

Utility Knowledge Exchange Platform (Technical Sessions)

Technical Session 2: Loss reduction and the role of smart metering

Utility Experience from India – BSES, New Delhi

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Agenda

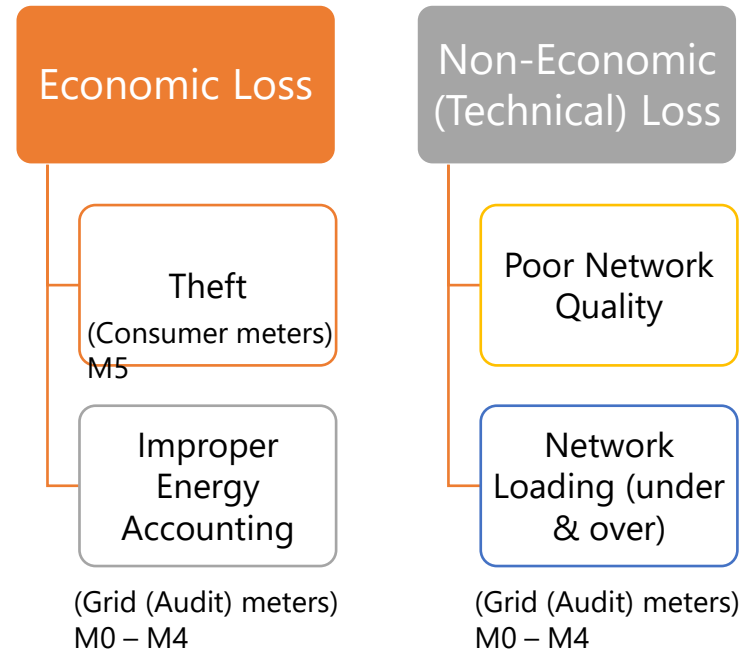
- Session Overview
- BSES – Utility Brief
- Loss Reduction Journey – Highlights
- AMI – Enabler for LR and Energy Accounting
- AMI – Other Use Cases
- Utility of Future

Session Overview

- Distribution Loss reduction is key to any distribution Utility's viability
- Economic & non-Economic Loss reduction strategies
- Need for Govt. focus in terms of policy and regulations
 - Example of Revamped Distribution Sector Scheme (RDSS 2022) from India
- AMI – Enabler for accurate Energy accounting & Loss Reduction as a going concern
- AMI – Enabler for Utility transformation through B2C use cases

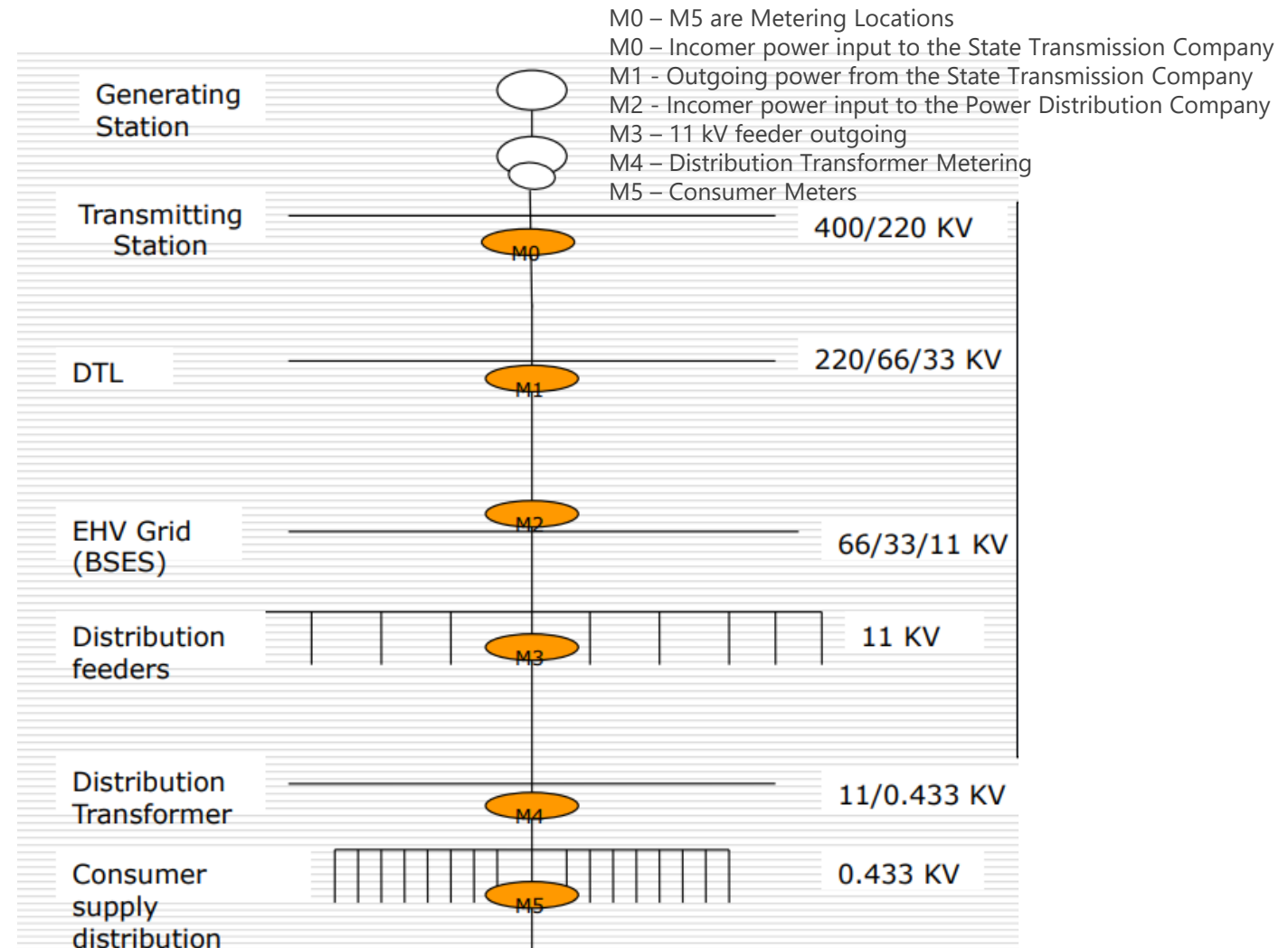
Power Distribution Loss comp.

Energy Flow Diagram



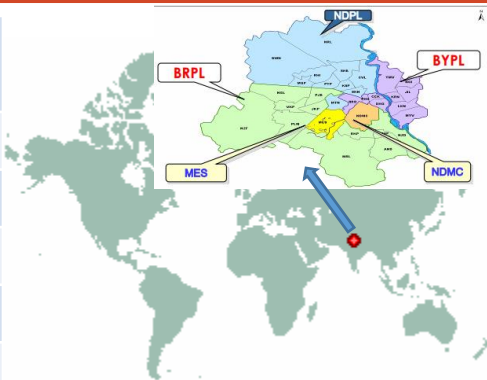
Smart Meters enable

- Real time load survey & energy Audit (economic loss)
- Real time network loading optimization, thereby reducing technical loss
- Predictive theft management (economic loss)
- Peak demand & Energy management
- Bill Management for consumers

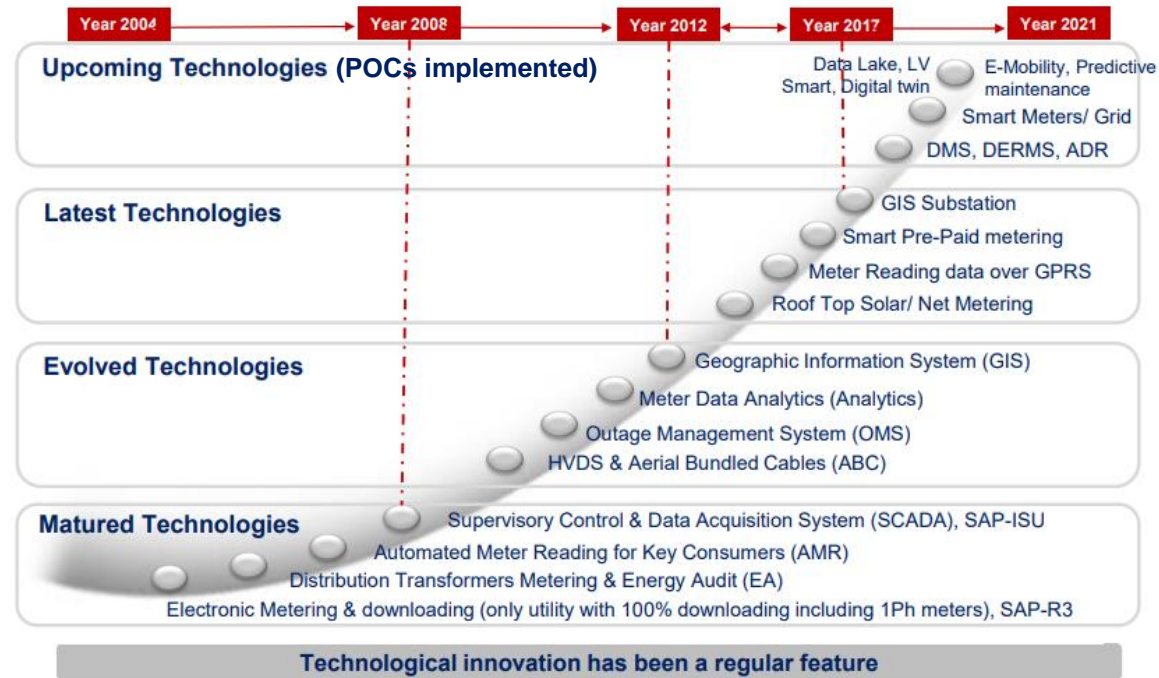


BSES Rajdhani: Utility Brief

Service Area	750 Km ² (South & West Delhi)
AT&C Loss	6.87%
No. of customers	2.7 M
Max Demand met	3211 MW
Energy Access	100%
DT Capacity	~6400 MVA



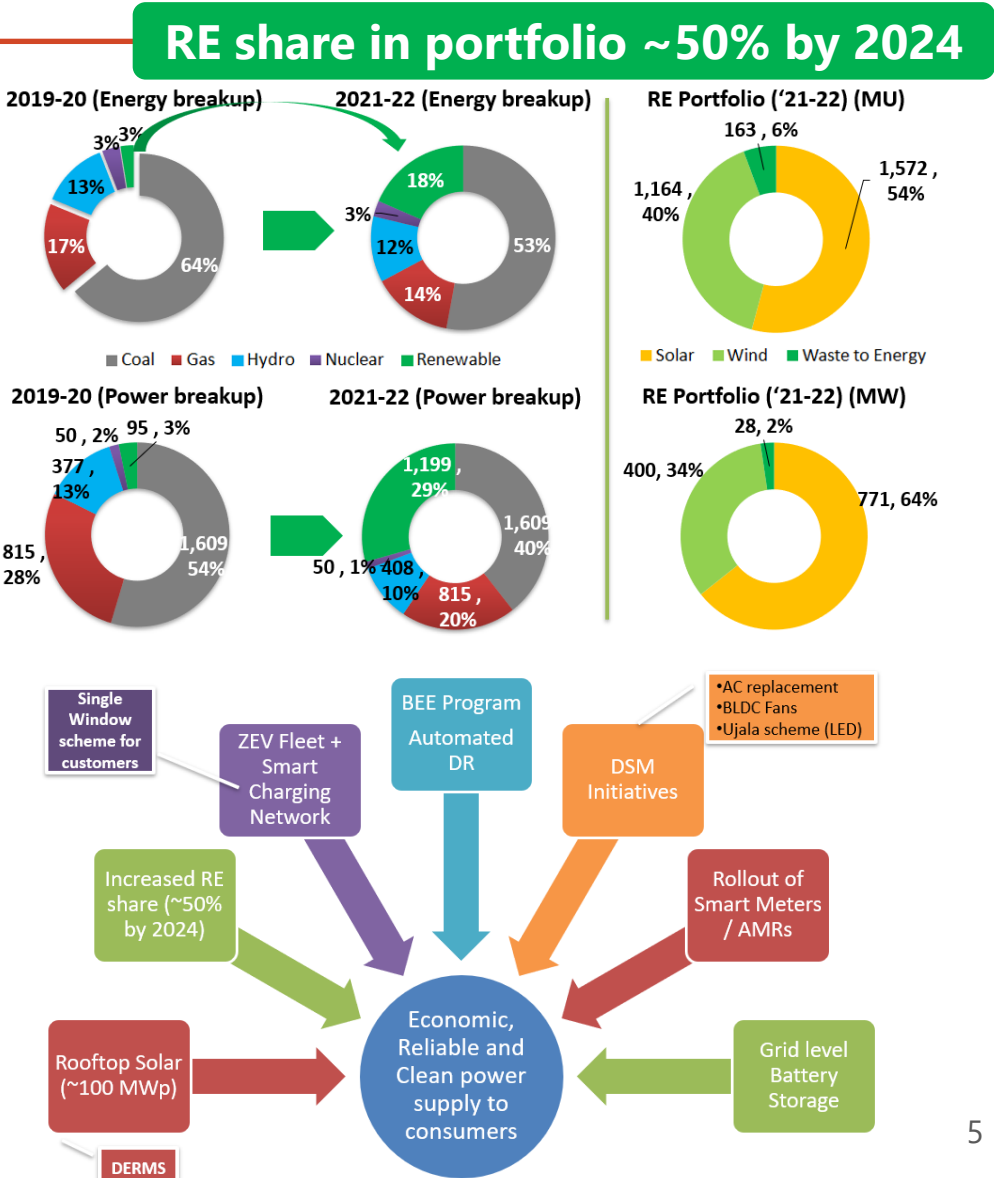
Technology Journey



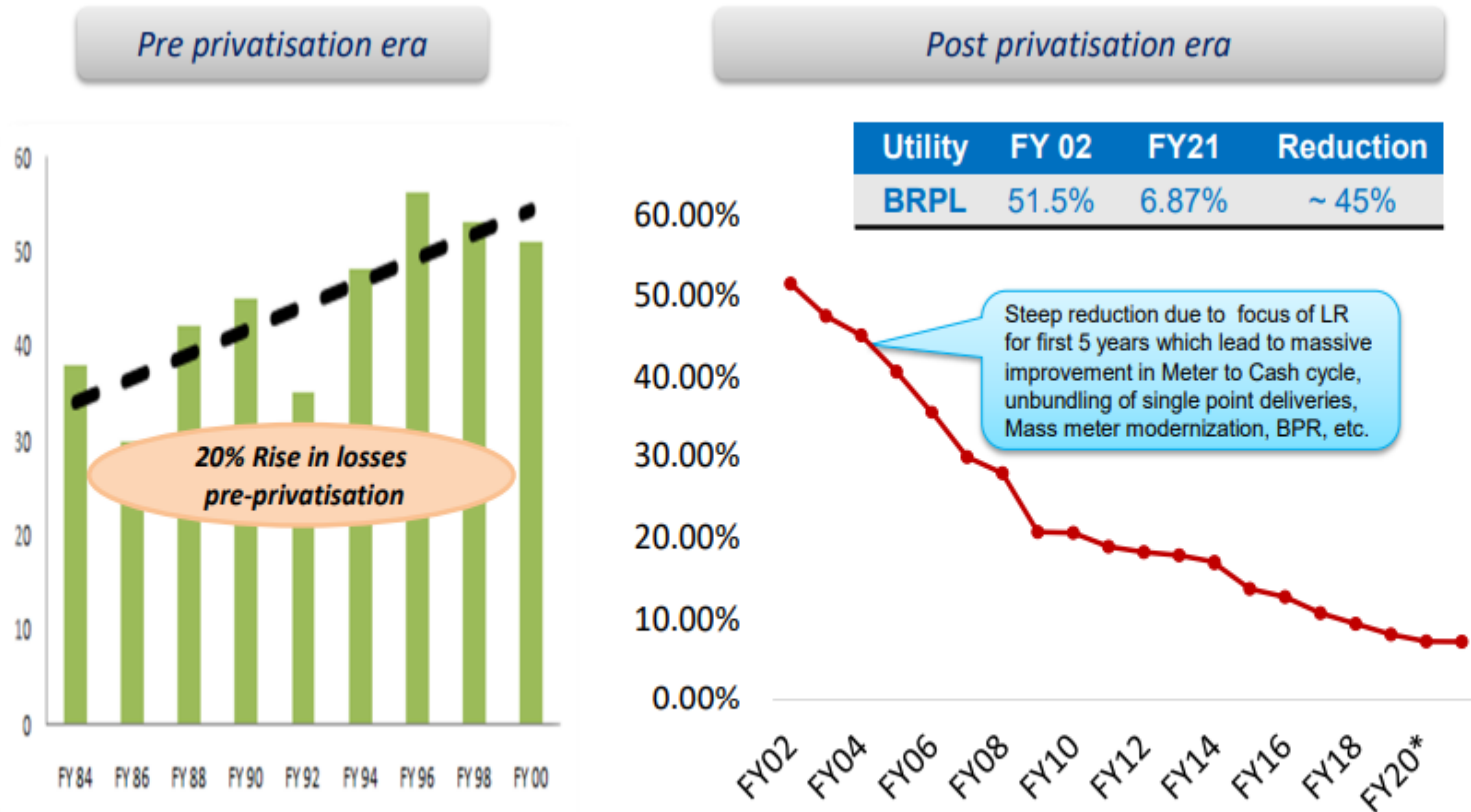
DMS – Distribution Management System, DERMS – Distributed Energy Resource Management System, ADR – Auto Demand Response, EV – Electric Vehicle

Energy Transition

Non-Wired Alternatives



BSES Rajdhani: – Loss reduction Journey



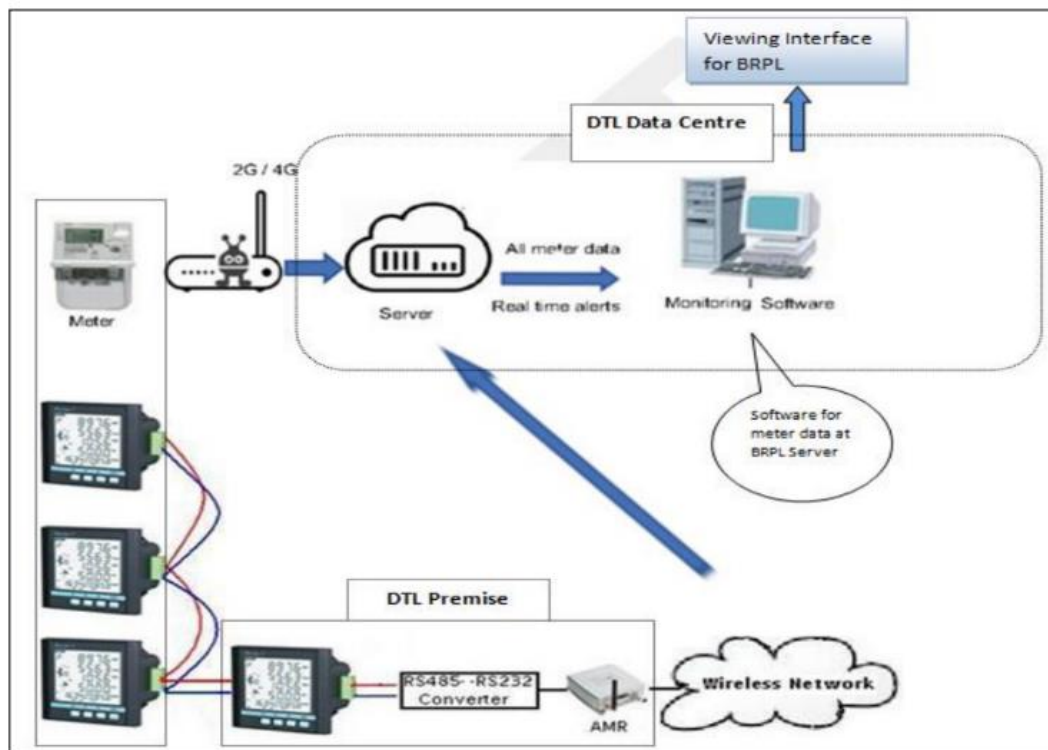
- Loss reduction Organization at district level
- Two pronged approach -
 - Customer focus – improvement in response time, metering, billing and payment options
 - Investment in network upgrades / last mile connectivity based on analytics from Meter data (AMR)

More than 87% reduction in losses post takeover against rising losses during privatization

Technology intervention led resilient and customer centric service approach being followed

AMI – Enabler for LR and Energy Accounting

AMR – System Architecture



Components

1. Modems 4G compliant with RS485 to RS232 converter
2. Cables and accessories
3. DLMS compliant ABT Check Meter (wherever required)
4. Server
5. Monitoring Software (HES)

- Smart meters automates meter reading and enables uniform billing cycle for all consumers
- Meter to cash cycle is reduced thereby lowering the need for Working capital
- TOTEX mode is preferred – Any agency undertakes entire operation including data management for a monthly fee per meter

4G Modem Specifications

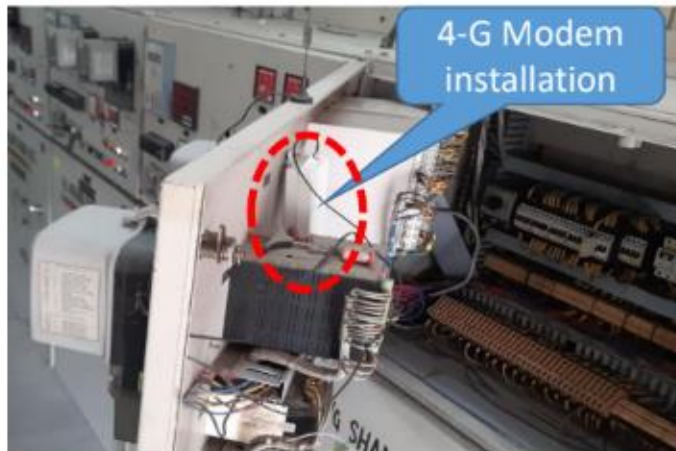
Modem is compliant with requirements of standards such as CISPR 22, IEC61000-4



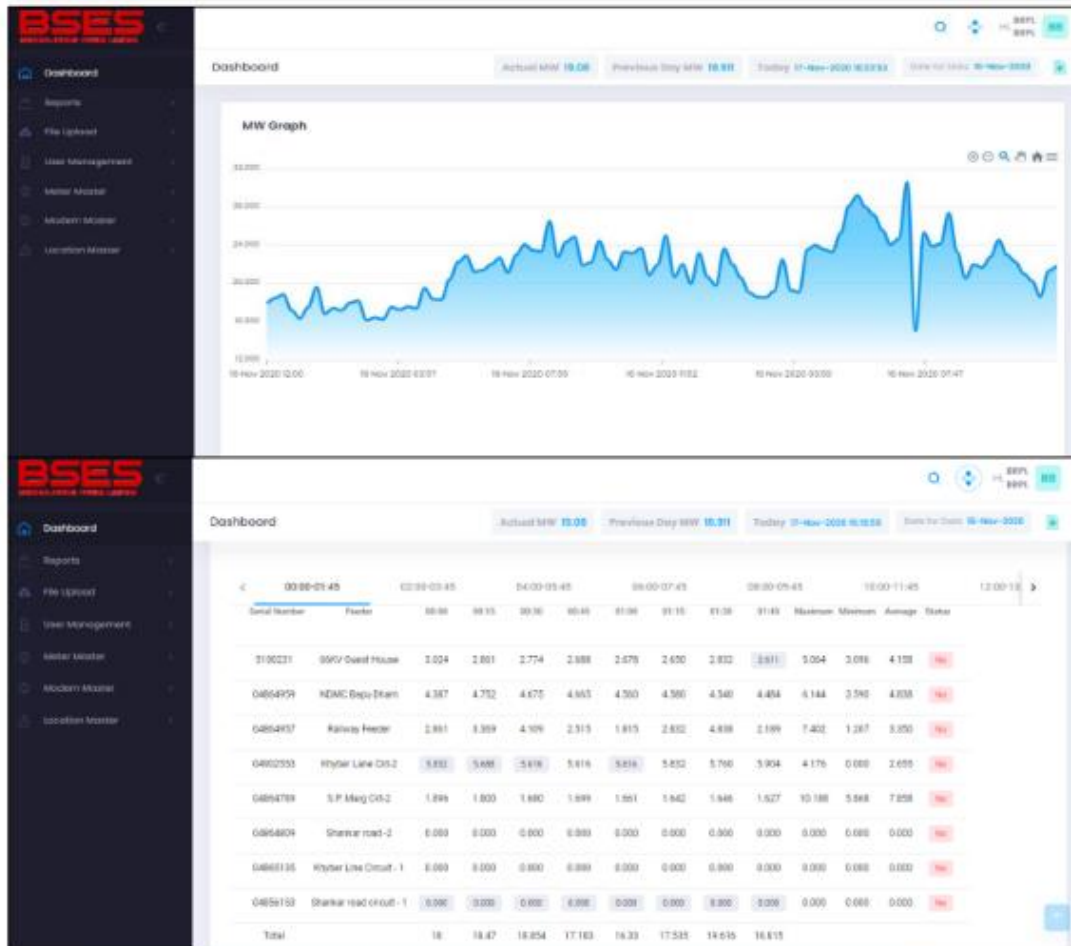
1. Rugged extruded enclosure (IP 54) with RS 232 interface and SMA Antenna Connection
2. LED indication of operation for status and Troubleshoot
3. Supported Baud rate from 1200 to 115,200 BPS
4. Modem has store and forward facility
5. Compatible with MODBUS Protocol for Data remote reading facility
6. Range: 40 -540 V AC with 3 phase supply system
7. Configurable Tamper and Alerts
8. Integrated with HES front end for data viewing
9. Modem has Inbuilt Antenna with provision of extension for improved signal strength
10. Auto reset functionality available (after 30-min)

POC – AMR installation on Grid ABT meters

- **220/66 kV Ridge Valley Grid** selected for PoC with DTL
- **4-G based AMR Modems** installed on existing ABT Interface Meters of M/S Elster Make
- **Eight modems** are continuously communicating, and Demand data of **every 15-min** is received remotely and stored at the Server via Head End Software (HES)
- PoC completed successfully at 66kV Ridge Valley Grid



POC – AMR Dashboard – real time data



Front End Head End System

S No	ABT Check Meter	Feeder/CKT Name	Voltage Level	Meter Type	Modem Status	Remote Meter Data Status
1	4864959	BAPUDHAM Earlier SPM NO-1	66kV	M+	Communicating	Updating
2	4864957	66 KV RAILWAY CKT	66kV	M+	Communicating	Updating
3	4865153	SHANKAR RD-1	33kV	M+	Communicating	Updating
4	4864809	SHANKAR RD-2	33kV	M+	Communicating	Updating
5	4902553	KHYBER LANE-2	33kV	M+	Communicating	Updating
6	4864849	KHYBER LANE-1	33kV	M+	Communicating	Updating
7	5100231	66 KV GUEST HOUSE	66kV	M++	Communicating	Updating
8	4864789	SPM NO-2	33kV	M+	Communicating	Updating
9	4865160	NEHRU PARK	33kV	M+	Check Meter port not functional	

Feeder Details

Automated metering of Distribution Transformers & retail consumers

Retrofitting of existing static meters with useful life left is one of the approaches being followed.

The old & deprecated meters being replaced with smart pre-paid meters in line with Govt. policy

Two major communication technologies:

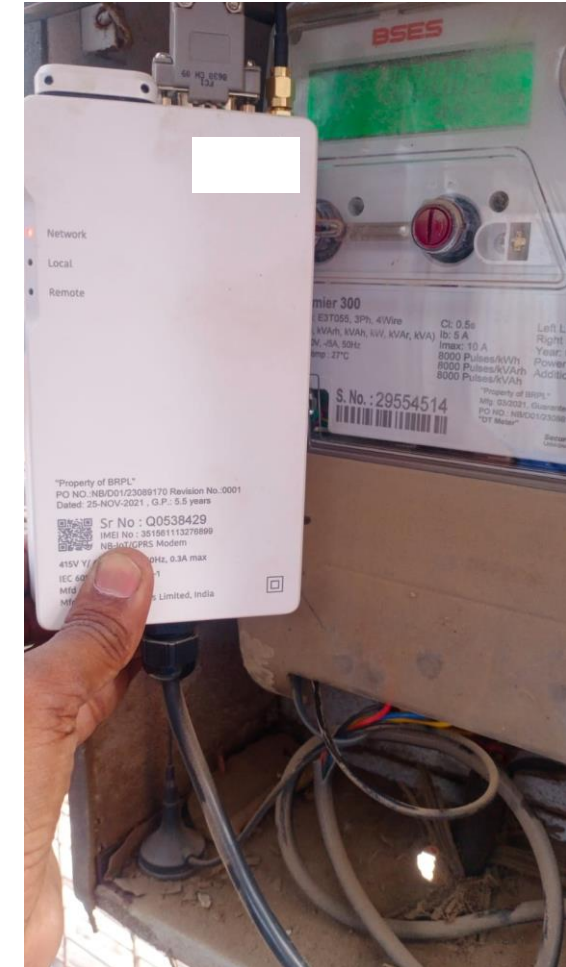
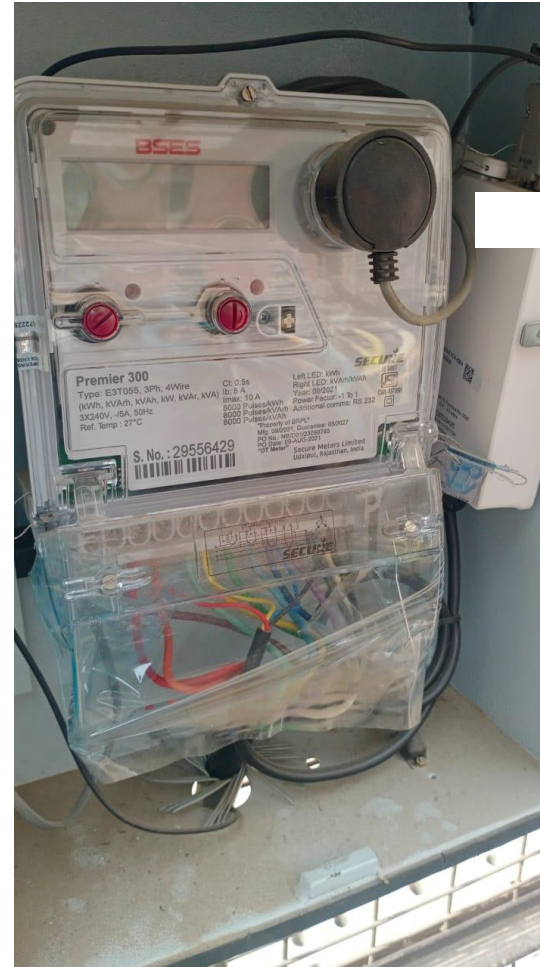
Radio Frequency (RF) (20 kHz to 300 kHz) (wireless)

Free bands in India : – Frequency Band: 865-867 MHz – Use: Low power RFID equipment or any other low power wireless devices or equipment – Frequency Band: 2.4-2.4835 GHz, Use : Low power equipment – Frequency Band: 5.825 to 5.875 GHz, Use : Low power equipment – Line of sight is essential

Cellular network (3G/4G) based modems

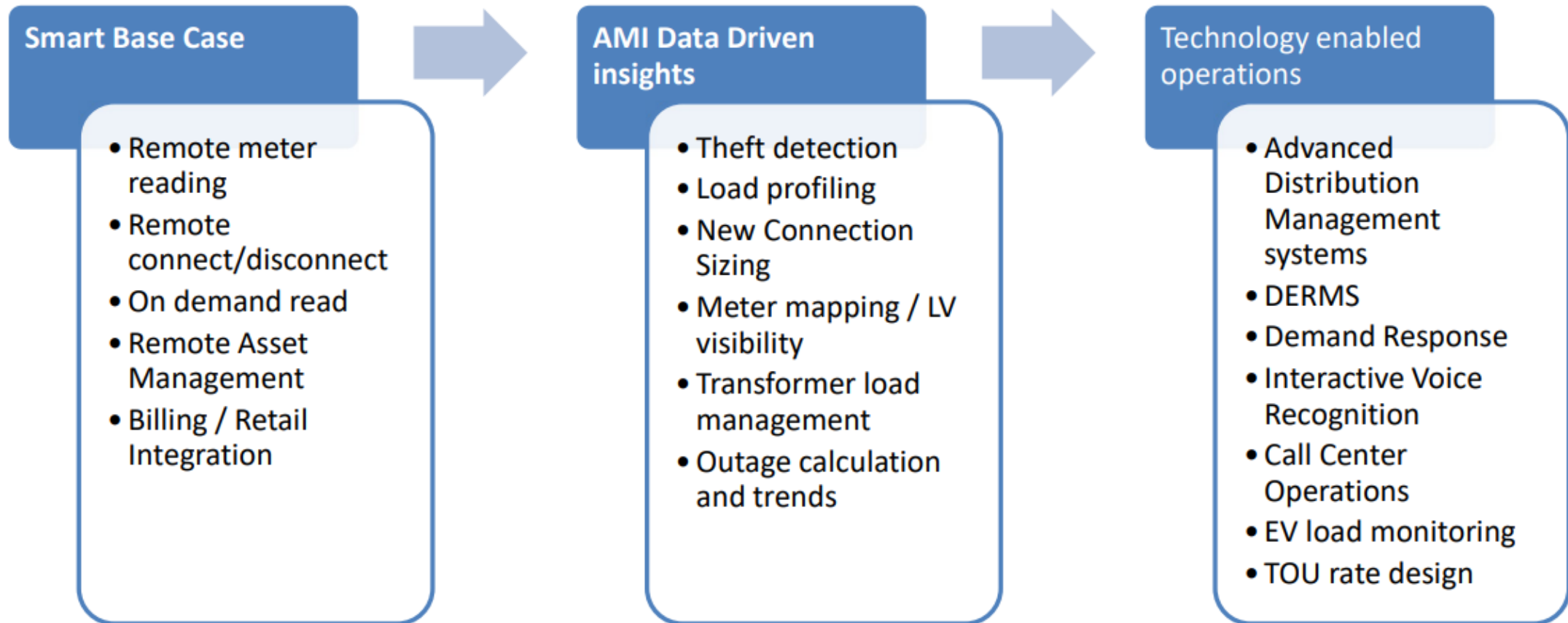
Big challenge of obsolesce of the technology in long run (as from 3G to 4 G and from 4G to 5 G etc.)

Blind spots



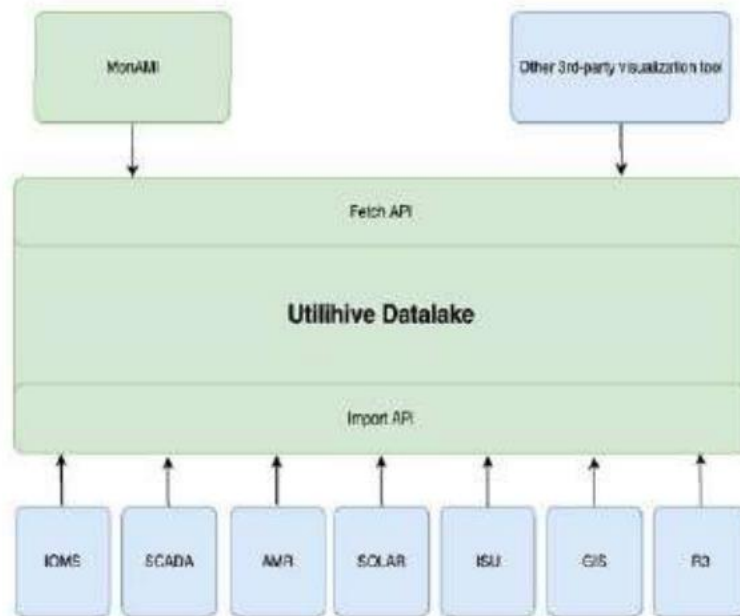
Mix of RF and Cellular communication technologies being implemented

AMI – Other Use cases



Use cases – Other applications

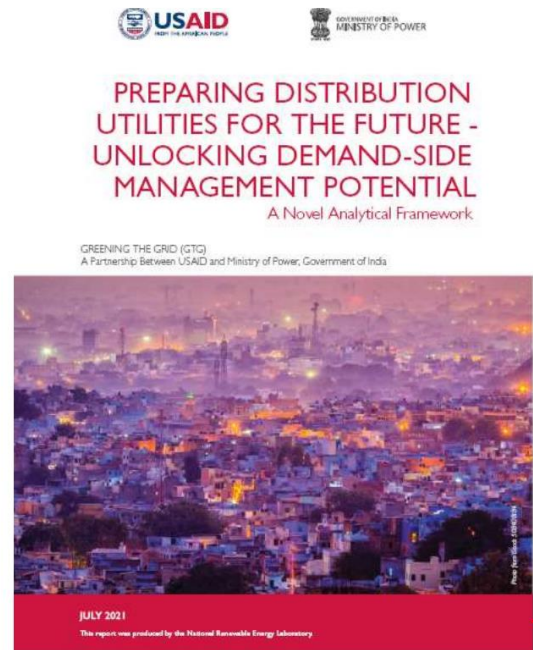
Utility Data Lake



Source: Greenbird, BRPL

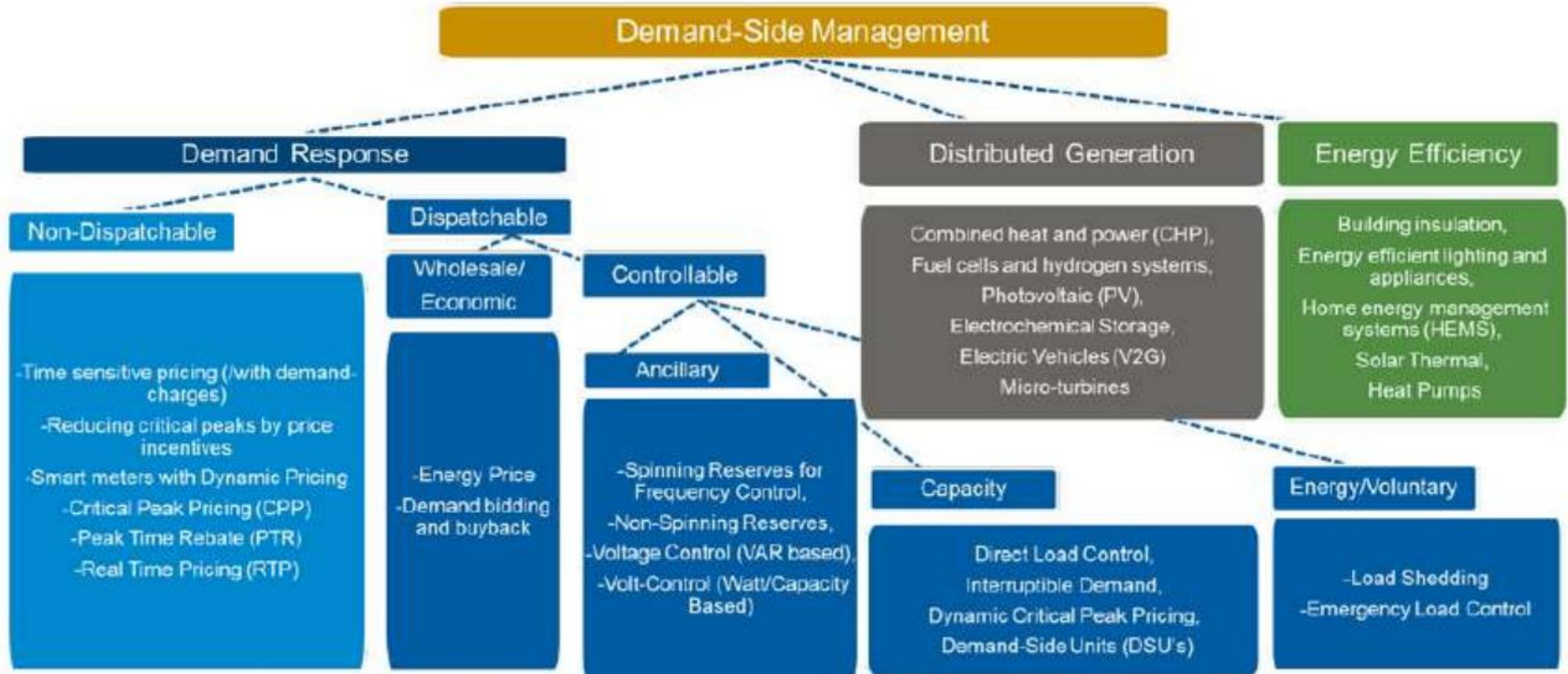


Implementation of TOU rate for customers



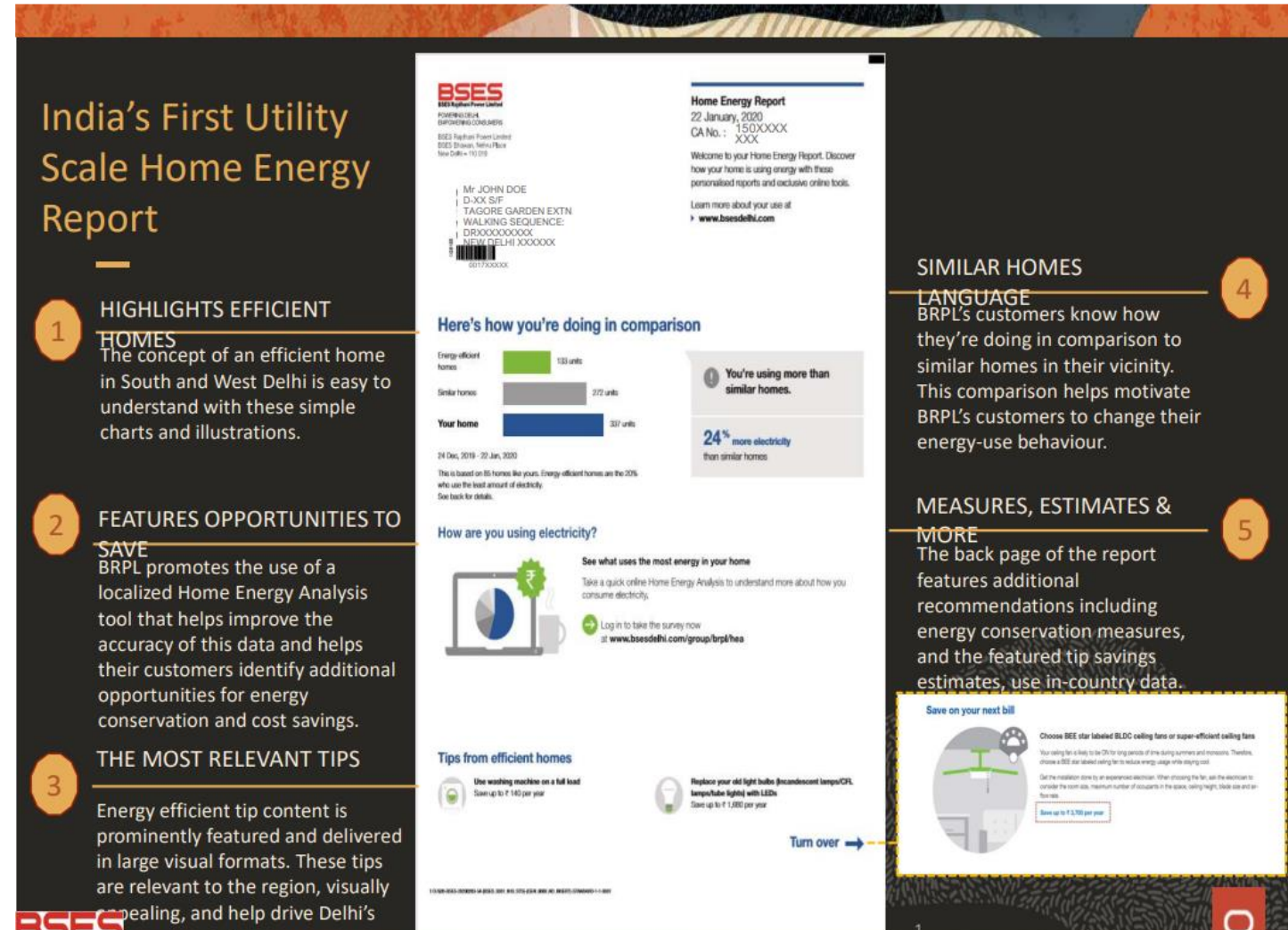
- Design of TOU for residential consumers
- Potential of DR in Peak demand reduction
- Customer segment wise results

Demand side Management programs



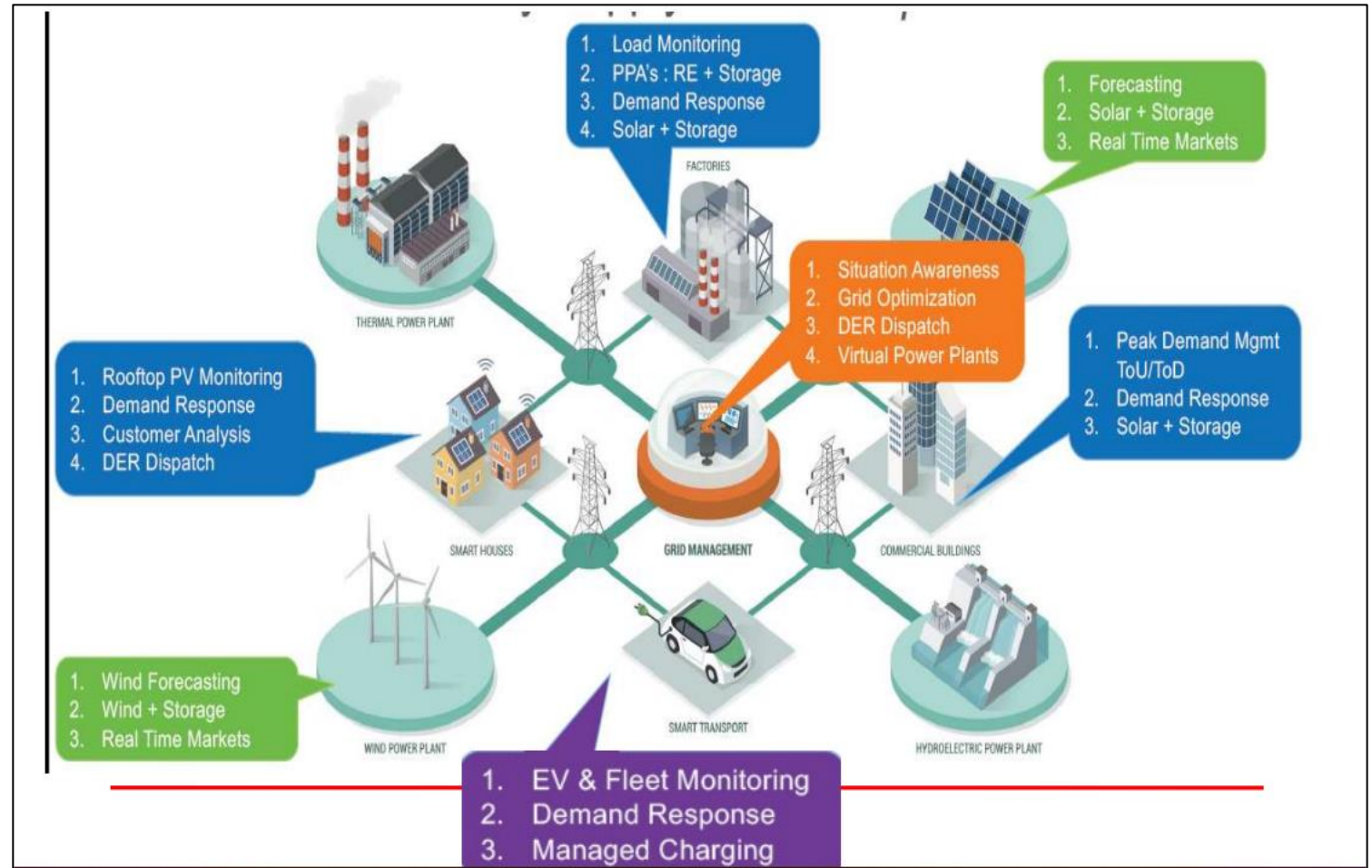
DSM – Behavioural Energy Efficiency POC in Delhi

- 2 year POC with Oracle Utilities
- 0.2 Million consumers covered
- Savings of ~1% in billing for the residential consumers
- Behavioural science helps in “no price no device” savings
- AMI rollout will further sharpen the results and widen the use case



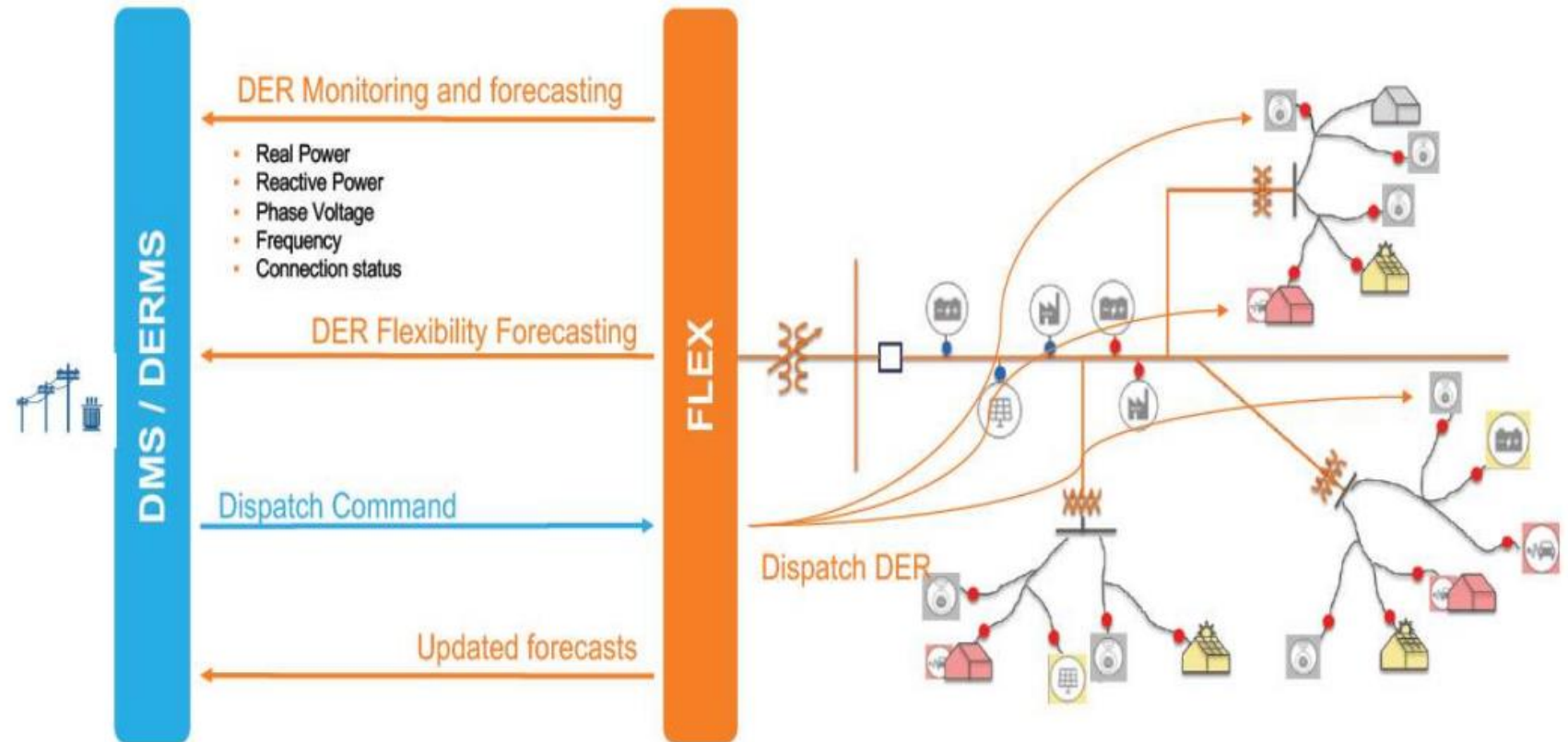
Utility of Future (DSO)

- Distributed System Operator
- Handling millions of DERs every minute
- Real Time situational awareness enables by AMI is essential



DSO – Advanced Situational Awareness

- AMI and IOT enabled advanced situational awareness of LV grid is essential for DSO
- DSO is vital for clean and stable RE powered grid with true democratization of electricity



Revamped Distribution Sector Scheme (RDSS – India)

- 1) The Central Government has approved a Revamped Distribution Sector Scheme- a Reforms-based and Results-linked Scheme with an outlay of Rs.3,03,758 crore over a period of five years from FY 2021-22 to FY 2025-26.
- 2) The Scheme aims to reduce the AT& C losses to pan-India levels of 12-15% and ACS-ARR gap to zero by 2024-25 by improving the operational efficiencies and financial sustainability of all DISCOMs/ Power Departments excluding Private Sector DISCOMs.
- 3) DISCOMs/ Power Departments would be able to access funds under the Scheme for Pre-paid Smart Metering, System Metering and Distribution infrastructure works for loss reduction and modernization.
- 4) On 17th August 2021, detailed guidelines for implementation of scheme in two parts (**Part-A: Metering & Distribution Infrastructure works** and **Part-B: Training & Capacity Building** and other enabling & supporting activities) have been notified by Ministry of Power.
- 5) Ministry of Power vide gazette notification dated 23rd May 2022 has revised the timelines.

Revamped Distribution Sector Scheme (RDSS – India)

S. No	Areas	Timelines
1	All Union Territories, all electrical divisions with high AT&C losses Urban Areas > 15% and Rural Areas > 25%	31st December 2023
2	All other Areas	31st March 2025
3	Smart DT Metering for all areas including UT	31st December 2023
4	All feeders	31st December 2022

- 1) All the feeder meters shall be made communicable under National Feeder Monitoring System (NFMS) by 31st December, 2022 and shall either have AMR facility or shall be recovered under AMI
- 2) In areas which do not have communication network, installation of prepayment meters, conforming to relevant IS, may be allowed by the respective State Electricity Regulatory Commission.
- 3) All consumer connections, having current carrying capacity beyond that specified in relevant IS, may be provided with smart meters having AMR facility.
- 4) Distribution Transformers (DTs) and High Voltage Distribution System (HVDS) transformers having a capacity of less than 25 kVA and DTs feeding only agricultural consumers may be excluded from the above timelines.

Revamped Distribution Sector Scheme (RDSS – India)

- 1) Under Part-A: Prepaid Smart metering for consumers, and System metering at Feeder and Distribution Transformer level with communicating feature along with associated Advanced Metering Infrastructure (AMI) will be done in TOTEX mode through PPP, to facilitate reduction of Distribution losses and enable automatic measurement of energy flows and energy accounting as well as auditing.
- 2) Under this mode:
 - A single agency will be contracted for supplying, maintaining and operating the metering infrastructure for purpose of meter related data and services to DISCOM;
 - It will make both capital and operational expenditure under DBFOOT (Design Build Fund Own Operate & Transfer) or similar modes and will be paid for a portion of its capital expenditure initially **(Rs. 900 in all States except NE/ Rs. 1350 in case of NE States)** and the remaining payment over the O&M period.
- 3) TOTEX (Total Expenditure includes Capex and Opex) with following options:
 - Option-1: Installation and commissioning of meters and cost recoveries in equated monthly instalments by PPP or implementation partner (or service provider) with no upfront payment by DISCOM;
 - Option-2: Some initial payment shall be made to the service provider upon installation and commissioning of the meters, with the rest of the payments made on equated monthly / quarterly instalments over the operational period.

Thank you