Renewable Generation – Tariff Mechanism for Enabling DSM and DR at Consumer Level

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Indian Power Context

Peak Demand – 130,000 MW app.
High Deficit of 13.9% & Avg of 11.1% in FY 11-12

High Energy deficit of 11% & Avg of 10% in FY12-13

Installed Capacity – 225GW

Per capita consumption Approx 870 kWh

Power sector to Grow @11.5%

Economy to grow @ 8-10% p.a.
Problems in Existing Distribution Infrastructure

- High Aggregate Technical & Commercial (AT&C) Losses
- Tariff inadequacy or the absence of cost-reflective tariffs
- High cost of short term power purchases
- Inept energy accounting and auditing
- Unmetered (Free) power to certain categories of consumers
- Poor infrastructure
- Poor demand side management
- Customer dissatisfaction
Smart Grid Priorities for India

- No more power cuts, *Prosumer* enablement
- Reduce AT&C losses, improve QoS
- Integrate Renewables/Distributed Generation efficiently
Integration of Roof Top Solar PV

To support the ever increasing capacity requirement of India.

For reduced dependence on depleting fossil fuels

Savings on Transmission network laying and reduction in T&D losses

Large deployments of solar generation is saddled by the requirement of large land areas. Small roof top Distributed capacities is the way to go.

Distributed solar PV over roof tops in conjunction with DSM and DR could help in load management right from the LT voltage end.
Objectives & Benefits of Dynamic Tariff Design

Objectives

• Implementation of dynamic tariff structures for executing demand response program
  • To improve the operational efficiency and reducing outages
  • To maximize social welfare by serving more no. of consumers
  • Peak load management
  • To improve consumer satisfaction
  • Integration of Distributed Generation

Benefits

• System efficiency improvements
• Proliferation of Solar roof top DG
• Improvement in Reliability & Quality of supply.
• Savings on costly peak power purchase
• Savings in electricity bills for the consumers
Proposed Dynamic Tariff Design includes

Components considered for tariff design

- ToD or pre-announced prices based on a forecast for peak load hours
- ToU/CPP that can be linked to frequency or to an average of daily maximum demand
- Power supply quality- based on voltage fluctuations, reliability and harmonics
- Feed-in-tariffs for renewable generation(for LT connected generation)
Features of Proposed Dynamic Tariff

- Frequency-based, ToU pricing
- Pre-determined ToD pricing for the utility-specific peak load time zones.
- A reliability surcharge.
- Discount of 2% to 5% on pre-paid bills depending on AT&C losses for that area.
- Tariff for rooftop solar power
Details of Frequency based, ToU Dynamic Tariff

- Consumer benefit
  - Saving in bills
- Utility benefits
  - Shift in peak and move towards cost reflective tariffs

- Frequency based:
  - Frequency <49.7 Hz - +20% of ARR
  - Frequency 49.7-49.95 Hz - ARR
  - Frequency >49.95 Hz - -20% of ARR

- Price signal generation:
  - High price
  - Moderate price
  - Low price

- Feedback for adjustments:
  - Day ahead forecasted peak
  - Price signal (based on PL in day ahead, f in real-time)
  - Display of bill (day/month/week)

- Utility metrics:
  - Revenue through ARR
  - Revenue through Reliability
  - Revenue through frequency linked tariff

- Proposed tariff based bill
- Normal bill (Business as Usual)
Proposed Mechanism

‘Aggregator’ for integration of Distributed roof top solar PV and DSM & DR so as to provide utility with a substantial quantum of controllable generation against numerous miniscule capacity controllable loads/generation.
Salient Features of Aggregator

- Monitoring & Control of roof top Solar PV
- Accounting of roof top Solar PV
- Shifting from a centralized control model to a distributed control model
- Advanced computer and communications technologies
- DSM thru Dynamic pricing implementation till consumption end
Prerequisite & Advantages of Aggregator

**Prerequisite**

- Communications and networking technology with suitable speed, reliability, and security.
- Higher bandwidths for Parallel Communication links.
- AMI system that has Smart meters with bi-directional metering units.
- Deployment of large no. of sensors for monitoring

**Advantages**

- Effective Load Management at day time peak period
- Reduced bandwidth requirement for utility control room
- With in the control area of a Aggregator ‘Micro Grid’ is formed by interconnection of solar roof top generators
### Experience on tariff mechanism in India at consumer level.

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<th>Feed–in tariff</th>
<th>On net-metering</th>
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<td>• In Gandhinagar roof top program Generated power is completely fed to the grid.</td>
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<td>• Roof owner gets paid lease rent (Rs.3.00 per unit) and the project developer gets feed-in-tariff (Rs.11.21) for 25 years.</td>
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<td>• West Bengal has initiated solar rooftop model promoting self consumption.</td>
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<td>• Under the WBERC Regulations, grid-integrated rooftop PV is allowed only for institutional consumers like government departments, academic institutions, etc</td>
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<td>• Solar injection is permitted only up-to 90% of the annual electricity consumption, and the net energy supplied by the utility would be billed as per existing slab tariffs.</td>
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<td>• Solar generation would first offset consumption in the highest tariff slab and then the lower slab.</td>
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Expectations for Future

Key Benefits of Roof top Solar PV projects:

- Avoids cost due to savings on T&D network losses
- Avoids Cost due to savings on Transmission Infrastructure related costs and land costs

Tariff policies should encourage usage at roof top generation end.

Net-metering model should provide for sharing of benefits to utilities with the pro-sumers.

Utilities & Distribution licensees should be eligible to get benefit of deemed RPO.
Investing in advanced metering infrastructure profitable or not?

Investment in AMI is profitable in all environments and in all nations at any stage of development.

In developed countries benefits are not immediately apparent due to already robust system. Some benefits could be:

- **Economic**
  - Improved asset utilisation
  - Deferred Capacity enhancement investment

- **Reliability**
  - Reduced power interruptions

- **Environmental**
  - Energy Security
  - Reduced GHG and carbon emissions- CDM benefits
Investing in advanced metering infrastructure profitable or not?

In developing countries benefits are more tangible and across the gamut and also include:

- **Economic (major initial)**
  - Theft reduction
  - Reduced electricity losses
  - Reduced O&M costs
  - Reduced Power Purchase Cost through minimizing need in time of high cost.

- **Reliability**
  - Reduced power interruptions

In Indian scenario AMI in rural areas could also help in virtual segregation of feeders for:

- Agricultural load
- Non Agricultural load
Possibilities of Cost reduction for AMI

With wide scale deployment the technology will start paying for itself through its benefits.

The cost won’t be of consequence as payback period in India is envisaged to be around 3-5 years for the SG pilots being undertaken.

With mass deployments this will reduce further.
Thank You!