



PFS Web Conference

Making Solar Roof-top & Decentralized Generation a Commercially Viable Option



Welcome address & Opening remarks by



Mr Tarun Kapoor
Joint Secretary
MNRE



Dr Ashok Haldia
MD & CEO
PTC India Financial Services Ltd

Panel Discussion by



Mr H.S.Wadhwa
COO
Azure Power



Mr .Pinaki Bhattacharyya
CEO
AMP Solar Group



Mr Rohit Chandra
Vice Chairman & Ex. Director
OMC Power

PFS successfully conducted, it's forth Web-conference on "Making Solar Roof-top & Decentralized generation a commercially viable option" on 13th June 2016.

Shri. Tarun Kapoor, Jt. Secretary, Ministry of New & Renewable Energy (MNRE), Govt. of India, was chief guest and hosted the session along with Dr. Ashok Haldia, MD&CEO, PTC India Financial Services Ltd. (PFS).

The conferences were great success with participation from the investors, lending community, developers, market analysts, PE players, manufacturers and other stakeholders.



Web Conference

"Transforming dream of Solar Roof-top on every roof into reality
and
Making Decentralized generation a commercially viable option".

Solar Rooftop Presentation, June 2016

Mr. H.S. Wadhwa

COO, Azure Power



Agenda

Topics

Why Rooftop ?

Solar Rooftop Present Scenario in India

Solar Rooftop Potential in India

State and Central Govt plans and support for Solar Rooftop in India

Challenges in Solar Rooftop and Reforms required for Solar Rooftop in India

Azure Power Contribution in growth of Solar Rooftop in India

Why Rooftop ?

Why Rooftop?

✓ Market Opportunity

- High cost of alternative sources
- Growing need for reliable power by commercial & industrial (C&I) entities
- Favorable policy - govt. target to reach 40GW by 2022

✓ Cost Effective

- Faster to install, low gestation period
- Generation @ point-of-consumption
- No requirement of expensive land
- No ROW or other approvals
- Productive use of otherwise idle roofs
- No requirement of Transmission Line/Evacuation
- Zero distribution losses

✓ Favorable Regulatory Support

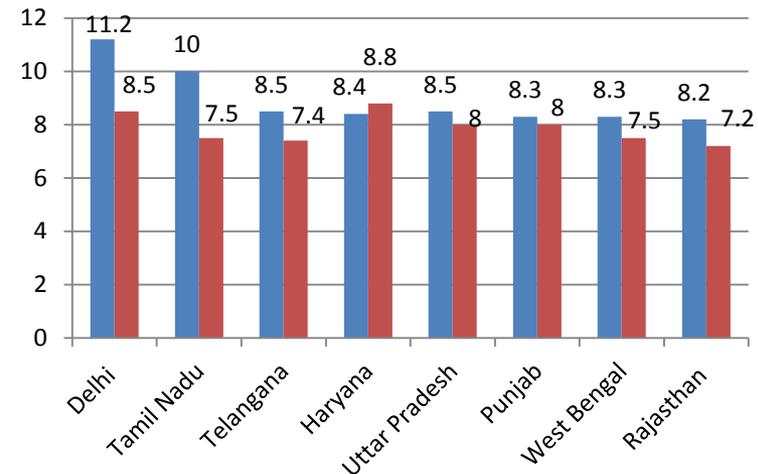
- Solar RPO to reach 8% by 2022
- Introduction of net-metering by many states
- Increase focus of sustainability by corporates

✓ Social Benefits

- Low cost of power
- Promotes Entrepreneurship , Skill Development and Employment

(all figures in INR Rs PwP)

Industrial & Commercial Tariff 2015-16



Solar Vs Commercial Tariff



Solar Rooftop Present Scenario in India

Solar Rooftop Present Scenario in India

Rooftop Solar Installed capacity

Total Rooftop Installed Capacity till 31st Mar'2016



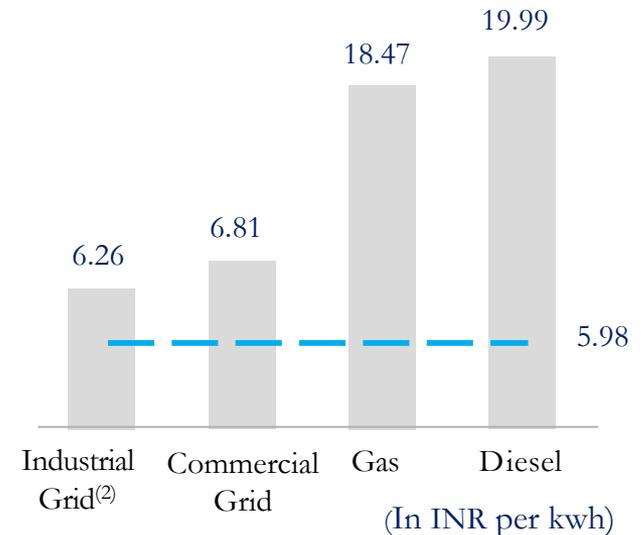
- Till date India has installed 740 MW of solar rooftop capacity
- 25 states and union territories have issued policy and regulations on net metering
- Tamil Nadu, Maharashtra and Gujarat are leading states in terms of capacity installed
- Gross metering, Net Metering and Captive consumption policies available

❖ Market potential as estimated by TERI – 'reaching the sun with rooftop solar'

❖ *Govt. target: 40GW by 2022, UK Climate Group Estimate: 26GW aggressive scenario

❖ Total installed data by Bridge to India, 2016

Solar power tariffs are competitive vs. other power sources

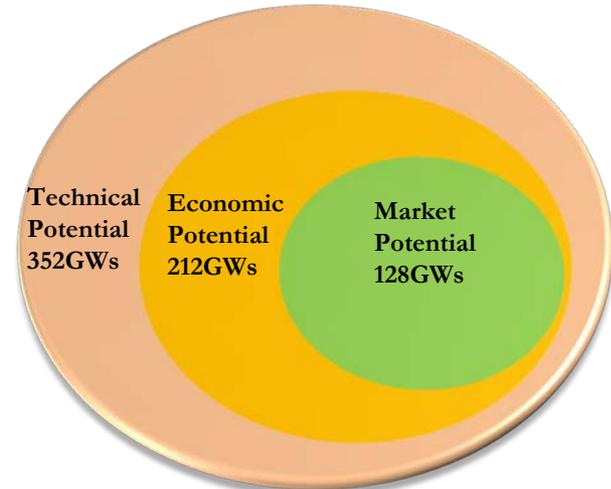


- Imported coal sets the price of power
- Rapid growth increasing demand for power
- Transparent and structured solar auction
- Increasing acceptability among people for solar rooftop

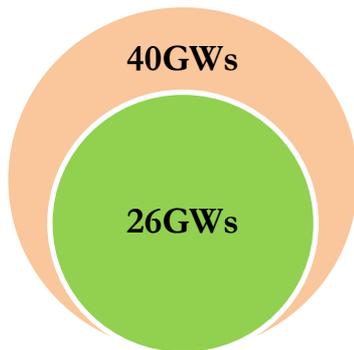
Solar Rooftop Potential & Opportunity in India

Solar Rooftop Potential & Opportunity in India

Market Potential

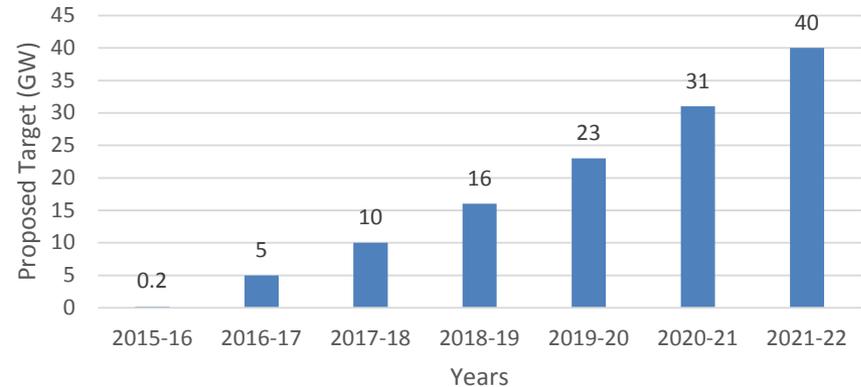


Addressable Market BY 2022*



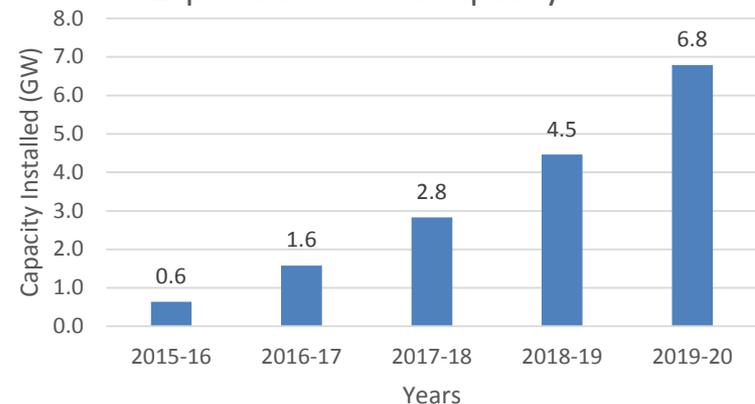
Government Target for 2022

Solar Rooftop Proposed Target



Market Expectation

Expected Installed capacity



- ❖ Market potential as estimated by TERI – ‘reaching the sun with rooftop solar’
- ❖ *Govt. target: 40GW by 2022, UK Climate Group Estimate: 26GW aggressive scenario
- ❖ Total installed data by Bridge to India, 2016

State and Central Govt. plans and support for Solar Rooftop in India

Strong Government Support Attracting Investment

40GW target by 2022 supported by strong regulatory support and robust domestic and foreign capital investments

Strong Regulatory Support

Strong and supportive federal- and state-level regulatory framework

- Center ministries to pledged to produce 5000MW solar power
- India launched global solar alliance at Paris Climate Summit involving 120 countries
- Strong renewable purchase obligations mechanism in place
- 25 states and union territories have issued policy and regulations on net metering

Transparent and structured solar auctions

- Not winner take all; bidders can win capacity while bidding above clearing price

Additional regulatory support for solar

- 10 year tax holiday, only minimum alternative tax applies
- Accelerated depreciation: up to 80% depreciation in 1st year
- Exempt from other taxes/duties and environmental compliance

Robust Solar Investments

Substantial domestic investment

- \$30bn in domestic funding⁽¹⁾ for renewable development

Improving access to domestic capital

- Local project debt costs have declined ~2.00% since 2011

Increasing foreign investment

- India received ~\$39bn in foreign direct investment in twelve months ended 2015, a 37% increase from 2014



Gujarat Energy Minister Visiting Azure Rooftop Plant

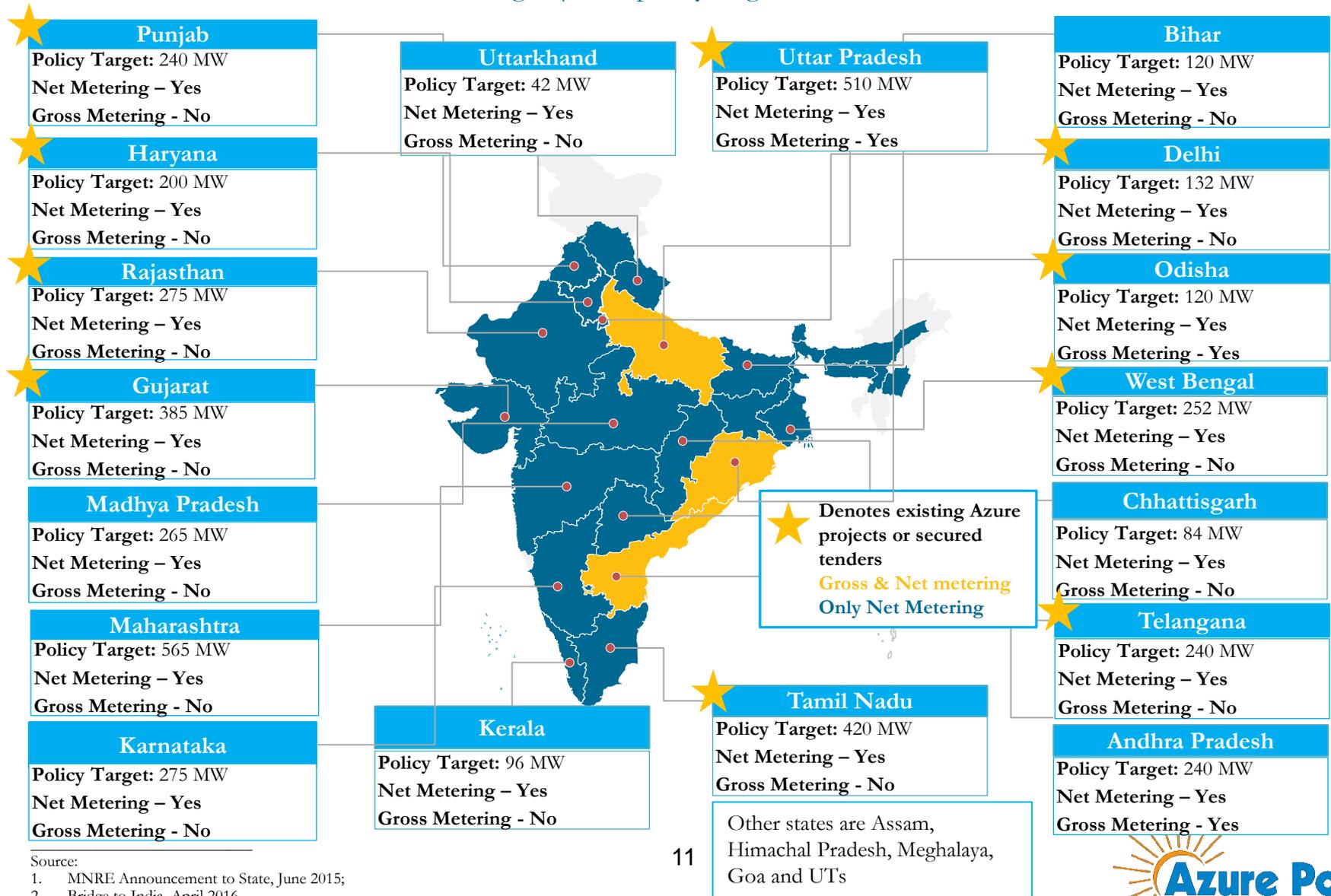
Note: Figures in USD.

Source: C-WET, MNRE, Planning Commission, The Final Report of the Expert Group on Low Carbon Strategies for Inclusive Growth; MNRE, projections based on Planning Commission Estimates.

1. Indian central government announced a \$5bn line of credit extended by the India Infrastructure Finance Company Ltd. (IIFCL). The Indian central government also plans to float five funds totaling \$25bn to finance renewable energy development.

Policy Initiative in India

40 GW Government target | State policy targets are of ~4.8 GW for 2016-17



Source:
 1. MNRE Announcement to State, June 2015;
 2. Bridge to India, April 2016

Challenges in Solar Rooftop and Reforms required for Solar Rooftop in India

Challenges and Reforms required for Solar Rooftop in India

Policy

- Standardization of policies including Net Metering and ensuring effective implementation across PAN India .
- Future regulation should allow group net metering projects along with 100% energy banking of consumption.
- Mandatory Rooftop Solar installations for Industrial/Commercial and High Consuming Residential.
- Strict compliance of RPO/SPOs for obligated entities.
- Standard PPA for all rooftop projects insulating the developer from the risks involved
- Policy for utilization of large warehouse roofs for generating solar power and supplying as a gross metering model to DISCOMs at FIT with responsibility of evacuation of DISCOM .
- Custom duty exemption on imported components of rooftop thus improving the quality of the solar plant.

Funding

- Banks / FIs should come forward for funding solar rooftop projects
- Banks/FI should provide debt at lower interest rate with higher repayment period
- Banks/Fs should roll out separate policies of funding solar rooftop projects
- Banks/FI should complete funding process in short time

Roof Aggregation

- All the tender implementing authorities or State Nodal agencies should first identify & aggregate roofs along with guaranteed long term offtake of power.
- Central level body to be mandated to aggregate roofs all across the country for these projects.

Execution

- DISCOMs to be sensitized to provide faster connectivity approvals.
- Priority/faster clearances for solar rooftop projects from all relevant agencies .

Azure Power Contribution in growth of Solar Rooftop in India

Strength in Rooftop Solar

Rooftop model gives Higher IRR than Utility-scale tariff with tariff linked to inflation

- ✓ 300+ Sites under management, ~450 under development and in pipeline, 16.5MW operating, 36.7MW under construction/committed
- ✓ Diesel Abatement, LEEDS rating, No government support required



Case Study: DLF Rooftop

Plant Capacity: 2.237MW

Number of roofs: 24

- Azure signs a 25 year PPA with DLF
- Builds-Owns-Operates solar plants across seven states



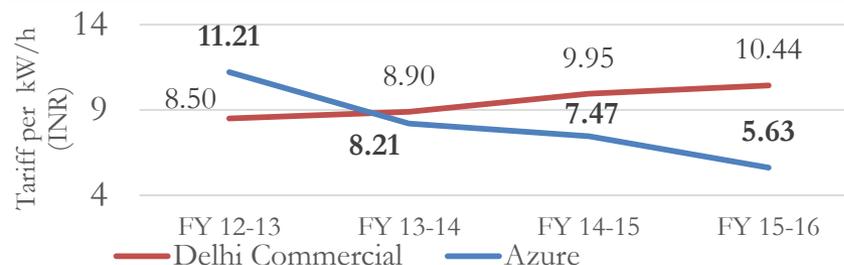
Case Study: Gujarat Rooftop, Smart City Enabler

Plant Capacity: 2.5MW

Number of roofs: 192 (Private roofs: 161, Govt. roofs: 31)

- India's first grid connected MW scale solar rooftop project
- Azure Power was awarded the top 10 Public Private Partnership, 2013 by IFC
- Torrent Power provides clean electricity to consumers
- Building owners get cash incentives from Azure Power for sharing roofs

Azure vs. Commercial Tariff

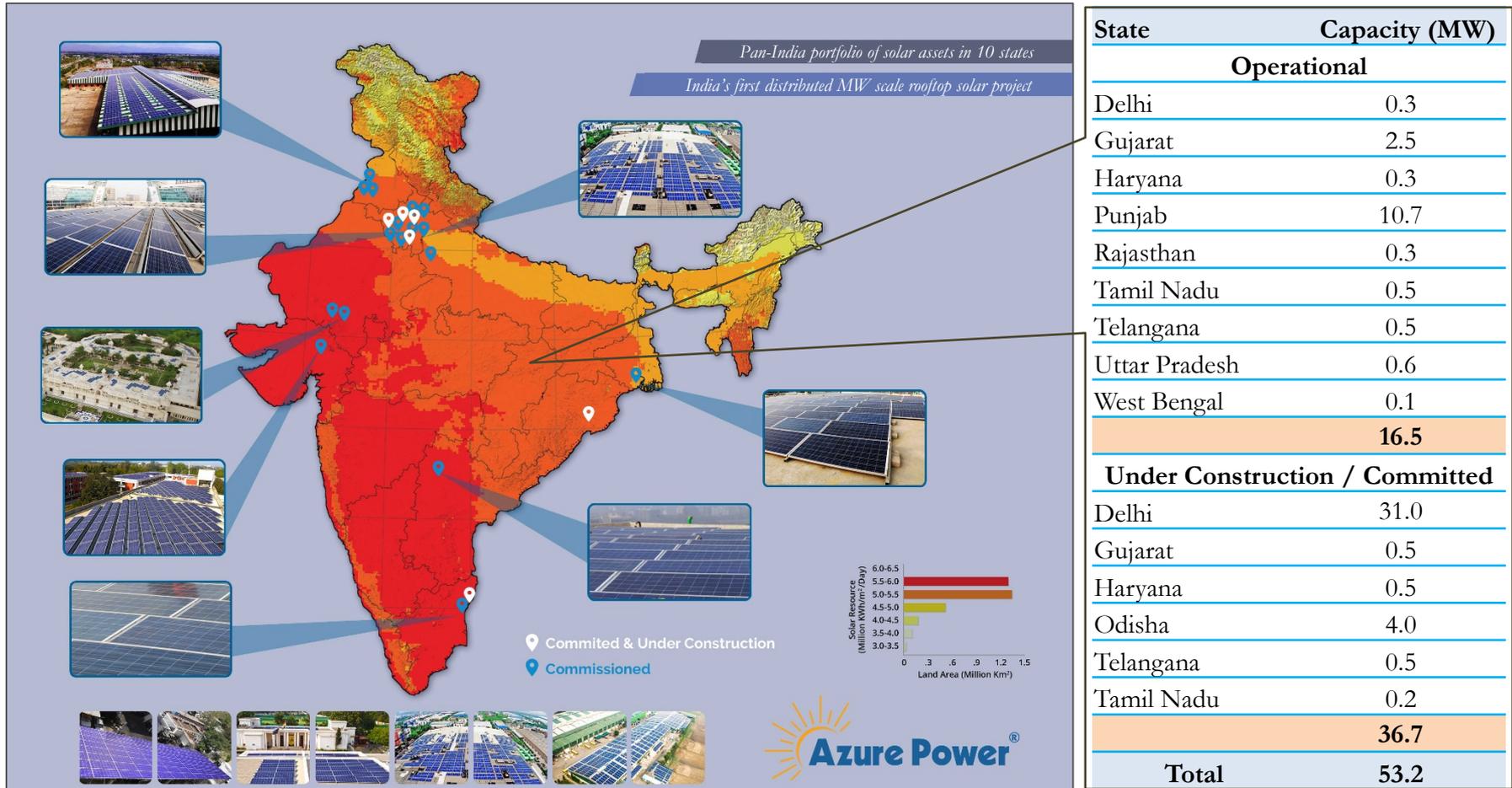


National Award received under category "Project Developers" by MNRE, 2016

Pan India Project Portfolio and Pipeline

Total portfolio of 53.2 MW with 16.5 MW in operation, 36.7 MW committed capacity and 120 MW in additional future pipeline

- Azure Power's offtakers include a diverse set of Commercial & Industrial users





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Rooftop Solar

Canadian Case Study and Learnings for the Indian Market

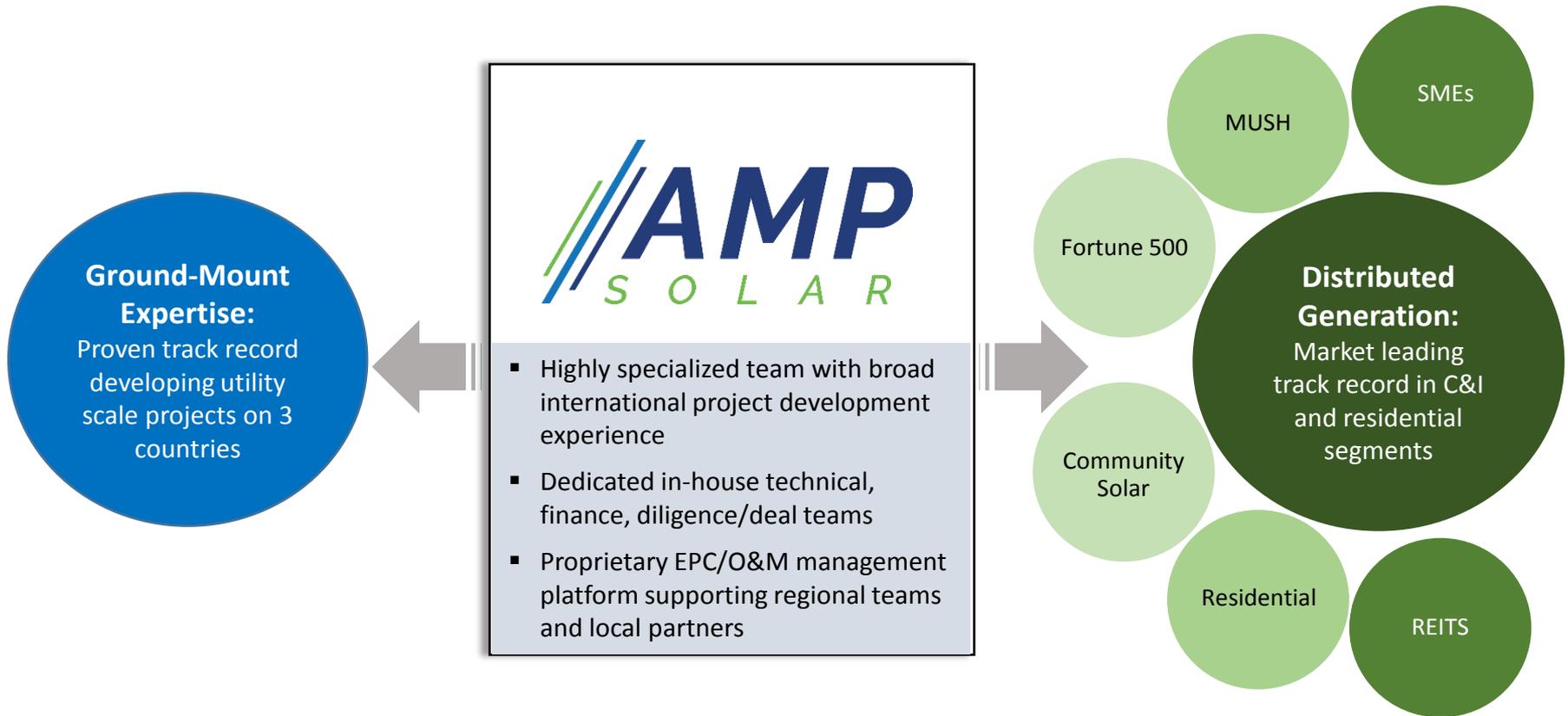
June 2016



AMP Solar Overview

Toronto District School Board Case Study

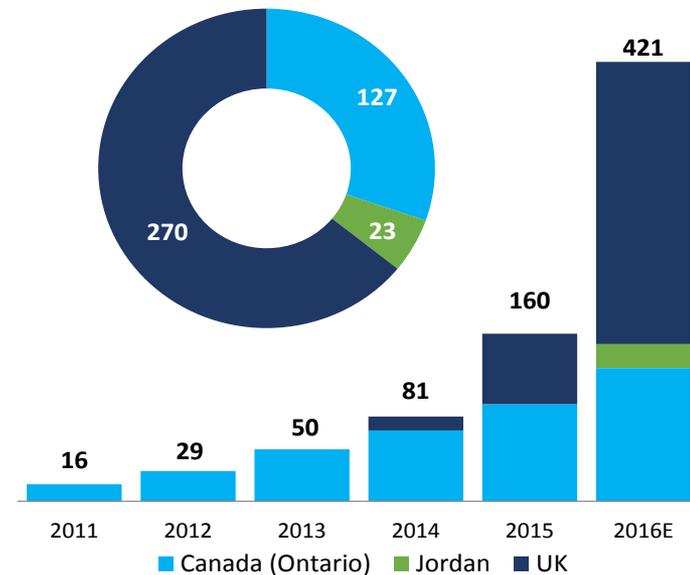
Recommendations based on Learning from this Project



Unique platform with experience in both ground mount utility scale + DG projects

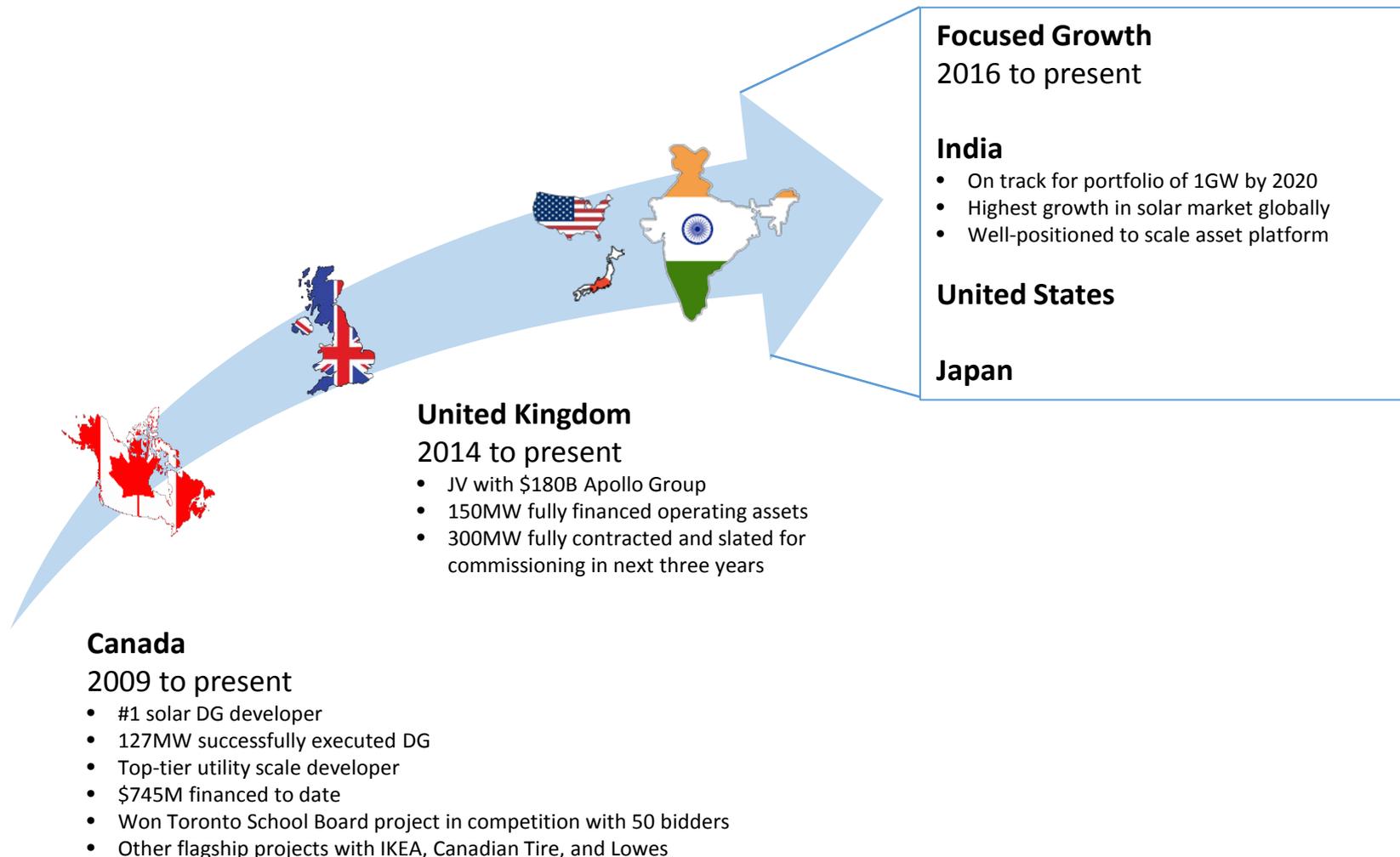
<p>420MW +</p> <p>Solar Power Assets Operating or in Construction</p> <p>More than 6,000 projects in NA, Europe, and ME</p>	<p>\$1.1B +</p> <p>Total Capex Financed Globally</p>
<p>1,600MW+</p> <p>Late-stage Pipeline</p>	<p>#1</p> <p>Solar Distributed Generation developer in Canada</p>

AMP Track Record in Cumulative Installed Capacity (MW)



(1) 2016-17 installed capacity reflects contracted work expected to COD in the next 18 months.

AMP Solar Group is active in the development, financing, and management of large-scale asset portfolios of distributed generation and utility scale projects



AMP Solar has leveraged strong experience in distributed generation and utility scale solar projects into targeted growth areas in the UK and India

Toronto District School Board (TDSB) Case Study

Project Description

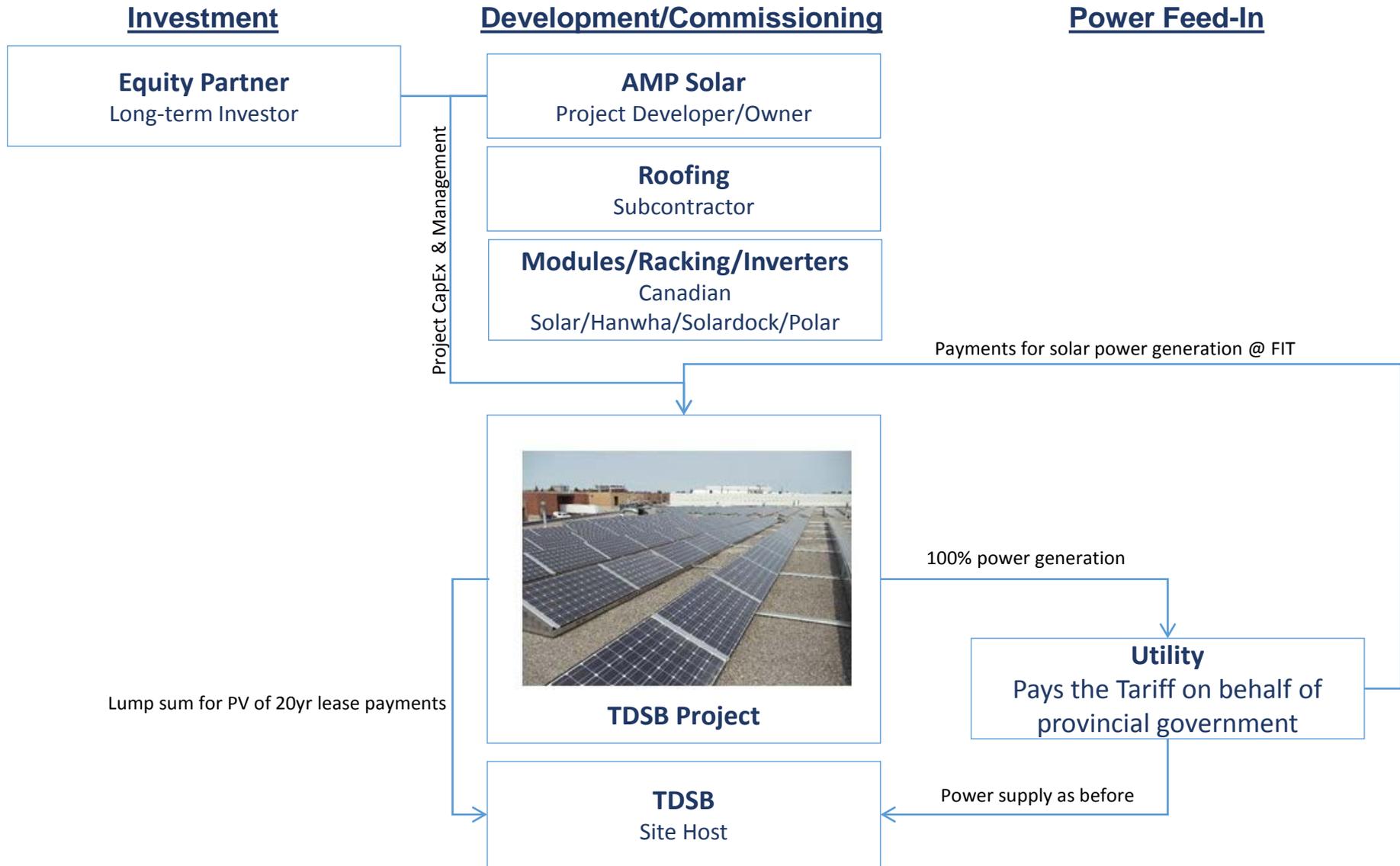
Toronto District School Board is one of the largest and most progressive School Boards in North America. The board was interested in utilising solar to promote environmental sustainability to students, teachers, and local communities while also earning a non-traditional long-term revenue stream to support its ongoing capital improvements. AMP Solar was chosen among numerous global competitors to develop the entire portfolio. AMP Solar provides all permitting, design & engineering, procurement & construction services as well as long-term financing.



TDSB – Project Detail

Total Project Size	66MW
Total Invested Capital	C\$450m (Rs. 2,365 crore)
Number of Locations	450 in Ontario, Canada
Duration of Construction	36 months
Deal Structure/Business Model	Developer Owned, Lease of rooftops, FIT goes to project directly, Project owned by investors,
AMP Solar Role	Project development, EPC Management, Monitoring & Operations Management
Incentive Program/Policy	Province FIT Program
Major Challenge	Special safety/security requirements around school children Finance structuring to allow for needs of client
Bid Process	Bid in multiple rounds of RFPs directly by School Board Won very competitive bid by listening closely to needs of the customer

Toronto District School Board: Stakeholders



Increase the Educational Value

- Curriculum support to integrate the project into school classes
- Exchange program for students to visit manufacturers
- Display of project output, sample cells and racks on display and for use in curriculum

One Size Does Not Fit All

- Unlike ground-mount projects, rooftop projects are constructed where the customer's main activities take place
- This requires an intimate understanding of their specific needs in order to add value to their work, or at the very least, not disrupt their work

Creative Financing to Meet Those Needs

- TDSB Example: Lump sum PV of 20 year lease payments
- Enabled special projects and infrastructure upgrading

Precision Execution for Special Customers

- Stage development around school timings to protect children
- Special design elements like closed racking to ensure safety around children
- Police and background checks for all people working on the project

Recommendation for Indian Market

- To help achieve target for 5GW target of rooftop solar on government ministry & department rooftops, the following recommendations are proposed:

Features of TDSB Project	In India Currently	Recommendations
1. Development of project with no upfront cost to customer	Yes	Continue with Opex model
1. Large-scale bundling of several hundred rooftop locations into one large project	No	Ministry of Education, Ministry of Health and Welfare, etc of central or state governments can estimate capacity and offer tenders for bids by experienced project developers
2. Payment of NPV 20 year lease rental up front to school board	No	Currently no rooftop rentals charged, but could see if an upfront payment (perhaps for 5 years) could be attractive to potential customers and discount the FIT as required. In similar lines with SECI CPWD tenders floated across India for putting solar on CPWD buildings on RESCO Mode with 15% Capital subsidy
4. No captive consumption	No, bi-directional net-metering	Continue with net-metering, but explore possibility of 100% power feed-in to the grid
5. Pairing of solar installation with roof repairs	Not quite	Currently installation with efficiency upgrades is happening. Repairs could be considered for older buildings. But more broadly understanding the needs of the customer and adapting to fit the requirement.



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DECENTRALIZED SOLAR PV MINIGRIDS

ENABLING SUSTAINABLE ENERGY ACCESS



BACKGROUND

ENERGY ACCESS DEFICIT

- 300 million Indians have no access to electricity
- No power during peak-hours even in electrified villages

TRADITIONAL GRID LIMITATIONS

- Reach, capacity and efficiency are inadequate
- High Transmission and Distribution losses

INCREASING GENERATION CAPACITY IS NOT ENOUGH

- Large scale capacity addition feeds into the same grid
- Urban areas need prioritized over rural
- Rural consumers are at the tail-end of the pipe

ENERGY ACCESS IS ESSENTIAL FOR DEVELOPMENT



RADICAL AFFORDABILITY → SPEND-SHIFTING



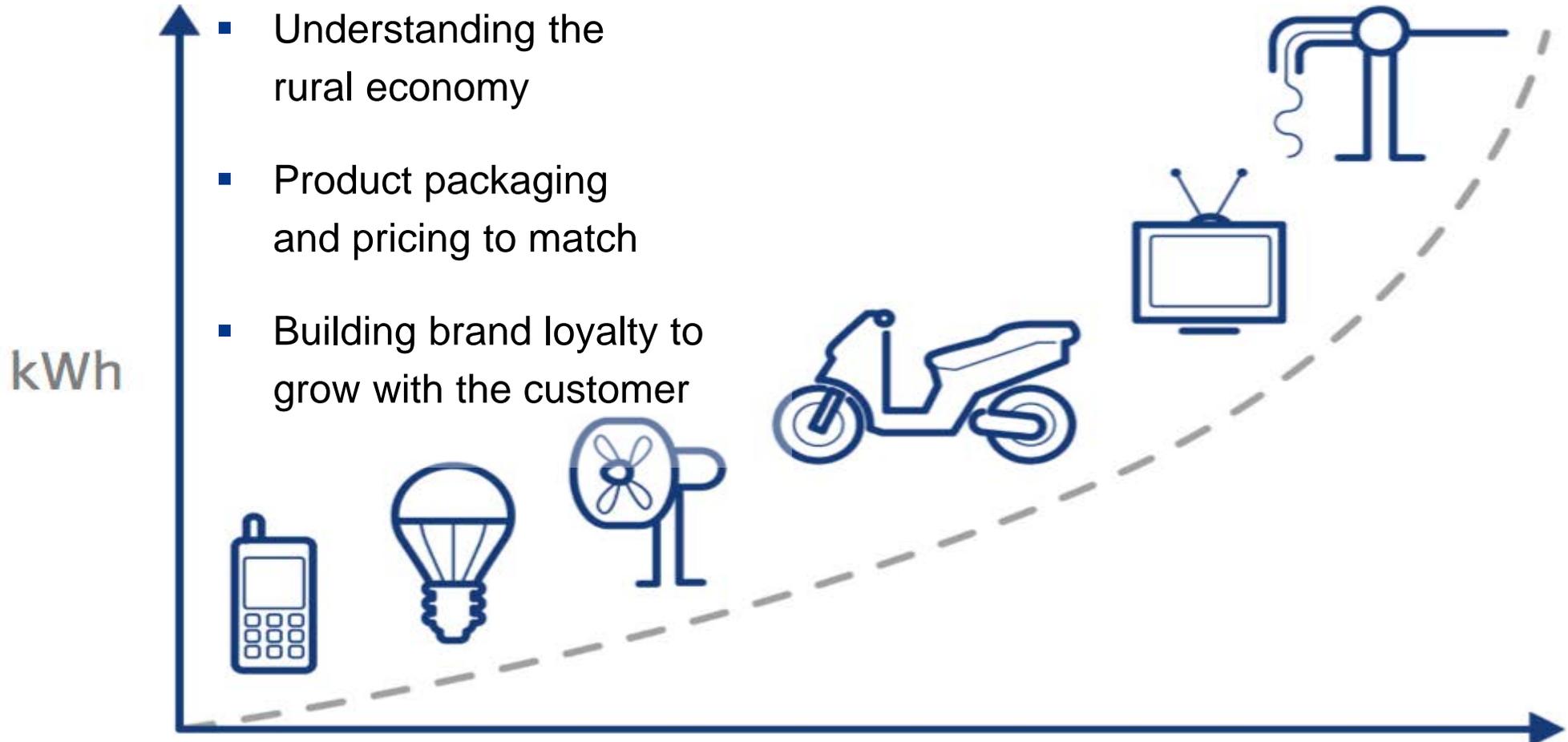
KEROSENE
(Rs. 180/month)



ELECTRICITY
(Rs 110/month)

- Renewable power is delivering better value to households
- Cost levels below existing budget for kerosene and mobile charging

ASCENDING THE ENERGY LADDER



OMC'S PIONEERING "ABC" MODEL FOR MINIGRIDS

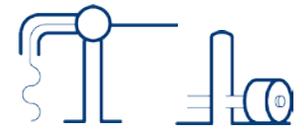


A – ANCHOR LOADS

- Mobile towers
- Revenues from day one, 24/7 demand
- Long-term power purchase agreements

B – BUSINESSES – Via Smart Grids

- Petrol pumps, irrigation pumps, mills
- Hospitals, banks, schools
- Small and medium enterprises

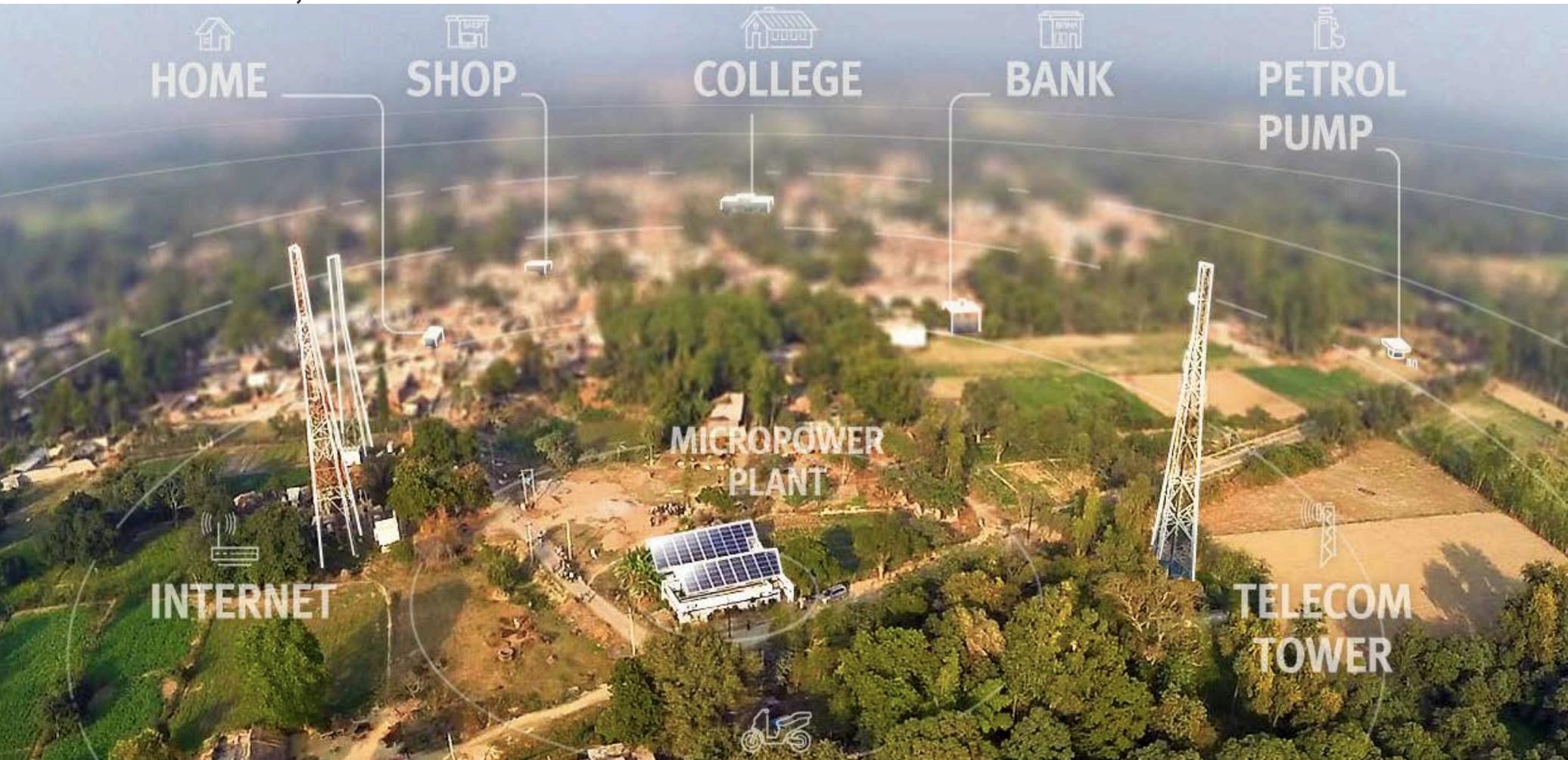


C – COMMUNITY HOUSEHOLDS – Via Smart Grids

- Illumination, mobile charging, cooling, entertainment, refrigeration
- Customized offerings to all segments



POWER, EVERYWHERE



NATIONAL MINIGRID POLICY DEVELOPMENTS

MNRE DRAFT NATIONAL POLICY FOR RE MINIGRIDS

- Developed by MNRE with inputs from stakeholders
- Published for comments

CLEAR FIVE YEAR TARGETS

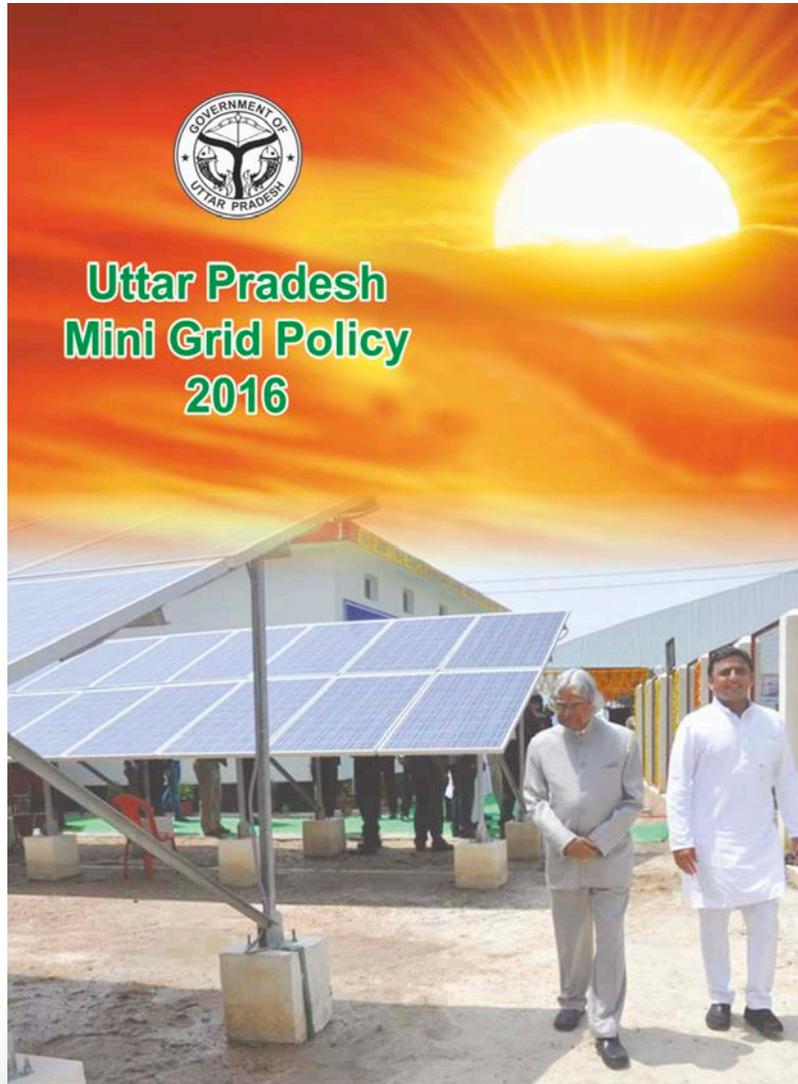
- 10,000 RE based micro and mini grid projects countrywide
- Minimum targets installed RE capacity of 500 MW

PROVIDES TEMPLATE FOR CORRESPONDING STATE POLICY AND REGULATION

- Recognizes issues of “grid-arrival” and exit options
- Flexible tariff guidelines to enable states to decide



MINIGRID POLICY DEVELOPMENTS IN UP



UTTAR PRADESH MINIGRID POLICY

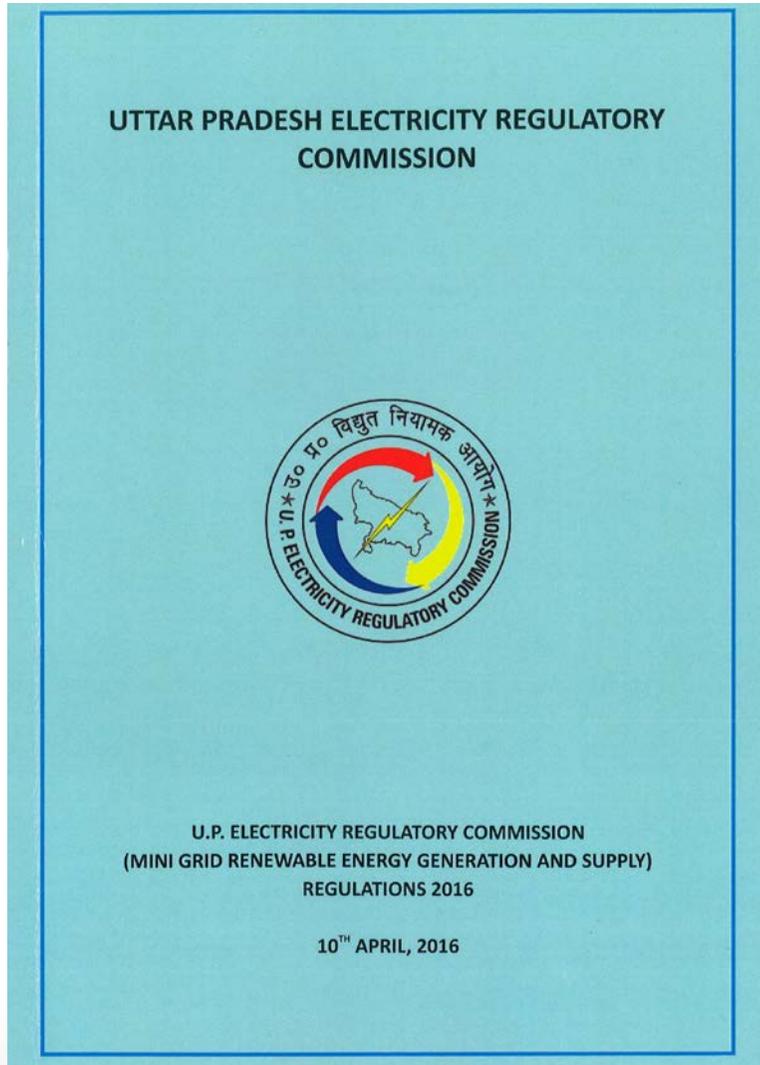
- First ever renewables minigrid policy announced by UP Govt in March 2016
- To provide energy access to nearly **2 Crore** households in the state

SALIENT FACTS

- Permits Minigrid Operators in ANY area with insufficient electricity
- Single-window system to provide clearances, approvals, permits etc.
- Infrastructure support including RoW, Water supply, access roads etc., by administration



SUPPORTING REGULATION IN UP



UTTAR PRADESH MINIGRID REGULATION

- In April 2016, the UPERC released supporting regulation for generation and distribution of power by MGOs as per the the UP Minigrid Policy
- Regulations are intended to facilitate the growth of the sector, and to provide energy access in power deficient areas

SALIENT FACTS

- Provides legitimacy and regulatory cover to the minigrid business, effectively formalizing it as an industry segment
- MGOs are permitted to function in parallel to the grid
- MGOs are allowed to charge mutually agreed tariff in line with the UP state Minigrid policy
- Defines Grid-Arrival, and lists options for exit in various scenarios for investment protection



THE KEYS TO SUCCESS

- Sustainable, Scalable business model
- Appropriate Design
- Speed of Execution
- Operational Efficiency
- Community Connect
- Regulatory Compliance
- Scale, Scale, Scale



WHERE WE ARE

- **Implementing the ABC business model** through OMC's minigrid
- **Long-term bankable PPAs with leading TowerCos**
- **Approximately 100 km of smart distribution network**
- **Over 2.2 MWp installed solar capacity**
- **5000 mini-grid customers connected in 5 months**
- **Unit-level profitable**

HOMES

BANKS, SCHOOLS,
BUSINESSES

Connected to OMC's local minigrid

MICROPOWER PLANT

2.2 MW Solar PV with storage and charging facilities



THE FUTURE OF ENERGY DELIVERY

- Minigrids have a long-term role in India's energy delivery eco-system
- Energy access fuels energy demand in a virtuous cycle
- The A-B-C model makes minigrids viable
- Policy and Regulatory developments are positive
- Minigrids of today may become last-mile energy infrastructure of tomorrow
- When grid arrives, RE Minigrids will contribute Green to the Grid

FIVE MORE HOURS OF VILLAGE LIFE



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