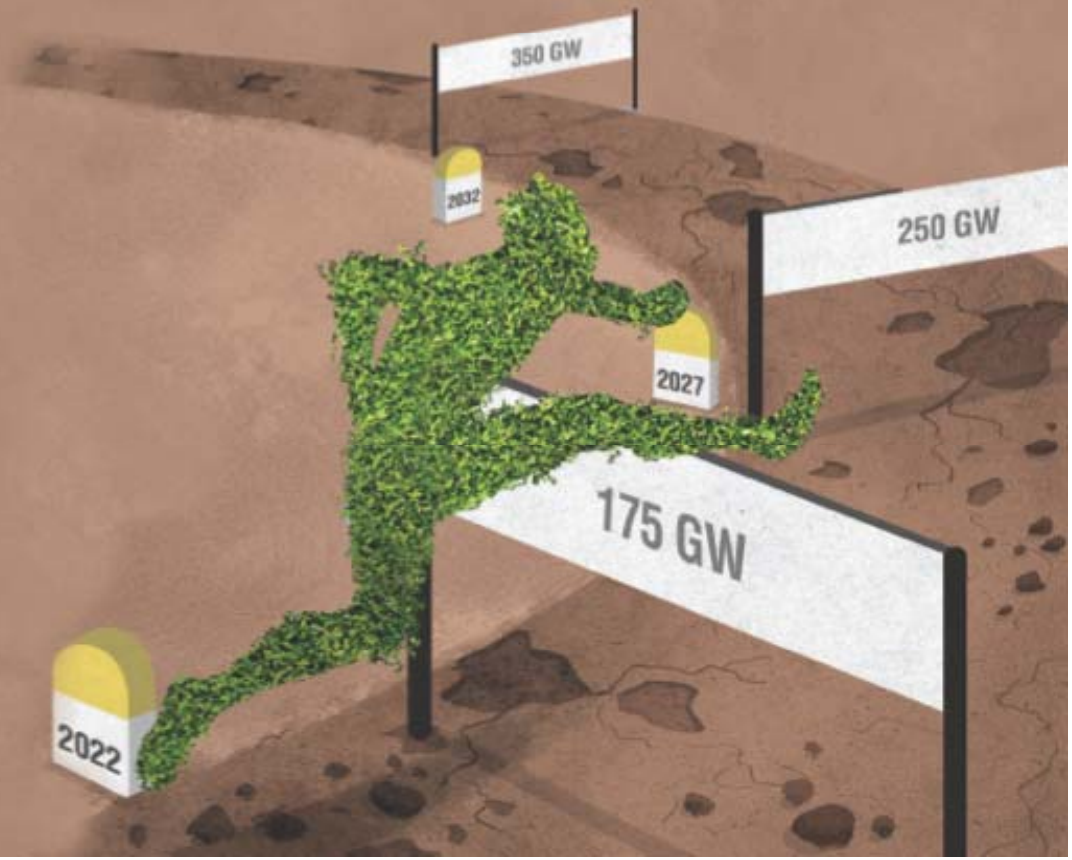
DEBUNKING MYTHS

SOLAR ROOFTOP FOR THE RESIDENTIAL SECTOR

Mobilizing Gurgaon for a solar-powered future



Shweta Miriam Koshy, CSE

June 5, 2019

About CSE

- The Centre for Science and Environment (CSE) is a **public interest research and advocacy organization**.
- CSE has helped **shape policies** and **build public awareness** to bring change for over three decades; is recognized for its role in **capacitating public institutions and regulatory agencies**

Research, monitoring and advocacy

Renewable Energy
Clean Air and Sustainable Mobility
Sustainable Water Management and Sanitation
Sustainable Industrialization
Climate Change
Food Safety and Toxins
Sustainable Buildings and Habitat
Environment Education

Communication for awareness

Down To Earth:

- Fortnightly publication on environment and development issues since 25 years

India Environmental Portal :

- One stop shop for open-access information on environment
- Over 0.5 million records

CSE researches into, advocates for and communicates the urgency of sustainable and equitable development for all.

CSE in Gurugram

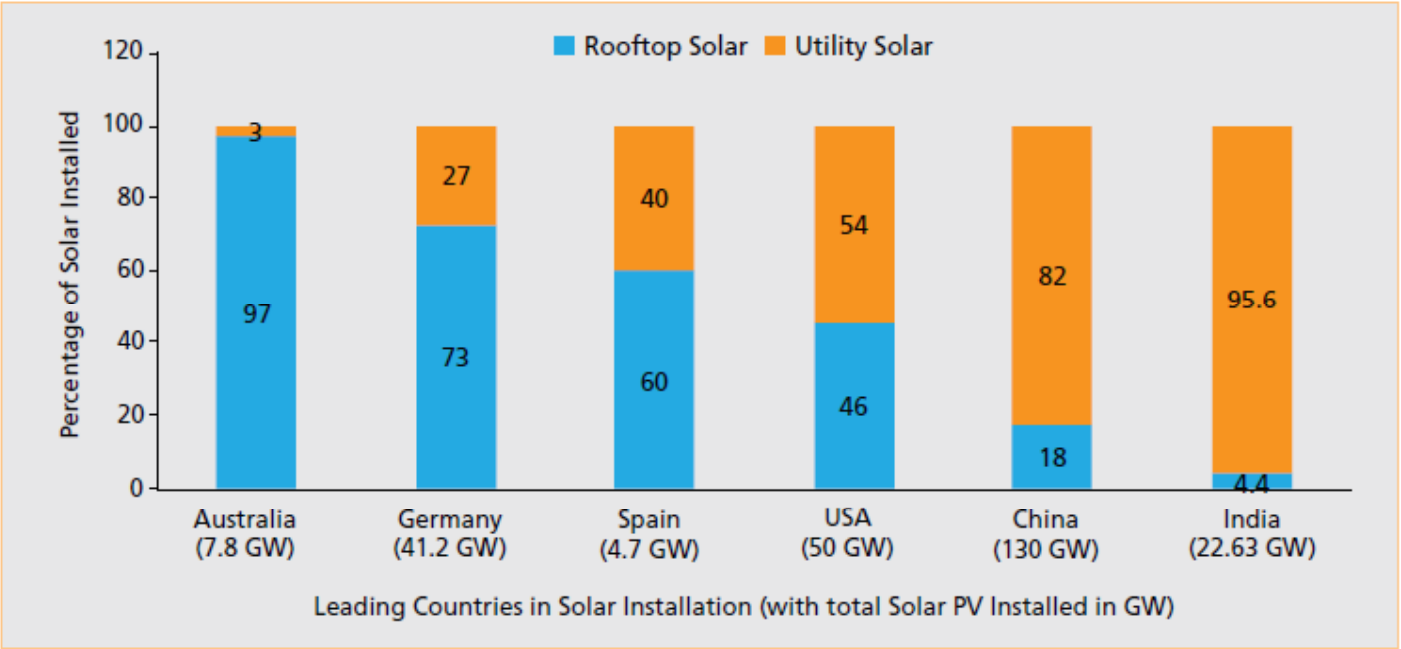
- Why Gurugram for SRT advocacy?
  - Gurugram receives over 300 clear days of sunlight and has **high insolation**
  - Large number of high rise buildings – residential, commercial and industrial buildings – plenty of rooftop space
  - The city currently struggles with power outages; and this will worsen as the per capita consumption is expected to increase from 4,000 kWh per annum to increase to 6,400 kWh by 2022
  - High dependence on expensive and polluting diesel generator for power supply
  - High acceptability and affordability

- What has CSE done?
  - Primary objective: Gurugram to emerge as a model city for SRT development
  - Our efforts have been multifold
    - **Studies that establish the very real economic and environmental benefits;**
    - **Increasing awareness and our local knowledge base**
    - **Government engagement and introducing supportive reforms**

Nationally, SRT sector lags; Large-scale RE thrives

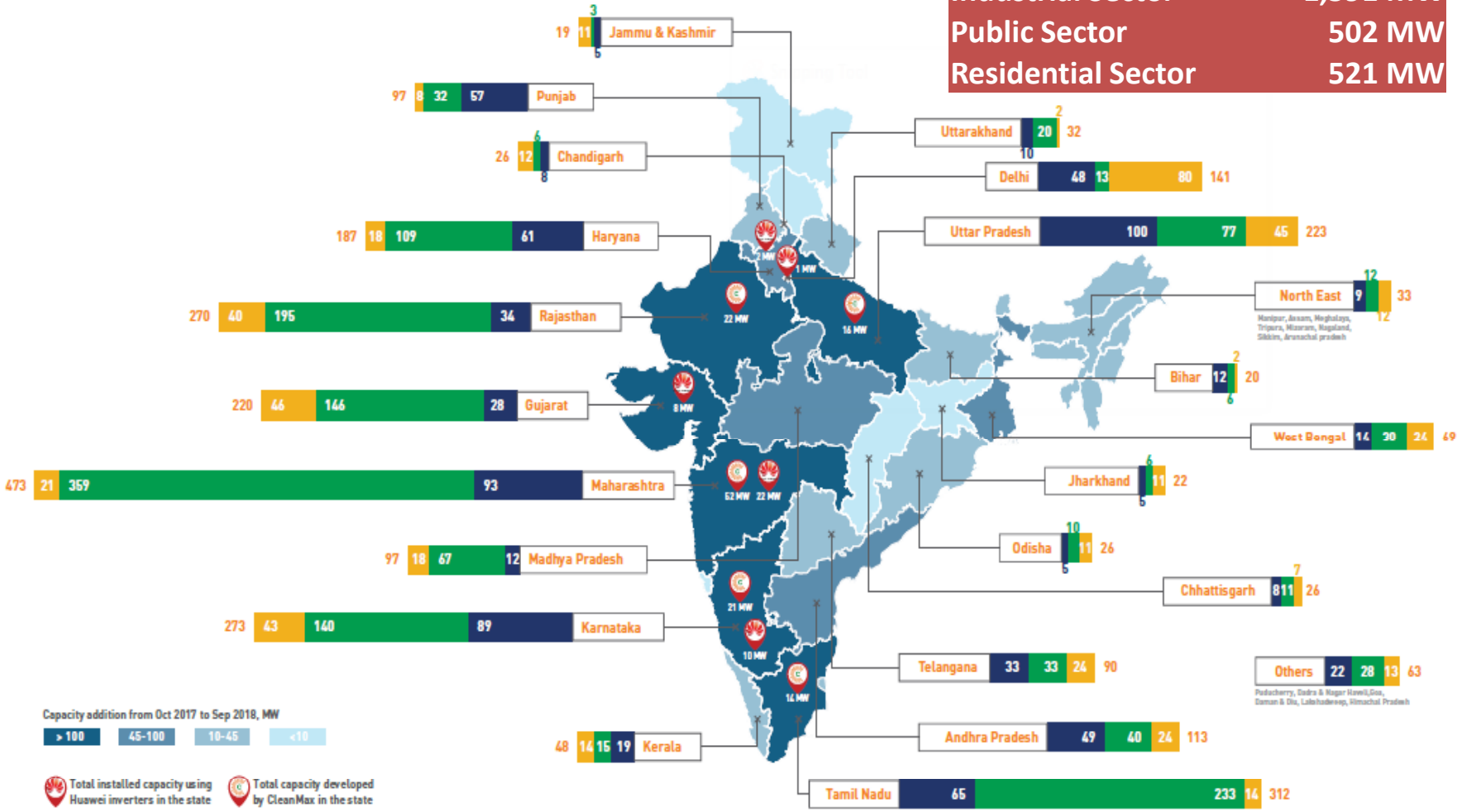
- India targets **175 GW of RE installations by 2022**. As of April 2019, cumulative installations stood at **79.03 GW**.
- This growth is bolstered by falling technology costs and increasing efficiencies
- Rooftop space is plentiful - commercial, industrial and the residential sector.
- However, SRT has accomplished less than **10% of its target** (1.8 GW of 40 GW) for 2022.

- Government continues to push for SRT – **Phase-II of Grid Connected Rooftop Solar Programme** has gained cabinet approval.



C&I has been quick to adopt SRT

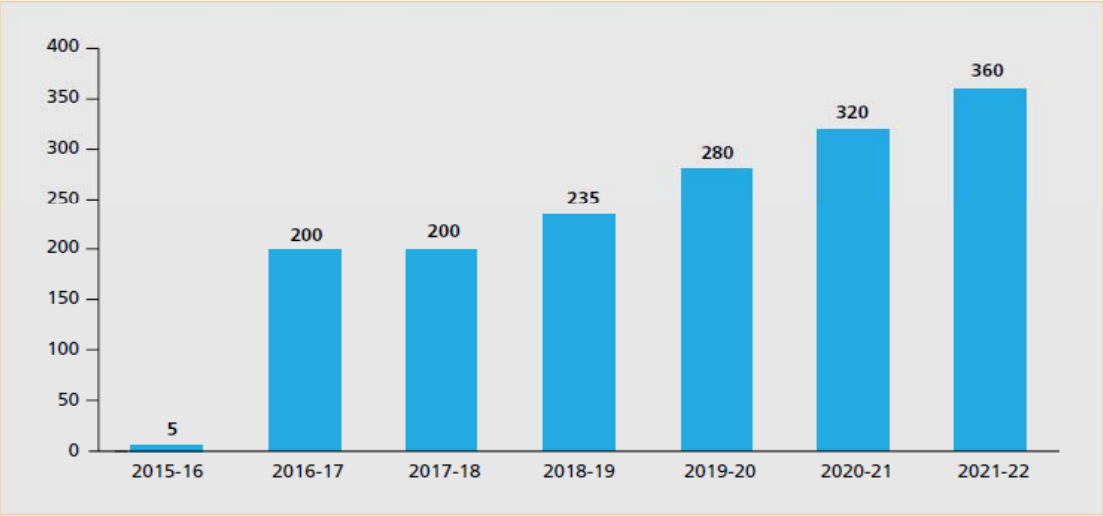
Commercial Sector	785 MW
Industrial Sector	1,591 MW
Public Sector	502 MW
Residential Sector	521 MW



Source: Bridge to India
As of September, 2019

Haryana looks to SOLAR to increase its RE base

- Solar RPO targets to be increased to **8% (3.2 GW)** by 2022
- Solar target - 4,142 MW by 2022; **SRT target – 1,600 MW by 2022**
- Installed Solar > 135 MW; **SRT installed > 85 MW**



Note: Initially, a total of 4,560 MW was the target for Haryana state, which now stands revised by MNRE at 4,142 MW

Measures undertaken by the state departments

- Tender released for 50 MW of solar rooftop system for various government buildings.
- DMRC has a 25-year PPA agreement sourcing solar energy for HUDA City Centre metro station.
- Department of Health plans to install SRT systems at primary and community health centers (PHC and CHC).
- Department of Education has approved tendering for SRT adoption by over 4,600 govt schools.

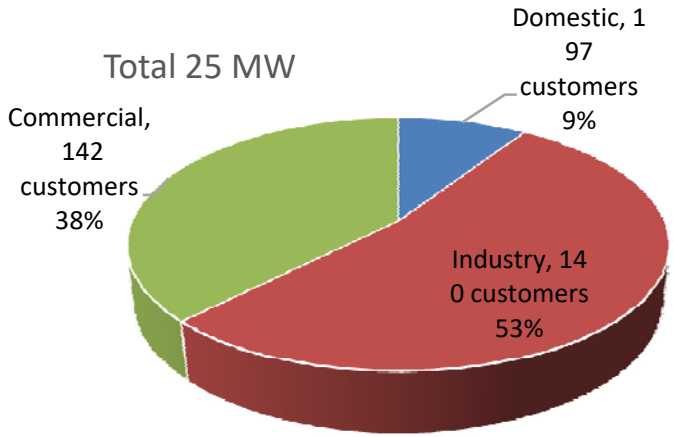
Haryana enforces SRT, through building code mandate

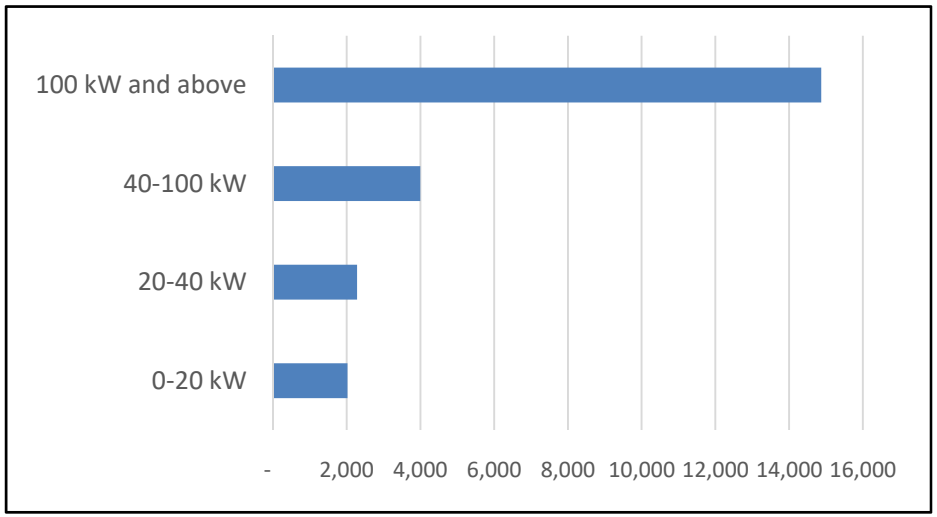
- **The state Government of Haryana (HAREDA order dated 21st March 2016) has made it mandatory for certain category of buildings to install solar rooftop systems.** (See table below)
- Existing mandate requires all new residential buildings on a plot size of 500 sq. yards or more have to install a solar rooftop system with a capacity of at least 1 Kwp or 5% of the sanctioned load, whichever is higher.
- Implementing authorities such as HUDA, Municipal Corporation, HSIIDC and other departments such police, PWD; required to incorporate relevant provisions in their departmental byelaws, within 3 months

S. No.	Category of buildings/area	Qualification	Size of the system
1	New residential buildings	Built on a plot size of 500 square yards	Minimum 1 KWp Or 5% of sanctioned load
2	Private educational institutes	Sanctioned load of 30 KW and above	Minimum 5 KWp Or 5% of sanctioned load
3	Government buildings and offices	Sanctioned load of 30 KW and above	Minimum 2 KWp Or 5% of sanctioned load
4	Private hospitals and nursing homes, industrial establishments, and commercial establishments	Sanctioned load of 50 KW to 1000 KW	Minimum 10 KWp Or 5% of connected load
		Sanctioned load above 1000 KW	Minimum 50 KWp Or 3% of sanctioned load

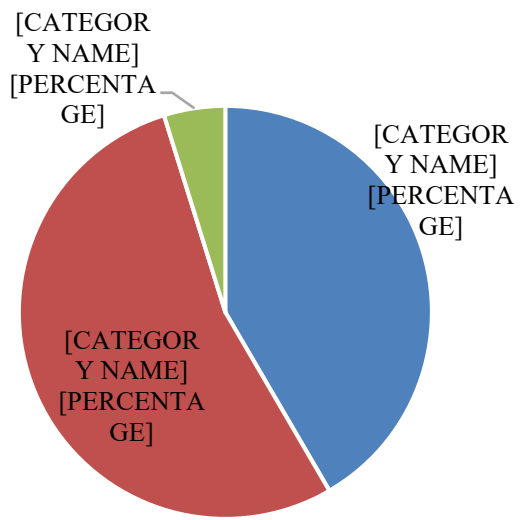
Gurgaon – Vision of a Solar City

- Gurugram has installed SRT capacity – 25 MW
- Another 55 MW has been sanctioned for installation
- Gurugram average load is 1,125 MW; and peak load is 1,700 MW;
- CSE study shows SRT can contribute to 15-20% of load; as high as 200 MW
- As is the national trend, majority of the installations were by large C&I consumers
- Of the 25 MW installed, commercial Sector – 38% and Industrial Sector – 53%
- Uptake by the residential segment was minimal – adding up to only 9% of all installations in Gurugram.



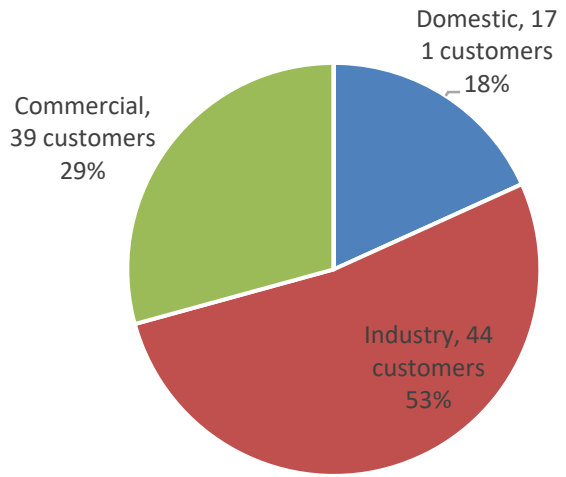


On-grid



Installed Capacity: 16,385 kW

Off-grid



Installed Capacity: 8,025 kW

- 95 % of the off-grid SRT systems were installed by the C&I customers
- Residential sector seems more amenable to net metering; 18% of grid-connected systems were installed by the residential sector.

- Unfortunately, there is no guiding target for the city.
- The 2014 Gurugram master plan, has set a goal of saving 155 million units (MUs) from renewable energy installation, which translates to 100 MW of SRT.
- Based on existing residential and projected residential settlements, CSE projects floor area that can accommodate 200 MW of SRT in the city

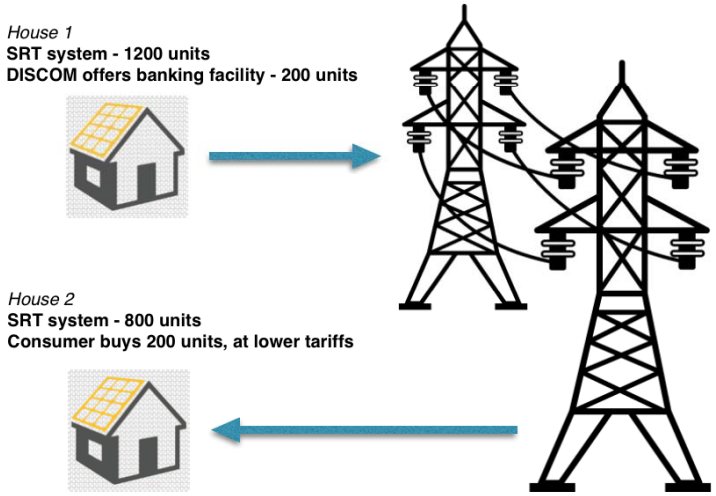
Case for Solar Rooftop – The Economical benefits

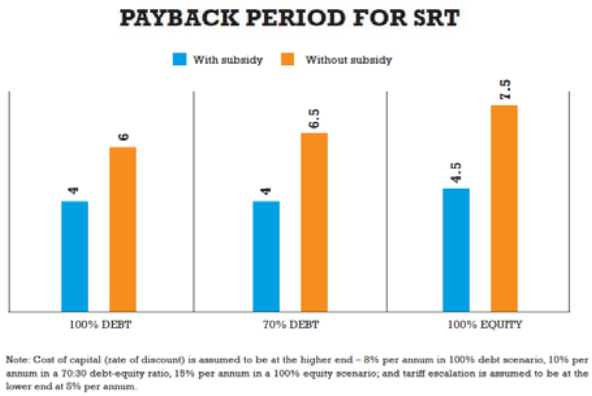
- SRT can generate approximately **1500 units of electricity per kWp annually**.
- SRT offers long term energy security - **25 years**.
- Panel costs are falling - current benchmark costs are as low as **Rs 40,000 per kW**
- The technology is heavily incentivized by the government
- SRT installations can avail capital support from the central government – **30% on the benchmark costs (See table below).**
- Solar prosumers in Haryana can claim a **rebate of Rs. 1 per unit for every unit** (kWh) of electricity generated from SRT systems. Another Rs. 1 per unit is available for prosumers utilizing battery back-up with the SRT systems.
- For on-grid systems, DISCOMs offer **net metering and banking facility-** offset power bills, which in turn translates to quicker payback period for the SRT system.

System Size (kWp)	HAREDA benchmark costs
1 kWp to 10 kWp	Rs 49,500 per kW
10 kWp to 100 kWp	Rs 41,700 per kW
100 kWp to 500 kWp	Rs 40,250 per kW

Incentives for residential 'prosumers'

- Net metering and Banking.
- **Net metering** allows for bi-directional movement of power between household and grid; i.e. you can send and receive electricity from the grid.
- **Banking** is the facility to store any excess electricity generated. In Gurugram, electricity can be stored for the length of a financial year.
- If your system generation falls short of the household consumption, electricity can be drawn from the grid.
- Further, reduction in the grid-electricity usage means the 'prosumer' slips to a lower tariff slab; is therefore charged a lower tariff for his electricity consumption.
- Savings on power bills can contribute to system cost recovery; pushing the payback period to as low as 4-5 years (with subsidy).





Offset Diesel Generator usage: economical and environmental benefits

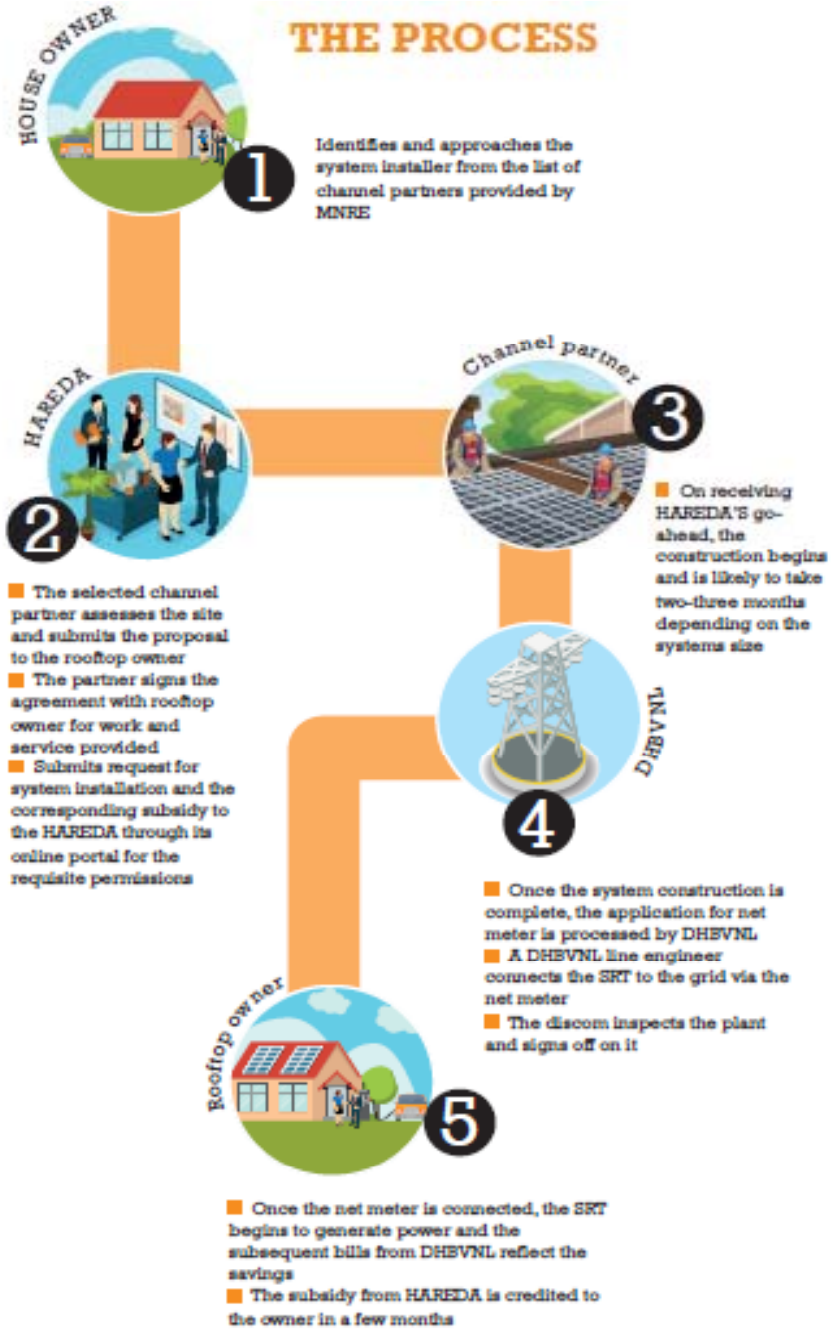
- Diesel generator sets are widely employed in Gurugram; there are over 10,500 units
- DG sets are **expensive**. This is around four times cost of generation from a DG set (including capital costs) is 4 times that of SRT systems to residential societies, over its lifetime.
- DG sets are **polluting**; responsible for 6% of PM 2.5, 4 %of PM10 and SO2, 25% of NOX and 7% of CO2 levels in the NCR region.

- CSE's study monitored the air pollution before, during and after DG set operation.
- PM 2.5 and PM 10 maximum levels shot up during the DG set operation.
- The pollution accumulates during DG set operation.
- Longer the DG use, higher the ambient levels.

CSE study results:
"Pollution in Residential societies from DG sets"

- 3 case studies - Devinder Vihar (moderate no: power cuts and ambient pollution levels), New Colony (high ambient pollution) and Times Residency (long power cuts and high DG operation times).
- The average PM10 levels increased by 20-50% after the DG operation, to more than thrice times the safe limits.
- The average PM2.5 levels increased 30-40% after DG operations, to more than twice the safe values.

DG SET TIME OF OPERATION	1 HOUR BEFORE	DURING OPERATION	1 HOUR AFTER	1 HOUR BEFORE	DURING OPERATION	1 HOUR AFTER
	Average PM 2.5 levels			**Maximum PM 2.5 levels**		
Devinder Vihar	95	111	129	122	164	156
New Colony	123	149	174	129	278	205
Times Residency	126	131	137	136	214	146
	Average PM 10 levels			**Maximum PM 10 levels**		
Devinder Vihar	190	235	296	247	500	352
New Colony	633	909	1314	687	1894	1686
Times Residency	277	278	328	302	352	1880



- Pick an empanelled vendor/developer
- Selected vendor develops a project proposal which, following consent from the 'prosumer', is submitted to HAREDA.
- Once approved by HAREDA, the project installation may commence – typically takes anywhere between 2-4 months.
- Following installation, DHBVNL must facilitate the installation of a net- meter.
- Once completed, a commissioning report is filed with the authorities for the subsidy disbursement

In Conclusion.....

1. **Environmentally sound**
    1. **Sustainable energy source**
    2. **Clean alternative for DG sets**
2. **Economically more viable**
    1. **Low costs**
    2. **High level of support from the government**
3. **Considerable solar potential in the city and the residents are the key to Gurugram untapping this potential to become a true model 'solar –city'**