ENERGY CONSERVATION AND EFFICIENCY

DSM Policy Initiatives in India

BUREAU OF ENERGY EFFICIENCY
NEW DELHI
(Ministry of Power)

Saurabh Kumar, Secretary
18th April 2007
Seoul
OVERVIEW

- Indian Power Sector Profile
- Energy Conservation Act, 2001
- Trends in Energy Efficiency and Conservation in India
- Barriers to EE/EC
- Regulatory Interventions
- Programmes for EE/EC promotion
- DSM Initiatives in India
- Agricultural DSM
INDIAN POWER SECTOR

- Power in concurrent list of Constitution
- Both Central and State can legislate - Central law prevails in the event of conflicting provisions
- India has been able to achieve an economic growth rate of 8% per annum during last few years.
  - Targeting an economic growth rate of 9-10% per annum.
Generating Capacity

Hydro: 33,193 MW (26%)
Thermal: 83,772 MW (66%)
  - Coal: 68,989 MW
  - Gas: 13,582 MW
Nuclear: 3,900 MW (3%)
Renewables: 6,191 MW (5%)

Total: 1,27,056 MW

Private Sector: 12.0% (15,231 MW)
Central Sector: 32.4% (41,214 MW)
State Sector: 55.6% (70,611 MW)

In addition captive generation capacity of appx. 41,000 MW.
## GROWTH OF POWER SECTOR

<table>
<thead>
<tr>
<th>CENSUS RESULTS</th>
<th>1996-97</th>
<th>2006-07*</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLF (%)</td>
<td>64.4</td>
<td>76.2</td>
</tr>
<tr>
<td>Energy Shortage (%)</td>
<td>11.5</td>
<td>9.2</td>
</tr>
<tr>
<td>Peaking Shortage (%)</td>
<td>18.0</td>
<td>14.2</td>
</tr>
<tr>
<td>Households Access to Electricity (%)</td>
<td>42.0</td>
<td>56.0</td>
</tr>
<tr>
<td>Rural Households Coverage (%)</td>
<td>31.0</td>
<td>43.8</td>
</tr>
</tbody>
</table>

* Upto February, 2007
<table>
<thead>
<tr>
<th>Country</th>
<th>Energy Intensity (KgOE/ $ GDP PPP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>0.16</td>
</tr>
<tr>
<td>World Average</td>
<td>0.21</td>
</tr>
<tr>
<td>China</td>
<td>0.23</td>
</tr>
<tr>
<td>US</td>
<td>0.22</td>
</tr>
<tr>
<td>Germany and OECD</td>
<td>0.17</td>
</tr>
<tr>
<td>Denmark</td>
<td>0.13</td>
</tr>
<tr>
<td>Brazil and Japan</td>
<td>0.15</td>
</tr>
</tbody>
</table>
POWER SECTOR DEVELOPMENT

OBJECTIVE

$ 

- Sufficient power for 9-10% growth
- Reliable power
- Quality power
- Inexpensive power
- Commercial viability
- Power to All

STRATEGY

- Generation
- Transmission
- Distribution
- Rural Electrification
- Conservation
- Regulation
- Financing
- Legislative
- Communication

ACTION
Energy Conservation Act, enacted in October 2001. BEE created as the nodal statutory body to improve energy efficiency through:

- Standards and labeling for appliances
- Energy Conservation Building Codes
- Energy consumption norms for Designated Consumers
- Certification and accreditation of energy auditors and energy managers
- Dissemination of information and best practices
- Capacity Building
- Establish EE delivery systems through Public-Private Partnerships

The Act creates the Bureau of Energy Efficiency (BEE) in the centre, and State Designated Agencies (SDAs) in the states

30 states have created SDAs
INCREASING ENERGY EFFICIENCY

TPES

GDP

TPES/GDP


0 0.05 0.1 0.15 0.2 0.25 0.3 0.35
Energy use transitions hold key to future trajectory

• Household energy mix is rapidly moving from inefficiently-utilized biomass to gas and electricity
• Commercial space is increasing; and energy use is commercial space is increasing at a faster pace
• Industrial energy intensity is declining, but there is a wide bandwidth of specific energy consumption within industrial sectors
Electricity Use in the Commercial Sector is increasing
Energy Intensity in Cement Sector
Barriers to Energy Efficiency

- Lack of proliferation of DSM projects and concepts
- Lack of information about comparative energy use – especially of appliances bought by retail consumers
- Perceived risk due to lack of confidence in performance of new technologies – in appliances, building design, industrial technologies
- Higher cost of energy-efficient technologies
- Asymmetry in sharing of costs and benefits – especially in the buildings sector
Key regulatory interventions

• Provide energy use information
  – Labeling of appliances
  – Energy use information by units within industrial sectors

• Reduce perceived risk
  – Bulk procurement
  – Utility-driven Demand Side Management
  – Performance guarantee contracting, throughESCOs

• Mandate standards
  – Building Codes
  – Sectoral energy consumption norms in industry
Standards & Labeling Programme

The Energy Efficiency Standards and Labeling programme is a key thrust area of BEE under the Energy Conservation Act, 2001 with powers to:

- Direct display of labels on specified appliances or equipment (14.d)
- Enforce minimum efficiency standards by prohibiting manufacture, sale, and import of products not meeting the minimum standards (14.c)

The National Energy Labeling Programme launched by Hon'ble Union Minister of Power on 18th May, 2006.

- Voluntary scheme for Frost-Free Refrigerators & Tubular Fluorescent Lamps, ACs in place covering 60%, 90% and 65% of sales respectively
- To be extended to Distribution Transformers, CFLs Direct Cool Refrigerators, Motors, etc.
The draft Energy Conservation Building Code prepared for five climatic zones for all new commercial buildings.

The code includes energy efficiency aspects of building envelope, Heating, Ventilation, Air conditioning (HVAC), service hot water, pumping, lighting, electrical power and distribution system.

Comments from various stakeholders received.

ECBC to be launched as a voluntary scheme soon with some pilot demonstrative projects.
8 Government buildings (including President House, PMO, Shram Shakti Bhawan) have been audited. Implementation of energy conservation measures in 4 buildings completed and remaining are on their way.

Impressive Energy savings achieved in Rashtrapati Bhawan

<table>
<thead>
<tr>
<th>Month</th>
<th>Estimated savings, kWh</th>
<th>Actual Savings achieved, kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>August, 2006</td>
<td>93080</td>
<td>124466</td>
</tr>
<tr>
<td>September, 2006</td>
<td>97549</td>
<td>142597</td>
</tr>
<tr>
<td>October, 2006</td>
<td>97549</td>
<td>169179</td>
</tr>
<tr>
<td>November, 2006</td>
<td>105642</td>
<td>222567</td>
</tr>
</tbody>
</table>

17 additional Central Government buildings undertaken for second phase through ESCO mode.

Energy Audit study in 15 Government buildings completed
## Demand Side Management (DSM)

<table>
<thead>
<tr>
<th>Strategies</th>
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</thead>
<tbody>
<tr>
<td><strong>Short Term</strong></td>
</tr>
</tbody>
</table>
| • National Policy and strategies  
  • Pilot projects CFL, Street lighting  
  • Case studies, best practices/guidelines on regulatory orders to promote utility DSM and Municipality DSM |
| **Medium Term** |
| • Load research capacity in 10 Utilities  
  • Pilot projects- TOD, kVAh metering, Thermal Storage, Power factor improvement, Load segregation in rural feeders,  
  • Facilitating innovative technologies  
  • Suggestive principles for incentives to utilities for electricity saved |
| **Long Term** |
| • Load research capacity in all Utilities  
  • 5% target for energy consumption reduction by DSM |
### Demand side measures taken by various Utilities

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Measures</th>
<th>Utilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Two part tariff/ TOD</td>
<td>1. Himachal Pradesh Electricity Regulatory Commission, Shimla-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. West Bengal State Electricity Board Vidyut Bhawan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Torrent Power AEC Limited Electricity House, Lal Darwaja, Ahmedabad</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Assam Electricity Regulatory Commission</td>
</tr>
<tr>
<td>2</td>
<td>Power factor correction</td>
<td>1. North Delhi Power Limited</td>
</tr>
<tr>
<td></td>
<td>capacitor</td>
<td>2. Ajmer Vidyut Vitrans Nigam Limited, DELHI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Torrent Power AEC Limited, AHMEDABAD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. The BEST Undertaking, MUMBAI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Reliance Energy Limited, MUMBAI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. The Mula Pravara Electric Co-op, Society Ltd., Shrirampur, AHMEDNAGAR,</td>
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<tr>
<td></td>
<td></td>
<td>MAHARASHTRA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Southern Power Distribution Company of A.P. Ltd. (APSPDCL), A.P</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Cochin Special Economic Zone (CSEZ), COCHIN</td>
</tr>
<tr>
<td>3</td>
<td>Penalties for harmonic</td>
<td>Himachal Pradesh Electricity Regulatory Commission, Kekonthal Commercial</td>
</tr>
<tr>
<td></td>
<td>injection</td>
<td>Complex, Khalini, Shimla-2</td>
</tr>
</tbody>
</table>
### Demand side measures taken by various Utilities (Contd.)

<p>| | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>6</td>
<td>Installation of electronic meters</td>
<td>1. North Delhi Power Limited, DELHI  2. Noida power company Ltd.  3. Chhattisgarh State Electricity board</td>
</tr>
<tr>
<td>7</td>
<td>Energy audit</td>
<td>1. North Delhi Power Limited  2. Central Electricity Supply Company of Orissa Ltd. IDCO Tower  3. Tamil Nadu Electricity Board  4. Noida power company Ltd.  5. Chhattisgarh State Electricity board</td>
</tr>
<tr>
<td></td>
<td>Demand side measures taken by various Utilities (Contd.)</td>
<td></td>
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<tr>
<td>---</td>
<td>----------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Providing Energy Efficient equipments to consumers by ESCO</td>
<td>Jaipur Vidyut Vitran Nigam Limited Vidyut Bhawan, Janpath, Jaipur-302 004</td>
</tr>
<tr>
<td>9</td>
<td>Dedicated feeders for agriculture sector</td>
<td>West Bengal State Electricity Board</td>
</tr>
</tbody>
</table>
| 10 | Pilot projects | 1. M.P. Madhya Kshetra Vidyut Vitaran Co. Ltd  
2. M.P. Poorva Kshetra Vidyut Vidyut Vitaran Company  
| 11 | Energy Efficient lighting program | 1. BESCOM Corporate Office, Bangalore |
| 12 | Replacement of GSL by CFL | 1. Cochin Port Trust, Willingdon Island, Kochi-682 009  
2. Assam Electricity Regulatory Commission  
3. Chhattisgarh State Electricity board  
4. NDPL/ BSES |
| 13 | Installation of solar water heater | 1. Cochin Port Trust, Willingdon Island, Cochin  
2. Assam Electricity Regulatory Commission |
| 14 | Installation of electronic choke | 1. Cochin Port Trust, Willingdon Island, Cochin  
2. Chhattisgarh State Electricity board |
Programme for Strengthening of SDAs

- Institutional, physical and financial support
- Information and knowledge sharing by BEE
- Facilitating activities to promote energy efficiency in states
<table>
<thead>
<tr>
<th>Programme</th>
<th>Outcomes/ Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capacity Building/ Outreach</strong></td>
<td></td>
</tr>
<tr>
<td>✓ Organisational setup (including SECF)</td>
<td>✓ Infrastructure/ manpower/ funding in position</td>
</tr>
<tr>
<td>✓ Workshop, conferences</td>
<td>✓ Adequate material/ speakers</td>
</tr>
<tr>
<td>✓ Advertising specially in local languages</td>
<td>✓ Templates for advertisements</td>
</tr>
<tr>
<td>✓ State Energy Conservation Awards</td>
<td>✓ Guidelines/ protocols/ procedures adoption</td>
</tr>
<tr>
<td>✓ Internet platform</td>
<td>✓ Organisation website</td>
</tr>
<tr>
<td><strong>Designated Consumers Programme</strong></td>
<td></td>
</tr>
<tr>
<td>✓ Designated consumers</td>
<td>✓ Identification, listing and notification</td>
</tr>
<tr>
<td>✓ Reporting process (format, method, etc.)</td>
<td>✓ Software for input collection/ collation and validation</td>
</tr>
<tr>
<td>✓ Training of designated consumers for reporting</td>
<td>✓ Enable online reporting</td>
</tr>
<tr>
<td>✓ Accredited auditors</td>
<td>✓ Adoption of BEE accredited list</td>
</tr>
<tr>
<td>✓ Energy Managers</td>
<td>✓ Adoption of BEE accredited list</td>
</tr>
</tbody>
</table>
| Standard & Labeling Programme      | Programme for at least two equipments/ appliances  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Implementation</td>
<td>➢ Requisite availability of Promotional material</td>
</tr>
<tr>
<td>➢ Outreach</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Conservation in Govt.</td>
<td>Energy Audit of at least two buildings in each district headquarter</td>
</tr>
<tr>
<td>Buildings</td>
<td></td>
</tr>
<tr>
<td>➢ Retrofit in government buildings</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Long Term- ECBC</td>
<td>Mandatory for all new buildings</td>
</tr>
<tr>
<td>➢ ECBC</td>
<td>Institutional set up in all district headquarters to target Architects, implementation agencies, developers and other stakeholders</td>
</tr>
<tr>
<td>➢ Training programme</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>➢ Developing linkages and programmes for energy efficiency</td>
<td>Policies and programmes for market transformation to achieve at least 5% reduction in energy consumption.</td>
</tr>
</tbody>
</table>
Designated Consumers (DCs)

- EC Act mandates Government to designate consumers who consume electricity beyond a benchmarked limit.
- The DCs are required to appoint Energy Manager.
- DCs are required to adhere to energy efficient consumption norms stipulated.
- DCs are required to submit consumption information, duly authenticated by the Energy Manager to BEE/SDAs as prescribed.
- Auditors/Managers certification examination held 3 times successfully - over 2700 Auditors/Managers accredited/certified - 4th examination being conducted.
- Web based e-filing of energy consumption returns to be mandated soon - first of its kind initiative.
<table>
<thead>
<tr>
<th>Timeframe</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Term</strong></td>
<td>Initiate comprehensive energy consumption norm studies in 15 sub-sectors&lt;br&gt;Development of specific energy consumption norms for 3 sectors&lt;br&gt;Initiate comprehensive studies in 25 clusters of SMEs&lt;br&gt;Initiate studies to establish specific fuel consumption norms in Transport sector&lt;br&gt;Initiate online reporting system for energy data</td>
</tr>
<tr>
<td><strong>Medium Term</strong></td>
<td>Preparation of industry specific manuals of energy efficient technologies and consumption norms&lt;br&gt;Dissemination of best practices, demonstrative case studies&lt;br&gt;Reporting and verification protocols, training and capacity building at cluster/ sub-sector level&lt;br&gt;Energy consumption norms for 6 sectors</td>
</tr>
<tr>
<td><strong>Long Term</strong></td>
<td>Target of at least 5% reduction at each sub-sector and cluster level&lt;br&gt;Integration of efficient fuel consumption norms in transport sector</td>
</tr>
</tbody>
</table>
Agriculture DSM

- Immense potential
- Capacity to reduce losses of Utilities and subsidy of Governments
- Those responsible for DSM should be
  - Knowledgeable
  - Competent
  - Devoted
- Effective DSM needs proper
  - Drafting of Purchase specifications
  - Selection of vendors
  - Installers

- Targets
  - Farmer friendly and educative
  - No reduction in output of farm
  - Least of Zero cost-burden
  - Reduced maintenance
  - Should achieve
    - Reduction in connected load
    - No theft of power
    - More comfortable regulation of power
- Appraisal and Review
Key Barriers to Ag DSM

- Vested interest in recommending cheap pump needing repetitive maintenance

- Efficiency issue is neutral to farmers due to subsidised or zero cost power.

- Repetitive maintenance and higher power consumption make LCC of pumps from unorganized sector about 35% higher.

- Vicious circle - DISCOMS use to circumvent their inefficiencies, political class to gain votes, losses in the system, high subsidy bill of governments, unreliability of power supply, high tariff to paying consumers and more losses....
Situation Assessment

- Farmers need / want
  * Adequate water for irrigation
  * Reliable electricity
  * 24 x 7 availability

- Policy makers need / want
  * Better livelihoods for farmers
  * Better electricity service for the majority of citizens who live in rural areas

- Discoms are caught in the middle
  * Priorities urban and Commercial/industrial
  * Low/no Ag tariffs stimulate consumption
  * Low/no cash flow limits service quality in rural areas
  * High agricultural consumption crowds out profitable sales

- A difficult technical model with many moving parts
  * Human factors, organization dynamics, and the need for extensive communication, education, Ag extension services and persuasion will be key to success
The Dimensions of the Challenge

- For Policymakers: How can the efficient use of scarce resources be achieved when low prices signal abundance?
  - Can an affordable subsidy be maintained while providing better electric service to farmers and other rural customers?

- For Discoms: How can adequate irrigation water for today be obtained at a reasonable cost?

- For Society: How can farmers earn a good livelihood without impairing sustainable water availability for the next generations?
Alternatives

♦ No Change – This approach does not appear to be sustainable and is creation increasingly difficult problems
  o Increasing damage to aquifers threatens future water supplies
  o High agricultural consumption of electricity (30-40% of total consumption) may crowd out profitable sales to other customers

♦ Cost Based Pricing – This is economically efficient but very difficult in socio-political terms

♦ Administrative Controls- Requires full metering and significant monitoring and enforcement capabilities

♦ Energy Service Company- This solution employs a combination of market drivers without disturbing the status quo to create a win-win-win situation

♦ Government Farmers Compact – The direct beneficiary of the intervention would be Government and farmers
  o Government: saves on subsidy
  o Farmers: improve their economic and living conditions
## Menu of Possible Interventions

<table>
<thead>
<tr>
<th>Distribution Upgrades</th>
<th>Pumpset Replacement</th>
<th>Irrigation Upgrade</th>
<th>Agricultural Best Practices</th>
<th>Watershed Management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interventions</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>HVDS Upgrades</td>
<td>Pumpsets meeting BIS Standards</td>
<td>Drip or sprinkler irrigation</td>
<td>Shift to less water intensive crops</td>
<td>Rainwater harvesting</td>
</tr>
<tr>
<td>• Load Management</td>
<td>Right-sized pumps</td>
<td>• Closed storage</td>
<td>• Best Practices</td>
<td>• structures</td>
</tr>
<tr>
<td></td>
<td>Panel boards</td>
<td>• tanks</td>
<td>• Reduce H₂O application</td>
<td>• Ground-water recharge</td>
</tr>
<tr>
<td></td>
<td>Fittings, valves,</td>
<td>(preferably) or</td>
<td>• Seeds/Fertilizer/Pesticides</td>
<td>• Tank rehab</td>
</tr>
<tr>
<td></td>
<td>• spares</td>
<td>liners for open</td>
<td></td>
<td>• Bunds/Check</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tanks</td>
<td></td>
<td>• Dams</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Conveyance</td>
<td></td>
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<tr>
<td><strong>Operational Functions</strong></td>
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<td></td>
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</tr>
<tr>
<td>• Improved billing and collection</td>
<td>Maintenance</td>
<td>• Extension services</td>
<td>• Extension services</td>
<td>• Participatory Planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Maintenance</td>
<td>• Marketing schemes</td>
<td>• Field advocacy</td>
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</tbody>
</table>
Stakeholders

- State Government
- Farmers (user of subsidized / free electricity)
- Electricity Regulator
- Financing Institutions
- Govt. of India – Ministry of Power, Water Resources, BEE, etc.
- Pump-set Manufacturers
- Drip irrigation/sprinkler system manufacturers
- Public at large
E-ESCO Structure for Ag DSM Intervention

- **Power Sale Agreement**: Regional Grid (Industrial buyer)
- **Power Trader**: Project Security
  - Submersible pump and piping
  - Drip irrigation (covenant with farmer)
  - Meter
- **End-Use Measure**: Farmer
  - Installs Drip irrigation (own investment and/or available subsidy)
  - Meter
- **Third Party M&V Agreement**: Monitoring Agency
- **Utility/Discom**: Project Security
  - Improved power delivery (reliability and quality)
  - Reduced losses, peak load, and energy savings
  - Subsidy reduction
- **Purchase & Sale Agreement – Deemed Savings**: Energy Service Agreement
- **Gov’t**: Policy guidance and approvals
  - Inclusion in Annual Revenue Requirement (ARR)
- **E-ESCO**: Design/installation/commissioning/O&M:
  - Capital for installation
  - Cash flow from power sales through trader
  - M&V to warrant base savings

- **Project design – addressing KWH and water savings**
- **Baseline measurements and M&V for energy and water, through metering**
- **Payment security – single revenue streams to E-ESCO & power trader**
- **Rapid sales process – utility to identify all possible installations**
- **Transactional issues include power trading and TOU matching of savings**
Government- Farmer Compact

Efficient irrigation agreement

Farmer
End-Use Measure:
- Submersible pump and piping
- Installs Drip irrigation (covenant w/ farmer)
- Meter

Utility/Discom
Project Security:
- Improved power delivery (reliability and quality)
- Reduced losses, peak load and energy savings
- M & V
- Subsidy reduction

Energy Savings

Efficient Pump agreement

Sale agreement

New Customers
Regional Grid
Industrial buyer

Gov’t
- Policy guidance and approvals
- Inclusion in Annual Revenue Requirement (ARR)

- Project design: addressing integrated KWH and water savings
- Baseline measurements and M&V for energy and water, through metering
- Rapid sales process – utility to identify all possible installations
- Transactional issues include power trading and TOU matching of savings
- Capital for installation
- Enhanced EPC
  - Design/installation/commissioning
  - O&M
  - Cash flow from power sales through trader
- M&V to warrant base savings
Elements of Water and Energy Management

- Financial Intermediary
- Panchayati Raj
- Agriculture
- Watershed
- Transport
- Minerals and Geology
- Irrigation and Cropping Efficiency
- Field Delivery
- Crop Yield
- Storage Tank Distribution Channels
- Pump Efficiency
- Farmer's Pumpset Connection
- Ag-DSM
- Distribution Upgrades
- Discom
- Distribution Line
- Farmers Pumpset Connection
Expectations from Joining IEA

- International Best Practices
- Deliverables for removal of EE/EC barriers
- Capacity building and training of Utilities / Regulators on DSM practices
- Financing Institutions
- Synergy between Government of India Programmes on EE/EC and Tasks of IEA
Visit us at www.bee-india.nic.in

Thank You!