SunEdison®

DMRC Roof Installations Case Study

A Global Renewable Energy Leader

We develop, build, finance, and operate renewable energy plants

- Global Market Leadership
  - 2010: Largest solar photovoltaic plant developed in Italy, EU, 70 MW
  - 2011: 306 MW of Wind farm with an 88 mile transmission line in US
  - 2012: Largest PV plant interconnected in Bulgaria, 60 MW, built in 5 months
  - 2013: Acquired Eco-First (A leading Solar Residential company in US)
  - 2014: Largest PV plant interconnected in Chile, 100 MW in 3 months
  - 2014: 267 MW tracker PV plant in US;
  - 2014 : 100MW in JNNSM phase 2 in India; pipeline of 500+MW
  - 2014: IPO of **TerraForm Power**, a YieldCo, market cap of $3B
  - 2014: **Acquired First Wind** (a leading wind company with 531 MW of operating assets, 1.1 GW Backlog, 531 MW Pipeline, 6.4 GW Development platform)
  - **Over 1500 power plants and >4GW fleet under management**
  - **5.9 GW of project pipeline globally**
- Global Financial Leadership
  - US$7.9 Billion in structured solar & wind financing
  - US$1.5 Billion in energy fund partnership with First Reserve
- Technology Innovation
  - Internal R&D to optimizes system design and production
  - JV with Samsung for FBR Poly silicon manufacturing in Korea

SunEdison®

Built the First Solar City in India

2.2 MW of Solar Rooftop Projects in Gandhinagar, Gujarat

Highlights

- 1st Solar City programme in the country
- Private and Residential Rooftops in Gandhinagar, Gujarat
- 2.2 MW constructed across 140 sites in 14 months
- Range of plant sizes commissioned:
  - **Government Projects:** 20kW to 380 kW
  - **Residential projects:** 2.4 kW to 22 kW

SunEdison®

Key Accomplishments – Narmada Canal

- Reduces evaporation – saves up to 7 million liters of drinking water per year
- Provides reliable power to nearby villages
- Reduces algae growth to produce more potable water

SunEdison

SunEdison Services – Global Footprint

4 CONTINENTS ...

SunEdison service provide system reliability and higher power plant production enabling maximum return on investment.

END-TO-END MONITORING SOLUTIONS

2000 MW

SunEdison operates and monitors a large portfolio of self-owned and third-party PV power plants across the globe.

>800 PLANTS

GLOBAL LOGISTIC EXPERIENCE

SunEdison Services is a business unit of SunEdison, and is also a separate legal entity, wholly-owned by SunEdison, LLC.

3 ROC's

RENEWABLE OPERATIONS CENTERS

Belmont (CA), Madrid (Spain), and Chennai (India) are all locations with Renewable Operations Centers.

Orders from DMRC till date (4.2MWp)

- Dwarka Sector 21 – 500KWp
- Faridabad Line Stations - 8NOs – 1.2MWp
- Ajronda Depot and Faridabad Substation – 476KWp
- Yamuna Bank Station and Yard (some locations) – 326KWp
- Balance Capacities currently under execution at Yamuna Bank

SunEdison

First solar plant of DMRC – Dwarka - 500KWp

DMRC wanted to put up its first 500 KWp Solar power plant at Sector 21 Dwarka Metro Station.

SunEdison was the successful bidder under SECI tender for subsidy - Delhi State

Proposed an apt solution with attractive tariff (flat for first 3 years and subsequently an increase of till 15 years and thereafter a flat tariff till 25 years. Helping in hedging the rising power costs for 25 years

No hassles for DMRC to maintain the system in terms of O&M and warranty management since the asset owned by SunEdison

DMRC has to pay for only energy generated

SunEdison

Considerations for Metro's First solar power plant

- Discussion on the terms of the PPA
- Installation was to be done at rooftop of a fully functional metro station
- Had stiff timelines to meet.
- No penetration type structure solution to be provided.
- Cable routing system was critical.
- Interconnection to the existing LT system

SunEdison

Timelines

- Receipt of LOI : 29th January 2014
- PPA signing – 20th February 2014
- Commencement of work – 16th June2014
- Commissioning – 27th June 2014
- (In record 11 days)

SunEdison

Considerations for Metro's First solar powered Line of 8 stations - Faridabad

- To meet the stiff lines of completion by 31st July 2015.
- LOI received on 22.05.14. Project completed in less than 2 months
- Installation to be done on curved roofs with no existing facility of access, safety lines, water pipeline
- Seeking design approval from competent team of DMRC for penetration of the roof. Conducted pull test.
- Had to brave the rains on a slippery surface of curved roofs. Had to employ high levels of safety standards
- Shifting of modules to rooftop and subsequent installation

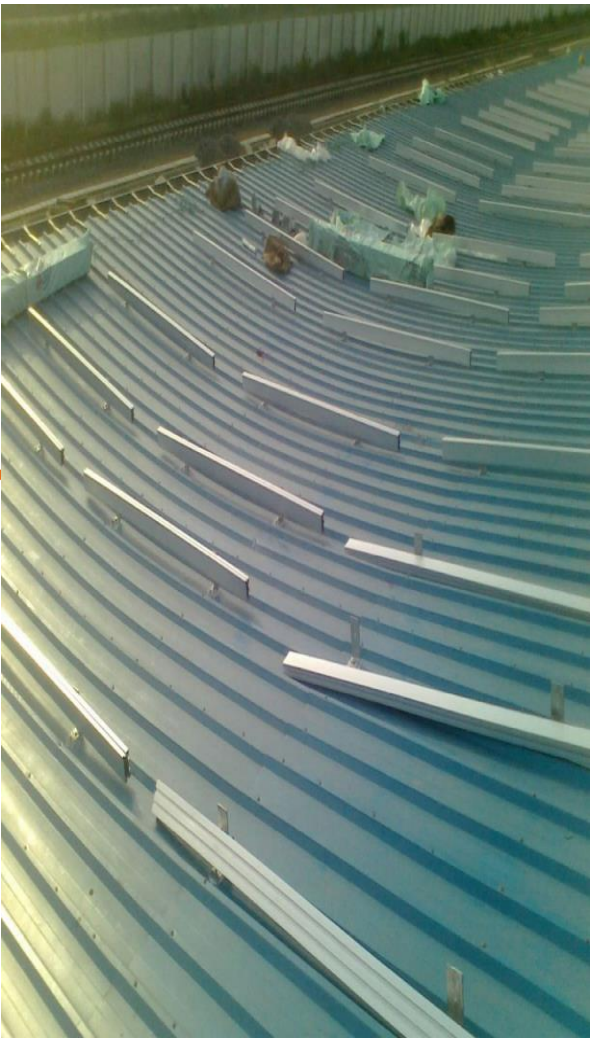
Challenges for Metro's First solar powered Line of 8 stations - Faridabad

- Had to penetrate roofs for the fixing of clamps to hold the structure for housing of modules
- Ensuring the 100% waterproofing of all the penetrated area
- Proper coordination with multiple agencies simultaneously operating at station..
- Considering the loading issues on roof . At a time only limited installers were allowed over the roof increasing the installation time

DMRC Faridabad Line installation

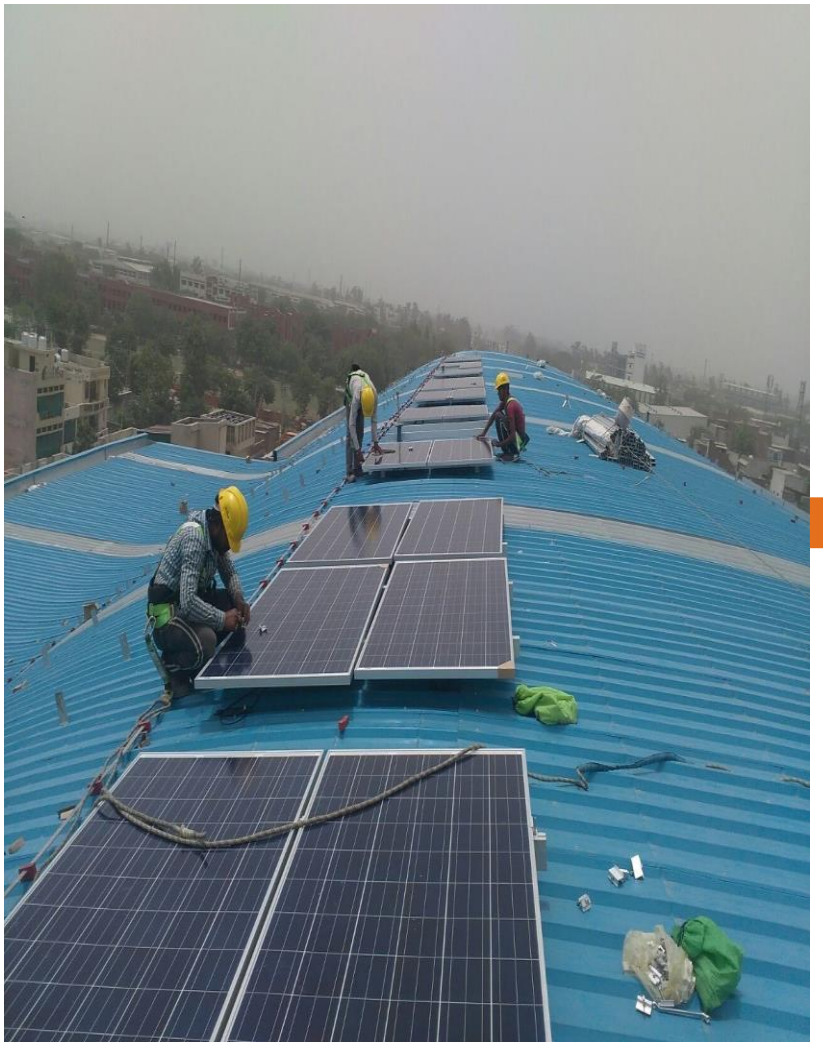
Installation of safety lines

Installation of clamps after penetration and sealing



Installation of structures

DMRC Faridabad Line installation



Installation of modules

Installation completed

SunEdison

Challenges for Metro's Yamuna bank installations

- Installation of solar power plant on a fully functional station/yard
- Roofs are above the HT line. Had to consider high levels safety mechanisms
- Power block/shutdown was available only during nights and that too for limited hours
- Coordination of the installation team was critical. One synchronization lapse means wastage of the entire day