MAHARASHTRA ELECTRICITY REGULATORY COMMISSION

Regulations
DSM Measures' and Programme's Cost Effectiveness Assessment

MERC

April 2010

MAHARASHTRA ELECTRICITY REGULATORY COMMISSION, MUMBAI

Maharashtra Electricity Regulatory Commission (Demand Side Management Measures and Programmes' Cost Effectiveness Assessment) Regulations, 2010

MAHARASHTRA ELECTRICITY REGULATORY COMMISSION, MUMBAI.

Maharashtra Electricity Regulatory Commission (Demand Side Management Measures and Programmes' Cost Effectiveness Assessment) Regulations, 2010

ELECTRICITY ACT, 2003

No. MERC /Legal/111/2010/ 181. In exercise of the powers conferred by sub-section (1) of Section 181 and clause (zp) of sub-section (2) of Section 181 of the Electricity Act, 2003, and all other powers enabling it in this behalf, the Maharashtra Electricity Regulatory Commission hereby makes the following Regulations, providing for methods and principles for assessing cost effectiveness of DSM programmes and charges recoverable by the distribution licensee in connection therewith and for matters incidental and ancillary thereto.

1. Short Title, Applicability, Commencement and Interpretation

1.1 These Regulations may be called the "Maharashtra Electricity Regulatory Commission (Demand Side Management Measures and Programmes' Cost Effectiveness Assessment) Regulations, 2010".

1.2. These Regulations extend to the whole of the State of Maharashtra.

1.3. These Regulations shall come into force from the date of their publication in the Official Gazette.

1.4 These Regulations shall be construed harmoniously with the Maharashtra Electricity Regulatory Commission (Terms and Conditions of Tariff) Regulations, 2005 and Maharashtra Electricity Regulatory Commission (Demand Side Management Implementation Framework) Regulations, 2010.

2. Definitions

2.1. In these Regulations unless the context otherwise requires:

(a) "**Act**" means the Electricity Act, 2003 (36 of 2003) and amended from time to time;

(b) "**Avoided Costs"** means the incremental costs avoided by the distribution licensee when it purchases power because of implementation of DSM programmes, or otherwise defers or avoids distribution related costs from existing/new distribution system upgrade investments;

(c) **"Cost Effectiveness**" means an indicator of the relative performance or economic attractiveness of any investment in DSM programme or when compared to the costs of energy produced and delivered in the absence of such an investment;

(d) "**DSM**" means Demand Side Management;

(e) "**DSM Consultation Committee**" means a Committee set up under the convenorship of Secretary MERC to facilitate DSM programme approval process for the Commission.

(f) **"Demand-Side Resource**" means a saving in consumption (kWh) and/or demand (kW/KVA) available as a result of implementation of DSM programme and as expressed in three important dimensions: Quantum – as to how much is available (kWh and/or kW); Time – as to when it is available (at what time of day, on what days, in what season); Cost – as to what cost;

(g) **"Evaluation, Measurement and Verification (EM&V)"** means activities which evaluate, monitor, measure and verify performance or other aspects of DSM / energy efficiency programmes or their market environment;

(h) **"Life"** means an estimate of the median number of years that the DSM measures installed under the programme are still in place and operable; or warrantied years of service or as defined by DSM Consultation Committee

(i) **"Load Research"** means an activity embracing the measurement and study of the characteristics of electric loads to provide a thorough and reliable knowledge of trends, and general behaviour of the load characteristics of the customers serviced by the electrical industry;

3. Basic Principles

3.1 Every Distribution Licensee shall adhere to the implementation framework specified under the MERC (Demand Side Management Implementation Framework) Regulations, 2010 and submit the required DSM programmes and plans for the Commission's approval in accordance with the said regulations.

3.2Distribution Licensees shall be guided by these regulations

(i) while submitting DSM programmes, portfolio and DSM plans for the approval of the Commission

(ii) while submitting to the Commission the impact on energy and demand, together with the cost-benefit analysis as included in ARR.

4. Coverage and Scope of the Cost-Effectiveness Assessment Methods

These Regulations will be used to assess the economic-effectiveness of a programme or plan and under simple assumptions regarding some of the decision variables such as, inter alia, DSM measure/programme costs and impacts (both, energy – kWh and demand – kVA or KW), discount rate, life, escalation rate and avoided cost.

5. Cost-effectiveness Criteria

(i) Distribution Licensees shall send to the Commission the DSM Programmes and Plans that pass the Cost-effectiveness Criteria set-forth through these Regulations.

(ii) Distribution Licensees shall evaluate Total Resource Cost (TRC) test as the main hurdle test; followed by the Ratepayer-Impact Measure (RIM) test that confirms the fact that programme implementation and costs incurred would not impact the tariffs adversely.

(iii) The Life-cycle revenue impact (LRIRIM) should not be more than Rs. 0.01/kWh or over 0.1% of existing tariff as tariff increase, whichever is higher.

(iv) The programme screening shall be carried out using following decision tree:

a) TRC as the main hurdle test: All DSM programmes that show positive number for the Net Present Value (NPV) of the Benefits over the NPV of Costs should be considered for evaluation of RIM test
b) RIM test: DSM Programmes that show positive number when NPV of the Benefits over the Costs for the Ratepayers are considered should be implemented
c) LRIRIM test: DSM Programmes that do not show positive number for RIM test should be implemented if the tariff impact due to the implementation of the DSM Programmes is less than Rs. 0.01/kWh or less than 0.1% of the existing tariff, whichever is higher.

5.1 Total Resources Cost test

(i) The main hurdle test shall be carried out by calculating Net Present Value (NPV) of Benefits (B) and Costs (C). NPV for a DSM measure/programme shall be determined as the difference between B and C.

Where,

B = NPV of measure/programme benefits discounted over a specified time period

C = NPV of measure/programme costs discounted over a specified time period

If, the measure/programme benefit in year "t" is say "B_t", and discounting rate is say "r", the time period for discounting is say "n" years, then B can be expressed as:

$$B = \sum_{t=1}^{n} \lfloor (B_t)/ (1+r)^{t-1} \rfloor \quad \text{(equation 1)}$$

Similarly, If , the measure/programme cost in year "t" is say "C_t", and discounting rate is say "r", the time period for discounting is say "n" years, then C can be expressed as:

$$C = \sum_{t=1}^{n} \lfloor (C_t)/ (1+r)^{t-1} \rfloor \quad \text{(equation 2)}$$

(ii) Cost elements for the TRC test shall be determined considering the following.

a) The cost of efficient device/equipment/appliance/ technology or practice, including the applicable taxes, duties and levies;
b) Installation, trial and commissioning costs associated with efficient device/equipment / appliance/practice/technology;
c) Yearly operation and maintenance costs over the life of the measure/programme;
d) Old inefficient equipment removal and safe disposal costs (if the DSM measure/programme involves replacement or retrofitting)
e) Programme administration, monitoring and evaluation costs
f) Programme marketing costs.

Note - If there are any tax credits, the same shall be considered as reduction to the cost. Similarly, if there is old equipment/device / appliance / technology etc. that is being replaced; the salvage value of this old equipment or device shall be considered as a reduction in the cost.

Benefits of a DSM programme or a DSM measure are the savings in the energy (kWh) consumed and/or savings in the demand (kW). The kWh savings shall be calculated based on the number of hours the energy efficient appliance/equipment is used and number of days in a year the appliance/equipment is used. These savings usually occur at the point of use and are experienced by the consumer installing a DSM measure or consumer participating in a DSM programme. To arrive at the avoided purchase of power by the licensee, the participant savings at the point of use have to be suitably adjusted to account for system transmission and distribution losses. The benefits have to be valued over the period over which the assessment is to be carried out.

Thus, if savings at point of use in year "t" are ΔS_t expressed in KWh, and if transmission and distribution losses expressed as percentage in the same year are TL_t and DL_t, respectively, the Avoided purchase of power in year "t" (APPt) by the licensee would be:
$= \Delta S_t/[(1\text{-}TL_t) \times (1\text{-}DL_t)]$

If, rate of power purchase in year "t", is R_t, then avoided power purchase cost ($APPC_t$) in year "t" would be: $= APP_t \times R_t$

Any reduction in "intra-state transmission charges", as a result of reduction in the average co-incident peak demand of the licensee shall be considered as a "benefit" under this test. While calculating energy and demand savings as benefits, year-on-year escalation rate of 5% should be considered. Tests should consider a discount rate of 10.5%.

Both benefits and costs; shall be calculated over the "Life" of the technology being deployed. Distribution Licensee shall use the

"warrantied" life of the retrofit by the technology provider as it is important to ensure that the savings considered are realized over the life-span of the equipment/appliances. Alternately, "life" as may be defined by the DSM Consultation Committee shall be used.

5.2 Ratepayer Impact Measure test

(i) Cost elements mentioned below shall be used in "equation 1"

a) The cost of efficient device/equipment/appliance/ technology or practice, including the applicable taxes, duties, levies, etc. paid for by the licensee or to the extent paid for by the licensee;
b) Installation, trial and commissioning costs associated with efficient device/equipment/appliance/practice/technology paid by the licensee or to the extent paid by the licensee;
c) Yearly operation and maintenance costs over the life of the measure/programme paid for by the licensee or to the extent paid for by the licensee;
d) Old inefficient equipment removal and safe disposal costs (if the DSM measure/programme involves replacement or retrofitting) paid for by the licensee or to the extent paid for by the licensee;
e) Programme administration, monitoring and evaluation costs paid for by the licensee or to the extent paid for by the licensee;
f) Programme marketing costs, including incentives, if any, paid by the licensee or to the extent paid for by the licensee;
g) Decrease in licensee revenues due to the DSM programme.

(ii) Benefits of the DSM programme shall be calculated as "Avoided Cost of Power Purchase". If savings due to a DSM programme/measure at point of use in year "t" are ΔS_t, and if transmission and distribution losses in the same year are TL_t and DL_t, expressed as a percentage, respectively, the Avoided purchase of power in year "t" (APPt) by the licensee would be:

$= \Delta S_t/[(1-TL_t) \times (1-DL_t)]$

If, rate of power purchase in year "t", is R_t, then avoided power purchase cost ($APPC_t$) in year "t" would be: = APP_t x R_t

(iii) Any reduction in "intra-state transmission charges", as a result of reduction in the average co-incident peak demand of the licensee shall be considered as a "benefit" under this test.

(iv) While calculating energy and demand savings as benefits, year-on-year escalation rate of 5% should be considered.

Note : Tests should consider a discount rate of 10.5%.

(v) Both, benefits and costs; shall be calculated over the "Life" of the technology being deployed.

(vi) Distribution Licensee shall use the "warrantied" life of the retrofit by the technology provider as it is important to ensure that the savings considered are realized over the life-span of the equipment/appliances. Alternately, "life" as may be defined by the DSM Consultation Committee shall be used.

5.3 Life-cycle Revenue Impact – RIM test

(i) LRIRIM test shall be conducted using same data used for calculating the RIM test described in Section 5.2 of these regulations.

(ii) Difference between NPV of Cost and NPV of Benefits shall be divided with total utility kWh sales to determine the rate impact on the non-participants.

(iii) Distribution Licensees shall also submit results of two more test – Participants Cost Test (PCT) and Societal Cost Test (SCT); though these are not considered in the decision-making. Methods for carrying out the PCT and SCT are provided in Annexure 1 to these Regulations.

6. Correction factors for power shortage situations

(i) The Cost Effectiveness tests when applied in the power shortage situations will have to be substantiated by sound information on the hours of usage of pre and post-DSM programme implementation for the end-uses that are retrofitted or changed or installed newly.

(ii) Measurement and verification process to be followed for the power shortage situations shall be designed in order to review the actual number of hours post-implementation.

7. Values of key inputs used in the tests

The default input values to be considered by all Distribution Licensees in the State, shall be as follows:-

a) Avoided cost of power purchase for TRC, RIM and PCT – Weighted Average of Highest Marginal Cost of Power Purchase related to top 10% of energy use stack for the past one year as computed by Maharashtra State Load Despatch Centre
b) Avoided cost of power purchase for SCT - Rs. 10.6/kWh (prevalent for diesel generator sets)
c) Escalation rates for power sales, avoided cost of purchase – 5% year-on-year
d) Discount rate for TRC and RIM tests – 10.5%
e) Discount rate for PCT – 13%
f) Discount rate for SCT – 10%

(ii) The Commission may, by order, revise the above values annually, if necessary.

8. Powers to remove difficulties

If any difficulty arises in giving effect to any of the provisions of these Regulations, the Commission may by order, take suitable action, not being inconsistent with the Act, which appears to the Commission to be necessary or expedient for the purpose of removing difficulties.

9. Orders and Practice Directions

Subject to the provisions of the Act, the Commission may from time to time issue orders, circulars and practice directions in regard to the implementation of these Regulations.

10. Power to Amend

The Commission may, at any time , vary,alter, modify or amend any provisions of these Regulations.

Annexure 1: Methods to carry out the PCT and SCT

A.1 Participants Cost Test (PCT)

This test provides a measure of the quantifiable benefits and costs to an "average" consumer for participating in a DSM programme. Since many consumers do not base their decision to participate in a DSM programme entirely on quantifiable variables (many times consumers decision to buy an appliance/device/equipment are based on factors such as discount offered, features, brand value, initial cost, etc.), this test may not fully represent the benefits and costs of a programme to a consumer.

A.1.1 Costs

In its simplest form, the costs in this test are the **programme costs paid by the participant**. In addition, any increase in electricity bill of the participant as a result of the DSM programme is also to be considered as costs under this test. Thus the "Cost" elements usually associated with this test are:

- The cost of efficient device/equipment/appliance/ technology or practice, including the applicable taxes, duties, levies, etc. paid for or to the extent paid for by the participant;
- Installation, trial and commissioning costs associated with efficient device/equipment / appliance/practice/technology paid or to the extent paid by the participant;
- Annual operation and maintenance costs over the life of the measure/programme paid for or to the extent paid for by the participant;
- Old inefficient equipment removal costs (if the DSM measure/programme involves replacement or retrofitting) paid for or to the extent paid for by the participant;
- Programme administration, monitoring an evaluation costs paid for or to the extent paid for by the participant;
- Programme marketing costs, including incentives, if any, paid or to the extent paid for by the participant;
- Increase in participant electricity bill due to the DSM programme

If there is old equipment/device / appliance / technology etc. that is being replaced; the salvage value of this old equipment or device is considered as a reduction in the cost.

Similarly, if there is tax credit or incentive offered to the consumer the same can be treated as reduction in cost. Conventionally, the same will be treated as benefits accruing to the participant as a result of DSM programme under PCT.

A.1.2 Benefits

Benefits under this test are the reduction in consumer's electricity bills, tax credit received by the consumer, and incentives received by the consumer.

A.1.3 Escalation Rates

The ad-hoc recommended escalation rate for power tariff is 5% or as may be revised under Sr. No. 7 of these Regulations.

A.1.4 Discount Rate

The discount rate for this test should ideally be the rate at which banks and financial institutions would lend to consumers. Thus, depending upon the credit standing of the consumer the rate is likely to vary. For households, it is likely to be higher than for commercial sector or industrial sector consumers. However, a discount rate of 13% may be taken for all categories of consumers or as may be revised under Sr. No. 7 of these Regulations.

A.1.5 Test Results

The NPV will be used as the primary evaluation criterion. A NPV value of zero or above will indicate that PCT test has been passed. It would also mean that the DSM programme is beneficial for an "average" participating consumer. On the other hand, a NPV value of less than zero will indicate that the DSM measure/programme being evaluated for PCT has failed the PCT, i.e. participation in a DSM programme is not beneficial for the consumer.

Tax credits and incentives appear on the benefit side of the NPV equation under this test. Thus the benefit side of the DSM programme can be boosted by offering incentives or tax credits or by offering larger tax credits or incentives. For DSM programmes that show negative NPV values, the PCT test can help identify the threshold level of tax credit/incentive that would need to be offered to make the DSM programme beneficial from participant perspective. Such threshold value will be the tax credit/incentive values for which NPV is zero.

Ideally, sensitivity analysis with respect to various assumptions should also be conducted in order to understand the level of influence of each assumption on the NPV value.

A.2 Societal Cost Test (SCT)

The Societal Cost Test is structurally similar to the Total Resource Cost Test. However, since the SCT goes beyond the TRC test in that it attempts to quantify the change in the total resource costs to society as a whole rather than to only the service territory (the licensee and its consumers), it would be necessary to consider different values for some of the input variables such as power purchase rate, discount rate, etc. More specifically, the Societal Test differs from the TRC Test in the following ways:

- The value of power purchase rate will need to be the "social cost of power" which could be considered as the consumers' willingness to pay for power or the price the consumers are willing to pay for power. In the Indian context, cost of diesel generation can be used as a proxy for consumers' willingness to pay for power, and thus the social cost of power can be taken as cost of diesel generation. For the purposes of calculating this test, diesel generation cost of Rs. 10.6/kWh or as may be revised under Sr. No. 7 of these Regulations should be used.

- Since taxes, duties, levies, tax credits etc. are treated as a transfer payment in the Societal Test, they should be excluded from the calculations.
- The value of the discounting rate under SCT should be the societal discount rate. In the context of DSM programmes, the licensees could use 10% as the societal discounting rate or as may be revised under Sr. No. 7 of these Regulations should be used.

Certain indirect benefits such as reduction in greenhouse gases that takes place as an effect of implementing a DSM measure should be considered while calculating SCT.

K. N. Khawarey ,
Secretary,
Maharashtra Electricity Regulatory Commission

Mumbai,
Dated: 26th April 2010.