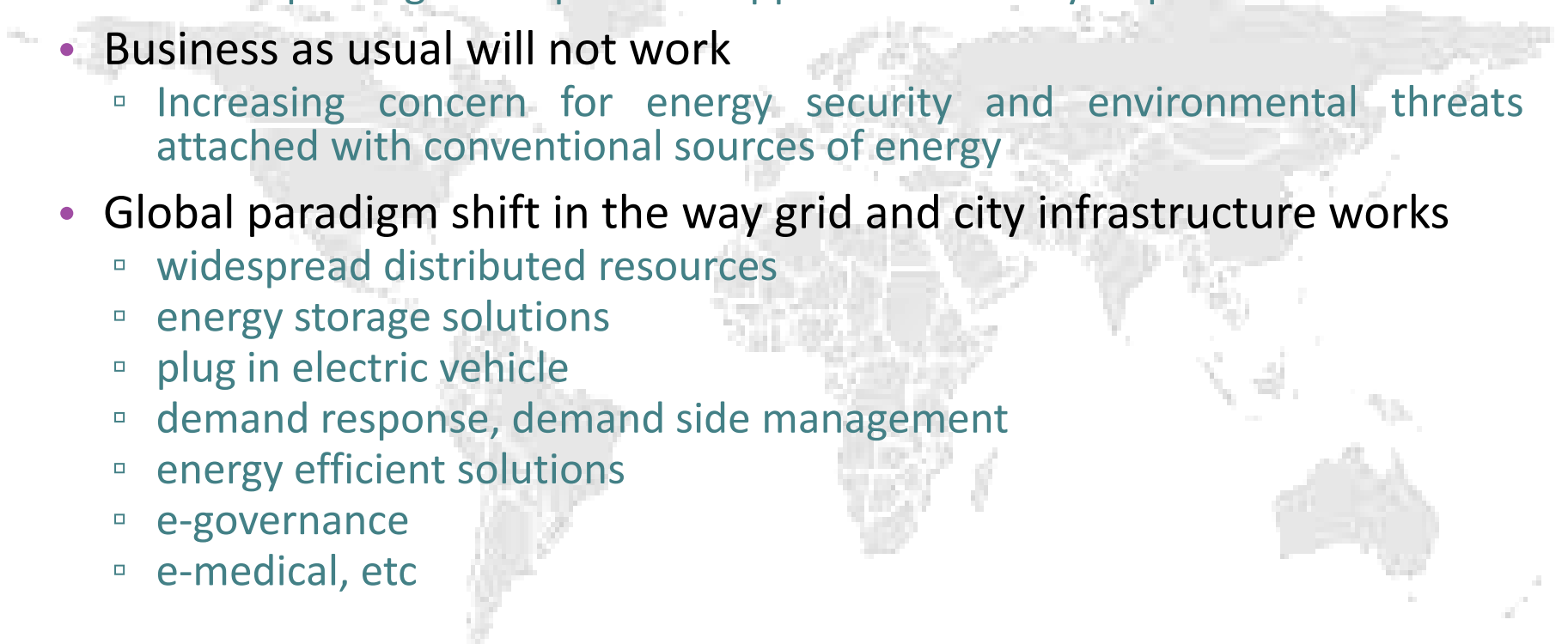


Development of smart grid/cities in Indian sub-continent - Issues and Challenges

47th Session of the International Seminars on Planetary
Emergencies, Erice, Italy

Global Grid/City scenario

- The existing Grid/city infrastructure is composed of disparate technologies that vary widely in age condition and capacity
 - Some are near completion of their useful life or becoming obsolete
 - others proving inadequate to support 21st century requirements
 - Business as usual will not work
 - Increasing concern for energy security and environmental threats attached with conventional sources of energy
 - Global paradigm shift in the way grid and city infrastructure works
 - widespread distributed resources
 - energy storage solutions
 - plug in electric vehicle
 - demand response, demand side management
 - energy efficient solutions
 - e-governance
 - e-medical, etc
- 

Indian Scenario

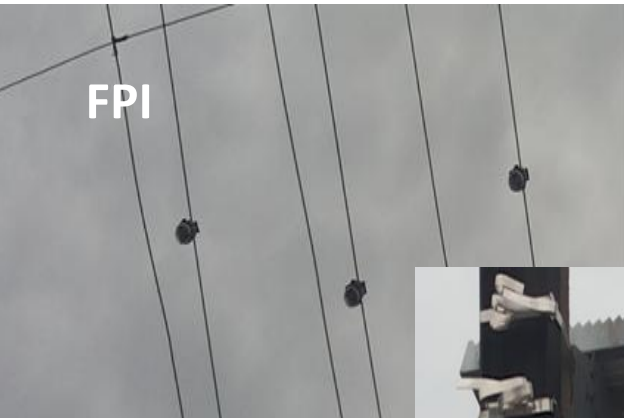


- Nearly 377 million Indians (about 31% of the country's population) live in urban areas
 - It is expected to add about 497 million to its urban population over the next four decades
- Cities are becoming the biggest consumers of the energy in the form of electricity
 - one-third of the population that lives in cities consumes 87% of the nation's electricity
- Owing to large demography, and varied climate, the demand varies over the day/week/month as well as on seasonal/regional basis
 - To cater to such variation, the generation portfolio should have a mix of various fuel technologies
- Development of a National Grid by the Power Grid Corporation of India, a major step in the smooth flow of electrical energy across the country

Smart Grid/City development plans in India

- POWERGRID has taken a leadership initiative towards development of Smart/Intelligent Grid
- In this direction, the Smart Grid Pilot project at Puducherry has been developed through open collaboration. Attributes implemented include:
 - Integration of renewable energy sources
 - Advanced Metering Infrastructure (AMI)
 - Power Quality Management (PQM)
 - Peak Load Management (PLM) with demand response
 - Outage Management System (OMS)
 - Micro-grid
 - Smart home
 - Energy Storage
 - Electric Vehicle

Snapshot of Installations at Puducherry



...Smart Grid/City development plans in India

- POWERGRID implemented WAMS (Wide Area Measurement System) pilot projects deploying Phasor Measurement Units in all the five Electricity Regions across the country
 - These pilot projects have been found to be very useful in facilitating better visualization and enhanced situational awareness of grid events as well as decision support tools
- Recognizing the need for full scale deployment of WAMS technology in the grid, POWERGRID is now implementing full scale country-wide Synchro-phasor WAMS technology, integrating State and Central grids
- 14 smart grid pilot projects being taken up as part of India Smart Grid Task Force (ISGTF) in various parts of the country

...Smart Grid/City development plans in India

- For addressing challenges of integration of large scale renewable resources, POWEGRID prepared a report titled “Green Energy Corridors”.
 - This reports includes comprehensive plan for creation of transmission infrastructure, Renewable Energy Management Center (REMC), Grid scale storage and associated control technologies etc.
- Several existing Indian cities have begun deployment of smart technologies like advanced communication systems, metro rail, traffic management, smart meters, solid waste management, etc to provide efficient civic services
- Development of 24 Smart Cities is planned on the Delhi-Mumbai Industrial Corridor (DMIC)

Major Drivers of smart grids for different stakeholders in India

Utilities

- Reduction of AT&C (Aggregate Techno and Commercial) Loss
- Peak load management- multiple options
- Reduction in power purchase cost
- Increased grid visibility
- Self-healing grid
- Renewable integration
- Dispersed generation
- Reduction in carbon and other pollutant emissions and emission intensity

...Major Drivers of smart grids for different stakeholders in India

Customers

- Expand access to electricity - "Power for All"
- Improve reliability of supply to all customers - no power cuts, no more DG sets and inverters
- Improve quality of supply- no need for in-home voltage stabilizers
- User friendly and transparent interface with utilities
- Increased choices for consumers, including green power

Issues and Challenges

- **Capacity Building**

- As the country moves towards Smart Grid/Cities, there will be a demand for new skill sets in analytics, communication, data management, decision support, e-governance, Renewable technologies, smart mobility, E-medical etc.
- This transition will require large investment from both government and private players to support capacity building program.

- **Business case for smart Grid/City technologies**

- There are uncertainties about mechanism of return on investment
- Stakeholders are not sure about the benefits that will accrue due to the implementation of these systems
- investors are hesitant to invest in smart grid/city projects

...Issues and Challenges

- **Policy and regulation**

- Moving forward, the regulatory framework has to adopt policies which focus on long term carbon reduction and energy security as well as empowering consumer for energy management process.
- For Development of Smart Grid and Smart Cities proper Government policies and regulation shall be in place

- **Telecommunication**

- Communication is the backbone of Smart Grid/City development
- Implementation of Smart Grid/City, there is need of holistic communication policy to accommodate all the evolving communication technologies in effective and affordable way

...Issues and Challenges

- **Technical maturity**

- For deployment of Smart Grid/City technical maturity for integration of vast amount of intelligent devices, handling and analysis of terabytes of data is required
- During implementation of pilot projects many issues like development of interoperable communication protocol, development of hardware as per Indian conditions are cropped up which need to be addressed in a holistic manner.

- **Standardization**

- In the smart Grid/City intelligent devices and systems from variety of vendors shall be deployed, for achieving interoperability at all levels, standardization of smart grid/city technologies is of primary concern

...Issues and Challenges

- **Cyber security and data privacy**

- With the entire city infrastructure embedded with sensors and intelligent devices coupled with web world and internet of things in place, cyber security challenges will increase manifold
- Cyber security shall be treated at par with physical security
- Invasion of privacy and security of personal data is also a big issue



Way Forward

- The best Smart Grid/Cities planning methodologies embody two related meta concepts called the “system of systems” and “network of networks” approaches.
- Planners need to identify potential relationships between systems and/or networks and design solutions that leverage these synergies.
- Advanced data analytics leverage synergies between data from different sources, and are already delivering value in different electric utility applications. We need to apply similar concepts and tools to build or renovate complex systems like electrical grids and city infrastructures.
- One should make sure to involve citizens in the earliest stages of the planning process. Lack of consumer awareness and engagement can create discord between consumer expectations and results.
- The major challenge for transition from analogous to digital infrastructure will be to move from utility-centric investment decision to societal-level decisions which determine wider scopes of the Smart Grid/City.

Thank you for your attention

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