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TATA POWER DELHI DISTRIBUTION LIMITED Smart Grid Journey

March 2, 2015
Bangalore, India



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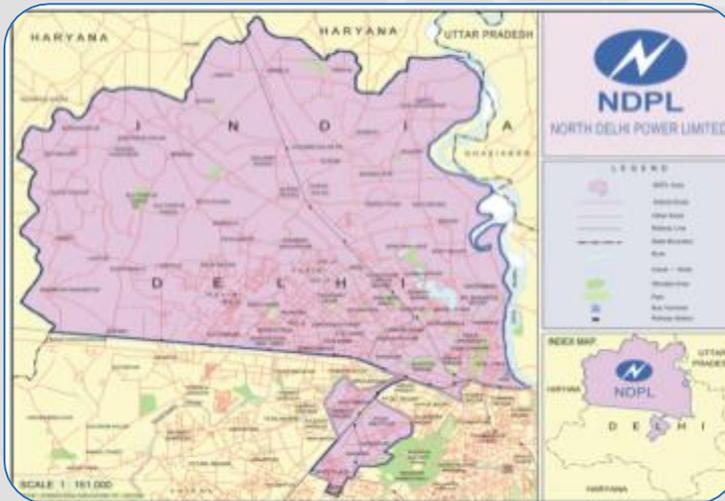
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About TATA Power Delhi Distribution Limited

Certifications : ISO 9001, 14001, 27001 ; SA
8000 ; OHSAS 18001
UN Global Compact Reporting



Joint Venture of Tata Power Company and Govt. of NCT of Delhi (51: 49)

Licensed for distribution of power in North and North West Delhi

Parameter	FY '15 (Estimated)
Turnover	INR 6155 Cr
Peak Load	1704 MW
Annual energy requirement	8082 MUs
Total registered consumers	1.5 Million
Number of employees	3527
Area	510 Sq Kms
Population serviced in Network area (approx)	7 Million
Number of consumers per Sq.Km	2726



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TPDDL Turnaround Snapshot

Parameter	Unit	Jul 02	Mar 14	% change
Operational Performance				
AT&C Losses	%	53.1	10.5	80%
System Reliability – ASAI -Availability Index	%	70	99.5	42%
Transformer Failure Rate	%	11	0.55	95%
Peak Load	MW	930	1508	62%
Length of Network	Ckt. Km	6750	10979	63%
Street Light Functionality	%	40	99.57	149%
Consumer Related Performance				
New Connection Energization Time	Days	51.8	6	88%
Meter Replacement Time	Days	25	6	76%
Provisional Billing	%	15	2	87%
Defective Bills	%	6	0.2	97%
Bill Complaint Resolution	Days	45	6	87%
Mean Time to Repair Faults	Hours	11	1.34	88%
Call Center Performance - Service Level	%	-	91	
Payment Collection Avenues	Nos.	20	5377	26785%
Consumer Satisfaction Index	%	-	88	
Financial Performance				
Capex Incurred (Cumulative)				
Distribution	Rs. Cr.	1210	4843	300%
Generation (Rithala + Solar)	Rs. Cr.	-	332	
Revenue (Annualized for FY 03 and FY14)	Rs. Cr.	1156.3	5979.0	417%
Others				
Consumers	Lacs	7	13.9	98%
Employees	Nos.	5,600	3,527	37%

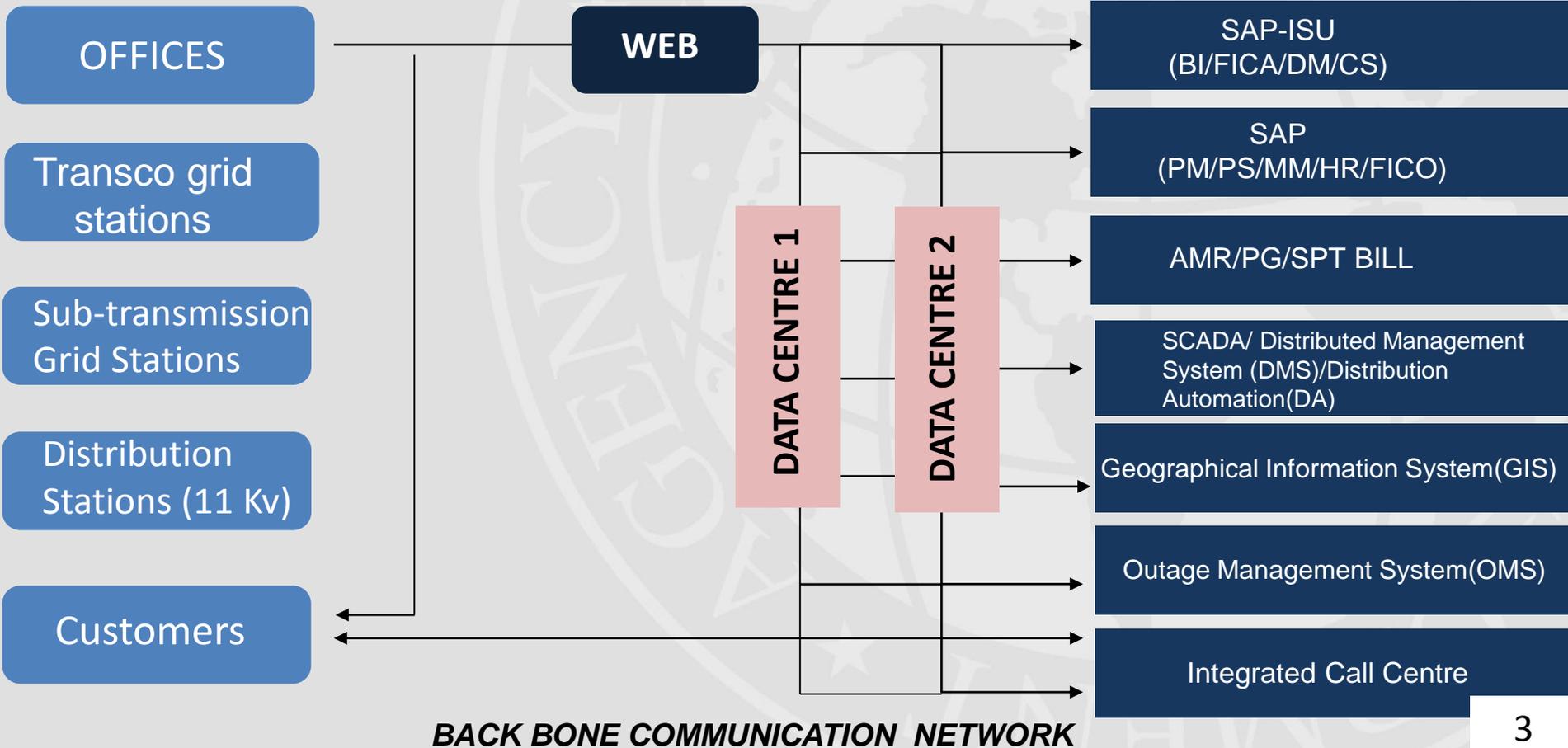


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TPDDL- Technology Landscape





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IT-OT Convergence

Operational Technology Progression

- Manned Grids
- Non communicable control panels

- Substation Automation
- Communication Infrastructure
- GIS readiness for Sub transmission

- SCADA system
- GIS readiness for Distribution Network
- DMS readiness

- SAP-ISU,
- Secondary Data Centre (SDC)
- GIS readiness for LT network & Consumers
- DMS & DA implementation
- Outage Management System

- DEBS - Billing
- Energize – Enterprise System
- E-mail and website
- IT Infrastructure

- SAP-R3 (FICO, PM, MM, PS, HCM)
- Bulk Billing System
- BIRD
- AMR, Sakshat, Sanchay and RMS

- SAMBANDH
- SAP-ESS, PMS
- DEBS Up-gradation
- Payment Gateway

AMI,
ESB,
FFA,
ICT,
BI,DA

Information Technology Progression



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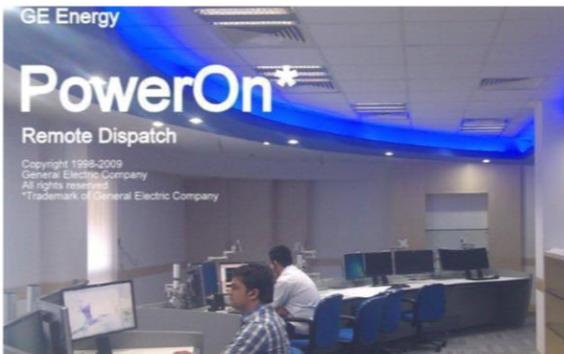
Year 2004 - USTDA Grant for Technology Roadmap KEMA Projects Implemented



Grid Sub-station Automation System



SCADA/ Distribution Management System



Outage Management System



Geographical Information System

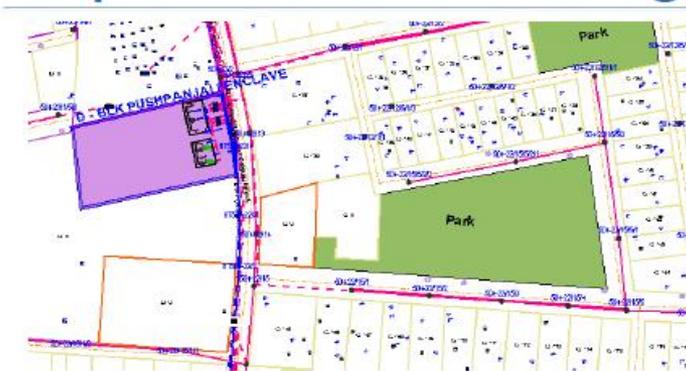


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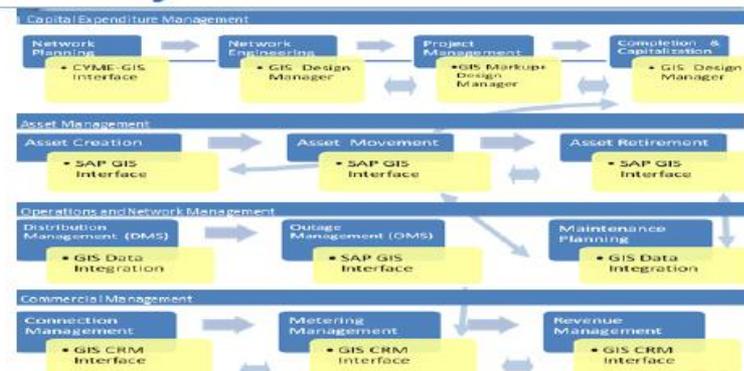
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Adoption of Technology – Many Firsts



Geographical Information System



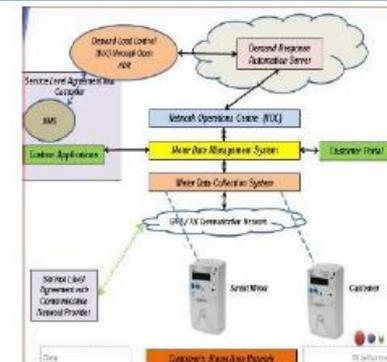
Integration of GIS with Operational and Commercial Sys.



Integrated Outage Management System



Integrated Call Center with BCM



Smart Grid Pilot (Demand Response) Architecture

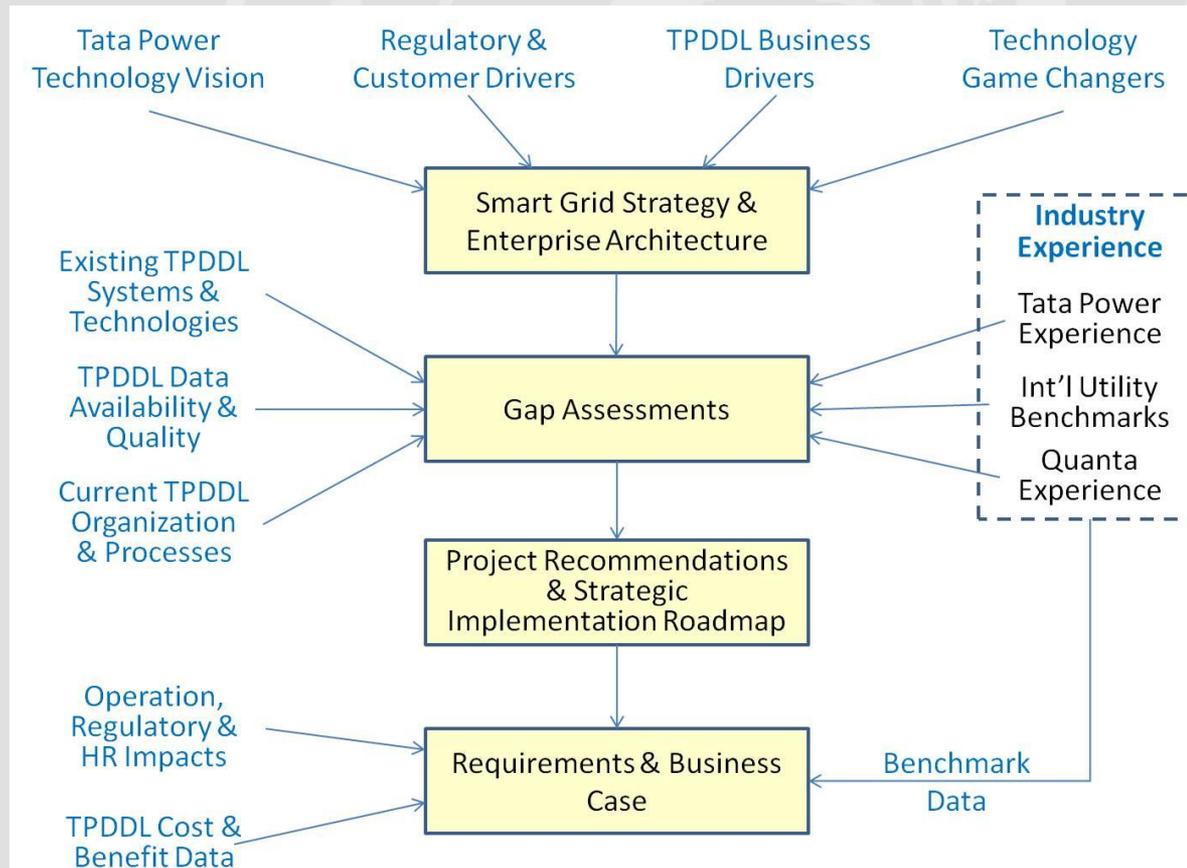


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Year 2011 – USTDA grant for Smart Grid Roadmap Quanta Technology- Methodology





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Year 2011 – USTDA grant for Smart Grid Roadmap Quanta Technology – Recommended Project

Advanced Metering Infrastructure (AMI)



Field Force Automation (FFA)

Load Forecast and Big Data Analysis.

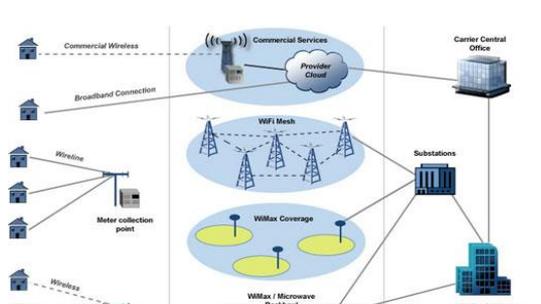


Business Intelligence/Data Analytics



Enterprise Service Bus

Smart Meters and Aggregation Backhaul / Transport Control and Management



Integrated Communication Technology



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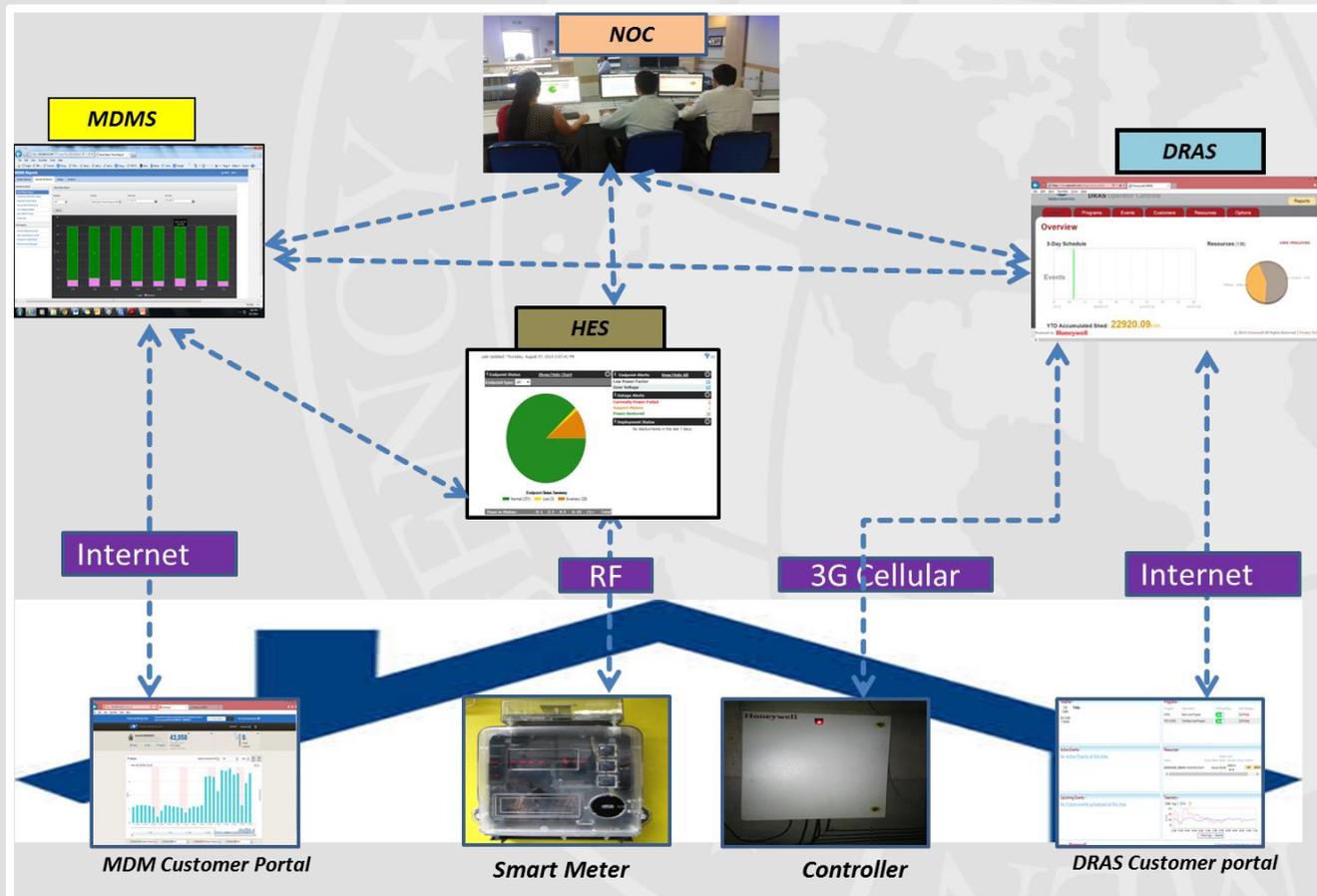
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ADR with Smart Meter- Architecture & Data Flow





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Smart Metering & Automated Demand Response Pilot Project

About the Project:

First Utility initiated Smart Meter based ADR program in the country Project approved by DERC

Project Objectives:

- To manage peak demand
- To manage Grid Stress situations

Pilot Project to cover 250 nos. of high end consumers with sanctioned load of 100 KW and above with an objective to reduction of peak load.

Project Components include :

- Automated Demand Response infrastructure including DR server and site controllers
- Smart Meters
- RF Mesh based Communication
- MDMS and its integration with other OT & IT systems like OMS, SAP, ADR.

Collaborative partnership with selected vendors

Project being undertaken to demonstrate:

- technological capability
- understand customer behavior
- Case study for regulator to work on differential tariffs and financial incentives.
- Processes required for scaling up



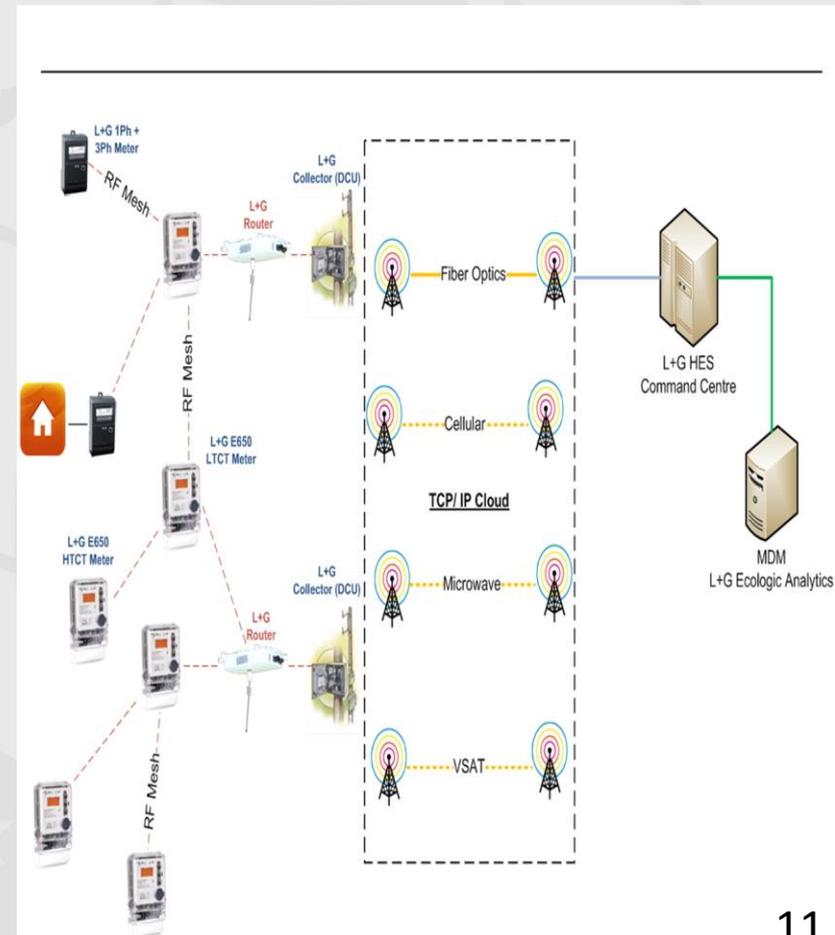
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Salient Features of the project

- RF Mesh network spread over an area of approx. 250 Sq km
- Entire 250 Sq Km has been covered by 35 Routers and 3 collectors
- 4 hour Advance intimation to the consumers in case of a scheduled DR event
- Real time data transmission of 15 min load interval data to TPDDL data acquisition
- Real time intimation to consumers through SMS with regards to Low PF and Load.
- Advanced customer portal for providing granular 15 min interval data to customers
- Integration of MDMS and DRAS , enabling elimination of aggregator and shadow meters
- Integration of MDMS system with the existing SAP





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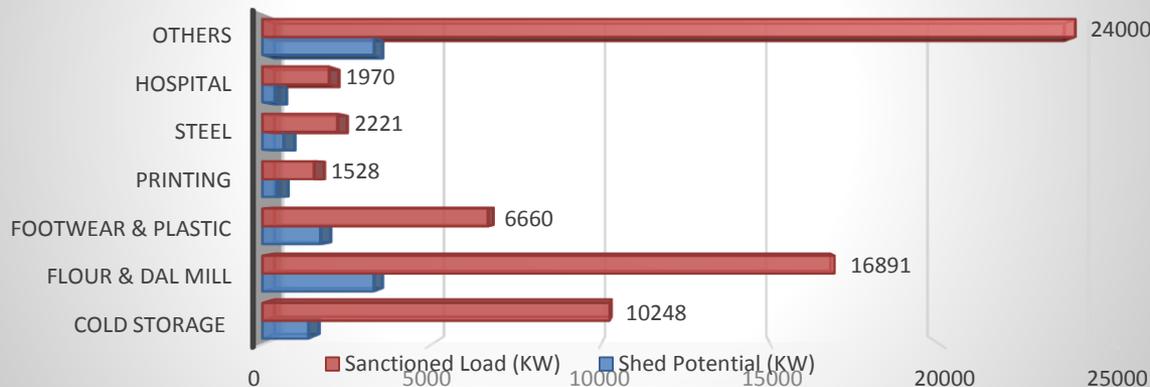
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Shed Potential Analysis

Shed Potential v/s Sanctioned Load

Plans to Scale up to 40 MW in the Future



Major Shed Potential Contributors

- Flour & Dal Mill
- Footwear & Plastic
- Printing
- Steel

INDUSTRY TYPE	Cold Storage	Flour & Dal Mill	Footwear & Plastic	Printing	steel	Hospital	Others	TOTAL
No of Consumers	8	39	39	7	10	3	56	162
Shed Potential (KW)	1364	3292	1718	423	629	375	3300	11101
Sanctioned Load (KW)	10248	16891	6660	1528	2221	1970	24000	63518



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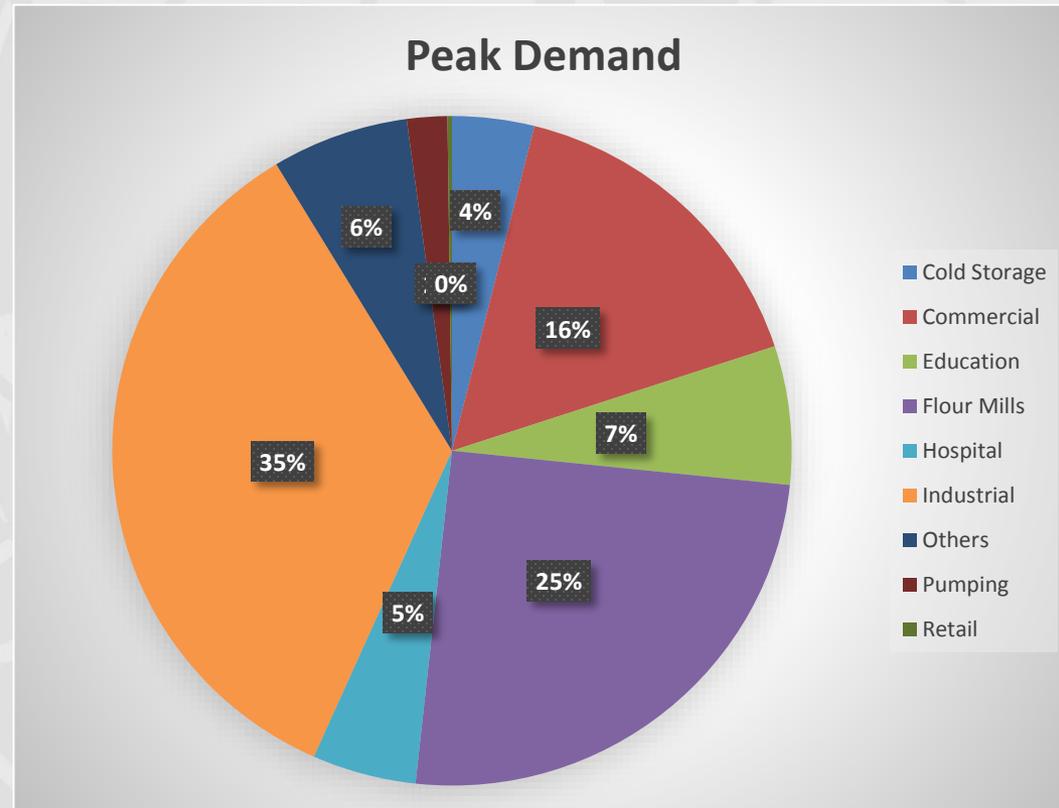
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Consumer Category wise contribution to Peak Demand

Major Contributors to TPDDL peak demand from C&I Segment

Industrial consisting of:
Printing,
Steel,
Plastic & Footwear
Flour Mill
Commercial



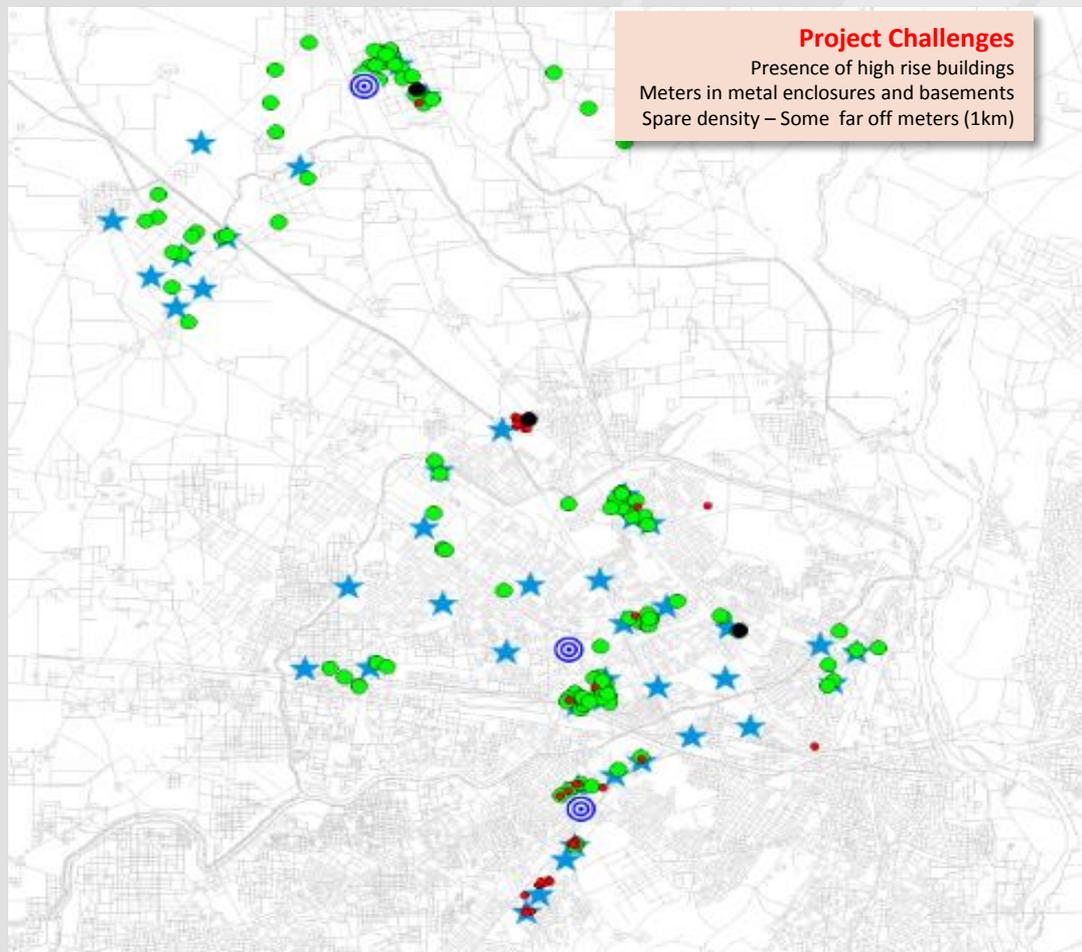


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GIS Map of Consumers



Area	250 Sq. kms area covered
Clusters	11
Meters	162 Meters Installed
Routers	49 Routers installed
Collectors	3 Collectors installed
Repeaters	12 installed

Smart Meter	Completed
HES	Completed
MDM	Completed
ADR	Completed
Integration	SAP, DR, MDM, HES, SMS Server



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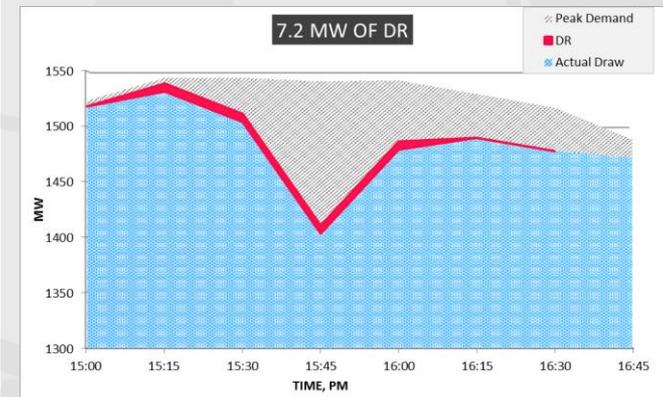
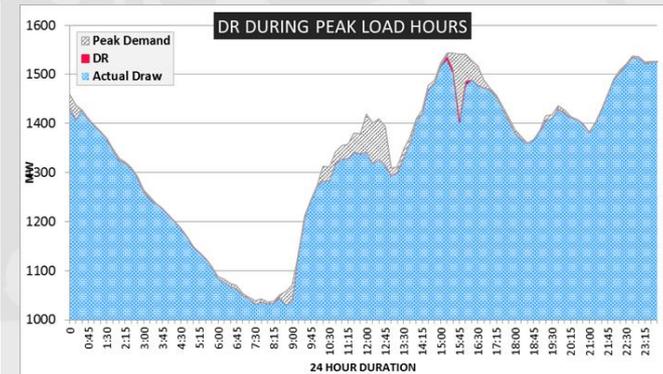
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Automated Demand Response with Smart Metering Results

Current Status Brief:

- 162 Consumer Enrolled
- 12 MW Shed potential
- 17 Events conducted starting May 2014 during peak load conditions
- Max Shed achieved was 7.2 MVA.
- Future Potential:
 - Potential to add another 33 MW by enrolling high revenue consumers.





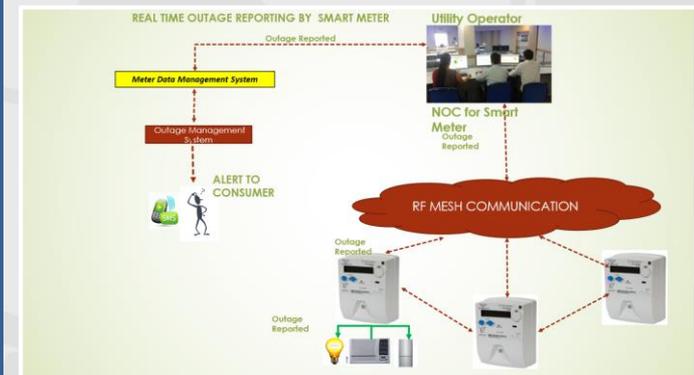
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Benefits for participating consumers

- Allows consumers to make informed decisions by providing highly detailed information
- Provides consumers with greater control over their electricity use when coupled with time-based rates, potentially saving money on their monthly electric bill.
- Allows for faster outage detection and restoration of service.
- Opt Out option for particular ADR event to consumers through SMS with no penalty





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Benefits for participating consumers

- Provides real time alerts to consumers in case of violation of threshold values for factors like
 - Power Factor
 - Load
- Web based consumer portal for accessing consumption related data and reports
- Increased availability of electricity for all consumers
- All this value at no cost
- At the time of full roll out Incentives for consumer for participating in DR.





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Research Findings from the Smart Grid Pilot (Published Papers)

ADR with Smart Metering – A Business Case Study : TPDDL

Characterization of Effectiveness of Technologies for India's Electric Grid Reliability and Energy Security : LBNL & TPDDL

Open Automated Demand response - Industry value to Indian utilities and Knowledge from the deployment : Honeywell, LBNL & TPDDL

Estimation of Potential and Value of Demand Response for Industrial and Commercial Consumers in Delhi : LBNL & TPDDL

Findings from an advanced demand response smart grid project to improve electricity reliability in India : LBNL & TPDDL



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Year 2014 – USTDA Grant for Distributed Energy
Resources E3 Studies





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Solar Potential at TPDDL Area

S. No.	Category	Probable Locations (Nos.) (A)	Avg Available Roof Size (in sq ft) (B)	Solar Potential (in MWp) (C) = (A)*(B) / (120*10 ³)
1	School*	350	2000	5.8
2	Hospital*	250	1500	3.1
3	Govt. Offices*	1200	1500	15
4	DJB*	200	1000	1.7
5	Delhi University	20	6000	1
6	DMRC	20	4000	0.7
7	Industries	30000	1500	375
GRAND TOTAL		32040		402

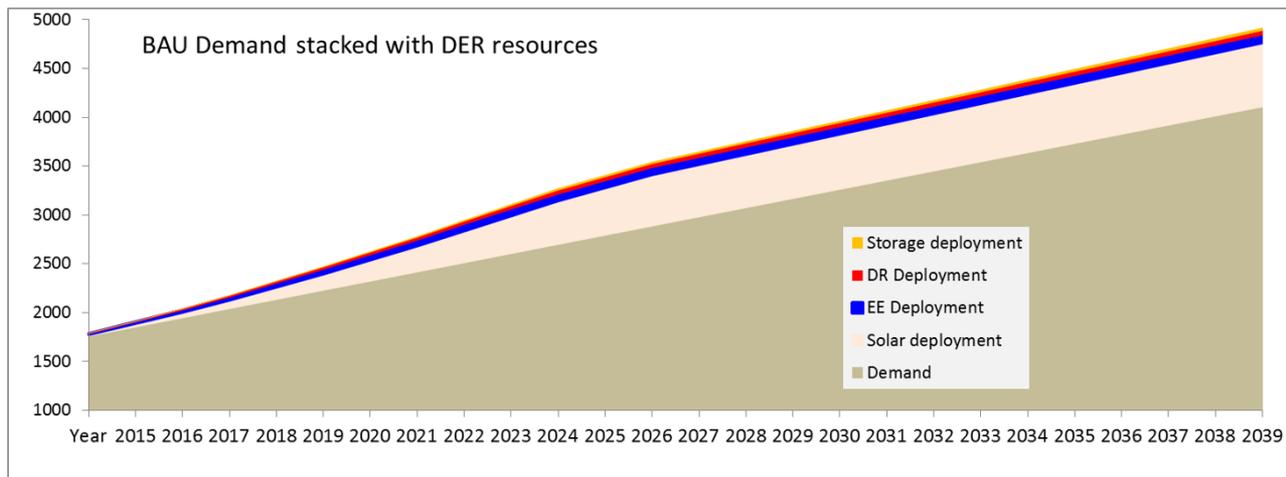


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TPDDL Demand Projections with DER till 2025



	Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
MW	EE Deployment	7	14	21	30	38	46	51	57	64	67	67	68	70	70	72	72	73	74	75	75	76	77	77	77	78	78
	DR Deployment	5	5	12	15	20	25	28	31	34	37	42	42	42	43	43	43	43	43	43	43	44	44	44	45	45	46
	Storage deployment	0	0	0	0	0	1	4	6	8	10	15	15	15	15	15	16	16	17	18	19	20	21	22	23	24	25
	Solar deployment	10	30	50	80	120	160	210	260	320	380	440	480	520	530	540	550	560	570	580	590	600	610	620	630	640	650
	Demand	1766	1860	1954	2048	2142	2236	2330	2424	2518	2612	2706	2800	2894	2988	3082	3176	3270	3364	3458	3552	3646	3740	3834	3928	4022	4116
	Demand Net of DER	1744	1811	1871	1923	1964	2004	2037	2070	2092	2118	2142	2195	2247	2330	2412	2495	2578	2660	2742	2825	2906	2988	3071	3153	3235	3317



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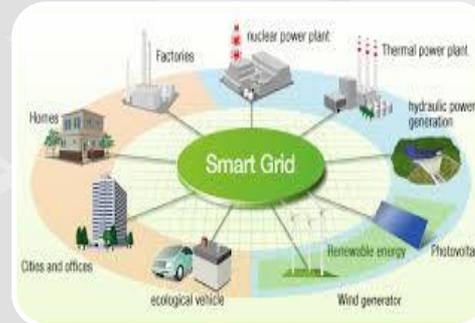
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Initiatives for future:



Distributed
Energy
Resources &
Demand Side
Management

New Technology
Introduction & Technology
upgrade
Automated Metering
Infrastructure
Advanced DMS
GIS Upgrade
Integrated Communication
Technology
Business Intelligence

Smart Grid
Demonstration
Lab



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Distributed Energy Resources Portfolio



Grid Connected
Rooftop Solar

440 MW rooftop
solar by 2025

No new fossil fuel
PPA sign off



Automated Demand
Response

40 MW potential by
2025

12 MW ADR
Potential connected
and in use



Energy Storage
Explore utility level
Energy Storage
options



Micro Grid

Working with MIT for
developing a model
for facilitating
development of
Micro Grid in Rural
India



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Demand Side Management



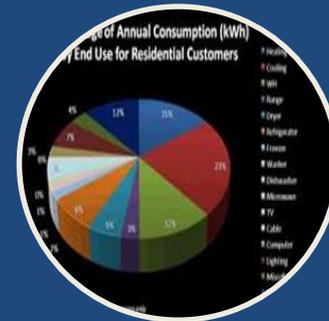
LED Replacement program

2.2 Million LED distribution at subsidized rates
15 MW load reduction to be achieved



AC replacement program

20000 old AC to be replaced with more 5 star efficient ACs
13.08 MW reduction to be achieved



Load Research Study

Covering Domestic, Commercial and Industrial Consumers
Results to be used for identifying segment specific DSM initiatives



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New Technology Introduction & Upgrade



Advanced Distributed Management System (ADMS)
Unified SCADA, DMS & OMS for better efficiency in monitoring & control



Geographical Information System (GIS)
Standards based integration possible with other IT /OT applications



Integreted Communication Technologies (ICT)
For meeting communication requirements of smart grid



Business Intelligence(BI)
Advanced Data analytics (DA) based on advanced Mathematical & Statistical modelling



AMI & ESB
Smart Metering for consumers having consumption >600 units per month.
2,50,000 consumers to be covered



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Smart Grid Demonstration Lab

- State of art Smart Grid Lab
- Demonstration of various smart grid technologies.
- Collaborative partnerships with Business Associates
- Centre of Excellence for all segments including students, consumers, technology providers and other state utilities.





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Smart Grid Vision for the Future

- Reduced Electrical Losses
- Improved Management of Outages
- Reduced manual processes
- Near real time access of energy information to consumers
- Dynamic tariff and more payment options
- Better management of renewable distributed generation resources
- Increased use of Demand Response
- Creating a platform for smart applications like EV charging, energy storage, building energy management system, street lights etc.





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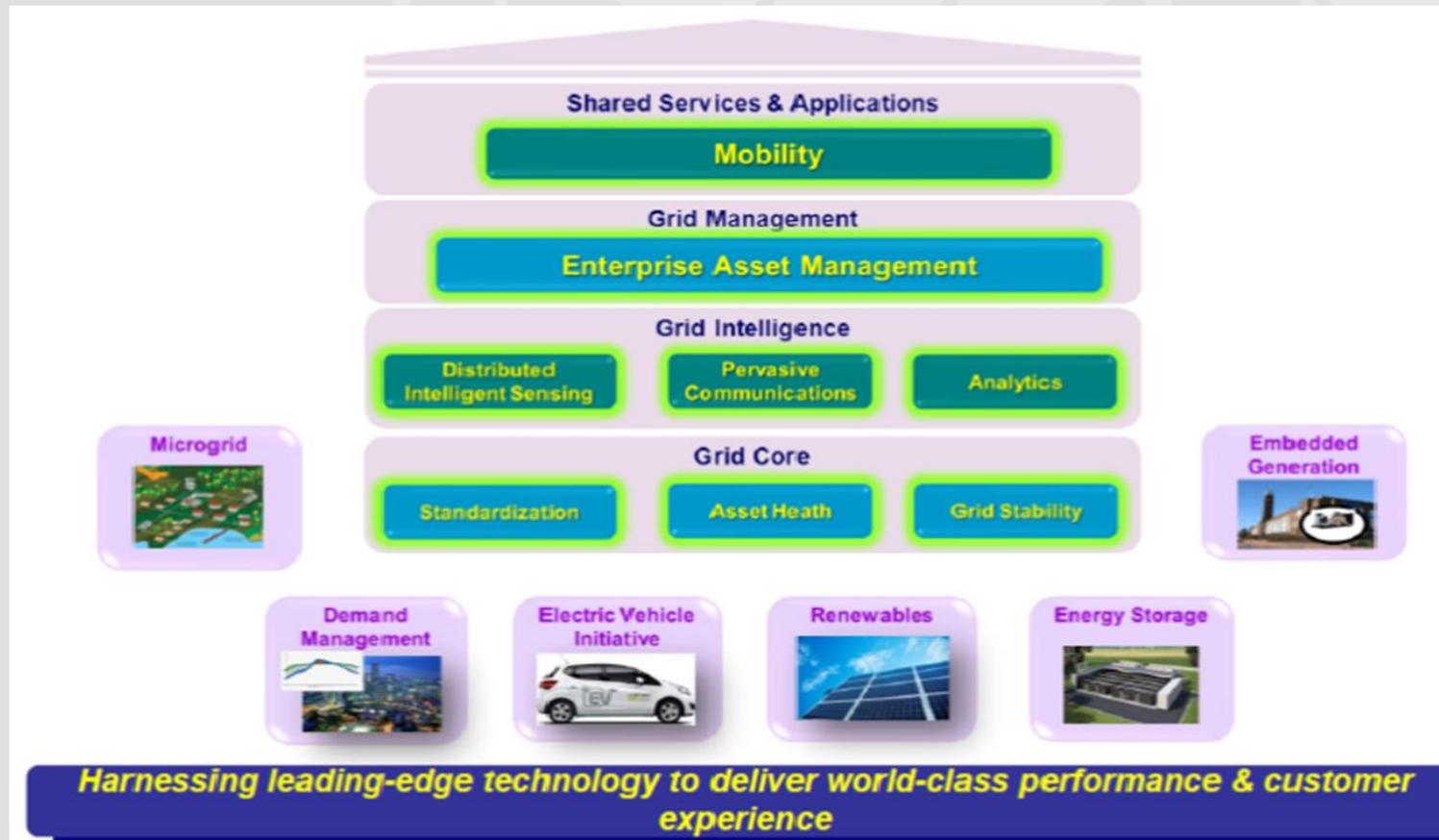
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Future Roadmap of Technology in Distribution





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Vision 2022

Single Digit AT&C Loss Levels

Great Places To Work For India
7%

1st CUSTOMER SATISFACTION

Smart Grid

Smarter Discom

0
Complaints
Accidents

Energy Neutral & Water Neutral for Self consumption

Significant presence: domestic & international



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Thank You