1st Meeting of SLPMU

8th February 2019

Agenda

1. Smart Grid Vision and Overview
2. Brief of NSGM, Objectives, Support and Value Proposition
3. Smart Grid Projects, Progress so far
4. Learnings and insights from SG project/Pilot implementation
5. SLPMU Role & Expectations
6. Challenges & Opportunities for DISCOMs

Smart Grid Vision for India

Transform the Indian power sector into a secure, adaptive, sustainable and digitally enabled ecosystem that provides reliable and quality energy for all with active participation of stakeholders

Traditional vs Smart Grid

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- Efficient, Near Energy Source (**Coal Mine, River Basin**) Generation;
- Consumer at Receiving End
- Grid Connects the Two
- Challenges of Quality at Customer end, Aging Infrastructure and Load Growth

Traditional Grid

Generation- centralized

Transmission- element control / WAMS not present

Distribution- one way street, fixed role, manually operated devices

Smart Grid

Generation- distributed

Transmission- element control / WAMS enabled

Distribution- automated devices (FRTUs, RMUs, TMUs, etc)

Transformer Monitoring Unit

GSM/GPRS Network

Monitoring Center

- Near Consumption and Green Energy Source (**Solar, Wind, Bio-Mass, Nega Watt**) Generation;
- Consumer can generate power and Bank with/ Sell to grid
- Two way communication with the Grid
- Grid Transformed to Energy Exchange Infrastructure of Economy

Technology Evolution for Smart Grid

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Becoming smarter is a long-term process and a step-by-step approach

Smart

Integrated

SaaS-based utility/customer **services**, applications, and management tools

Managed

Integration of isolated systems and across cities

Real-time analysis & control of city systems

Networked

Node connections through low-cost **communications**

Measured

Pervasive **sensor networks** throughout city

Recent advances in key technologies are enabler
- Pervasive sensor networks
- Low-cost communications
- Software-as-a-Service

Brief of NSGM

National Smart Grid Mission
Ministry of Power
Government of India

1 NSGM establishment approved - March 2015 (www.nsgm.gov.in/en)

2 Established under aegis of MoP, Government of India. Operationalized from January 2016

3 To plan and monitor implementation of policies and programs

4 NSGM has its own resources, authority, functional & financial autonomy

5 NSGM has 3 tier hierarchical institutional structure

6 Outlay for NSGM activities for 2017-20:

₹ 990 Cr. with a budgetary support of ₹ 312 Cr.

7 NSGM - Project Management Unit (NPMU) housed in POWERGRID at national level

8 Other than NPMU, each state to have a State Level Project Management Unit (SLPMU)

NSGM Institutional Framework

Governing Council
Chair – Minister of Power
Convenor – JS (D)

Empowered Committee
Chair – Secretary (Power)
Convenor – JS (D)

Technical Committee
Chair – Chairperson, CEA
Mem. Secy. – Dir. NPMU

NSGM Project Management Unit
Head – Director NPMU

Smart Grid Knowledge Centre (SGKC)

State Level Project Management Unit
Chair – Energy Secretary (State)
* 16 state has formed SLPMUs

Utility Smart Grid Cells

NSGM Objectives

- Bringing in development of Smart Grids:
  - Enable access and availability of quality power to all
  - Loss reduction
  - AMI roll out, prosumer enablement, Demand Response (DR)/Demand Side Management (DSM)
  - Policies and tariffs – Dynamic tariff implementation, DR programs, tariff mechanisms for solar PVs
  - Renewable integration – Green power and energy efficiency
  - Electric vehicles (EV) and energy storage – EV charging stations & energy storage systems

- Capacity building in utilities and regulators for Smart Grid

- Technical cooperation, research and collaboration with national and international development partners like ISGAN,USAID, DFID, NEDO, KfW, World Bank, ADB etc.

- Facilitate consumer awareness etc.

NSGM Support for Smart Grids

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- Funding of projects (up to 30%)

- Assistance in formulation of projects including
  - pre-feasibility studies, technology selection, cost benefit analysis, financing models etc.

- Training and capacity building for State Level PMUs & project implementation teams

- Technology selection guidelines and best practices

- Facilitate consumer awareness initiatives

- Project appraisal post implementation

NSGM Documents

Smart Meter Rollout Report

Funding Models

Value Proposition

Smart Grid Ecosystem
Formation of standards, specifications, functionalities, strategies, model documents etc.

Workshops, Communication and Outreach
Brainstorming sessions, AMI solutions, business models, ISGAN ExCo, KTP etc.

Training and Collaboration
SG training programs, MoUs, ISGAN, SGKC, SG Test Bed etc.

Standard Documents and Participation in R&D
Model RfP, model DPR, DST India report, Mission Innovation proposals etc.

Smart Grid Projects
City wise projects, phase wise rollout of Smart Grids, smart and prepaid meter rollout etc.

Smart Grid Pilot Projects
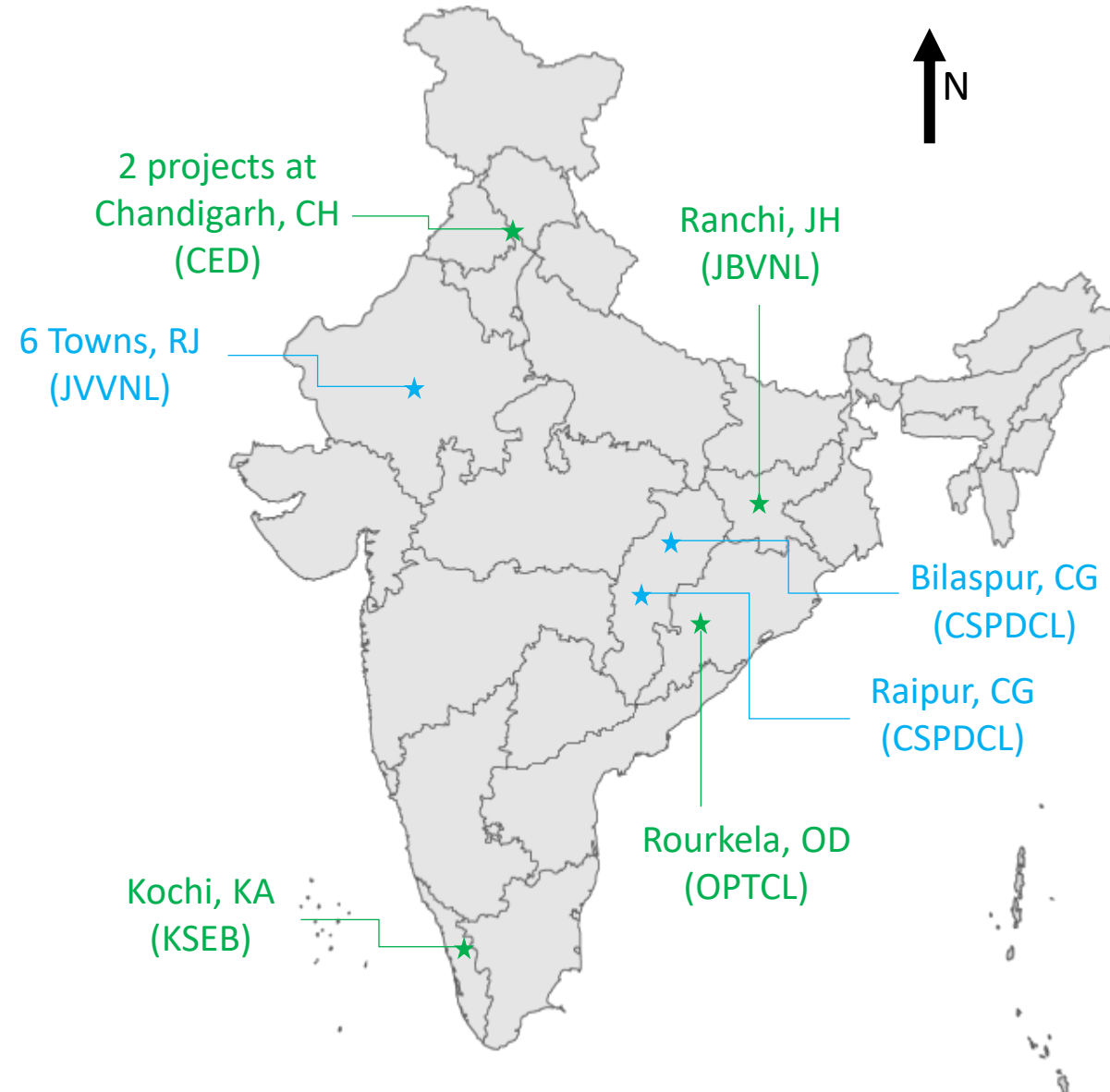Monitoring of 12 pilot projects, learning, case studies etc.

Progress

Smart Grid Readiness – Self
Assessment Tool (SGR-SAT)^

Five projects worth Rs.686.6 Cr.
sanctioned for ~7.50 lakh
consumers with 30% funding

IS 16444 (Part 1 & 2) and
IS 15959 (Part 2 & 3)

- ➢ 5 training programs for utilities
- ➢ 6 national and 3 international workshops
- ➢ 2 brainstorming sessions

Under NSGM

AMI functional
requirements

- ➢ NSGM Framework, Model RfP & Model DPR ready for release
- ➢ Draft smart meter rollout plan submitted

Model Smart Grid Regulations
adopted by 5 states

18 State Level PMUs formed

^ Under development

Smart Grid Projects

N

2 projects at Chandigarh, CH (CED)

Ranchi, JH (JBVNL)

6 Towns, RJ (JVVNL)

Bilaspur, CG (CSPDCL)

Raipur, CG (CSPDCL)

Rourkela, OD (OPTCL)

Kochi, KA (KSEB)

Sanctioned Projects
Projects under consideration
Map not-to-scale

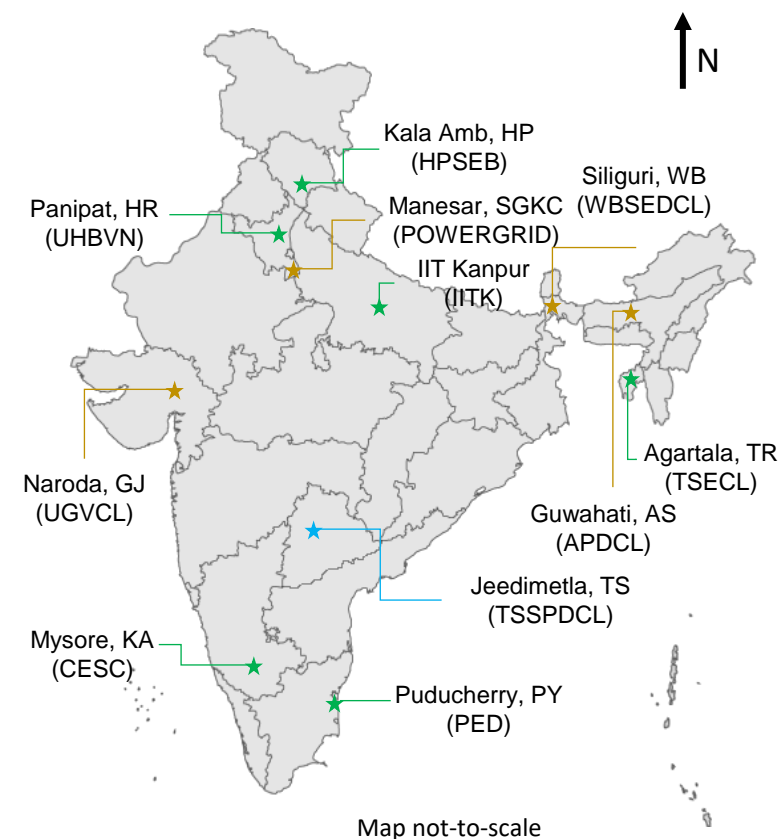# Smart Grid Pilot Projects

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5 pilots at CESC (Mysore), IIT Kanpur, PED (Puducherry), UHBVN (Haryana) and TSECL (Tripura) completed SGKC at Manesar inaugurated

Remaining pilots nearing completion

~1.4 lakh Smart Meters installed out of 1.7 lakh envisaged

12 pilots including SGKC

Kala Amb, HP (HPSEB)

Panipat, HR (UHBVN)

Manesar, SGKC (POWERGRID)

Siliguri, WB (WBSEDCL)

IIT Kanpur (IITK)

Naroda, GJ (UGVCL)

Agartala, TR (TSECL)

Guwahati, AS (APDCL)

Jeedimetla, TS (TSSPDCL)

Mysore, KA (CESC)

Puducherry, PY (PED)

Map not-to-scale

Learnings From SG Pilots/Projects

- **Technical:** Need for '**standard' & 'specific tampers**' necessitated redesign of existing meters. IS 16444 developed and followed for NSGM projects

- **Financial:** Delay in arranging *counterpart funding* (50% for pilot projects/ 30% for NSGM projects) *hampered the implementation – Advocacy of Opex (rental) Model*

- **Commercial:** Regulatory support for **ToD metering**, connect/disconnect, benefits from **operational efficiency** and **loss reduction** etc. may expedite Utility initiative for SG projects. It is generating more interest amongst vendors.

- **Procurement & Contractual Issues:** *Stringent technical & commercial QRs* hampered workable consortiums/JVs. *At least 5-7 years O&M* be included in project for sustainability, Projects on **ESCO/lease model** with minimal financial risk to utilities

- **Focus Constraints:** Utility focus remained on equipment deployment & technology demonstration. *Process redesign, regulatory & requisite change management lag behind*

Issues in Deployment

Technological
- Grid architecture and planning
- Integration of new energy technologies
- System operation
- Interoperability

Institutional
- Process reengineering
- Skill sets
- Capacity building

Regulatory
- Pricing and tariffs
- Business models
- Investment approvals

Societal
- Support and adoption
- Ease of use
- Affordability

State Level Project Management Units

- Every state is to have a State Level Project Management Unit (SLPMU) chaired by Energy/Power Secretary (or equivalent) of the state

- SLPMU will be the apex body for steering the state level programs
  - State DISCOMs
  - Regulators
  - State Power And Finance Departments
  - Academia (IIT/NIT/IIM Etc.)
  - Prominent NGOs etc.

- Expected to meet on quarterly basis

Functions of SLPMUs

- Broad objectives and functions of SLPMU includes:
  - Define the vision, goals and roadmap for the state Smart Grid activities
  - Develop program proposals and submit to NSGM
  - Sanction projects (if resources for execution are available with the state and utility)
  - Evaluate and screen program/project proposals from utilities
  - Provide budgetary support from the state to the state level Smart Grid activities
  - Initiate implementation of National Smart Grid Policies by working with SERCs to develop state focused regulations and policies
  - Ensure that Smart Grid standards are incorporated in various Smart Grid projects undertaken in the state
  - Monitor the impact of Smart Grid activities, provide reports and data for national level integration

Expectations from SLPMU

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- Establishment of SLPMU

- Successful completion of the ongoing Smart Grid Pilots/Projects

- Articulate learnings from the pilots/projects execution

- Selection of best technology and practices

- Prepare Smart Grid DPRs based on the key requirements and considerations

- Plan and implement the Smart Grid projects through innovative financial and business models

- Consumer awareness, engagement & participation program

- Large scale rollout of smart metering schemes and fulfill regulatory requirements for adopting dynamic tariff etc.

SLPMUs at 18 states:
1. Andhra Pradesh
2. Assam
3. Chandigarh
4. Chhattisgarh
5. Delhi
6. Haryana
7. Himachal Pradesh
8. Jammu & Kashmir
9. Jharkhand
10. Karnataka
11. Kerala
12. Maharashtra
13. Odisha
14. Rajasthan
15. Tamil Nadu
16. Telangana
17. Tripura
18. West Bengal

Expectations from DISCOMs

- Address technical and commercial implications

- Interact with possible development partners/ agencies

- Mobilize cooperation

- Analyze as is state

- Enable informed goals for SG
  - ARU – Feeder/ Consumer Groups
  - Pricing
    - Reliability
    - Temps+Reliability
    - Feeder Load profile
      - Confirmative to DISCOM average
      - Contrarian

Challenges for DISCOMs

- Tariff framework based on cross subsidy

- Stranded, aging and under utilized assets

- Distributed generation like solar rooftop and other sources

- Mismatch between fixed cost payable and fixed asset recoverable

- Last mile connectivity and maintenance

- Increased RE – planning and scheduling

- Recovery challenges due to geography and certain class of consumers

- Demand uncertainty and long term PPAs

- Demand for day time power from agricultural consumers

- Stiff scheduling norms and lack of forecast mechanisms

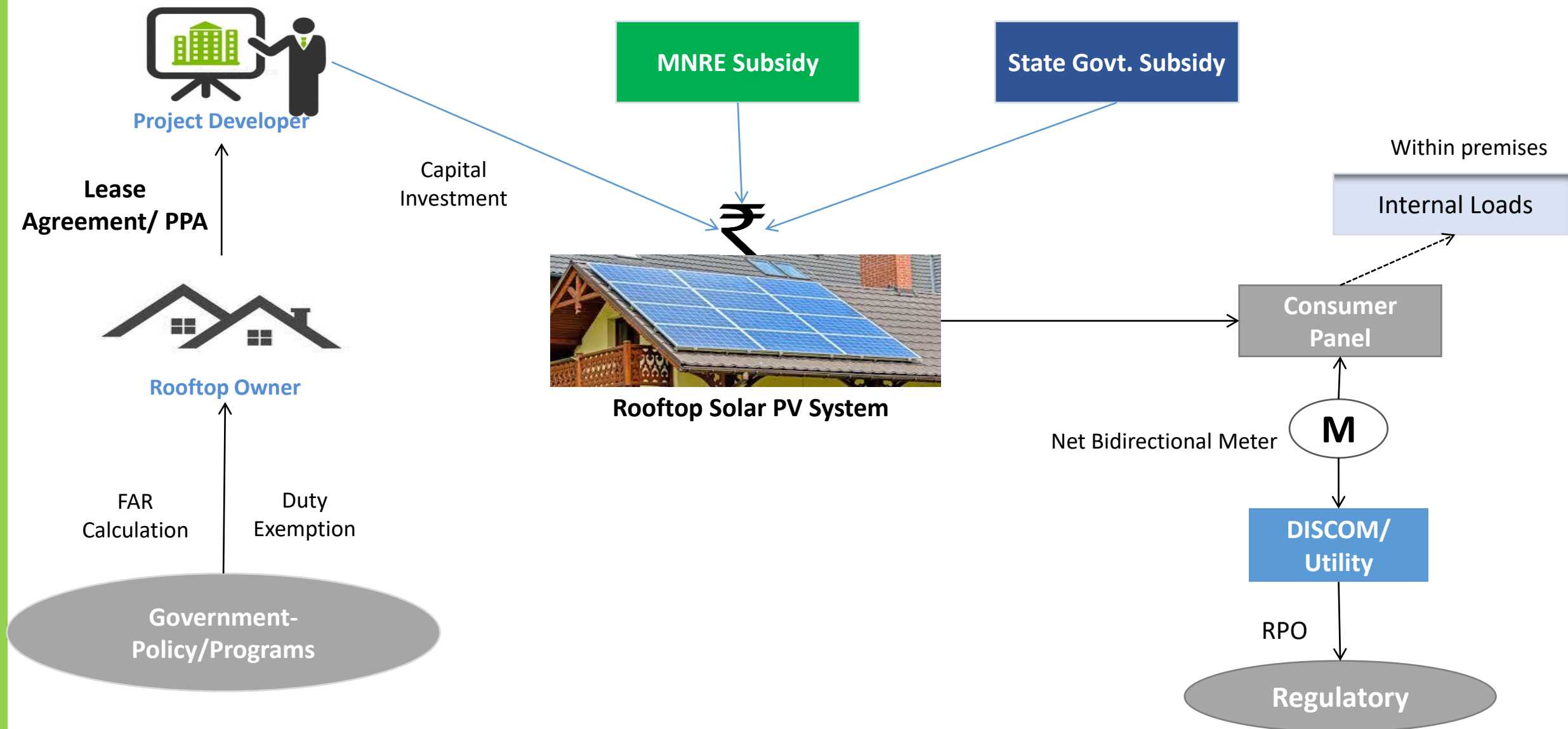- Policy focus on more capex with uncertain returns etc.

Installed capacity of Grid Interactive RE Power as on 31.12.2018 - Leading States

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S.No.	State	Wind (MW)	Solar (MW)	Total (MW)
1.	Karnataka	4682.80	5255.11	12968.44
2.	Tamil Nadu	8631.19	2228.44	11986.56
3.	Maharashtra	4788.13	1607.79	9300.18
4.	Gujarat	5955.07	1827.38	7894.85
5.	Rajasthan	4299.72	3130.99	7575.86
6.	Andhra Pradesh	4076.45	2641.76	7380.66
7.	Madhya Pradesh	2519.890	1586.25	4322.80
8.	Telangana	128.10	3410.26	3806.83
9.	Uttar Pradesh	-	891.01	3033.62
10.	Punjab	-	905.62	1405.52

Opportunities for DISCOMs

- Availability of better and newer IT solutions

- Redesigning business process and harnessing IT and digitized data

- Timely and proactive services through adoption of appropriate technology

- Data analytics and automation of various routines

- EV charging stations

- Advancement through storage technologies

- Reducing rate of RE power to meet day demand (preferably through solar)

- Solar agri pumps to reduce burden of cross subsidy

- Decentralized generation to reduce T&D losses and increase availability

- Real time monitoring and energy accounting etc.

Rooftop Operational Model – RESCO

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Project Developer

MNRE Subsidy

State Govt. Subsidy

Lease Agreement/ PPA

Capital Investment

Within premises

Internal Loads

Rooftop Owner

Rooftop Solar PV System

Consumer Panel

Net Bidirectional Meter

M

FAR Calculation

Duty Exemption

DISCOM/ Utility

Government-Policy/Programs

RPO

Regulatory

Thank You

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NSGM Goals – Under Deliberation

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Goals Relating to Smart Grid Rollout	Phase I	Phase II
	Up to 2020	2020-2025
1. SLPMU- actions (number, percentage of utilities taking action)		
1.1 SLPMU units	100 percent	
1.2 SmartGrid regulations	100 percent	
1.3 SmartGrid roadmap formulation		100 percent
2. SmartGrid - utility level actions (number/percentage of utilities taking action)		
2.1 SmartGrid Cell formation by utilities	100 percent	
2.2 SmartGrid Roadmap preparation by utilities		100 percent
3. Utility preparedness (Number of utilities with target maturity level, total number of utilities)		
3.1 Preparation of Maturity level framework	By 2020	
3.2 Assessment of Utilities as per Finalized Framework	100 Percent	
4. AMI		
4.1 Utility's having AMI experience	10	100 percent
4.2 AMI rollout in all towns	25 number	100 percent
5. Network mapping and consumer indexing		
5.1 Number of utilities with network mapping and consumer indexing (live and updated)	100% (Urban)	100 percent Rural)
6. Distribution automation		
6.1 Distribution automation (SCADA/DMS)in Urban census towns with population as per IPDS		100 percent
7. Microgrid and renewable integration		
7.1 Utilities with institutional capabilities to manage renewable integration	10	100 percent
7.2 Utilities having the technological capabilities to manage local generation and microgrid projects	10	100 percent
8. Electric Vehicles		
8.1 Utilities with technological capabilities to deploy EV Infrastructure	10	100 percent

NSGM Documents

NSGM Framework Document

- NSGM framework for implementation was envisaged to define the policies, goals and strategies for Mission. The framework document has four modules namely vision & institutional structure, standards & policy framework, business models, and MRV framework.

Model DPR for Smart Grid Projects

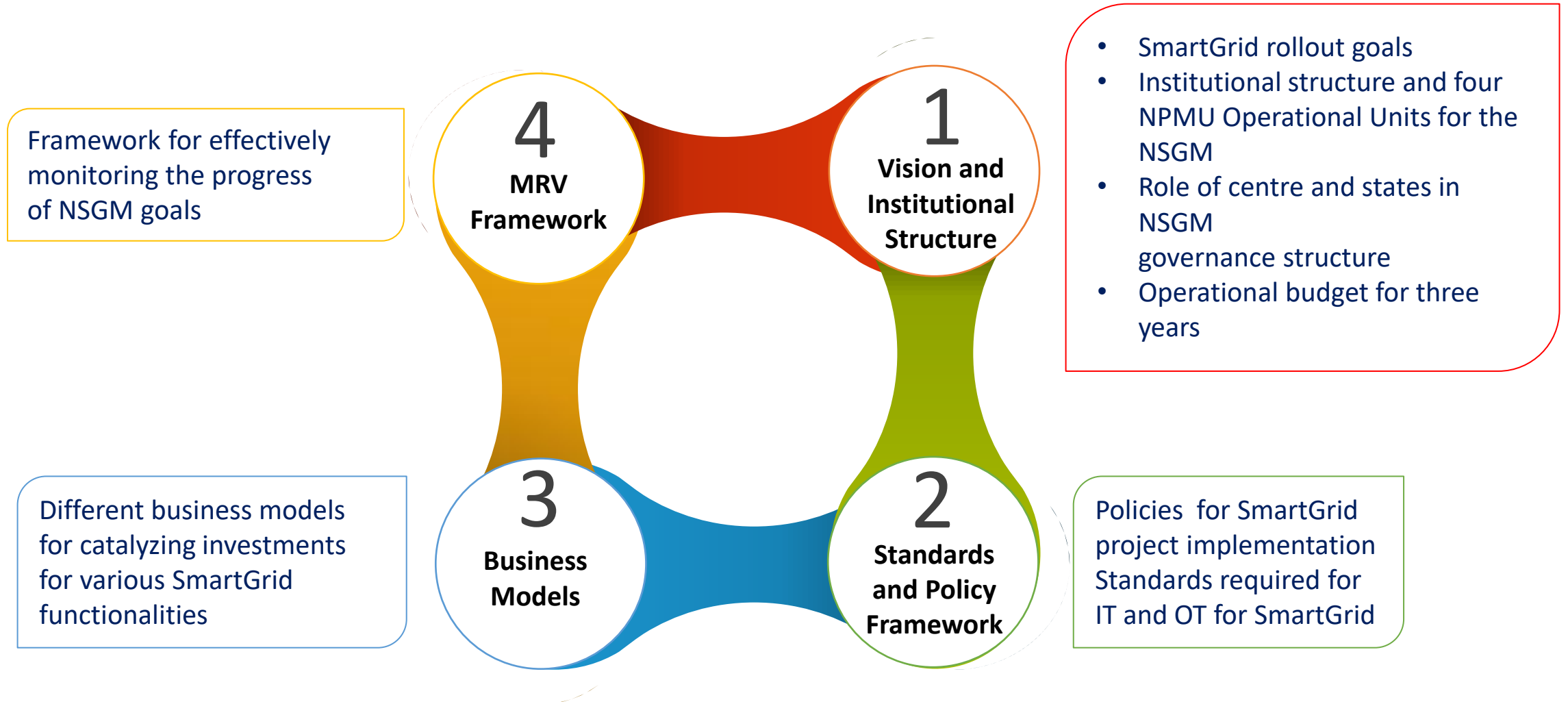- The need for model DPR for Smart Grid Projects to harmonize the proposals to be submitted. Accordingly, model DPR template with fillable sheets was prepared.

Model RfP/SBD Documents

- To harmonize approach towards tendering and bid evaluation for appointment of a System Integrator for Smart Grid project deployment, a model Request for Proposal (RfP) / Standard Bidding Documents (SBD) was prepared in two volumes

These documents were formally released by Hon'ble MoSP (I/C) on 16.01.2019.

These documents are available at our website (www.nsgm.gov.in/en/nsgm-documents)

NSGM Framework

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Ministry of Power
Government of India

4 MRV Framework

1 Vision and Institutional Structure

3 Business Models

2 Standards and Policy Framework

Framework for effectively monitoring the progress of NSGM goals

- SmartGrid rollout goals
- Institutional structure and four NPMU Operational Units for the NSGM
- Role of centre and states in NSGM governance structure
- Operational budget for three years

Different business models for catalyzing investments for various SmartGrid functionalities

Policies for SmartGrid project implementation Standards required for IT and OT for SmartGrid

Funding Models

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- IT expenses were under capital expenses and with infrastructure 'as a Service' model enterprises are successfully shifting IT expenses to operational expenses i.e. **Opex in place of Capex**

- Utilities are being encouraged to adopt Opex business models to mitigate Smart Grid funding constraints

- M/s EESL has already adopted Opex model for large scale deployment of smart metering in the country

- MoP has constituted a Committee under CE (DP&T), CEA with NSGM, PFC & REC member to examine OPEX based solutions, with reference to Cloud IT solutions, in place of capital grants. Recommendations of the study are under consideration.

Smart Meter Rollout Report

A report was prepared for Smart Grid Rollout with following recommendations:

- IS 16444 standard to be adhered for Smart Meters for next 3 years i.e. Mar 2021
- Deployments can continue by building/varying contractual/commercial conditions in tenders for showcasing integration with 3 or 4 makes of meters to ensure interoperability and future competition and avoid single source dependency
- A report is under initiation at BIS in collaboration with NPMU for adoption, post relevant customization, of protocols being followed by various associations internationally like Wi-SUN for RF technology, Prime/G3 for PLC etc.
- RF/GPRS both Communication Technologies are recommended
  - For Zone I & II communication, choice for deployments may predominantly be RF
  - For zone III and IV, GPRS may be a viable option
  - Technology selection to be done by Project Management Agency (PMA) and Utility

Smart Meter Rollout Report (Contd.)
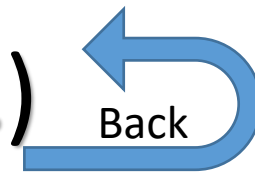
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- Currently, 4 labs are ready for testing smart meters as per IS 16444 Part 1
  - CPRI (Bengaluru), CPRI (Bhopal), ERDA (Vadodara), YMPL (Udaipur)
- CPRI Bengaluru is also ready for testing smart meters as per IS 16444 Part 2
- The labs should come up with testing facilities for smart meters latest by end of 2018
- The Smart Meter rollout is being encouraged through
  - Funding of close to 5 million Smart Meters under IPDS
- Encouraging States for Opex model based Smart Meter rollout through EESL as well as other Govt. of India Agencies
  - EESL awarded 5 million smart meters tender and installation started
  - EESL awarded another 5 million smart meters tender
  - JV under establishment by EESL for managing meter deployment

Regulatory Considerations

- Investment approval
- Investment cost recovery
  - Through ARRs
  - Through specific tariffs schemes
  - Through surcharges
  - Through pricing of new services
- Tariff design
- Customer participation and protection
- Evaluation, measurement and verification
- Smart Grid safety and standards

Smart Grid Knowledge Center

Aim of SGKC is to develop a vibrant platform to:

- Bridge the gap between applied research and business

- Support co-creation and demonstration of new technologies and innovations in the smart grid space

- Act as a national level Center of Excellence for capacity and skill development via:
  - Facilitating demonstration of new innovations (Innovation Park)
  - Technology incubation
  - Facilitating demand based research
  - Platform for showcasing innovation in Smart Distribution in India
  - Alliances and partnerships
  - Capacity building and knowledge exchange hub

International Engagement

International Smart Grid Action Network (ISGAN)

- ISGAN is an Implementing Agreement under IEA framework (25 Countries)
  - Meets twice year

- **India is founding member of ISGAN** - *the strategic platform to support high-level government attention and action for the accelerated development and deployment of smarter, cleaner electricity, and more flexible electricity grids around the world*

- **Benefit**
  - Learn and Show Case Best Practices on Smart Grid - Internationally
  - A 3-day knowledge workshop with ISGAN held in Nov 2017 at CPRI, Bangalore - 100+ domestic & international participants
  - India's **Training modules on Smart Grids** and **Model Smart Grid Regulations** were accepted as in-kind contribution from India (as fee for 3 years)

International Engagement (Contd.)

Mission Innovation (MI), R&D Coordination

- Mission Innovation (MI) is a global initiative of CEM with 23 countries and the EU led by India, Italy and China
  - DST (Department of Science and Technology) is the nodal agency in India
- NSGM is engaged with MI and working closely with DST
- National Report on Smart Grids finalized in partnership with DST
  - Organized SG R&D Conclave workshop jointly with DST at IIT Delhi in August 2018
  - Supported screening and finalization of nine (9) research proposals
- **Benefit**
  - Adoption of innovative technologies and solutions – Block Chain for Distributed Generation
  - Joint collaboration between Indian and overseas institutes to carry research in Smart Grids

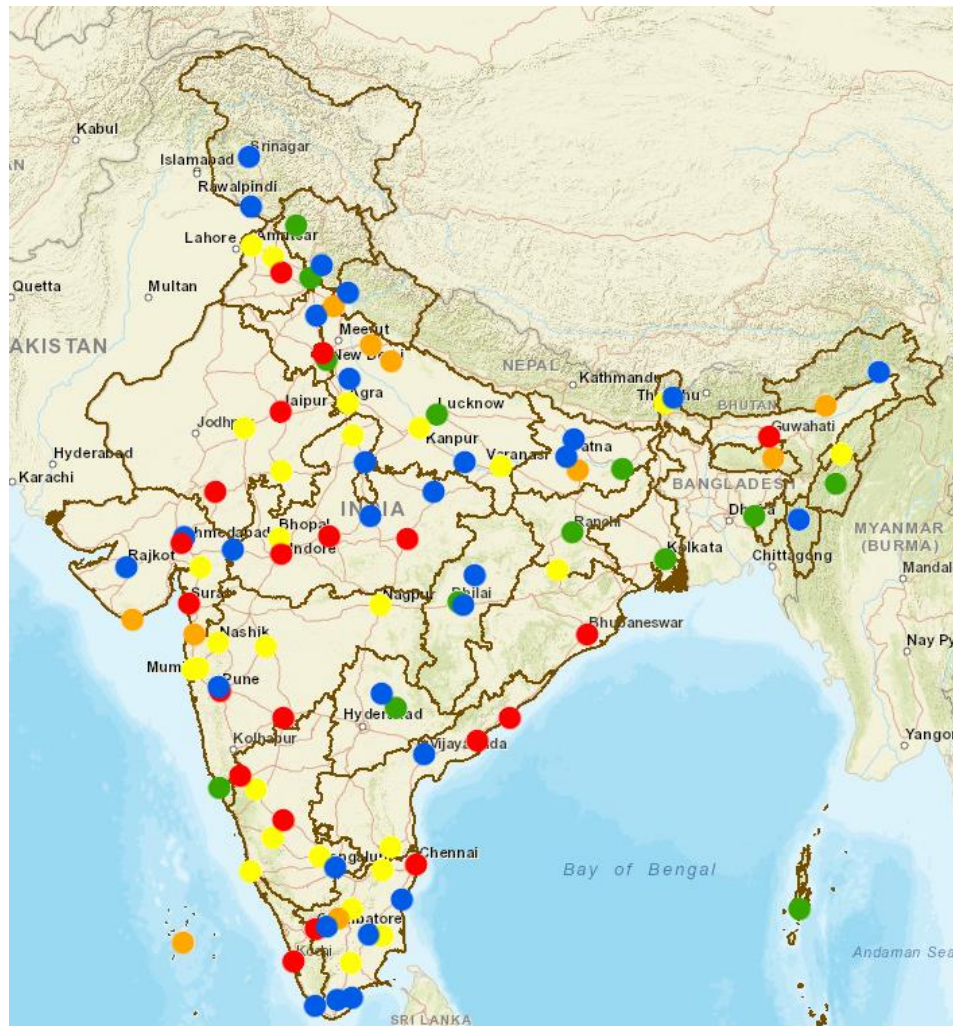# International Engagement (Contd.)

United States Agency for International Development (USAID), USA

- AMI test pilot at AVVNL, Ajmer successfully completed
  - Case study released Substantiating possibility of Rs/Node/Month model
- Basic Smart Grid Training Course Content
- NSGM framework document
- Report on learnings from SG Pilot Projects

Department for International Development (DFID), UK

- Smart Grid Readiness and Self Assessment Tool (SGR-SAT) under development

Smart Cities in India