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Leveraging R-APDRP Infrastructure to Progress Towards Smart Grid

Partnership to Advance Clean Energy-Deployment (PACE-D)
Technical Assistance Program

USAID PACE-D TA Program

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Structure of the Presentation

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Context and Objective of the Presentation

- **IT systems and automation systems created under the R-APDRP provide basic building blocks for Smart Grid.**
- **Infrastructure created under R-APDRP can be effectively leveraged to transform distribution utilities to smarter grids with low incremental costs which would result in better utilization of R-APDRP assets as well as those installed under new smart grid programs.**
- **In this context, the objective is to identify and map the synergies in the infrastructure created under R-APDRP with the requirements for smart grid applications**



R-APDRP Synergies with Smart Grid

Supervisory Control and Data Acquisition and Geographic Information Systems

Combined with Advanced Metering Infrastructure (AMI) allows

- Visibility over the entire network, identify faults or outages faster, initiate remedial action and manage the workforce and assets effectively through Outage Management System (OMS)

Metering, Billing, Customer Management Solutions

Combined with AMI system enables

- Remote connect disconnect of smart meters installed at customer premises for part or full load.
- This functionality facilitate in Demand Side Management (DSM), Peak Load Management (PLM) and controlling commercial losses

Asset and Maintenance Management

Can be enhanced to include condition based monitoring

- To initiate preventive action and ensuring optimal operational levels
- Also includes real-time work management i.e. work allocation and follow up with O&M crew, real time feedback of abnormal field conditions etc.

R-APDRP Synergies with Smart Grid cont.

- Capability of storing, processing and managing huge amount of data on real time basis.
- This data can be accessed by many applications like consumer indexing, asset mapping, identifying fault location, GIS etc.
- Smart meters will generate huge amount of data which needs to be stored, analyzed and visualized in real time for load management.

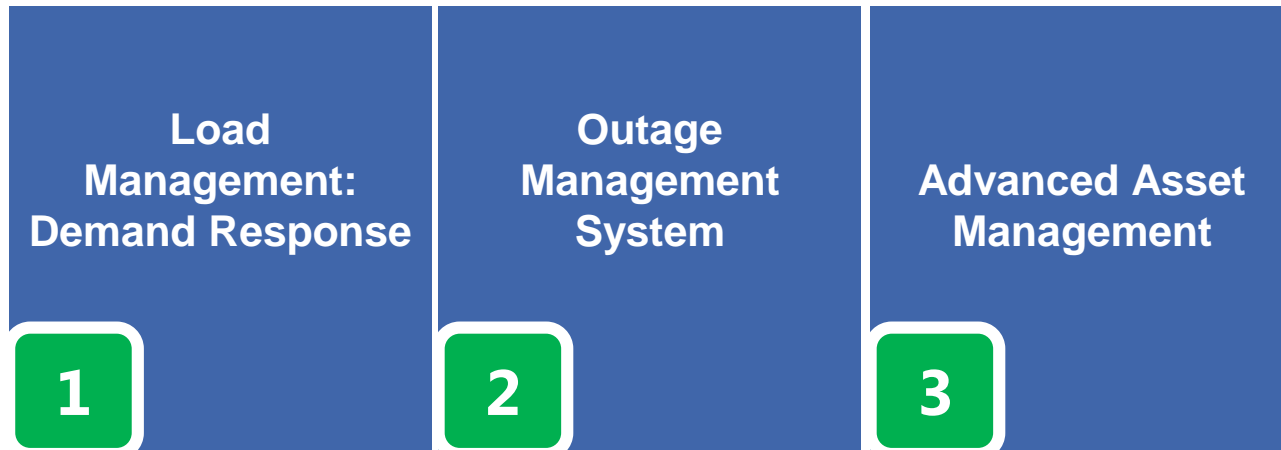
Data Centre

Energy Audit

- Smart meters enable more detailed and realistic audit of energy at substation, feeder, DT and end customer level
- With integration of GIS, consumer indexing and SCADA, AT&C losses can be identified and located on map

Use Cases

The following section maps the infrastructure and processes implemented under R-APDRP and identifies how with incremental infrastructure and services various smart grid applications can be initiated. This is explained through specific cases of:



Load Management And Demand Response (DR)

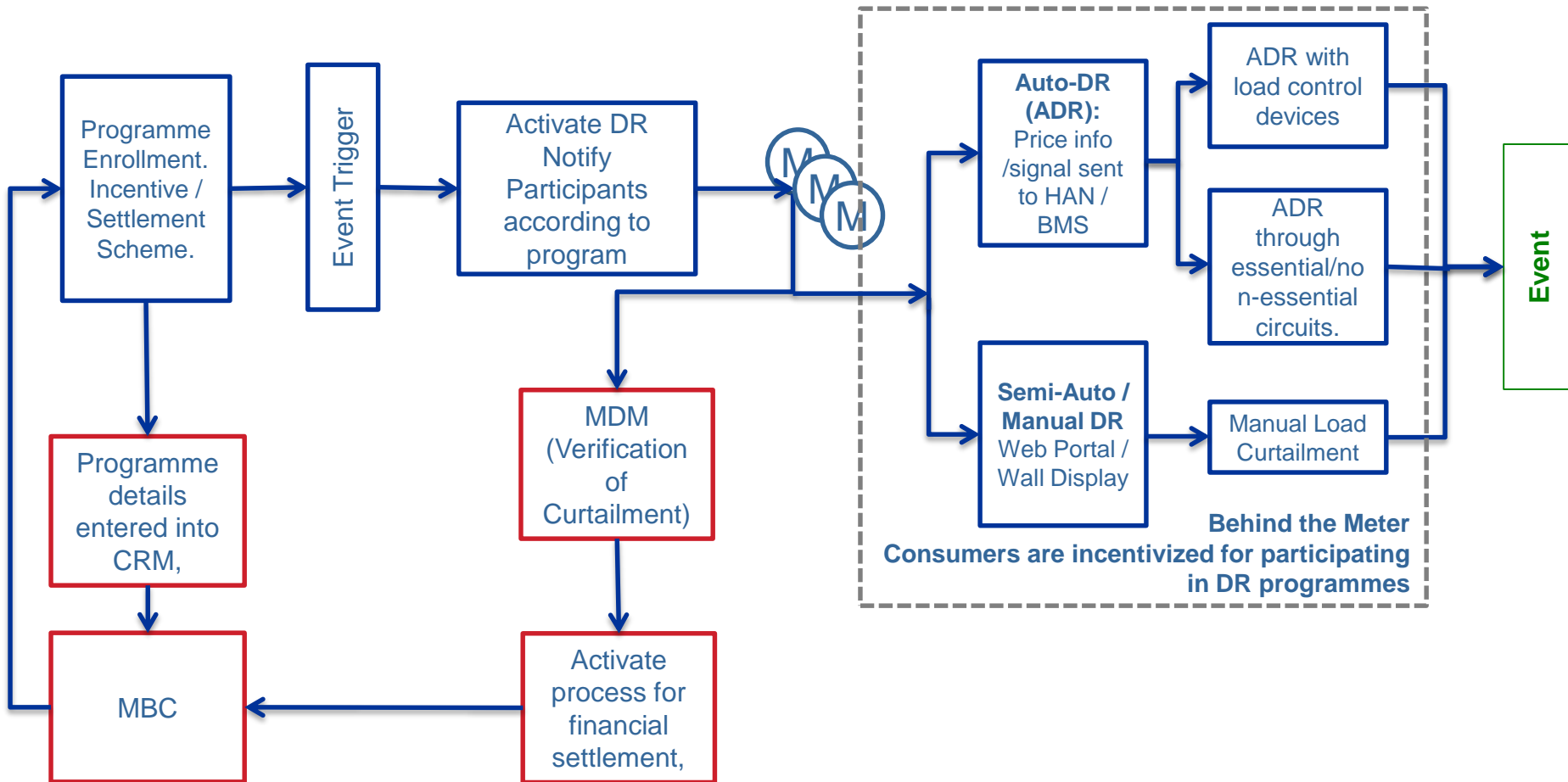
Smart Utility Goals

- Enhanced consumer satisfaction through load curtailment in place of load shedding
- Uniform distribution of load
- Reduction in the Cost of Electricity
- Save on the additional investment in capacity addition
- Environmental Considerations

Processes required to enable load management

- Consumer profiling
- AMI/Integrated BMS (Building Management System) /HAN (Home Area Network) for automated DR systems
- Program design and consumer enrollment.
- Mechanisms for performance Measurement & Verification (M&V) and financial settlement.

DR Process: Activate DR through interruptible loads



- Red boxes = implemented under R-APDRP or available within existing procedures
- Blue boxes = additional smart grids requirement

Load Management And Demand Response (DR)

Functionality			R-APDRP	Need
Event Trigger	Demand/Price Forecasting	Required to predict 'hours of need'	Info from power purchase history and MDM (Meter Data Management)	Accurate demand, price forecasting.
	Aggregated DR Capacity Forecasting	Required to match demand with capacity	Info from MDM	Customer analysis and research.
Customer Interface	Customer Enrollment Program	<ul style="list-style-type: none"> • Incentive program • Contractual Agreement 	Functionality through CRM (Customer Relationship Management)	Incentive and Penalty scheme to be designed.

Load Management And Demand Response (DR) cont.

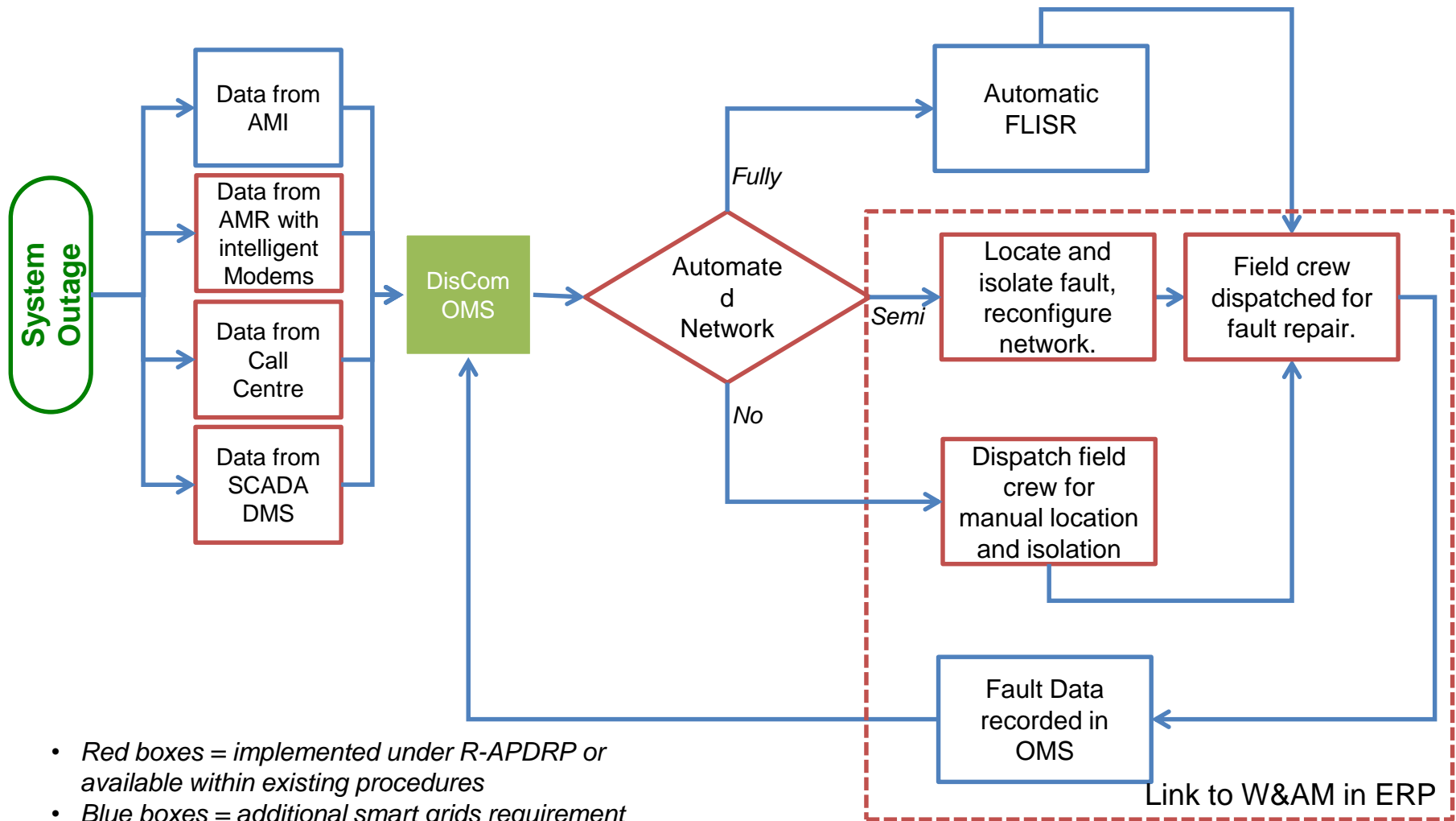
Functionality			R-APDRP	Need
Customer Interface	Event Management	<ul style="list-style-type: none"> • Scheduling • Notification of event (participation, commitment, start, finish etc.) 	Functionality through CRM	AMI/BMS Optimization calculations to understand magnitude, number and frequency of DR events.
Customer Interface	Measurement & Verification	<ul style="list-style-type: none"> • Calculation of Customer Base Line • Monitoring of performance during event. 	Data from MDM	Need to develop M&V e.g. calculation of customer baseline, verification of performance.
Customer Interface	Billing & Settlement	Monthly financial settlement including penalties for non-performance.	Through CRM and billing system	



Outage Management System

Smart Utility Goals	Processes required to enable OMS
<ul style="list-style-type: none">• Locating outages beyond sub-station level.• Performance improvement<ul style="list-style-type: none">✓ Response time✓ Restoration time✓ SOP Regulations Compliance• Process for restoring outages.<ul style="list-style-type: none">✓ Network configuration✓ Dispatching crew/equipment	<ul style="list-style-type: none">• Fault Location, Isolation & System Restoration<ul style="list-style-type: none">✓ Network configuration to enable automation and self-healing characteristics✓ AMI: real-time information on outages incorporating whole network and control features etc.• Workforce & Asset Management

Outage Management System Processes



- Red boxes = implemented under R-APDRP or available within existing procedures
- Blue boxes = additional smart grids requirement

Outage Management System

Functionality	R-APDRP	Need
Network Visibility	GIS Asset Mapping & Consumer Indexing	Visibility at consumer level
Real time fault location	SCADA at substation level. (for qualifying towns)	No option for remote fault location at consumer level. Relies on calls into call center and crew locating fault based on data received at call center. AMI at consumer level will support this requirement.
Near real-time fault isolation	Fault isolation to substation/11kV level through substation automation provided as part of R-APDRP Part B	No option for remote fault isolation beyond substation level (DT/Consumer). Relies on crew manually isolation fault. AMI at consumer level will support this requirement.

Outage Management System

Functionality	R-APDRP	Need
<p>Near real-time system restoration</p> <p>(Crew dispatch and fault repair)</p>	<p>In some instances networks have been upgraded to ring systems with some level of automation and possibility of network reconfiguration.</p>	<p>Full network automation required. AMI at consumer level with self healing characteristics</p>
	<p>In some instances this function (Workforce and Asset Management) exists within the ERP</p>	<p>W&AM/ERP to be integrated with OMS.</p>

Advanced Asset Management

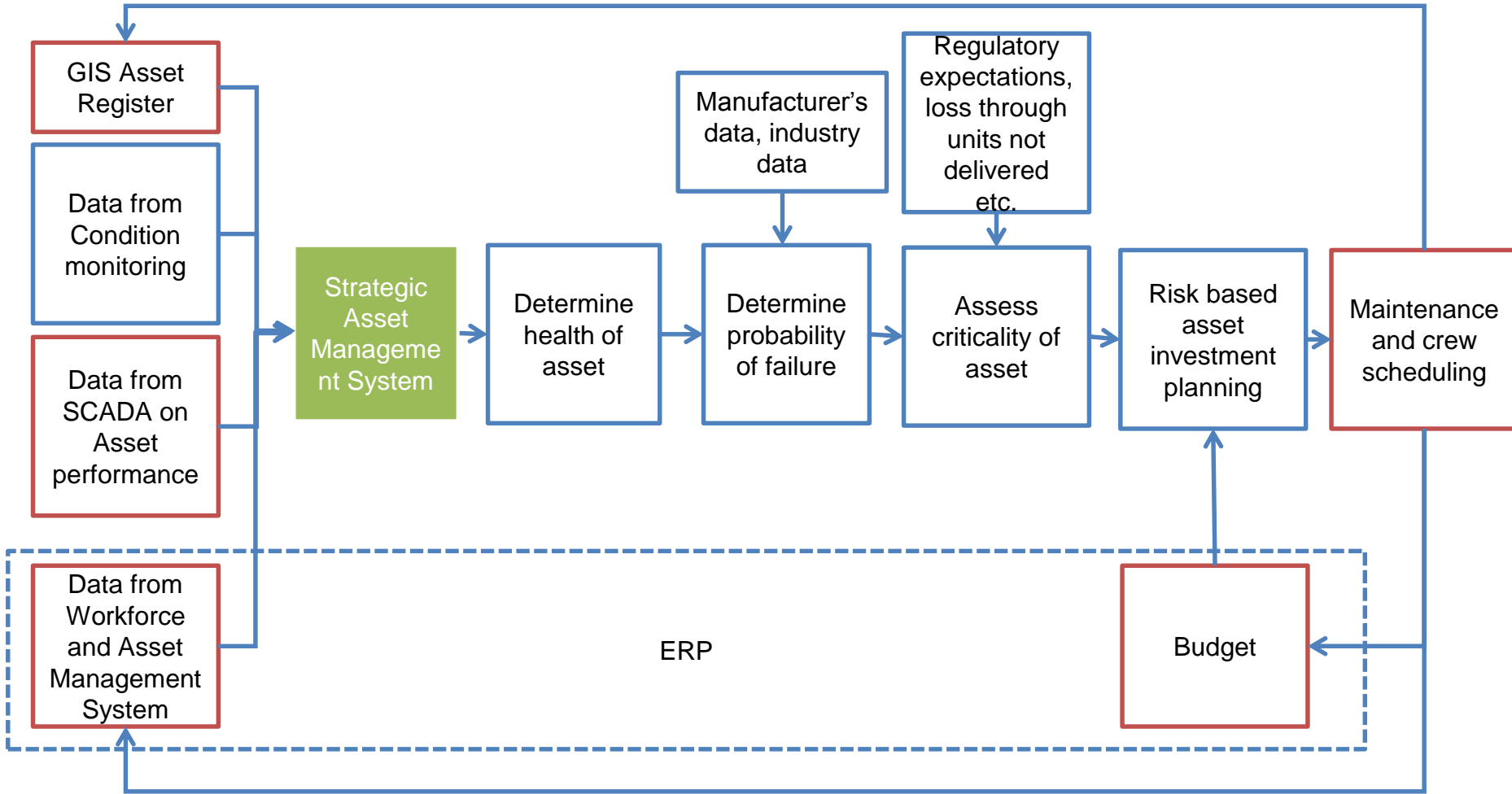
Challenges faced by Discoms to meet the Smart Utility Goals

- High cost of O&M
- Inadequate Asset Records
- No system for managing assets according to criticality/risk
- No means for reporting performance.
- Limited track record of past maintenance, repair and/or overhaul

Processes required to enable advanced asset management

- Performance Monitoring & Reporting
 - ✓ Asset Condition Monitoring
 - ✓ Asset Health Assessment
- Risk Assessment
- Resource Planning
 - ✓ Asset Replacement
 - ✓ Maintenance
 - ✓ Workforce management

Advanced Asset Management Processes



- Red boxes = implemented under R-APDRP
- Blue boxes = additional smart grids requirement

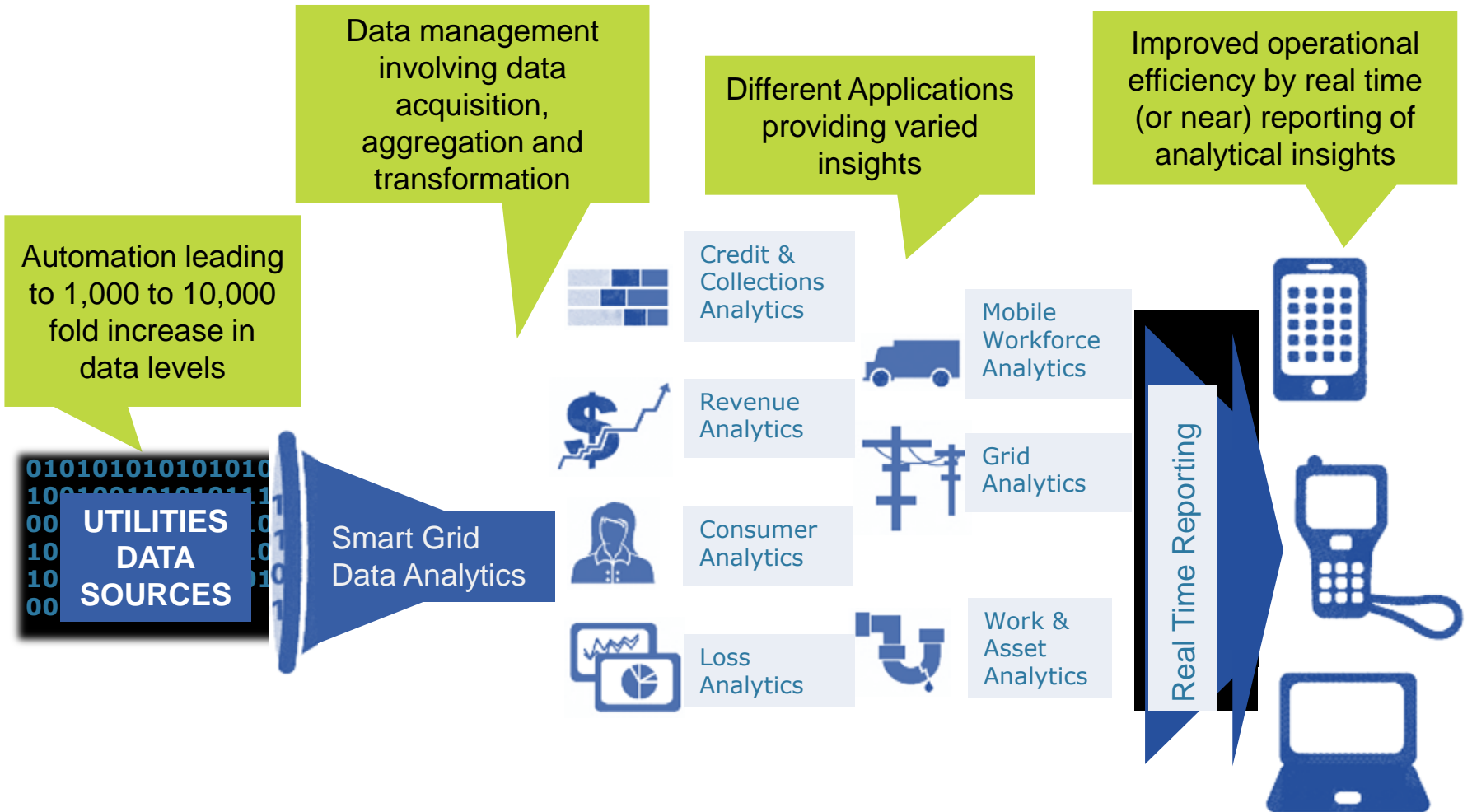
Advanced Asset Management

Functionality		R-APDRP	Need
Asset Data	Asset register/Location	GIS Asset Mapping	
	Asset Operational History/O&M cost	Data from SCADA and W&AM in ERP	-
Asset Health	Asset Health	-	Ability to determine condition based on all sources of information
	Probability of failure		Statistical knowledge based on condition
	Expected lifetime of asset		Statistical knowledge based on condition and manufacturer's information

Advanced Asset Management

Functionality		R-APDRP	Need
Risk of Failure	Criticality of the asset / Financial Risk	Information on technical losses available	<ul style="list-style-type: none"> • Estimated loss of revenue should the asset fail • Regulatory penalty related to outage frequency/ time should the asset fail (SoP Regulations)
	Prioritization of assets for maintenance and replacement	-	Calculation on priorities for maintenance and replacement based on probability, risk and cost of failure.
Asset Investment Planning	Maintenance planning and asset replacement strategy according to budget availability and priority	Budgets available through Scheduling available W&AW ERP. in	Priority maintenance schedules and asset replacement strategy according to budget availability.

Smart Grid Analytics



Systems generate data but Actual Decision making comes through analytics



Way Ahead

- **The R-APDRP has laid a strong foundation for discoms to introduce information and communication technology to manage their business operations and networks transparently and more efficiently**
- **Going beyond R-APDRP and ascending towards Smart Grid would require discoms to clearly formulate their Smart Grid strategy.**
- **Discoms who have successfully implemented R-APDRP are in a good overall position to start their Smart Grid journey by leveraging infrastructure deployed under R-APDRP for Smart Grid initiatives.**



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THANK YOU