Odisha	2133	2097	1038	1034
21.	Punjab	4338	4279	1894	2385
22.	Rajasthan	6897	6720	1210	5082
23.	Sikkim	72	72	20	52
24.	Tamil Nadu	13422	12844	9430	2301
25.	Telangana	9965	9965	7530	991
26.	Tripura	334	318	214	13
27.	Uttarakhand	1458	1379	780	-
28.	Uttar Pradesh	14710	14292	5520	0
29.	West Bengal	13709	13356	668	202
30.	Andaman & Nicobar Islands	89	82	75	7



S1. No.	State	Solid waste Generated (TPD)	Collected (TPD)	Treated (TPD)	Landfilled(TPD)
31.	Chandigarh	513	513	69	444
32.	DDDNH	267	267	237	14
33.	Delhi	10990	10990	5194	5533
34.	Lakshadweep	35	17	17	Nil
35.	Puducherry	505	482	36	446
	TOTAL	160039	152750	79956	29427

Source: Solid Waste Management Annual Report 2021

# 2.3 Trends in Solid Waste management

#### 2.3.1 Solid Waste Management Trend (Year-wise)

The Solid Waste Management information for the last six years (2015-21) has been examined and following are the observations:

a) **Per-capita Solid waste generation**: Per capita solid waste generation has been calculated for the last six years and is given in **Table 2-2**. The per capita solid waste generation over the last six years has ranged between 99 grams/day to 133 grams day, with the mean value of 119 grams/day.

Year	Solid Waste Generation Per Capita (gm/day)
2015-16	119
2016-17	133
2017-18	99
2018-19	122
2019-20	119
2020-21	119

Table 2-2: Solid Waste Generation per Capita

Source: Solid Waste Management Annual Report 2021

#### 2.3.2 SWM Trend (State-wise)

**Trend in solid waste generation:** Per capita generation of solid waste in different States/UTs is illustrated in **Figure 2**. It is observed that maximum quantity of per capita solid waste is generated in Delhi followed by Lakshadweep and Mizoram in that order.





Figure 2: State-wise per capita solid waste generation

Source: Solid Waste Management Annual Report 2021

## 2.4 Review of Policy and Regulatory Framework

Several steps have been taken post the enactment of the Act for promotion of renewable energy in the Country. The Ministry of New and Renewable Energy (MNRE) has estimated renewable energy potential of about 900 GW from commercially exploitable sources, viz., Wind – 102 GW (at 80 metre mast height); Small Hydro – 20 GW; Bio-energy – 25 GW; and 750 GW solar power, assuming 3% wasteland is made available.

The increasing industrialization, urbanization and changes in the pattern of life, which accompany the process of economic growth, give rise to generation of increasing quantities of waste leading to increased threats to the environment. Management of Municipal Solid Waste (MSW) has always been a challenge for Urban Local Bodies (ULBs) in the Country. Multipronged efforts are required to improve collection and disposal of MSW. Utilization of MSW for generation of electricity could be one of such efforts. Though MSW has potential to be a source of renewable energy, it has not been harnessed or exploited systematically on a significant scale. Using MSW as fuel for generation of electricity could increase efficiency of collection and also help in more environment friendly disposal of MSW. In recent years, technologies have been developed that not only help in generating substantial quantity of decentralized energy but also in reducing the quantity of waste for its safe disposal.



MNRE is promoting all the technology options available for setting up projects for recovery of energy in the form of Biogas/BioCNG/Electricity from agricultural, Industrial and urban wastes of renewable nature such as MSW, vegetable and other market wastes, slaughterhouse waste, agricultural residues and industrial/STP wastes and effluents.

MNRE has estimated the total potential of 9,116 MW from Waste to Energy Projects. The total estimated energy generation potential from **urban and industrial organic waste** in India is approximately 5690 MW.

The following Table shows the State-wise potential and achievement of MSW to Energy Projects:

Sl. No.	State	Solid Waste (Million TPA)	Liquid Waste (Million cu. M.)	Potential Capacity (MW) as on 31.12. 2021	Bio- CNG Potential (TPD)	Installed Capacity (MW) as on 31.12.2021
1.	UTTAR PRADESH	103	2,525	1,861	8,935	0
2.	MAHARASHTRA	38	3,168	800	3,834	13
3.	*GUJARAT	40	1,783	776	3,720	0
4.	TAMIL NADU	25	1,600	656	3,149	6
5.	PUNJAB	14	610	293	1,405	11
6.	MADHYA PRADESH	46	932	516	2,487	15
7.	WEST BENGAL	41	1,364	549	2,633	0
8.	KARNATAKA	26	1,426	484	2,329	1
9.	ANDHRA PRADESH	26	965	422	2,021	23
10.	RAJASTHAN	47	849	472	2,264	0
11.	BIHAR	46	582	485	2,329	0
12.	TELANGANA	16	681	318	1,518	49
13.	ASSAM	16	170	191	916	0
14.	ODISHA	13	318	174	840	0
15.	HARYANA	12	511	172	823	0
16.	JHARKHAND	15	371	161	768	0
17.	CHHATTISGARH	12	268	137	662	0
18.	UTTARAKHAND	5	185	134	638	0
19.	KERALA	4	360	121	581	0

Table 2-3: State-wise potential and achievement of MSW to Energy Projects



Sl. No.	State	Solid Waste (Million TPA)	Liquid Waste (Million cu. M.)	Potential Capacity (MW) as on 31.12. 2021	Bio- CNG Potential (TPD)	Installed Capacity (MW) as on 31.12.2021
20.	JAMMU AND					0
	KASHMIR	6	102	74	354	
21.	HIMACHAL PRADESH	8	24	54	260	0
22.	ANDAMAN AND					0
	NICOBAR	8	19	13	64	
23.	PUDUCHERRY	8	66	23	109	0
24.	CHANDIGARH	8	82	22	106	0
25.	DADRA AND					0
	NAGAR HAVELI	8	21	13	60	
26.	DAMAN AND DIU	8	17	14	66	0
27.	DELHI	10	1,228	98	468	52
28.	LAKSHADWEEP	8	12	12	56	0
29.	LADAKH	0	12	11	54	0
30.	TRIPURA	1	30	15	75	0
31.	MEGHALAYA	1	18	14	65	0
32.	NAGALAND	0	19	7	33	0
33.	MIZORAM	0	26	3	15	0
34.	MANIPUR	1	17	7	35	0
35.	ARUNACHAL					0
	PRADESH	0	5	7	31	
36.	GOA	0	21	4	21	0
37.	SIKKIM	0	8	3	13	0
Total		623	20,395	9,116	43,737	170

*Source*: MNRE portal for potential capacity through the given link <u>https://bio-energy.isid4india.org/</u>

MNRE portal for installed capacity through the given link <u>https://mnre.gov.in/waste-to-energy/current-</u>

## <u>status</u>

*Note:* \**Gujarat has commissioned its first MSW plant at Jamnagar of capacity 7.5 MW on 6<sup>th</sup> July 2022.* 







As can be seen from the above Table, the utilisation of MSW for setting up MSW to Energy projects is very poor, with Delhi and Telangana having the highest such capacities of 52 MW and 49 MW, respectively. There is only 170 MW such capacity in India as a whole.

The State of Gujarat has Waste to Energy potential of 776 MW, which can be promoted through enabling framework and generic tariff. The above Table shows that as on 31<sup>st</sup> December 2021, there is Nil installed capacity. The State DISCOMs, in their ARR and Tariff Petitions for FY 2022-23, have projected that MSW to Energy capacity of 67.20 MW is expected to be commissioned by March 2022. Gujarat has commissioned its first MSW plant at Jamnagar of capacity 7.5 MW on 6<sup>th</sup> July 2022. There are 3 MSW projects of 14.90 MW each at Rajkot, Vadodara, and Junagadh, while one 15 MW MSW project is coming up at Ahmedabad.

According to the amended Tariff Policy, Distribution Licensee(s) shall compulsorily procure 100% power produced from all the Waste-to-Energy plants in the State, in the ratio of their procurement of power from all sources including their own, at the tariff determined by the Appropriate Commission under Section 62 of the Act. This will facilitate meeting the objective of Swachh Bharat Mission for disposal of waste besides generation of electricity.

Source: MNRE Portal



# 2.5 Technology Options for WTE Projects

There are various technology options available for Waste to Energy projects including:

## a) Biomethanation

Biomethanation is anaerobic digestion of organic materials, which is converted into biogas. Anaerobic Digestion (AD) is a bacterial fermentation process that operates without free oxygen and results in a biogas containing mostly methane ( $\sim$ 60%), carbon dioxide ( $\sim$ 40%) and other gases. Biomethanation has dual benefits. It gives biogas as well as manure as end product.

#### b) Incineration

Incineration technology is complete combustion of waste (Municipal Solid Waste or Refuse derived fuel) with the recovery of heat to produce steam that in turn produces power through steam turbines.

## c) Gasification

Gasification is a process that uses high temperatures (500-1800 $^{\circ}$  C) in the presence of limited amounts of oxygen to decompose materials to produce synthetic gas (a mixture of carbon monoxide (CO) and hydrogen (H<sub>2</sub>)). Biomass, agro-residues, Segregated MSW and RDF pellets are used in the gasifier to produce Syngas. This gas can be further used for thermal or power generation purposes.

## d) Pyrolysis

Pyrolysis uses heat to break down combustible materials in the absence of oxygen, producing a mixture of combustible gases (primarily methane, complex hydrocarbons, hydrogen, and carbon monoxide), liquids and solid residues.

All these technologies have their own merits and demerits. The choice of technology has to be made based on the waste, quality, and local conditions. The best compromise would be to choose the technology, which has lowest life cycle cost, needs least land area, causes practically no air and land pollution, produces more power with less waste, and causes maximum volume reduction.

# 2.6 Need for WtE projects

Households, commercial and industrial activity generate large volume of waste. This waste generation is continuously increasing with the rapid urbanization and industrial development. Such large volumes of waste have created environmental pollution in terms of



air pollution, water pollution besides emission of toxic substances. The current method of waste disposal, i.e., landfill, requires large tracts of land and is becoming economically and environmentally unacceptable.

The ill effects of inadequate and improper waste disposal have called for the urgent need for efficient waste disposal techniques. Globally, efforts are being made for reducing Green House Gas (GHG) emissions, effects on Climate Change and Global Warming.

Environment friendly technologies can be adopted for treatment and processing of waste before it is finally disposed of. These technologies also provide for decentralized power generation along with improving the quality of waste and subsequent reduction in pollution. These advanced waste management techniques provide the following benefits:

- **□** Reduction in volume of waste that has to be disposed of finally
- **D** Reduces the requirement of land for landfill
- **□** Reduction in cost of transportation
- **□** Reduction in environmental pollution
- **u** Utilisation of residual waste in the form of manure
- Other socio-economic benefits to the society in terms of employment, development etc.,

Hence, the focus for better waste management should be on:

- □ Minimising waste to be disposed of on land
- □ Maximising environmentally sound reuse and recycling
- Promoting environmentally sound waste treatment (like converting waste to energy) and disposal
- Extending waste service coverage (in terms of waste collection)

#### **Disadvantages of Waste Incineration**

- **□** It is expensive. The installation of an incineration plant is an expensive process.
- □ Pollutes the environment.
- Damaging public health.
- Describility of long-term problems.
- □ Ash waste can potentially harm people and the environment.



# 2.7 MSW plants in the country

There are several MSW plants in the country at various stages, viz., some are commissioned, some are yet to be commissioned, while many are under development stage. Details of the projects completed and projects under execution are given below:

<b>S1</b> .	State	Plant Location	Power	Remark	
No.			Generation		
			(MW)		
1.	Andhra Pradesh	Vishakhapatnam	15.0	Operational - 1133 TPD	
		(4 ULBs)	15.0	Operational - 1202 TPD	
		Guntur (9 ULBs)			
2.	Goa	Sailogo, Bardez, Goa	0.6	In operation	
3.	Gujarat	Jamnagar	7.5	Commissioned	
		Vadodara	14.9	Yet to be be	
				commissioned	
		Rajkot	14.9	Yet to be be	
				commissioned	
		Ahmedabad	14.9	Yet to be be	
				commissioned	
4.	Haryana	Sonepat	7.0	Operational	
		Gurugram (Bhandwari)	23.0	Under Construction	
5.	Himachal Pradesh	Shimla Manali	Not Provided	Under Construction	
6.	Kerala	1. Kozhikode		Work awarded	
		2. Kannur		Work awarded	
		3. Kollam		Work awarded	
		4. Palakkad		DPR Stage	
		5.Kochi		Re-tendering completed	
		6.Thiruvananthapuram		Land not identified	
		7. Munnar		Tendering	
		8. Thrissur		Land identified	
		9. Malappuram		Land identified	
7.	Madhya Pradesh	Jabalpur	11.5 MW	Operational	
	5	Rewa	2X6 MW	Under Construction	
8.	Maharashtra	Solapur Municipal	4.0	In operation	
		Corporation		-	
9.	Manipur	Lamdeng, Imphal	Not Provided	Under Installation	
10.	Punjab	Bathinda		Both plants are not	
		Ludhiana		operational	
11.	Rajasthan	M/s JITF Urban	600 TPD	Land allotted. Lease deed	
		Infrastructure Ltd.		pending PPA &. Lease	
		Jaipur		deed pending	
		M/s IITF Urban	400 TPD	PPA & Lease Deed	
		Infrastructure Ltd.		pending	

Table 2-4: Waste to Energy Plants



S1.	State	Plant Location	Power	Remark
No.			Generation	
			(MW)	
		Jodhpur		
12.	Telangana	Jawaharnagar,	19.8	Issued Consent For
		Hyderabad		Operation (CFO)
		Chennaravulapally,	11.0	Undergoing pre
		Bibi Nagar		commissioning activities.
				not commissioned due to
				financial issues.
		Yacharam,	12.0	Permission for granting
		Ibrahimpatnam		extension of time to
				agency for entering into
				PPA with TSSPDCL is
				under examination of
		D 11 1 11	12.0	GHMC
		Rebladevpally,	12.0	Presently, the unit is not
		Sultanabad		operational due to non-
		Survanet	12.6	Presently the unit is not
		Suryuper	12.0	operational due to non-
				viability of tariff.
		Dindugal	14.5	Construction work not
		0		yet started
13.	Uttarakhand	Haridwar	5.0	RDF (Refuse
				Derived Fuel) of nearby
				town.
		Dehradun	-	Proposed WtE Plant in
				Dehradun
14.	Uttar Pradesh	Barabanki	2.5	Operational
		Meerut	2.5	Operational
15.	Chandigarh	Opp. Dumping ground,	RDF	RDF production
		Dadumajra, Sector-25	generated is	Approx. 60 TPD
		West, Chandigarh	utilized in their	
			own Hot Air	
			generator and	
			the rest is	
			supplied to	
			nearby	
16	Dolhi	Okhla	23.0	Operational
10.		Chazipur	12.0	Operational
		Bawana	24.0	Operational
		Dawalla	24.0	Operational

Source: Solid Waste Management Annual Report 2021



# 2.8 State-wise progress of MSW

## • <u>Gujarat</u>

Total 164 ULBs are responsible for MSW management in the State. Total Solid Waste collection in Gujarat is 10373.79 TPD, out of which 10332 TPD is collected, 6946 TPD of waste is treated and 3385.82 TPD of waste is landfilled /dumped. 38 Composting plants, 95 Vermi-compost plants, 3 Biogas and 2 RDF/Palletization have been set up in the State. It is reported that 28 Regional/Individual landfill sitesare identified, 25 Landfill under planning stage and 11 Landfill sites are constructed. There are 164 dumpsites present in the State. About 100% door to door collection of mixed MSW has been reported with 82% segregation at source.

S	Location	Capacity	Developer Name	
no.				
1	Jamnagar	7.5	Goodwatts WTE Jamnagar Pvt. Ltd.	
2	Vadodra	14.9	Goodwatts WTE Vadodra Pvt. Ltd.	
3	Rajkot	14.9	Goodwatts WTE Rajkot Pvt. Ltd.	
4	Ahmedabad	14.9	Goodwatts WTE Ahmedabad Pvt. Ltd.	

#### Table 2-5: Gujarat capacity

Source: GERC Website

#### • <u>Delhi</u>

Delhi has 3 Waste to Energy Plants (WTE plants) of combined capacity 4550 TPD at 3 different locations in Delhi namely Okhla, Ghazipur and Bawana. One new Waste to Energy Plant of capacity about 2000 TPD is proposed at Tehkhand and another one of 600 TPD capacity in the Integrated Municipal Solid Waste Processing Facility at Ghonda Gujran. After commissioning of these 2 proposed WTEs capacity of WTE plants will increase from 4550 TPD to about 7150 TPD by September, 2022.



S No	Name of Waste to Energy Plants	Existing Capacity (in TPD)	7 Installed Capacity (in MW)
1	Timarpur Okhla Waste Management Company Ltd., Old NDMC Composite site Okhla	1950	23
2	East Delhi Waste Processing Company Ltd., Ghazipur	1300	12
3	Delhi MSW Solutions Ltd, Narela Bawana Road, Bawana	1300	24
Total		4550	59

#### Table 2-6: Operational Waste to Energy Plants in Delhi

Source: Solid Waste Management Annual Report 2021

#### Madhya Pradesh

Total 378 Urban Local Bodies and 05 Cantonment Boards are responsible for implementation of SWM Rules, 2016 in the State. Total waste generation in the State is approximately 8022.5 TPD, out of which 7235.5 TPD waste is collected and 6472 TPD is treated & 763.5 TPD is landfilled. It is reported that there are 341 landfill sites identified at present in the State, 8 landfill sites (Bhopal, Gwalior, Indore, Jabalpur, Katni, Rewa, Sagar and Ujjain) are in operation and 2 landfillsites at Vijaypur (Gwalior) and Singrauli are under construction. There are 326 existing dumpsites in the State. 100% door to door collection of the waste has been achieved in 372 ULBs and 14 ULBs are facilitating partial door to door collection of the waste.

Indore is one of the economically evolved urban areas of Madhya Pradesh and is the budgetary capital of the state. The city is divided into 85 Wards and 19 Zones as the operational zone for Solid Waste Management (SWM). In Indore, waste is gathered in an isolated way for example the waste is isolated at source by the generators. The absolute waste generation in Indore is 1115 MTPD. Out of all waste, 58.25% is wet or natural waste, 41.75% is dry waste and 0.5% is a household hazardous and sanitary waste. The complete wet waste generation is approximately 650 MTPD and the dry waste is 465 MTPD.


#### Technique used by Indore in MSW

**Gasification:** It is the process where organic material with carbonaceous compounds become carbon monoxide (CO) when heated above the temperature of 700 °C. The product of this process is a syngas which is an alternative renewable source of energy. The by-product also includes solid waste (ash). The various gasifiers available are bed fluidizes bed, fixed bed in parallel, fixed bed in counter-current, plasma, entrained flow and free radicals.

**Incineration:** This involves burning of organic matter present in MSW with combustion and ashes as a by-products. It is beneficial for pathogens, toxins and other hazardous wastes. The process is carried out in an incinerator. the installation and maintenance costs are higher, also the waste mainly consists of high inert content (30-50%), high organic matter (40-60%), high moisture content, low heat content (~1000 kcal/kg), and thus proves to be a bad option of waste management.

**Composting:** This includes breaking down of an organic material and process materials into fertilizers and soil amendments. Compost is rich in nutrients and is used in soil rehabilitations.

**Landfill:** One among the oldest method, this is done on a dump where waste is poured uniformly and is covered with layer of soil.

**Recycling:** This process converts wastes into new products. The materials generally includes glass, paper, electronics, textiles, plastic, metal, etc. It is considered as the key element of modern waste reduction.



# **3 COMPUTATION OF TARIFF FOR MSW PROJECTS**

# 3.1 Approach and Methodology

The revised Tariff Policy notified by the Central Government on 28 January 2016 stipulates that the Appropriate Commission may determine preferential tariff for procurement of power by Distribution Licensees from non-conventional projects up to and below a notified capacity. The relevant extract of Clause 6.4 of the Tariff Policy is given below.

"......(2) States shall endeavor to procure power from renewable energy sources through competitive bidding to keep the tariff low, except from the waste to energy plants. Procurement of power by Distribution Licensee from renewable energy sources from projects above the notified capacity, shall be done through competitive bidding process, from the date to be notified by the Central Government.

However, till such notification, any such procurement of power from renewable energy sources projects, may be done under Section 62 of the Electricity Act, 2003. While determining the tariff from such sources, the Appropriate Commission shall take into account the solar radiation and wind intensity which may differ from area to area to ensure that the benefits are passed on to the consumers.

(3) "The Central Commission should lay down guidelines for pricing intermittent power, especially from renewable energy sources, where such procurement is not through competitive bidding. The tariff stipulated by CERC shall act as a ceiling for that category."

### 3.2 General Principles

In this section, the general principles for Waste to Energy tariff determination such as Control Period, tariff period, tariff structure, tariff design, plant life, etc., have been discussed.

- **3.2.1 Control Period:** The Control Period of the Tariff Order is proposed from the Date of Final Order till 31<sup>st</sup> March, 2028.
- **3.2.2 Useful life of plant:** In its earlier Order dated 10 November, 2016 the project life was considered as 20 years for Waste to energy projects. CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2020 dated 23 June, 2020 as well as other SERCs who have recently issued Orders/Regulations in this regard have considered the WTE project life of 25 years. Considering the above, it is proposed to keep the useful life of Waste to energy project as 25 years.



ERC	Date of Order/ Regulation	Useful Life of	
		Plant for MSW	
		projects	
TSERC	Order dated 13-06-2016 in O.P.No.18	20 years	
	of 2016 (RDF/MSW)		
	Order dated 18-04-2020 in O.P.No.18	20 years	
	of 2020 (RDF)		
MPERC	Order dated 29-09- 2021	25 years	
GERC	Order No.4 of 2016 (MSW Project) dated 10-11-	20 years	
	2016		
MERC	Order dated 22-03-2021/03.07.2021	25 years	
KERC	Order dated 19-09-2016	20 years	
KSERC	Order dated 06-03-2018	20 years	
CERC	Regulation dated 23.06.2020	25 years	
TNERC	Order dated 28-03-2019	20 years	

- **3.2.3** Tariff Period: In line with the approach adopted in the previous Orders, the Tariff period for procurement of electricity from Waste to Energy projects by the Distribution Licensees shall be equal to the useful life, i.e., 25 years. Hence, the Tariff period for projects commissioned in the Control Period is proposed to be 25 years.
- **3.2.4** Tariff Structure and design: Generally, a 'single part levelized tariff' methodology is being adopted by different SERCs including GERC, while determining the generic Tariff Order for MSW, and hence, the same approach is proposed. CERC has specified norms for generic tariff determination for incineration and RDF based MSW to energy projects. SERCs of few other States have also determined generic tariff for MSW to energy projects.
- **3.2.5** Eligibility criteria: As per the practice followed by CERC, the project has to use new plant and machinery based on Rankine cycle technology and use MSW or RDF as a fuel, to be eligible for the tariff determined through this Order.
- **3.2.6** Applicability of Merit Order Despatch principle: The MSW to energy projects are provided with 'MUST RUN' status and exempted from the principle of Merit Order Despatch. However, the project operator should follow the instructions of the grid operator in view of overall security of the grid.
- **3.2.7 Interconnection point and Metering point:** The Commission proposes that the MSW WtE Power Project shall be connected at appropriate voltage for injection of power as per the connectivity granted by GETCO/STU in accordance with the provisions of the



GERC Regulations as amended from time to time and Orders passed by the Commission. The evacuation facility shall be approved by GETCO/DISCOM after carrying out System Studies. The developer of Power Projects based on MSW shall establish dedicated evacuation lines for evacuation of power up to GETCO Substation/ Distribution Licensee's network as approved by the concerned licensees, install RTUs, other equipment as may be determined by GETCO/Distribution Licensees at their own cost. The Metering Point and Interconnection Point for the MSW WtE Power Project shall be the point of connection at the GETCO substation where feasibility and connectivity is granted by GETCO. The WTE Project Developers shall provide energy metering and communication facility in accordance with the (a) the CEA (Installation and Operation of meters) (Amendment) Regulations 2014 and its subsequent amendments, (b) Gujarat Electricity Grid Code 2013 and its subsequent amendments and (d) the GERC Distribution Code 2004 and its subsequent amendments.

### 3.3 Evaluation of Capital Cost and Other Performance Parameters

#### 3.3.1 Benchmark Capital Cost for Waste to Energy Project in Gujarat

The National Electricity Policy highlights the importance of setting up of Municipal Solid Waste Energy projects in urban areas with a view of reducing environmental pollution apart from generating additional energy. Promoting MSW based projects are equally important given the scarcity of urban land in the State.

Mass incineration/ Refuse Derived Fuel incineration based technologies are emerging as preferred option for managing the growing problem of waste in country. Most of the projects commissioned and under pipeline in the country for which the concession agreements are signed between the developers and Urban Local Bodies are based on incineration technology

The Commission decides not to allow any fuel cost for MSW based projects because the cost of fuel preparation is included in the overall Capital Cost of the Project that will address both Capacity Charge and Fuel preparation cost and other incidentals. Hence, the related norms like Station Heat Rate, Fuel cost escalation, Gross Calorific Value, etc. are not applicable herein.

The bidding documents for Public Private Partnership in 'Integrated Solid Waste Management and Integrated Liquid Waste Management' notified by **Niti Aayog**, **Government of India in June 2020** in compliance of the order passed by Hon'ble National



Green Tribunal (OA No 606/2018) mentioned that the developer should establish Waste to Energy Plant using suitable and commercially viable technology in accordance with the terms of the Concession Agreement, Solid Waste Management Rules 2016 and good industry practices

The Commission notes that Mass incineration/ Refuse Derived Fuel (RDF) Incineration based technologies are emerging as preferred option for managing the growing problem of waste in country. Both of above technology are part of Incineration process by which the electricity generation from Municipal Solid Waste (MSW) carried out in the power plant. The purpose of aforesaid technology deployed by the generators is with a view to that the minimum discharge of the Municipal Solid Waste (MSW) available after process which will be dumped in landfill site by the corporation of Urban Development Authorities so that the burden of waste required to be dumped in landfill site shall be minimum.

In the mass incineration projects the Municipal Solid Waste received from the Municipal Corporation or Urban Development Authority or Panchayat as case may be directly used as fuel in the generating plant without any process of such waste at power plant.

While in case of the RDF based plant the Municipal Solid Waste provided at the doorstep/power plant place by the Municipal Corporation/Urban Development Authority at NIL cost be processed by the project developer/generator and converted the MSW received in Refuse Derived Fuel (RDF) by utilisation of various equipments. Such processed MSW (RDF) is utilised in the power plant as fuel. Thus, the cost for process of MSW received at power plant by the project developer at NIL cost shall require to incur expenditure (cost) towards installation of equipment/plant for processing MSW, Manpower employed for such process and also consumption of energy in such processing unit installed at the generating plant (MSW based power project). It is therefore necessary to factor the process cost of the MSW received at zero cost at power plant as per the concession agreement with corporation by the project developer (generator) by way of additional cost of process equipment as part of capital cost. While the cost of manpower deployed for processing of MSW and repair and maintenance of it as part of O&M cost of the project. Similarly, the consumption of energy in the process equipment also need to factored in the auxiliary consumption of the power plant.

Most of the projects commissioned and under pipeline in the country for which the concession agreements are signed between the developers and Urban Local Bodies are



based on incineration technology, i.e. mass incineration or Refuse Derived Fuel (RDF) based incineration technology.

The main cost components of MSW to energy project can be broadly grouped into six important categories, i.e., (i) plant and machinery (including pre-processing equipment), (ii) land cost, (iii) civil works, (iv) evacuation infrastructure, (v) associated miscellaneous expenses, and (vi) cost towards restricting the emissions from the plant within the permissible limits specified in the Solid Waste Management Rules, 2016 (in case of incineration technology).

The Commission notes that the Concessional Agreement signed by the MSW developer with the Municipal Authorities provides for doorstep delivery of the MSW collected in the city implying that the developer have to process the incoming raw MSW in the form of processed fuel and use it for power generation in the MSW Plant in case of RDF based power plant.

In view of above, the Commission decides not to allow any fuel cost in case of MSW based projects based on RDF, instead the Commission prefer to include the cost of fuel preparation (process equipment) in the overall Capital Cost of the Project that will address both Capacity Charge and Fuel preparation cost and other incidentals. Hence, the related norms like Station Heat Rate, Fuel cost escalation, Gross Calorific Value, etc. are not applicable herein.

The capital cost has been stipulated for MSW to energy using mass incineration technology and RDF based MSW to energy projects, which have to confirm that the technology deployed for the project complies with the SWM Rules 2016. The aforesaid compliance shall be substantiated by the project developer with a certificate of Original Equipment Manufacturer (OEM) of the project stating that the technology/equipment provided for the project complies with the environmental norms as stipulated under SWM Rules, 2016 specified under Environmental Protection Act, 1986.

As per the MNRE administrative approval FNo. 20/222/2016-17-WTE, dated 28.02.2020, Central Financial Assistance (CFA) of Rs 500 lakh / MW is available from MNRE to the project proponent generating power based on MSW and RDF. This subsidy is available for power generation from Municipal Solid Waste/ Refused derived fuel (RDF) through incineration or other approved thermal technology, provided that min size of installed capacity of plant shall be 5 MW.



In order to arrive at benchmark capital cost for the next Control Period, the approach followed in CERC Regulations and Orders and other SERCs while fixing the benchmark capital cost have been analysed.

Worldwide four technologies are commonly used for conversion of MSW to energy in MW scale, viz., Biomethanation, Gasification, Mass Incineration, and Refuse Derived Fuel (RDF) based incineration technology.

The main cost components of MSW to energy project can be broadly grouped into six important categories, i.e., (i) plant and machinery (including pre-processing equipment), (ii) land cost, (iii) civil works, (iv) evacuation infrastructure, (v) associated miscellaneous expenses, and (vi) cost towards restricting the emissions from the plant within the permissible limits specified in the Solid Waste Management Rules, 2016 (in case of incineration technology).

The capital cost has been stipulated for MSW to energy using mass incineration technology and RDF based MSW to energy projects, which have to confirm that the technology deployed for the project complies with the SWM Rules 2016. The aforesaid compliance shall be substantiated by the project developer with a certificate of Original Equipment Manufacturer (OEM) of the project stating that the technology/equipment provided for the project complies with the environmental norms as stipulated under SWM Rules, 2016 specified under Environmental Protection Act, 1986.

In order to arrive at benchmark capital cost for the next Control Period, the approach followed in CERC Regulations and Orders and other SERCs while fixing the benchmark capital cost have been analysed.

**3.3.2** The capital cost approved by GERC and other SERCs under different regulatory approaches, viz., Generic Tariff and Project-specific tariff approach, are presented in the Tables below:



Electricity	Date of Order/	Mass	RDF based	Technology
Regulatory	Regulation	Incineration	Incineration	
Commission		Capital Cost	<b>Capital</b> Cost	
GERC	Order No.4 of 2016	Rs.16.00	Rs.9.00	Mass Incineration and RDF
	(MSW Project) dated	Crore/MW	Crore/MW	based Incineration
	10-11-2016			
MPERC	Order dated 29-09-2021	Rs.18.50		Applicable to all MSW
		Crore/MW		based power project using
				mass incineration/ RDF
				incineration technology
TNERC	Order dated 28-03-	Rs.17.00		Applicable to all MSW
	2019	Crore/MW		based power projects
				irrespective of the
				technology therein
KERC	Order dated 19-09-2016	Rs.17.00		Applicable to all MSW
		Crore/MW		based power projects
TSERC	Order dated 13-06-2016	Rs.14.00	Rs.9.00	MSW and RDF based
	in O.P.No.18 of 2016	Crore/MW	Crore/MW	
	(RDF/MSW)			
	Order dated 18-04-2020		Rs.9.00	RDF
	in O.P. NO. of 14 of		Crore/MW	
	2020			

#### Table 3-2: Generic Tariff - Capital cost approved by different SERCs

#### Table 3-3: Project Specific Tariff - Capital cost

Electricity	Date of Order/	Mass Incineration	RDF based	Technology
Regulatory	Regulation	Capital Cost	Incineration	
Commission			Capital Cost	
MERC	Order dated 22-	Rs. 20.98 Crore/MW		Mass Combustion
	03-	(without CFA)		
	2021/03.07.2021	Rs.17.19 Crore/MW		
		(with CFA)		
KSERC	Order dated 06-	Rs. 16.52 Crore/MW		Mass
	03-2018			Combustion

Note: CFA – Central Financial Assistance

The capital cost considered by MPERC, MERC and TSERC in their Tariff Orders are most recent and based on comprehensive study. Since, CERC in its CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2020 has specified



that the Commission shall determine only project-specific capital cost and Tariff based on prevailing market trends for WTE projects, hence, capital cost determined by CERC is not mentioned in the above Table.

The Capital cost of mass incineration is almost higher than that of RDF technology because more equipment is needed to operate the plant such as Furnace water walls; Primary Superheater; Secondary Superheater; Evaporator; Air-heater, contamination control mechanisms, the transport of waste to the incinerator, etc., which add to the capital cost.

An incinerator is a furnace for burning waste. There are various types of incinerator plant design: moving grate, fixed grate, rotary-kiln, and fluidised bed.

The RDF (Residual Derived Fuel) made from the MSW by project developers with processing the MSW provided at project site by the Municipal Corporation by installing separate plant for removal of the content of the MSW which are avoided for burning in the furnace of the power plant and good value of heat contents material be feed in to MSW power plant so that power plant can operate efficiently. In such process the capital cost of the RDF power plant, its consumption and O&M cost required to done by the project developer. Hence, the capital cost of such RDF manufacturing plant, auxiliary consumption and O&M cost needs to consider while determining the tariff of such plant. It is also noted that while making RDF in the plant the compost also made out which are use for fertiliser purpose. Thus, the RDF plant provide two products from the MSW process at such plant.

It is fact that RDF is higher energy content as compared to mass incineration, RDF combustion systems can be physically smaller than comparatively rated mass-fired systems. However, more space will be required if the front-end processing system needed to prepare the RDF is to be located adjacent to the combustor. A RDF-fired system can also be controlled more effectively than a mass-fired system because of the more homogeneous nature of RDF, allowing for better combustion control and better performance of air pollution control devices. Additionally, a properly designed system for the pre-processing of MSW can effect the removal of significant portions of metals, plastics, and other materials that may contribute to harmful air emissions.

The average of capital cost considered by GERC, MPERC, TNERC, KERC, TSERC, MERC and KSERC has been taken for mass incineration project. While in case of the RDF technology based power plant for deriving the capital cost the cost considered by various



Commission as well as the cost of process of RDF by the project developer at plant with consideration of various equipments is considered. Considering the above aspects, it is proposed that capital cost is Rs. 18.00 Crore/MW for Mass Incineration and Rs. 16.75 Crore/MW for RDF for the next Control Period. Hence, the proposed capital cost is Rs. 18.00 Crore/MW for RDF for the next Control Period. Hence, the proposed capital cost is Rs. 18.00 Crore/MW for RDF for the next Control Period. Hence, the proposed capital cost is Rs. 18.00 Crore/MW for RDF for the next Control Period.

The Commission observes that after factor in the subsidy / CFA available from MNRE has considered capital cost of Rs 5.00 Cr/MW for projects using incineration technology which includes mass incineration and RDF from MSW as fuel for incineration projects.

# 3.4 Operation and Maintenance Cost

Operations and Maintenance (O&M) cost consists of the statutory charges, spares, employee cost, administrative and general expenses, consumables, repairs and maintenance, and insurance expenses, etc. Considering the heterogeneous nature of MSW and the process involved in conversion of MSW to energy as well as emission control norms specified in SWM Rules 2016, the Commission had, in its MSW Tariff Order No. 4 of 2016 dated 10 November, 2016 considered the O&M cost equal to 6% and 5% of capital cost in case of mass incineration and RDF based MSW to energy projects, respectively, with escalation of 5.72%. It has been observed that in CERC RE Regulations, 2020, the annual escalation rate is revised to 3.84% with respect to change in WPI and CPI during last 5 years.

The O&M Expenses approved by GERC and other SERCs under the regulatory approach are presented below:

Electricity	Date of Order/Regulation	Mass Incineration-	RDF - O&M
Regulatory		O&M Expenses	Expenses
Commission			
GERC	Order No. 4 of 2016 dated 10-	6% of the capital cost	5% of the capital cost
	11-2016	with annual	with an escalation of
		escalation of 5.72%.	5.72%.
TSERC	Order dated 13-06-2016 in	6% of Capex with	
	O.P. No. 18 of	annual escalation of	
	2016(RDF/MSW)	5.72%	
	Order dated 18-04-2020 in		5% of the capital cost
	O.P. No. 14 of 2020		with an escalation of

#### Table 3-4: O&M Expenses approved by GERC and other SERCs



Electricity	Date of Order/Regulation	Mass Incineration-	RDF - O&M
Regulatory		O&M Expenses	Expenses
Commission			
			5.72%.
MPERC	Order dated 29-09-2021	5% of the capital cost	
		with an escalation of	
		3.84%. (O&M cost for	
		incineration projects	
		include mass	
		incineration and RDF	
		based projects)	
MERC	Order dated 22-03-	Rs. 1928.33 Lakh with	
	2021/03.07.2021	an annual escalation	
		of 3.79% (with and	
		without CFA)	
KERC	Order dated 19-09-2016	6% of the capital cost	
		with an escalation of	
		5.72%.	
KSERC	Order dated 06-03-2018	6% of the capital cost	
		with an escalation of	
		5.72%.	
TNERC	Order dated 28-03-2019	5.5% on the 85% of the	
		normative capital cost	
		with an annual	
		escalation of 5.72%	
		and 0.90% on the 15%	
		the capital cost with	
		an annual escalation	
		of 5.72% per annum.	

Considering the fact that in the mass incineration project the MSW received at project site free of cost by the corporation/ULB and same is utilised in generation of electricity, no processing on such material carried out at the project site. Hence, considering the aforesaid facts as well as O&M considered by various Commission and Commission in its Order, it is proposed that O&M cost of mass incineration project as 6% of the capital cost of such project.

While, in case of RDF based Waste to Energy Project as the MSW provided at project site by the Municipal Corporation/ULB without any cost and such material is processed by the project developer by keeping separate equipment and operating it and made out RDF and other materials like compost etc. The Commission has stated earlier para considered the capital cost of such equipment plant and also consumption of such plant and equipment separately as part of auxiliary consumption. It is therefore, the Commission is of the view



that the O&M cost of such RDF processing plant need to factor as part of cost of power project capital cost. Hence, considering the above the Commission proposed O&M cost of RDF based plant as 8.5% of capital cost. Further, in case of Mass Incineration and RDF based MSW to energy projects, the escalation on the annual O&M cost proposed at the rate of 3.84 % per annum as per the CERC RE Regulations, 2020 for determination of Tariff for WtE projects to be commissioned in the next Control Period.

Considering the recent orders of the Commission, Municipal Solid Waste Management and Handling Rules, 2000, NITI Aayog reports, and Government Policies, it is proposed that the O&M cost for the mass incineration projects be 6% of the Capital Cost, while in case of the RDF based MSW to energy projects where an additional cost of processing equipment required to be incurred by the project developer for O&M of such equipment. It is proposed 8.5% of the capital cost of RDF based project as O&M cost for such project. It is further proposed to escalate the O&M cost at the rate of 3.84% of the O&M cost on annual basis.

### 3.5 Plant Load Factor

The MSW for the power project is to be supplied by the ULB/UDD free of cost at the site of the project as stated in the Gujarat Waste to Energy Policy, 2022. Thus, the requisite quantum of MSW and quality of MSW, which is important factor for the PLF of the plant, is dependent on the MSW provided by these authorities. The PLF in case of MSW to energy project is dependent on factors like availability of MSW, number of operating hours, moisture content in the MSW, etc. Variation in supply and quality of MSW at project site affects the plant load factor of the project. The quality of MSW varies from season to season. It also dependent on the management of the MSW (provided by the municipal corporation/ULB/ULD) by the project developer with consideration of various aspects needed observed and follow prior to utilise such MSW by the project developer with efficient/non-efficient utilisation of MSW, which affect the generation from MSW to WtE projects.

The PLF approved by GERC, and other SERCs are presented below:

#### Table 3-5: PLF considered by different SERCs in their Generic Tariff Order for WtE



Electricity	Date of	Mass Incineration- PLF	RDF- PLF
Regulatory	Order/Regulation		
Commission			
GERC	Order No. 4 of 2016	1 <sup>st</sup> Year – 65%	1 <sup>st</sup> Year – 65%
	dated 10-11-2016	2 <sup>nd</sup> Year onwards - 75%	2 <sup>nd</sup> Year onwards -
			80%
TSERC	Order dated 13-06-2016	1 <sup>st</sup> Year – 65%	1 <sup>st</sup> Year – 65%
	in O.P. No. 18 of	2 <sup>nd</sup> Year onwards - 75%	2 <sup>nd</sup> Year onwards -
	2016(RDF/MSW)		80%
	Order dated 18-04-2020		1 <sup>st</sup> Year – 65%
	in O.P. No. 14 of 2020		2 <sup>nd</sup> Year onwards -
			75%
			3 <sup>rd</sup> Year onwards -
			85%
MPERC	Order dated 29-09-2021	1 <sup>st</sup> Year – 65%	
		2 <sup>nd</sup> Year onwards - 75%	
MERC	Order dated 22-03-	1 <sup>st</sup> Year – 65%	
	2021/03.07.2021	2 <sup>nd</sup> Year onwards - 80%	
		(with and without CFA)	
KERC	Order dated 19-09-2016	1 <sup>st</sup> Year – 65%	
		2 <sup>nd</sup> Year onwards - 75%	
KSERC	Order dated 06-03-2018	1 <sup>st</sup> Year – 65%	
		2 <sup>nd</sup> Year onwards - 75%	
TNERC	Order dated 28-03-2019	75%	
CERC	Regulation dated 23-	During stabilization period	During stabilization
	06-2020	and first year after	period and first year
		stabilizing period- 65%	after stabilizing
		From 2 <sup>nd</sup> year onwards- 75%	period- 65%
			From 2 <sup>nd</sup> year
			onwards- 80%

Considering the above, the PLF proposed is 65% for the 1st year, 75% for the 2nd year to 25th year for mass incineration project, while for RDF based projects the same is proposed as 65% for the 1st year, 80% for the 2nd year to 25th year for determining the Tariff for WtE projects to be commissioned in the next Control Period.

# 3.6 Auxiliary Consumption

The auxiliary consumption varies depending on the technology chosen for conversion of the waste to energy. In Mass Incineration Project the MSW received at project site directly utilised for generation of electricity. The auxiliary consumption of such plant is different and distinct than RDF based plant.



In RDF based MSW to energy projects the MSW received at project site is required to process by the power plant project developer to prepare RDF from such MSW. The process equipment also consume electricity which is part of integrated power plant needs to consider as auxiliary consumption of the power plant. Thus, the electricity consumption at RDF based power projects is considered separately. The auxiliary consumption considered by the various SERCs in their tariff order are stated below:

Table 3-6: Auxiliary Consumption considered by different SERCs in their Tariff Or	ders
for WtE.	

Electricity	Date of Order/ Regulation	Mass Incineration	<b>RDF</b> Auxiliary
Regulatory		Auxiliary Consumption	Consumption
Commission			
GERC	Order No.4 of 2016 (MSW	16%	12%
	Project) dated 10-11-2016		
	Order dated 13-06-2016 in		11%
	O.P.No.18 of 2016		
TSERC	(RDF/MSW)		
	Order dated 18-04-2020 in		11%
	O.P. NO. of 14 of 2020		
MPERC	Order dated 29-09-2021	15%	
MERC	Order dated 22-03-	16.57% for the $1^{st}$ year,	
	2021/03.07.2021	18.67% for the second year	
KERC	Order dated 19-09-2016	12% for the	
		integrated plant and power	
		plant	
KSERC	Order dated 06-03-2018	15%	
TNERC	Order dated 28-03-2019	15%	
CERC	Regulation dated 23-06-2020	15%	

In view of the above, the proposed auxiliary consumption is 14% for RDF based MSW projects and 15.5% for MSW projects based on mass incineration for determining the Tariff for WtE projects to be commissioned in the next Control Period.

# 3.7 Station Heat Rate, Fuel cost, Escalation on Fuel Cost and Gross Calorific Value of fuel

The Mass incineration/ Refuse Derived Fuel incineration-based technologies are emerging as preferred option for managing the growing problem of waste in country. Most of the



projects commissioned and under pipeline in the country for which the concession agreements are signed between the project developers and Urban Local Bodies are based on incineration technology.

Further, the Commission has proposed not to allow any fuel cost for MSW based projects because the cost of fuel preparation is included in the overall Capital Cost of the Project that will address both Capacity Charge and Fuel preparation cost and other incidentals. Hence, the related norms like Station Heat Rate, Fuel cost escalation, Gross Calorific Value, etc. are not applicable herein for determination of tariff of mass incineration based and RDF based MSW to energy projects.

Further, the MSW WtE Power Project Developer receive MSW at power project site free of cost provided by the Municipal Corporation or Urban Local Bodies, as the case may be.

In furtherance to above wherein the Commission has proposed not to allow any fuel cost for MSW based projects because the cost of fuel preparation is included in the overall Capital Cost of the Project that will address both Capacity Charge and Fuel preparation cost and other incidentals as well as Project Developer to receive MSW at project site free of cost provided by the Municipal Corporation or Urban Local Authority as the case may be. Therefore, it is proposed that there is no Fuel Cost for MSW based projects and consequentially question of escalation in Fuel cost, SHR, GCV etc. does not arise.

# 3.8 Evaluation of Financial Parameters

#### 3.8.1 Debt-Equity Ratio

GERC (Multi-Year Tariff) Regulations, 2016 specify the normative debt-equity ratio of 70:30 for Generating Company/Licensees. CERC has also considered the debt equity ratio of 70:30 in its RE Tariff Regulations 2012, 2017 and 2020. All other SERCs have also considered the debt-equity ratio as 70:30. Therefore, the proposed debt-equity ratio is 70:30.

#### 3.8.2 Loan Tenure

GERC in its latest MSW Tariff Order dated 10 November, 2016 had stipulated the loan tenure of 10 years. However, it has been noted that the CERC in its RE Tariff Regulations, 2020 has recommended the loan repayment period as 15 years. Therefore, it is proposed to keep loan tenure equal to 15 years, while determining the tariff during the next Control Period, which reflects the present market conditions and will also help to reduce the tariff in the initial years of the project.



#### 3.8.3 Interest on Term-loan

In the MSW Tariff Order dated 10 November, 2016, the long-term interest rate of 11.8% was considered. This was equivalent to prevalent SBI Base Rate at that time with a spread of 250 basis points. CERC, in its RE Tariff Regulations, 2020, specified that for computation of tariff, normative interest rate of two hundred (200) basis points above the average State Bank Marginal Cost of Funds based Lending Rate (MCLR) (one-year tenor) prevalent during the last available six months shall be considered. Same norms are being followed by most of the SERCs for fixing the normative interest on term loan.

The Interest on term loan approved by GERC and other SERCs under the regulatory approach are presented below:

# Table 3-7: Interest on term loan considered by different SERCs in their Tariff Order for WtE

Electricity	Date of Order/ Regulation	Interest on
Regulatory		Debt
Commission		
GERC	Order No.4 of 2016 (MSW Project) dated 10-11-	11.80%
	2016	
	Order dated 13-06-2016 in O.P.No.18 of	12.00%
	2016 (RDF/MSW)	
TSERC	Order dated 18-04-2020 in O.P. NO. of 14 of 2020	12.00%
MPERC	Order dated 29-09-2021	9.00%
MERC	Order dated 22-03-2021/03.07.2021	10.99%
KERC	Order dated 19-09-2016	12.00%
KSERC	Order dated 06-03-2018	9.90%
TNERC	Order dated 28-03-2019	10.55%

The prevalent SBI MCLR rate is shown in the Table below:

#### Table 3-8: SBI MCLR (one-year tenure) for last six months

Effective Date	Interest Rate (%)
15.02.2023	8.50
15.01.2023	8.40
15.12.2022	8.30
15.11.2022	8.05
15.10.2022	7.95



Effective Date	Interest Rate (%)
15.09.2022	7.70

Source: SBI web-site

Hence, the proposed interest rate on loan is 8.15% + 200 basis points, i.e., 10.15% for determining the Tariff for WtE projects to be commissioned in the next Control Period, in line with the CERC RE Tariff Regulations, 2020.

#### 3.8.4 Rate of Depreciation

CERC, in its RE Tariff Regulations, 2020 had considered the Capital Cost of the assets admitted by the Commission as value base for the purpose of depreciation. Further, the salvage value of the assets has been considered as 10% and depreciation is allowed up to maximum of 90% of the capital cost of the assets. Depreciation rate of 4.67% per annum has been specified for first 15 years and remaining depreciation is to be spread during remaining useful life of the RE projects considering the salvage value of the project as 10% of project cost.

The Commission had, in its latest MSW Tariff Order dated 10 November, 2016 considered a depreciation rate of 7% per annum during the loan period of 10 years. The Commission further decided that beyond the loan tenure, the remaining depreciation shall be allowed as per 'Straight Line Method' over remaining useful life of plant, i.e., depreciation @ 2% from 11<sup>th</sup> year to 20<sup>th</sup> year shall be allowed for the purpose of tariff determination.

Table 3-9: Rate of depreciation consider	ed by different SERCs	in their Tariff C	Order for
WtE Projects			

Electricity	Date of Order/ Regulation	Depreciation	
Regulatory			
Commission			
GERC	Order No.4 of 2016 (MSW Project)	a) 7% (up to 10 years)	
	dated 10-11-2016	b) 2% (11 to 20 years)	
	Order dated 13-06-2016 in O.P.No.18	Depreciation at 5.83% for 12	
	of 2016 (RDF/MSW)	years and at 2.50% for the	
TSERC		following 8 years	
	Order dated 18-04-2020 in O.P. NO. of	Depreciation at 5.83% for 12	
	14 of 2020	years and at 2.50% for the	
		following 8 years	
MPERC	Order dated 29-09-2021	4.67% (up to 15 years)	
		2% (16 to 25 years)	
MERC	Order dated 22-03-2021/03.07.2021	Depreciation at 5.83% for 12	
		years and at 2.50% for the 13	



Electricity	Date of Order/ Regulation	Depreciation	
Regulatory			
Commission			
		years onwards	
KERC	Order dated 19-09-2016	Depreciation at 5.83% for 12	
		years and at 2.50% for the 13	
		years onwards	
KSERC	Order dated 06-03-2018	Depreciation at 5.28% for 12	
		years and at 3.05% for the 13	
		years onwards	
TNERC	Order dated 28-03-2019	4.5% straight line method or	
		85% of the capital cost	
CERC	Regulation dated 23-06-2020	4.67% p.a., for the first 15 years	
		and remaining depreciation	
		shall be evenly spread during	
		remaining useful life of the	
		project.	

Hence, the depreciation rate is proposed at 4.67% per annum for the first 15 years and 2% from 16<sup>th</sup> year to 25<sup>th</sup> year as per the CERC (Terms and Conditions for Tariff determination from Renewable Energy Sources) Regulations, 2020 for determining the Tariff for WtE projects to be commissioned in the next Control Period.

#### 3.8.5 Working Capital

The Commission in its earlier MSW Tariff Order had considered the components of working capital as follows:

For Refused Derived Fuel based MSW to Energy Projects

- 1. Fuel stock for 30 days,
- 2. O&M expenses for one month,
- 3. Receivables of one month charges for sale of electricity,
- 4. Maintenance spares at 1% of the capital cost escalated at 5% per annum.

For mass incineration based MSW to Energy projects

- 1. O&M expenses for one month,
- 2. Receivables of one month charges for sale of electricity,
- 3. Maintenance spares at 1% of the capital cost escalated at 5% per annum

It is proposed to consider the above components for computing the working capital requirement for determination of tariff for next Control Period.



Electricity	Date of Order/	Mass Incineration - Working	RDF- Working Capital
Regulatory	Regulation	Capital	
Commission			
GERC	Order No.4 of 2016 (MSW Project) dated 10-11-2016	<ul> <li>a) O&amp;M expenses for one month</li> <li>b) Receivables of one-month charges for sale of electricity</li> <li>c) Maintenance spares @1% of the capital cost escalated at 5% p.a.</li> </ul>	<ul> <li>a) Fuel Stock for 30 days</li> <li>b) O &amp; M expenses for one month</li> <li>c) Receivables of one-month chargesfor sale of electricity</li> <li>d) Maintenance Spares @ 1% of the capital cost escalated at 5% p.a.</li> </ul>
TSERC	Order dated 13- 06-2016 in O.P.No.18 of 2016 (RDF/MSW)	<ul> <li>a) O&amp;M expenses for one month</li> <li>b) Maintenance spares @15% of O&amp;M</li> <li>c) Two months receivables for sale of electricity calculated on target PLF</li> </ul>	<ul> <li>a) O&amp;M expenses for one month</li> <li>b) Maintenance spares @15% of O&amp;M</li> <li>c) Two months receivables for sale of electricity calculated on target PLF</li> <li>d) Fuel cost for 4 months equivalent to normative PLF (only for RDF)</li> </ul>
	Order dated 18- 04-2020 in O.P. NO. of 14 of 2020	<ul> <li>a) O&amp;M expenses for one month</li> <li>b) Maintenance spares @1% of the capital cost escalated at 5% per annum.</li> <li>c) One month receivables for sale of electricity calculated on normative PLF</li> <li>d) Fuel cost for 1 month equivalent to normative PLF</li> </ul>	
MPERC	Order dated 29- 09-2021	<ul> <li>a) O&amp;M expenses for one month</li> <li>b) Receivables equivalent to 2 months of energy charges</li> <li>c) Maintenance spares @15% of O&amp;M expenses</li> </ul>	
MERC	Order dated 22- 03-2021/03-07- 2021	<ul> <li>a) O&amp;M expenses for one month</li> <li>b) Receivables equivalent to 2 months of fixed and variable charges</li> <li>c) Maintenance spares @15% of O&amp;M expenses</li> </ul>	
KERC	Order dated 19- 09-2016	Receivables Two months	
KSERC	Order dated 06-	a) O&M expenses for one month	

# Table 3-10: Working Capital considered by different SERCs in their Tariff Order for WtE



Electricity	Date of Order/	Mass Incineration - Working	RDF- Working Capital
Regulatory	Regulation	Capital	
Commission			
	03-2018	<ul><li>b) Receivables equivalent to 2 months of energy charges</li><li>c) Maintenance spares @15% of O&amp;M expenses</li></ul>	
TNERC	Order dated 28- 03-2019	<ul><li>a) O&amp;M expenses for one month</li><li>b) Receivables equivalent to 2 months</li></ul>	
CERC	Regulation dated 23-06-2020	<ul> <li>a) Fuel costs for four months equivalent to normative Plant Load Factor, if appliable;</li> <li>b) Operation and Maintenance expense for one month;</li> <li>c) Receivables equivalent to 45 days of tariff for sale of electricity calculated on the plant load factor; and</li> <li>d) Maintenance spares equivalent to 15% of Operation and Maintenance expenses</li> </ul>	<ul> <li>) Fuel costs for four months equivalent to normative Plant Load Factor, if appliable;</li> <li>) Operation and Maintenance expense for one month;</li> <li>) Receivables equivalent to 45 days of tariff for sale of electricity calculated on the plant load factor; and</li> <li>1) Maintenance spares equivalent to 15% of Operation and Maintenance expenses</li> </ul>

Hence, the components of working capital are retained as per its latest MSW Tariff Order dated 10 November, 2016 for determining the Tariff for WtE projects to be commissioned in the next Control Period.

#### 3.8.6 Interest on Working Capital

The Commission in its MSW Tariff Order dated 10 November, 2016 had considered the interest rate on working capital at 11.8%, which was equal to the SBI Base Rate plus 250 basis points. GERC (Multi-Year Tariff) (First Amendment) Regulations 2016 specifies that "Interest on working capital shall allowed at a rate equal to the weighted average State Bank Base Rate (SBBR) / 1 year State Bank of India (SBD Marginal Cost of Funds Based Lending Rate (MCLR) / any replacement thereof by SBI for the time being in effect applicable for 1 year period, as may be applicable prevailing during the financial year plus 250 basis points."

The Short-term interest rates offered by Financial Institutions such as PFC, REC varies from 11.00% to 12.75% depending on whether the company is AAA rated companies or other than AAA rated companies. The short-term interest rate of IREDA is "Highest Interest rate of the sector + 0.50% p.a."



CERC RE Tariff Regulations, 2020 has provided the norms for interest on working capital as three hundred (350) basis points above the average SBI MCLR (one-year tenor) prevalent during the last available six months. The interest rate on working capital considered by other SERCs is shown in the Table below:

Table 3-11: Rate of interest on Working Capital considered by different SERCs in their
Tariff Order for WtE

Electricity	Date of Order/ Regulation	Rate of Interest
Regulatory		on Working
Commission		Capital
GERC	Order No.4 of 2016 (MSW Project) dated 10-11-	11.80%
	2016	
	Order dated 13-06-2016 in O.P.No.18 of	12.50%
TSFRC	2016 (RDF/MSW)	
	Order dated 18-04-2020 in O.P. NO. of 14 of 2020	10.90%
MPERC	Order dated 29-09-2021	10.50%
MERC	Order dated 22-03-2021/03.07.2021	8.55%
KERC	Order dated 19-09-2016	12.50%
KSERC	Order dated 06-03-2018	10.90%
TNERC	Order dated 28-03-2019	11.55%

Accordingly, interest on working capital for tariff determination is proposed as SBI MCLR rate of 8.15% (average of last six months) plus 250 basis points i.e., 10.65% (8.15% + 2.5%), as per the MSW Tariff Order dated 10 November, 2016 of GERC for determining the Tariff for WtE projects to be commissioned in the next Control Period.

#### 3.8.7 Return on Equity

The Return on Equity considered by various Commissions are stated below:

Table 3-12 Return	on Equit	v considered b	v different SER(	<b>Cs in their</b>	Tariff C	)rder for V	NtE
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Electricity Regulatory Commission	Date of Order/ Regulation	Return on Equity
GERC	Order No.4 of 2016 (MSW Project) dated 10-11- 2016	14%



Electricity Regulatory	Date of Order/ Regulation	Return on
Commission		Equity
	Order dated 13-06-2016 in O.P.No.18 of	16% (Post Tax)
	2016 (RDF/MSW)	
TSERC	Order dated 18-04-2020 in O.P. NO. of 14 of 2020	16% (Post Tax)
MPERC	Order dated 29-09-2021	14%
MERC	Order dated 22-03-2021/03.07.2021	First 10 years: 14%
		10 <sup>th</sup> year onwards: 14%
KERC	Order dated 19-09-2016	16%
KSERC	Order dated 06-03-2018	14% (Pre Tax)
TNERC	Order dated 28-03-2019	17.60% (Pre Tax)
CERC	Regulation dated 23-06-2020	14%

The Commission has notified Regulations on GERC (Multi Year Tariff), 2016, which envisages the return on equity at 14% per annum. Further, the Commission has also in earlier MSW to WtE project Order of year 2016 considered the RoE as 14% per annum. On the same lines, for MSW to WtE power projects also the commission propose the return on equity at the rate of 14% per annum and also Income Tax on it.

Hence, the proposed Rate of Return on Equity is 14% for the next Control Period. The Commission also propose to allow Income Tax at 17.470% (MAT) for the initial period of 10 years and thereafter from 11th year onwards upto the 25th year, a Corporate Tax at the rate of (34.94%) for both, MSW to WtE power projects based on Incineration Technology of Mass Incineration and RDF to energy projects.

#### 3.8.8 Discount Rate

The discount rate has been considered by this Commission, CERC and other SERCs as Weighted Average Cost of Capital (WACC). The formula for computation of WACC is given below.

WACC = Cost of Debt + Cost of Equity;

Where,

Cost of Debt (For first 10 years) = 0.70 x (Market Rate of Interest) x (1- MAT)

Cost of Debt (11<sup>th</sup> year to 25<sup>th</sup> year) = 0.70 x (Market Rate of Interest) x (1- Corporate tax);

Cost of Equity = 0.30 x Return on Equity (i.e., normative 14%)



Resulting WACC = {(WACC for first 10 Years X 10) + (WACC 11<sup>th</sup> Year to 25<sup>th</sup> Year X 15)}/ (10 + 25)

Interest Rate considered for the loan component (i.e., 70% of the capital cost) is 10.15%.

For the equity component (i.e., 30% of the capital cost), the rate of Return on Equity (ROE) is normatively considered at a post-tax rate of 14%. Further, the MAT is considered as 17.34% and Corporate Tax rate has been considered as 34.94%.

Cost of Debt (For first 10 Years) = 0.70 x 10.15% x (1-17.47%) = 5.86%

Cost of Debt (11<sup>th</sup> Year to 25<sup>th</sup> Year) = 0.70 x 10.65% x (1- 34.94%) = 4.62%

Cost of Equity = 0.30 x 14% = 4.20%

The computation of Discount Factor is given below:

WACC for first 10 Years = 10.46%

WACC 11<sup>th</sup> Year to  $25^{th}$  Year = 8.82%

Discount Factor (WACC) =  $[{(10.46\% x 10) + (8.82\% x 15)}/(10 + 25)] = 9.32\%$ 

Thus, the WACC works out to 9.32%, and it is proposed to consider the discount rate of 9.32% for determination of levelized tariff of WtE projects to be commissioned during the Control Period.

#### 3.9 Incentives for MSW Projects

The incentives/subsidies offered by Central Government/State Government to be considered while calculating tariff for MSW projects are discussed below.

#### 3.9.1 Benefit due to Accelerated Depreciation

As per the current provisions under Income Tax Act, RE project owners can avail accelerated depreciation at the rate of 40% in the first year on a **written-down value (WDV)** basis. In addition to this 40% depreciation, an additional depreciation of 20% in the initial year is extended to new assets acquired by power generation companies vide amendment in the section 32, sub-section (1) clause (iia) of the Income Tax Act, 1961. With this, the projects can avail 60% depreciation in the first year of commissioning. From the second year onwards, depreciation at the rate of 40% on written-down-value (WDV) is available.



In view of above, the tariff for the projects availing the Accelerated Depreciation (AD) benefit and projects not availing the AD benefit has been computed accordingly, by considering 60% AD benefit in 1<sup>st</sup> year and 40% AD benefit from 2<sup>nd</sup> year onwards, for eligible projects.

#### 3.9.2 Financial Assistance, Subsidy or Incentive by State or Central Government

If any benefit/support/financial assistance in any form is received by the project developer from Central Government/State Government/ULB/UDD/Municipal Corporations/any other agency, the same shall be passed on to the procurer (purchaser) of electricity. The project developer or Distribution Licensee shall approach the Commission for re-determination of the tariff.

The Commission noted that the Central Financial Assistance (CFA) of Rs. 500 lakh/MW is available from the Ministry of New and Renewable Energy (MNRE), Government of India to the eligible MSW based power projects (as per MNRE File No. 2/222/2016-17-WTE, dated 28.02.2020). This is significant amount, which is almost 25-30% of the capital cost of the MSW to WtE project. Hence, the Commission is of the view that the Project Developer shall avail such benefit. Further, for clarity, the tariff has been determined with and without factoring in the CFA/subsidy or any grant or concession or any income component. When such benefit(s) is available to the project developer, the project developer avail the benefit(s) so that the same be passed on to the licensee and consumers.

The Urban Administration and Development Dept should inform the Commission, in case the project proponent avails incentive/benefit from other schemes of Central Government under Swatch Bharat Mission / Ministry of Housing and Urban Affairs. The project developer shall also undertake with regard to the financial assistance, subsidy or incentive if any available to it from any authority. In such instances, the Commission shall issue separate order indicating the applicable tariff for sale of electricity considering actual financial assistance, subsidy/ incentive received by the project proponent.

#### 3.10 Tariff Determination

Based on the above assumptions, the various operational and financial parameters considered for determination of MSW tariff, the MSW Tariff approved for the next Control Period, is summarised in the Table below:

#### **Table 3-13 Tariff Computation**



Proposed for new Control Period starting from the date of this Order to 31st March, 2028			
Parameters	Mass Incineration	RDF based Incineration	
	Project Cost	and O&M	
Total Project Cost (including Evacuation			
Infrastructure Cost up to Interconnection	1800	1675	
Point) (Rs. Lakh/MW)			
Central Financial Assistance (Rs. Lakh/MW)	500	500	
Total Project Cost considering Central Financial Assistance (Rs. Lakh/MW)	1300	1175	
Normative O&M Cost for first year (% ofproject cost)	6%	8.5%	
Escalation in O&M (per annum from 2ndyear)	3.84%	3.84%	
	Performance Parameters		
	65% for 1st year & 75% from	65% for 1st year & 80% from	
PLF	2nd yearOnwards	2nd yearOnwards	
Auxiliary Consumption	15.50%	14%	
Project Life in Years	25	25	
Station Heat Rate kcal/kWh	NA	NA	
Gross Calorific Value of Fuel kcal/kg	NA	NA	
Cost of Fuel	NA	NA	
Fuel Cost Escalation	NA	NA	
	Financial Para	ameters	
Debt-Equity ratio	70:30	70:30	
Tenure of Loan in Years	15	15	
Interest on Term Loan	10.15% p.a.	10.15% p.a.	
Interest on Working Capital	10.65% p.a.	10.65% p.a.	
Depreciation	4.76% (up to 15 years)	4.67% (up to 15years)	
	2% (16 to 25 years)	2% (16 to 25 years)	
Minimum Alternate Tax	17.47%	17.47%	
Corporate Income Tax	34.94%	34.94%	

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Proposed for new Control Period starting from the date of this Order to 31 <sup>st</sup> March, 2028			
Parameters	Mass Incineration	<b>RDF</b> based Incineration	
Return on Equity	14%	14%	
Discount Rate	9.32%	9.32%	
Levelized Tariff for 25 years	<u>Capital Cost Excl. CFA</u> Tariff Rs.7.07/kWh for the projects not availing the AD benefit.	<u>Capital Cost Excl. CFA</u> Tariff Rs.7.10/kWh for the projects not availing the ADbenefit.	
	Tariff Rs. 6.46/kWh for the projects availing AD benefit <u>Capital Cost incl. CFA</u> Tariff Rs. 5.87/kWh for the projects not availing the AD benefit. Tariff Rs. 5.43/kWh for the projects availing AD benefit	Tariff Rs. 6.54/kWh for the projects availing AD benefit <b>Capital Cost incl. CFA</b> Tariff Rs.5.99/kWh for the projects not availing the AD benefit. Tariff Rs. 5.59/kWh for the projects availing AD benefit	

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The extract of the tariff calculation sheet is given at **Appendix 1 to Appendix 4** to this Discussion Paper, while the calculation of Depreciation benefit is given at **Appendix 5** to **Appendix 8** to this Discussion Paper.

The above tariff shall be applicable for all projects to be commissioned in the next Control Period.



# **4 OTHER COMMERCIAL ISSUES**

# 4.1 Transmission and Wheeling Charges

#### For Captive Consumption:

The Commission proposes 'Transmission and Wheeling Charges' as under:

#### For Captive Consumption:

- a) Wheeling of power to consumption site at 66 kV voltage level and above: The wheeling of electricity generated from Project to the desired location(s) within the State, shall be allowed on payment of Transmission Charges and Transmission Losses applicable to normal Open Access consumer.
- b) Wheeling of power to consumption site below 66 kV voltage level:
  - I. In case injection or drawal is at 66 kV and drawal or injection is at 11 kV, wheeling of electricity generated from Power Project to the desired location(s) within the State shall be allowed on payment of Transmission Charges and Transmission Losses applicable to normal Open Access consumers and 50% of Wheeling Charges and 50% of Distribution Losses of the energy fed to the grid as applicable to normal Open Access consumers.

#### II. Injection at 11 kV and drawl at 11 kV and below voltage level:

- a) When the point of injection and drawal at 11 kV or below voltage level lies within the same Distribution Company, the user shall pay 50% of Wheeling Charges and 50% of Losses of the energy fed to the grid as applicable to normal Open Access consumers.
- b) In case the point of injection and drawal at 11 kV or below voltage level lies in different distribution area, the user shall pay 50% of Wheeling Charges and 50% of Losses of the energy fed to the grid as applicable to normal Open Access consumers for each Distribution Company. Moreover, transmission charges and transmission losses as applicable to normal Open Access Consumer shall also be levied.
- III. Waste to energy Project owners who desire to wheel electricity to two or more locations, shall pay 5 paise per unit on energy fed in the grid to the Distribution Company concerned in whose area power is consumed in addition to above mentioned transmission charges and losses, as applicable.



#### c) Cross Subsidy Surcharge:

- Cross Subsidy Surcharge and Additional Surcharge shall not be applicable for WTE Projects under Captive Route.
- Cross Subsidy Surcharge and Additional Surcharge shall be exempted for WTE Projects under Third Party Sale.

# 4.2 Metering

The Commission proposes following with regard to Metering arrangement:

- "Power Project based on MSW shall have to provide four quadrant ABT compliant meters at the interface point which shall conform to the Central Electricity Authority (Installation and Operation of Meters) Regulations, 2014, as amended from time to time. GETCO/DISCOM to stipulate necessary specifications in this regard.
- The electricity generated shall be metered and readings taken jointly by MSW WTE Project developer with the representative of DISCOM and GETCO at the metering point, on monthly basis.
- The WTE Project Developers shall also install Remote Terminal Unit (RTU) at their own cost for transferring the real time date to SLDC for its monitoring purpose, and in accordance with the GERC orders from time to time.
- State Load Dispatch Centre shall certify actual injected energy and energy drawn (if any) from local DISCOM on monthly basis.

# 4.3 Pricing of Reactive Power

The applicable Reactive Energy Charges are determined in the Transmission Tariff Order, GETCO Order for FY 2022-23, i.e.:

"10 paise/kVARh – For the drawl of reactive energy at 10% or less of the net energy exported.

50 paise/kVARh – For the drawl of reactive energy at more than 10% of the net active energy exported".

It is proposed to adopt the same Reactive Energy charges as determined in the Transmission Tariff Order by the Commission from time to time.

# 4.4 Banking of Energy and Purchase of Surplus Power:

Banking of energy permitted for MSW to energy-based projects on billing cycle basis as per the provisions of the MoP Green Energy Open Access Rules, 2022 as amended and



the GERC Green Energy Open Access Regulations notified by the Commission and amended from time to time.

# 4.5 Renewable Energy Certificates for Third Party Sale and Captive Use of Electricity Generated from MSW to energy Projects

The Commission proposes that Power projects based on MSW availing Open Access for captive use/third-party sale under REC mechanism shall be governed as per the CERC REC Regulations. Such projects shall be allowed to wheel the electricity on payment of applicable Transmission Charges/Losses, Wheeling Charges/Losses and other charges as applicable to other normal Open Access consumers.

No Cross subsidy Surcharge and Additional Surcharge shall be applicable as applicable for the energy generated and supplied from MSW WtE Project to the consumer.

# 4.6 Security Deposit

The Commission proposes that the MSW WtE power project developers are required to furnish Bank Guarantee of Rs. 15 Lakh/MW as a security deposit after entering into PPA with obligated entities (entities obliged to fulfil the RPO). The Bank Guarantee shall be returned if the developer achieves commercial operation within the time period mentioned in the PPA. The Bank Guarantee shall be encashed if the project is not commissioned within the specified time period as stipulated in the PPA.

# 4.7 Energy Accounting and Surplus Power Injection

The Commission proposes that the energy accounting for all WtE Projects shall be in accordance with the provisions of the MOP's Green Energy Open Access Rules 2022 as amended and applicable Regulations framed by the GERC and order of the Commission from time to time.

The Banking of energy facility and charges for it shall be allowed as per the provisions of the MoP's Green Energy Open Access Rules 2022 as amended and applicable Regulations framed by the Commission and Order, if any, on this subject matter from time to time.

The Surplus Energy, if any, after giving set off shall be purchased by the Distribution Licensee as per the provisions of the MoP's Green Energy Open Access Rules 2022 as amended and applicable Regulations framed by the Commission and Order, if any, from time to time.



For net import of power by the MSW based WtE Power Project, Distribution Company/Licensee will charge applicable tariff of respective category to the consumer including fixed / demand charge, energy charges, peak charge, other charges / penalty etc. as applicable to other consumers.

The surplus power if any available at the end of banking cycle shall be considered as inadvertent flow of energy.

# 4.8 Forecasting Scheduling

The varying calorific value of waste due to its heterogeneous nature & its characteristics, and management of the fuel done by the power project developer, the energy generation from MSW based energy project / plant may be affected. However, with verifying and measuring the various parameters of MSW at power plant site and an option available for revision in schedule to such power plant after some time with consideration of parameters it may be predicted in a range and in order to ensure grid discipline and grid security, it is proposed that the MSW Projects shall require to declare plant availability with consideration of the available MSW at project site and its parameters & plant on day ahead basis as well as intra-day basis. Since, the MSW based project having must run status. However, the WTE Projects shall abide by the provisions of Intra-State ABT, Forecasting, Scheduling & Deviation Settlement Mechanism as per the Order/Regulations of the Commission & National Policy/Guidelines as amended from time to time.

### 4.9 Commissioning of MSW based Waste to Energy Plant

The Project Developer shall provide the copy in advance to the Nodal Agency GUVNL/DISCOMs of the (i) Manner in which 'Performance Test' to be undertaken as prescribed by the Original Equipment Manufacturer (OEM) and (ii) copy of relevant Contract including Guaranteed Performance Parameter by the OEM as per Supply Agreement for demonstrating the achievement of said parameters to be undertaken as part of testing & commissioning activity prior to actual commissioning of MSW WtE Plant. Moreover, said 'Performance Test' (like continuous 72 hours test of rated parameters) shall be done in presence of the representatives of the GEDA, GUVNL (Nodal Agency as per GoG Policy), relevant distribution licensee, transmission licensee and Independent Engineer appointed by the Procurer(s). The Project Developer shall intimate in advance regarding the date & time of said Performance Test to the (i) GEDA (ii) GUVNL (Nodal Agency as per GoG Policy)/DISCOM, (iii) Transmission licensee and (iv) Independent



Engineer appointed by the Procurer(s) and the representatives authorised by respective entity/person shall witness such test on the date & time so provided. The test results of Performance Test shall be verified as regard meeting the Guaranteed Parameters of the OEM supplier and test report shall be jointly signed by the representatives of (i) MSW WtE Project Developer, (ii) GEDA, (iii) GUVNL (Nodal Agency as per GoG Policy)/DISCOM, (iv) Transmission licensee and (v) Independent Engineer appointed by the Procurer(s). It is made clear that commissioning will qualify only when the aforesaid Performance Test is witnessed by all representatives and necessary certificate is jointly signed.

Thereafter, the commissioning of MSW WtE Power Plant shall be done in presence of the representatives of (i) MSW WtE Project Developer (ii) GEDA (iii) GUVNL (Nodal Agency as per GoG Policy)/DISCOM (iv) Transmission licensee and (v) Independent Engineer as appointed by the Procurer(s). All these representatives shall sign the Commissioning certificate including all other relevant information. Any commissioning undertaken in absence of representative of any of above entities and not witnessed shall not qualify as 'Commissioning'.

The MSW WtE Power Project Developer shall co-ordinate with GEDA for aforesaid procedure. GEDA shall in turn intimate and co-ordinate with all other entities with regard to above activities, date, time etc.

# 4.10 Information and Data sharing by the MSW WtE Project Developer

The Project Developer shall maintain the record on (a) Daily basis, (b) Monthly basis and (c) Annual basis (Financial Year) of following information:

- (i) Opening Balance of MSW fuel, if any
- (ii) Opening Balance of Calorific Value of MSW fuel, if any
- (iii) Quantity of MSW received from the concerned Municipal Corporation/ULB with whom Concession Agreement is signed by the MSW WtE Project Developer
- (iv) Calorific Value of MSW fuel received, if determined by approved laboratory
- (v) Quantity of MSW utilised for generation of electricity
- (vi) Calorific Value of MSW fuel utilised
- (vii) Gross Electricity Generation
- (viii) Auxiliary consumption
- (ix) Net Electricity Generation as per SEA of SLDC
- (x) Closing Balance of Quantity of MSW fuel,



- (xi) Closing Balance of Calorific Value of MSW fuel etc.
- (xii) Quantum of RDF and other product if any available from the process of MSW at power plant site while processing the MSW to RDF.
- (xiii) Fly ash if any available after the production of electricity.
- (xiv) Disposal of waste from the plant.
- (xv) Additional information as suggested in Gujarat Solid Waste Policy 2022.

The above information shall be provided with monthly invoices raised by the MSW WtE Project Developer (Supplier) to the Nodal Agency (GUVNL)/DISCOM (Procurer). Moreover, the MSW WtE Project Developer shall also upload the above data/information/details on its website duly updated on day to day basis.

The Nodal Agency shall verify above aspects will processing the invoice(s) raised by the MSW WtE Project Developer.

It is made clear that any electricity generated through use of any other fuel other than MSW fuel to be supplied by the concerned Municipal Corporation/ULB in terms of the Concession Agreement executed by the MSW WtE Project Developer with concerned Municipal Corporation/ULB shall require prior approval of the Procurer/Commission.

# 4.11 Sharing of Clean Development Mechanism (CDM) Benefit

It is proposed that the sharing of CDM benefits or any other benefit under Clean Energy Mechanism or any other mechanism under any provision from any source providing such benefits to the MSW based WtE power project for which it shall qualify to receive such benefit on the energy generation from the MSW based power generation project shall apply to the concerned authority to avail / receive the benefit for the project. The benefits which shall be receivable or received shall be shared with the procurer of power and / or licensee as under:

"100% of the gross proceeds on account of such CDM benefit or any other benefit under Clean Energy Mechanism from any source to be retained by the project Developer in the first year after the date of commercial operation of the generating station.

In the second year, the share of the Beneficiaries like power procurer/licensee shall be 10% which shall be progressively increased by 10% every year till it reaches 50%, where after the proceeds shall be shared in equal proportion, by the Generating Company and the Beneficiaries like power procurer/licensee."



# 4.12 Applicability of the Order

It is proposed that the tariff determined in the MSW based energy projects Order will be applicable to all MSW based power project using mass incineration / RDF incineration technology commissioned on or after the date of issue of the Order for sale of electricity to the distribution licensees in the State with procurement of new equipment's, machinery etc. and EPC contract and commission the power plant.

The control period of this tariff Order is from this Order till 31<sup>st</sup> March 2028 (i.e., end of FY 2027-28). The tariff determined by the Commission under Order shall be the ceiling tariff, the distribution licensee may procure electricity from the interested MSW based Power project proponent / generator at a tariff lower than the tariff determined by the Commission.

The MSW based Power projects commissioned prior to Order on present discussion paper shall be governed by the terms and conditions given in the earlier MSW Based Energy Project Tariff Order No. 04 of 2016 dated 10.11.2016 and subsequent Suo-Motu Order dated 23.10.2017 in Petition No. 1654 of 2017.

The Order to be passed on this discussion paper may not come in way of agreed terms & conditions of the Power Purchase Agreement, if any, executed between the MSW Based Power Project Developer (Supplier) and distribution licensee and/or nodal agency for procurement of power from such project like GUVNL.

Sd/-[Roopwant Singh, IAS] Secretary Gujarat Electricity Regulatory Commission Gandhinagar, Gujarat

Place: Gandhinagar

Date: 02/06/2023



#### Appendix 1: Tariff for MSW to Energy projects based on Mass Incineration Technology (Excl. CFA)

	Tariff Calculations for MSW Based Power Plant - Mass Incineration																								
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Net Energy sold (lakh kWhs)	48.11	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52
Costs																									
O&M	108.00	112.15	116.45	120.93	125.57	130.39	135.40	140.60	146.00	151.60	157.42	163.47	169.75	176.26	183.03	190.06	197.36	204.94	212.81	220.98	229.47	238.28	247.43	256.93	266.79
Depreciation (SLM)	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	84.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00	36.00
Interest on term loan	123.63	115.10	106.58	98.05	89.52	81.00	72.47	63.95	55.42	46.89	3.20	2.49	1.78	1.07	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working capital	6.52	6.62	6.72	6.83	6.95	7.08	7.21	7.36	7.52	7.68	7.66	7.92	8.20	8.48	8.78	8.66	8.99	9.34	9.70	10.08	10.48	10.89	11.32	11.78	12.25
Return on Equity	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60	75.60
Tax on equity	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41
Total Cost (Rs lakh)	410.96	406.67	402.56	398.61	394.85	391.27	387.89	384.71	381.74	378.99	354.30	359.89	365.73	371.82	378.18	336.74	344.37	352.29	360.52	369.08	377.96	387.18	396.77	406.72	417.06
Tariff (Rs/kWh)	8.54	7.33	7.25	7.18	7.11	7.05	6.99	6.93	6.88	6.83	6.38	6.48	6.59	6.70	6.81	6.07	6.20	6.35	6.49	6.65	6.81	6.97	7.15	7.33	7.51
Levelized Fixed Tariff Calculations																									
Discount Rate	9.32%			1																					
Levelized Fixed Tariff (Rs / kWh)	7.07	0.61	6.46																						

**Note:** As per the MNRE revised guideline of Waste to Energy Plant dated 28.02.2020, Ministry provides Central Financial Assistance (CFA) of Rs. 5 Crore/MW (Maximum CFA- Rs. 50 Crore/Project) for power generation from Municipal Solid Waste/Refused derived fuel through Incineration or other approved thermal technologies. Minimum size of the plant of 5 MW of installed capacity shall be supported for availing CFA. Both scenarios have been considered for determining the Generic Tariff, viz., including CFA and excluding CFA.



# Appendix 2: Depreciation benefit calculations for MSW to Energy projects based on Mass Incineration Technology

Capital cost					1800	.00																			
Depreciable amount					1620	.00																			
SLM depreciation (book depreciation) rate					5.2	8%																			
IT Depreciation rate					4	0%	20%			extra allowed during year 1															
MAT rate					17.4	7%																			
Corporate tax rate					34.9	4%																			
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Book Depreciation																									
Book depreciation Rate	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	0.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Amount of book depreciation (Rs	05.04	05.04	05.04	05.04	05.04	05.04	05.04	05.04	05.04	05.04	05.04	05.04	05.04	05.04	05.04	05.04	05.04	4.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Accelerated depreciation	95.04	95.04	95.04	95.04	95.04	95.04	95.04	95.04	95.04	95.04	95.04	95.04	95.04	95.04	95.04	95.04	95.04	4.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Opening	100%	40.0%	24.0%	14.4%	8.6%	5.2%	3 1%	1 9%	1 1%	0.7%	0.4%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Allowed during the	60.0%	16.00%	0.60%	E 76%	2.46%	2.07%	1.24%	0.75%	0.45%	0.27%	0.16%	0.10%	0.06%	0.02%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
year	00.0%	10.00%	9.00%	5.70%	5.40%	2.07%	1.24%	0.75%	0.45%	0.27%	0.10%	0.10%	0.06%	0.03%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Closing Amount of	40.0%	24.00%	14.40%	8.64%	5.18%	3.11%	1.87%	1.12%	0.67%	0.40%	0.24%	0.15%	0.09%	0.05%	0.03%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
accelerated depreciation (Rs lakh)	1080.00	288.00	172.80	103.68	62.21	37.32	22.39	13.44	8.06	4.84	2.90	1.74	1.04	0.63	0.38	0.23	0.14	0.08	0.05	0.03	0.02	0.01	0.01	0.00	0.00
Net depreciation benefit (Rs lakh)	984.96	192.96	77.76	8.64	-32.83	-57.72	-72.65	-81.60	-86.98	-90.20	-92.14	-93.30	-94.00	-94.41	-94.66	-94.81	-94.90	-4.24	0.05	0.03	0.02	0.01	0.01	0.00	0.00
Tax Benefit (Rs	344.15	67.42	27.17	3.02	-11.47	-20.17	-25.38	-28.51	-30.39	-31.52	-32.19	-32.60	-32.84	-32.99	-33.08	-33.13	-33.16	-1.48	0.02	0.01	0.01	0.00	0.00	0.00	0.00
Net energy Generation (lakh																									
Units)	48.11	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52
depreciation benefit per unit (Rs																									
/ KWh)	7.15	1.21	0.49	0.05	-0.21	-0.36	-0.46	-0.51	-0.55	-0.57	-0.58	-0.59	-0.59	-0.59	-0.60	-0.60	-0.60	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Discount factor	1.00	0.91	0.84	0.77	0.70	0.64	0.59	0.54	0.49	0.45	0.41	0.38	0.34	0.31	0.29	0.26	0.24	0.22	0.20	0.18	0.17	0.15	0.14	0.13	0.12
Levellised benefit of accelerated depreciation (Rs / kWh)	0.61																								



# Appendix 3: Tariff for MSW to Energy Project based on RDF Technology ((Excl. CFA)

									Ta	ariff Calcula	ations for M	ISW Powe	r Plant - R	)F Based											
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Net Energy sold (lakh kWhs)	48.97	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27
Costs																									
O&M	142.38	147.84	153.52	159.41	165.54	171.89	178.49	185.35	192.46	199.86	207.53	215.50	223.77	232.37	241.29	250.56	260.18	270.17	280.54	291.31	302.50	314.12	326.18	338.70	351.71
Insurance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation (SLM)	78.17	78.17	78.17	78.17	78.17	78.17	78.17	78.17	78.17	78.17	78.17	78.17	78.17	78.17	78.17	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50
Advance Against Depreciation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on term loan	111.74	103.80	95.87	87.93	80.00	72.07	64.13	56.20	48.26	40.33	32.40	24.46	16.53	8.60	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working capital	6.79	6.91	7.03	7.17	7.31	7.46	7.62	7.80	7.98	8.17	8.49	8.71	8.94	9.18	9.44	9.38	9.74	10.11	10.51	10.92	11.34	11.79	12.26	12.74	13.25
Return on Equity	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35	70.35
Tax on equity	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	12.29	24.58	24.58	24.58	24.58	24.58	24.58	24.58	24.58	24.58	24.58	24.58	24.58	24.58	24.58	24.58
Fuel cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Cost (Rs lakh)	421.71	419.36	417.23	415.32	413.65	412.23	411.06	410.15	409.51	409.17	421.51	421.77	422.34	423.24	424.49	388.37	398.35	408.71	419.48	430.66	442.28	454.34	466.87	479.88	493.40
Fixed cost (Rs lakh)	421.71	419.36	417.23	415.32	413.65	412.23	411.06	410.15	409.51	409.17	421.51	421.77	422.34	423.24	424.49	388.37	398.35	408.71	419.48	430.66	442.28	454.34	466.87	479.88	493.40
Fuel cost (Rs lakh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tariff																							1	1	·
Fixed tariff (Rs / kWh)	8.61	6.96	6.92	6.89	6.86	6.84	6.82	6.81	6.79	6.79	6.99	7.00	7.01	7.02	7.04	6.44	6.61	6.78	6.96	7.15	7.34	7.54	7.75	7.96	8.19
Variable tariff (Rs / kWh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tariff (Rs/kWh)	8.61	6.96	6.92	6.89	6.86	6.84	6.82	6.81	6.79	6.79	6.99	7.00	7.01	7.02	7.04	6.44	6.61	6.78	6.96	7.15	7.34	7.54	7.75	7.96	8.19
Levelized Fixed Tariff Calculations		_																							
Discount Rate	9.32%			_																					
Levelized Fixed Tariff (Rs / kWh)	7.10	(0.56)	6.54																						


# Appendix 4: Depreciation benefit calculations for MSW to Energy Project based on RDF Technology

Consider a const			4.675																						
Capital cost			16/5	0.00																					
Depreciable amount		、 .	1507	.50																					
SLM depreciation (bo	ок aeprec	lation) rat	e 5.2	28%	200/ aut																				
MAT roto			17.4	10% 4	20% ext	ra allowe	a auring y	eari																	
Corporate tax rate			24.0	1 70																					
			54.5	74 /0																					
				1																					Т
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Book Depreciation																									
Book Deprediation																									-
Book depreciation	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	5 28%	0.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Trate	5.20%	5.20%	5.2070	5.2070	5.20%	5.2070	5.2070	5.2070	5.2070	5.2070	5.2070	5.2070	5.2070	5.2070	5.2070	5.20%	5.20%	0.2470	0.0070	0.0070	0.0076	0.0070	0.0070	0.0070	0.0076
Amount of book																									
depreciation (Rs lakh)	88.44	88.44	88.44	88.44	88.44	88.44	88.44	88.44	88.44	88.44	88.44	88.44	88.44	88.44	88.44	88.44	88.44	4.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
depreciation																									
Opening	100%	40.0%	24.0%	14.4%	8.6%	5.2%	3.1%	1.9%	1.1%	0.7%	0.4%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Allowed during the	60.0%	16.00%	9.60%	5 76%	3.46%	2.07%	1 24%	0.75%	0.45%	0.27%	0.16%	0.10%	0.06%	0.03%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
your	00.076	10.0076	5.0070	5.7070	5.40%	2.0770	1.2470	0.7570	0.4570	0.2770	0.1076	0.1076	0.0076	0.0370	0.0270	0.01/0	0.0176	0.0070	0.0070	0.0070	0.0076	0.0076	0.0070	0.0070	0.0070
Closing	40.0%	24.00%	14.40%	8.64%	5.18%	3.11%	1.87%	1.12%	0.67%	0.40%	0.24%	0.15%	0.09%	0.05%	0.03%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Amount of accolorated																									
depreciation (Rs lakh)	1005.00	268.00	160.80	96.48	57.89	34.73	20.84	12.50	7.50	4.50	2.70	1.62	0.97	0.58	0.35	0.21	0.13	0.08	0.05	0.03	0.02	0.01	0.01	0.00	0.00
Net depreciation	016 56	170 56	72.26	8.04	-20.55	-52 71	-67.60	-75.04	-80.94	-92.04	-95 74	-96.92	-97 47	.97.96	- 88 00	-99.72	-99 21	-2.04	0.05	0.02	0.02	0.01	0.01	0.00	0.00
	510.50	175.50	72.30	8.04	-30.33	-55.71	-07.00	-75.54	-80.94	-83.94	-85.74	-00.02	-07.47	-87.80	-88.09	-00.23	-00.31	-3.54	0.05	0.03	0.02	0.01	0.01	0.00	0.00
Tax Benefit (Rs lakh)	320.28	62.75	25.29	2.81	-10.68	-18.77	-23.62	-26.54	-28.28	-29.33	-29.96	-30.34	-30.56	-30.70	-30.78	-30.83	-30.86	-1.38	0.02	0.01	0.01	0.00	0.00	0.00	0.00
Not operation																									
(lakh Units)	48.97	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27
Accelerated																									
depreciation benefit																									
per unit (Rs / kWh)	6.54	1.04	0.42	0.05	-0.18	-0.31	-0.39	-0.44	-0.47	-0.49	-0.50	-0.50	-0.51	-0.51	-0.51	-0.51	-0.51	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Discount factor	1.00	0.01	0.01	0.77	0.70	0.01	0.50	0.54	0.40	0.45	0.41	0.30	0.21	0.35	0.20	0.20	0.25	0.22	0.20	0.10	0.17	0.15	0.1.5	0.12	0.12
Discount factor	1.00	0.91	0.84	0.77	0.70	0.64	0.59	0.54	0.49	0.45	0.41	0.38	0.34	0.31	0.29	0.26	0.24	0.22	0.20	0.18	0.17	0.15	0.14	0.13	0.12
Levelliged hereft -f																									
accelerated																									

depreciation (Rs / kWh)

0.56



## Appendix 5: Tariff for MSW to Energy projects based on Mass Incineration Technology (Inclusive CFA)

	Tariff Calculations for MSW Based Power Plant - Mass Incineration																								
	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24   nergy null																								
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Net Energy sold (lakh kWhs)	48.11	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52
Costs																									
O&M	108.00	112.15	116.45	120.93	125.57	130.39	135.40	140.60	146.00	151.60	157.42	163.47	169.75	176.26	183.03	190.06	197.36	204.94	212.81	220.98	229.47	238.28	247.43	256.93	266.79
Depreciation (SLM)	60.67	60.67	60.67	60.67	60.67	60.67	60.67	60.67	60.67	60.67	60.67	60.67	60.67	60.67	60.67	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
Interest on term loan	89.29	83.13	76.97	70.81	64.66	58.50	52.34	46.18	40.02	33.87	2.31	1.80	1.28	0.77	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working capital	5.25	5.34	5.43	5.53	5.64	5.76	5.88	6.01	6.15	6.30	6.32	6.54	6.76	7.00	7.25	7.20	7.48	7.76	8.07	8.38	8.71	9.05	9.41	9.78	10.18
Return on Equity	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60	54.60
Tax on equity	9.54	9.54	9.54	9.54	9.54	9.54	9.54	9.54	9.54	9.54	19.08	19.08	19.08	19.08	19.08	19.08	19.08	19.08	19.08	19.08	19.08	19.08	19.08	19.08	19.08
Total Cost (Rs lakh)	327.34	325.42	323.66	322.08	320.67	319.45	318.43	317.60	316.98	316.58	300.40	306.14	312.14	318.38	324.88	296.94	304.51	312.38	320.55	329.04	337.85	347.01	356.51	366.39	376.65
Tariff (Rs/kWh)	6.80	5.86	5.83	5.80	5.78	5.75	5.74	5.72	5.71	5.70	5.41	5.51	5.62	5.73	5.85	5.35	5.49	5.63	5.77	5.93	6.09	6.25	6.42	6.60	6.78
Levelized Fixed Tariff Calculations																									
Discount Rate	9.32%		-	-																					
Levelized Fixed Tariff (Rs / kWh)	5.87	0.44	5.43																						

**Note:** As per the MNRE revised guideline of Waste to Energy Plant dated 28.02.2020, Ministry provides Central Financial Assistance (CFA) of Rs. 5 Crore/MW (Maximum CFA-Rs. 50 Crore/Project) for power generation from Municipal Solid Waste/Refused derived fuel through Incineration or other approved thermal technologies. Minimum size of the plant of 5 MW of installed capacity shall be supported for availing CFA. Both scenarios have been considered for determining the Generic Tariff, viz., including CFA and excluding CFA.



# Appendix 6: Depreciation benefit calculations for MSW to Energy projects based on Mass Incineration Technology including CFA

Capital cost	1300.00		
Depreciable amount	1170.00		
SLM depreciation (book depreciation) rate	5.28%		
IT Depreciation rate	40%	20%	extra allowed during year 1
MAT rate	17.47%		
Corporate tax rate	34.94%		

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Book Depreciation																									
Book depreciation Rate	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	0.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Amount of book depreciation (Rs lakh)	68.64	68.64	68.64	68.64	68.64	68.64	68.64	68.64	68.64	68.64	68.64	68.64	68.64	68.64	68.64	68.64	68.64	3.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Accelerated depreciation																									
Opening	100%	40.0%	24.0%	14.4%	8.6%	5.2%	3.1%	1.9%	1.1%	0.7%	0.4%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Allowed during the year	60.0%	16.00%	9.60%	5.76%	3.46%	2.07%	1.24%	0.75%	0.45%	0.27%	0.16%	0.10%	0.06%	0.03%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Closing	40.0%	24.00%	14.40%	8.64%	5.18%	3.11%	1.87%	1.12%	0.67%	0.40%	0.24%	0.15%	0.09%	0.05%	0.03%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Amount of accelerated	780.00	208.00	124.80	74.99	44.03	36.06	16 17	0.70	5 92	3.40	2.10	1.26	0.75	0.45	0.37	0.16	0.10	0.06	0.04	0.02	0.01	0.01	0.00	0.00	0.00
Net depreciation benefit (Rs	711.36	139.36	56.16	6.24	- 23.71	- 41.68	- 52.47	- 58.94	- 62.82	- 65.15	- 66.54	- 67.38	67.89	- 68.19	- 68.37	- 68.48	- 68.54	-3.06	0.04	0.02	0.01	0.01	0.00	0.00	0.00
Tax Benefit (Rs lakh)	248.55	48.69	19.62	2.18	-8.28	- 14.56	18.33	20.59	- 21.95	22.76	23.25	- 23.54	23.72	23.82	23.89	23.93	23.95	-1.07	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Net energy Generation (lakh Units)	48.11	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52	55.52
Accelerated depreciation benefit per unit (Rs / kWh)	5.17	0.88	0.35	0.04	-0.15	-0.26	-0.33	-0.37	-0.40	-0.41	-0.42	-0.42	-0.43	-0.43	-0.43	-0.43	-0.43	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Discount factor	1.00	0.91	0.84	0.77	0.70	0.64	0.59	0.54	0.49	0.45	0.41	0.38	0.34	0.31	0.29	0.26	0.24	0.22	0.20	0.18	0.17	0.15	0.14	0.13	0.12
Levellised benefit of accelerated depreciation (Rs / kWh)	0.44																								



# Appendix 7: Tariff for MSW to Energy Project based on RDF Technology (Inclusive CFA)

									Та	riff Calculati	ons for MSV	V Power Pla	nt - RDF Ba	ised											
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Net Energy sold (lakh kWhs)	48.97	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27
Costs																				•					
O&M	142.38	147.84	153.52	159.41	165.54	171.89	178.49	185.35	192.46	199.86	207.53	215.50	223.77	232.37	241.29	250.56	260.18	270.17	280.54	291.31	302.50	314.12	326.18	338.70	351.71
Insurance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Depreciation (SLM)	54.83	54.83	54.83	54.83	54.83	54.83	54.83	54.83	54.83	54.83	54.83	54.83	54.83	54.83	54.83	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50	23.50
Advance Against Depreciation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on term loan	78.38	72.82	67.25	61.69	56.12	50.55	44.99	39.42	33.86	28.29	22.73	17.16	11.59	6.03	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest on working capital	5.52	5.64	5.75	5.88	6.01	6.15	6.30	6.46	6.63	6.80	7.06	7.26	7.47	7.68	7.91	7.92	8.22	8.54	8.87	9.21	9.57	9.95	10.34	10.75	11.18
Return on Equity	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35	49.35
Tax on equity	8.62	8.62	8.62	8.62	8.62	8.62	8.62	8.62	8.62	8.62	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24
Fuel cost	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Cost (Rs lakh)	339.09	339.10	339.33	339.78	340.47	341.40	342.59	344.03	345.75	347.75	358.75	361.35	364.26	367.51	371.09	348.57	358.49	368.80	379.51	390.62	402.17	414.16	426.62	439.55	452.98
Fixed cost (Rs lakh)	339.09	339.10	339.33	339.78	340.47	341.40	342.59	344.03	345.75	347.75	358.75	361.35	364.26	367.51	371.09	348.57	358.49	368.80	379.51	390.62	402.17	414.16	426.62	439.55	452.98
Fuel cost (Rs lakh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tariff																						r			
Fixed tariff (Rs / kWh)	6.92	5.63	5.63	5.64	5.65	5.66	5.68	5.71	5.74	5.77	5.95	6.00	6.04	6.10	6.16	5.78	5.95	6.12	6.30	6.48	6.67	6.87	7.08	7.29	7.52
Variable tariff (Rs / kWh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tariff (Rs/kWh)	6.92	5.63	5.63	5.64	5.65	5.66	5.68	5.71	5.74	5.77	5.95	6.00	6.04	6.10	6.16	5.78	5.95	6.12	6.30	6.48	6.67	6.87	7.08	7.29	7.52
Levelized Fixed Tariff Calculations																									
Discount Rate	9.32%		-																						
Levelized Fixed Tariff (Rs / kWh)	5.99	(0.40)	5.59																						



# Appendix 8: Depreciation benefit calculations for MSW to Energy Project based on RDF Technology including CFA

Capital cost			1175	5.00																					
Depreciable amount			1057	7.50																					
SLM depreciation (boo	ok deprec	iation) rat	te 5.2	28%																					
IT Depreciation rate			4	40% 2	20% ex	tra allowe	ed during	year 1																	
MAT rate			17.4	47%																					
Corporate tax rate			34.9	94%																					
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Book Depreciation																									
Book depreciation Rate	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	5.28%	0.24%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Amount of book	62.04	62.04	62.04	62.04	62.04	62.04	62.04	62.04	62.04	62.04	62.04	62.04	62.04	62.04	62.04	62.04	62.04	2 92	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	02.04	02.04	02.04	02.04	02.04	02.04	02.04	02.04	02.04	02.04	02.04	02.04	02.04	02.04	02.04	02.04	02.04	2.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Accelerated depreciation																									
Opening	100%	40.0%	24.0%	14.4%	8.6%	5.2%	3.1%	1.9%	1.1%	0.7%	0.4%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Allowed during the year	60.0%	16.00%	9.60%	5.76%	3.46%	2.07%	1.24%	0.75%	0.45%	0.27%	0.16%	0.10%	0.06%	0.03%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Closing	40.0%	24.00%	14.40%	8.64%	5.18%	3.11%	1.87%	1.12%	0.67%	0.40%	0.24%	0.15%	0.09%	0.05%	0.03%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Amount of accelerated																									
depreciation (Rs lakh)	705.00	188.00	112.80	67.68	40.61	24.36	14.62	8.77	5.26	3.16	1.89	1.14	0.68	0.41	0.25	0.15	0.09	0.05	0.03	0.02	0.01	0.01	0.00	0.00	0.00
Net depreciation benefit (Rs lakh)	642.96	125.96	50.76	5.64	-21.43	-37.68	-47.42	-53.27	-56.78	-58.88	-60.15	-60.90	-61.36	-61.63	-61.79	-61.89	-61.95	-2.77	0.03	0.02	0.01	0.01	0.00	0.00	0.00
Tax Benefit (Rs lakh)	224 68	44.02	17 74	1 97	-7 49	-13 17	-16 57	-18 61	-19 84	-20 58	-21.02	-21 28	-21 44	-21 54	-21 59	-21 63	-21 65	-0.97	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Net energy Generation	221.00	1.102	2///	1.57	7.15	10.17	10.07	10/01	10.01	20.00	21.02	21.20		21.51	22.00	21.00	21.00	0.57	0.01	0.01	0.00	0.00	0.00	0.00	0.00
(lakh Units)	48.97	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27	60.27
Accelerated depreciation benefit per unit (Rs / kWh)	4.59	0.73	0.29	0.03	-0.12	-0.22	-0.27	-0.31	-0.33	-0.34	-0.35	-0.35	-0.36	-0.36	-0.36	-0.36	-0.36	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Discount factor	1.00	0.91	0.84	0.77	0.70	0.64	0.59	0.54	0.49	0.45	0.41	0.38	0.34	0.31	0.29	0.26	0.24	0.22	0.20	0.18	0.17	0.15	0.14	0.13	0.12
Levellised benefit of accelerated depreciation (Rs / kWh)	0.40	0.51	0.04	0.77	0.70	0.04	0.53	0.54	0.43	0.43	0.71	0.50	0.54	0.51	0.23	0.20	0.24	0.22	0.20	0.10	0.17	0.13	0.14	0.13	0.12