Chandigarh: On way towards a Model Solar City

Presentation By:
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Science & Technology and
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Chandigarh Administration,
Solar Energy

- Most abundant energy resource on earth.
- Solar energy, that hits the earth’s surface in one hour is equivalent to the amount consumed by all human activities in a year
- One of the Greenest form of energy
- Will Reduce Green House Gas Emission
- Available across the country & Throughout the Year
- Decentralized / off-grid applications – addressing rural electrification issues

Solar Power Plant 1 MW
at
PEC University, Chandigarh
Contribution of Conventional Energy sources in Green House Gas (CO$_2$) emissions:

- The use of conventional fuels is one of the major contributors towards the global CO$_2$ emissions. Following is the details of fuel wise and sector wise contribution of India towards CO$_2$ emissions.

<table>
<thead>
<tr>
<th>Sources</th>
<th>CO$_2$ Emission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal (kg)</td>
<td>2.750 kg</td>
</tr>
<tr>
<td>Gasoline (L)</td>
<td>2.392 kg</td>
</tr>
<tr>
<td>Kerosene (L)</td>
<td>3.157 kg</td>
</tr>
<tr>
<td>Diesel (L)</td>
<td>2.640 kg</td>
</tr>
<tr>
<td>LPG (L)</td>
<td>1.66 kg</td>
</tr>
<tr>
<td>CNG (kg)</td>
<td>2.626 kg</td>
</tr>
</tbody>
</table>
MNRE, GOI, New Delhi selected Chandigarh to develop as Model Solar City through Chandigarh Renewable Energy, Science and Technology Promotion Society (CREST).

Master Plan for 10 years for Model Solar City was prepared by The Energy and Resource Institute (TERI)

The Master Plan was approved by MNRE, Govt. of India in Jan/2012.
A "solar city" is an urban area that aims to:

- Reduce dependence on fossil fuels for its energy needs
- Reduction of conventional Energy Consumption of 10% within 5 years
- Limit emission levels to sustainable levels even while maintaining the desired socio-economic development growth
• **Approved Master plan** of 'Chandigarh Solar' City envisaged mid term target of **5 MWp** Rooftop Solar (by 2017) and long term target of **10 MWp** rooftop solar plants installation by **2022** to be achieved.

• Chandigarh was well ahead in terms of achievement and has already installed & commissioned **9.8 MWp** Grid tied Rooftop Solar plants as on 31st Dec,2016.

• In view of enhanced target of **100 GW** to be achieved by **2022** as announced by Govt of India recently, MNRE, GOI has set **50 MWp as Solar PV target for Chandigarh Administration** to be achieved by **2022**.
Nodal Agency

Department of Science & Technology and Renewable Energy, UT Chandigarh

Through

CHANDIGARH RENEWAL ENERGY SCIENCE & TECHNOLOGY PROMOTIONAL SOCIETY (CREST)
18th EPS POWER REQUIREMENT BY CEA (GOI)

PEAK POWER REQUIREMENT (in MW)

<table>
<thead>
<tr>
<th>Year</th>
<th>Requirement (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-16</td>
<td>406</td>
</tr>
<tr>
<td>2016-17</td>
<td>426</td>
</tr>
<tr>
<td>2017-18</td>
<td>450</td>
</tr>
<tr>
<td>2018-19</td>
<td>475</td>
</tr>
<tr>
<td>2019-20</td>
<td>501</td>
</tr>
</tbody>
</table>

Source: Chandigarh Electricity Department
Chandigarh has Per capita power consumption of 1,601 units per year against National average of 1,010 units per year
### Chandigarh : Solar RPO

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>Energy Consumption (MU) as per 18th Electric Power Survey Forecast.</th>
<th>Energy Consumption excluding Hydel Power (MU) (35% of total Consumption)</th>
<th>Solar RPO (%) As Per JERC</th>
<th>RPO (Solar Requirement) (MU)</th>
<th>SPV Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-16</td>
<td>1739</td>
<td>608.65</td>
<td>0.85</td>
<td>5.17</td>
<td>3.98</td>
</tr>
<tr>
<td>2016-17</td>
<td>1841</td>
<td>644.35</td>
<td>1.65</td>
<td>10.63</td>
<td>8.18</td>
</tr>
<tr>
<td>2017-18</td>
<td>1948</td>
<td>681.8</td>
<td>2.5</td>
<td>17.05</td>
<td>13.11</td>
</tr>
<tr>
<td>2018-19</td>
<td>2062</td>
<td>721.7</td>
<td>3.6</td>
<td>25.98</td>
<td>19.99</td>
</tr>
<tr>
<td>2019-20</td>
<td>2182</td>
<td>763.7</td>
<td>4.7</td>
<td>35.89</td>
<td>27.61</td>
</tr>
<tr>
<td>2020-21</td>
<td>2309</td>
<td>808.15</td>
<td>6.1</td>
<td>49.30</td>
<td>37.92</td>
</tr>
<tr>
<td>2021-22</td>
<td>2444</td>
<td>855.4</td>
<td>8</td>
<td>68.43</td>
<td>52.64</td>
</tr>
</tbody>
</table>

- Chandigarh has already installed & commissioned **9.6 MWp** Solar PV Plants as on 31st Aug, 2016.
- Chandigarh is in the process of installation of another 5 MWp Solar plants By March, 2017 thereby meeting all its Solar RPO Obligation by end of FY 2015-16 through production of solar energy in its own territory.
SOLAR ENERGY INITIATIVES/STRATEGIES

- Chandigarh has conceived installation of Rooftop based SPV Power Projects as use of other renewable sources like wind power, Hydro power etc. is minimal in the Union Territory.

- Chandigarh is almost fully built up and land is very precious so Rooftop Solar was the best alternative available to utilize vacant roof space as resource.

- All are Grid tied solar PV Plants mostly under Net metering arrangement so that solar energy generated is first consumed locally at respective building loads and excess if any, is exported to the grid.
Major Highlights:

- CREST has commissioned **145 rooftop solar plant** with overall installed capacity of about **8.0 MWp** as on **31st Dec, 2016**.

- These **145** solar plants include followings:
  
  - Installation& commissioning of Rooftop solar plants in **59 Govt schools of UT Chandigarh of overall capacity of 2290 kWp**.
  
  - Installation& commissioning of Rooftop solar plants on **13 Govt colleges in Chandigarh leading to overall capacity of 2770 kWp**.
  
  - One of the largest rooftop Solar PV Plant of **1 MW capacity installed & commissioned at Punjab Engineering college, Sec 12**
  
  - Installation of rooftop Solar plants on **28 Govt residential Houses for Demonstration purposes**
Innovation in Procurement / Installation of SPV Power Plants:

- Guaranteed Minimum Electricity Generation for each solar plant

- **Make in India** Initiative by having only Indian made Solar Panel with Minimum Efficiency of 15%

- Grid Interactive SPV System

- Third Party Inspection for solar plants installed to ensure its technical standards & quality

- Provision for 10 years O&M in the DNIT itself to ensure good quality products being installed by EPC Contractor.
Solar Installation in Private sectors (As on 31st Dec, 2016)

• **Net Metering:**
  - Total 164.5 kWp Solar Power Plants installed on 38 Nos. private Residential Houses in Chandigarh.
  - Total 1245.9 kWp Solar Power Plants installed on 17 Nos. different private institutions in Chandigarh.

• **Gross Metering:**
  - Total aggregate capacity of 121.24 kWp Solar Power Plants installed on 17 Nos. private Residential Houses in Chandigarh.
  - Total aggregate capacity of 275 kWp Solar Power Plants installed on 5 Nos. different private institutions in Chandigarh.

**Grand Total = 1806.64 kWp**
Climate Change Initiative

- As on 31st Dec, 2016, Chandigarh has already generated 16.5 MU of solar energy (in last 3.5 years) which is equivalent to reduction of 11,385 metric ton of CO₂ and in turn equivalent to planting of 12.2 lakh trees.

- Chandigarh plants about 2 Lakh saplings every year as part of Greening Chandigarh Action plan and hence above efforts in Solar City is equivalent to planting another 3.5 Lakh saplings every Year.
### Future Strategies:

<table>
<thead>
<tr>
<th>S. No</th>
<th>Agency</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>UT Administration's intervention</td>
<td>35 MW</td>
</tr>
<tr>
<td>2.</td>
<td>Private Sector/ Industries/Institutions/</td>
<td>15 MW</td>
</tr>
<tr>
<td></td>
<td>Residential Houses/ RESCO Mode</td>
<td></td>
</tr>
</tbody>
</table>

1. Covering all rooftop of UT government office as well as residential buildings

2. Encouraging & facilitating other Govt. Offices like Central Govt. offices, Punjab Govt. offices & Haryana Govt. offices to go for solar installation

3. Encouraging Private/third party solar installation mode on buildings
Joint Electricity Regulatory Commission for Goa & UTs (JERC) has notified the Solar Tariff & Net metering Regulation which is offering a very attractive rate which shall definitely lead to installation of Solar Plants on private houses/Industrial/commercial establishments.

As per the Regulation, any electricity consumer/resident can opt for ‘Gross Metering’ billing arrangement or for ‘Net Metering’.

Any electricity consumer/resident can install & sell Solar power @ Rs 9.19 per unit (kW hr) from solar plant without subsidy and @ Rs 6.89 per unit with capital subsidy of 30%.
## Solar Tariff 2016-17

<table>
<thead>
<tr>
<th>Kw</th>
<th>Subsidy</th>
<th>FY 2016-17</th>
<th>FY 2017-18</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>W/out AD</td>
<td>With AD</td>
</tr>
<tr>
<td>1-10</td>
<td>0%</td>
<td>9.19</td>
<td>8.71</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>6.89</td>
<td>6.55</td>
</tr>
<tr>
<td>11-100</td>
<td>0%</td>
<td>9.08</td>
<td>8.6</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>6.81</td>
<td>6.48</td>
</tr>
<tr>
<td>101-500</td>
<td>0%</td>
<td>8.86</td>
<td>8.40</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>6.66</td>
<td>6.34</td>
</tr>
<tr>
<td>&gt; 501</td>
<td>0%</td>
<td>8.72</td>
<td>8.26</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>6.56</td>
<td>6.24</td>
</tr>
</tbody>
</table>
**Initiatives taken to promote Solar Power in Private Sector:**

• **CREST** has **empanelled 45 EPC Contractors** for installation of rooftop Plants and **30% subsidy** as provided by GOI shall be released to the consumer if they get it installed through any on of the. However, the subsidy is limited to L-1 rate arrived or as per rate notified by MNRE Whichever is less.

• **CREST** has launched an **online portal**: [www.solarchandigarh.com](http://www.solarchandigarh.com) wherein any regulatory clearances including subsidy can be obtained online by any consumer as part of Ease of Business.

• **UT Chandigarh** has recently **notified amended Building By- laws** to make Solar PV Installation mandatory on all buildings in U.T., Chandigarh **above 500 Sq yard Plot size** to promote the Chandigarh as a Model Solar City
AWARDS/RECOGNITION:

Year 2015:

Awards from the MNRE, GOI on the First Foundation day of Association of Renewable Energy Agencies of State (AREAS) on **27th August, 2015** at Bengaluru for its excellent performance in the field of Renewable Energy.


2. Second highest cumulative grid connected renewable power capacity addition amongst the Ts in the country in 2014-15.

3. Ranked Second Prize for installation of renewable power applications in its office building at Chandigarh

Year 2016:

CREST received following from the MNRE, GOI on **7th June, 2016** at Vigyan Bhawan, New Delhi for its excellent performance in the field of Solar Energy.


50 kWp Rooftop SPV Plant at Paryavaran Bhawan
495 kWp, SPV Plant, GCG, Sector 11

SPV Plant, Kansal Forest

200 kWp, SPV Plant PGGCG, Sector 42

435 kWp, SPV Plant, PGGC, Sector 11
200 kWp Rooftop Solar Plant at ISBT, SEC-43
300 kWp Rooftop Solar Plant at ISBT, Sec-17
10 kWp Floating Solar Plant with Fountain at Dhanas Lake
Thank you