Questionnaire for Stakeholders



Infrastructure: Power and IT

Distribution

End Consumer

Bulk Generation

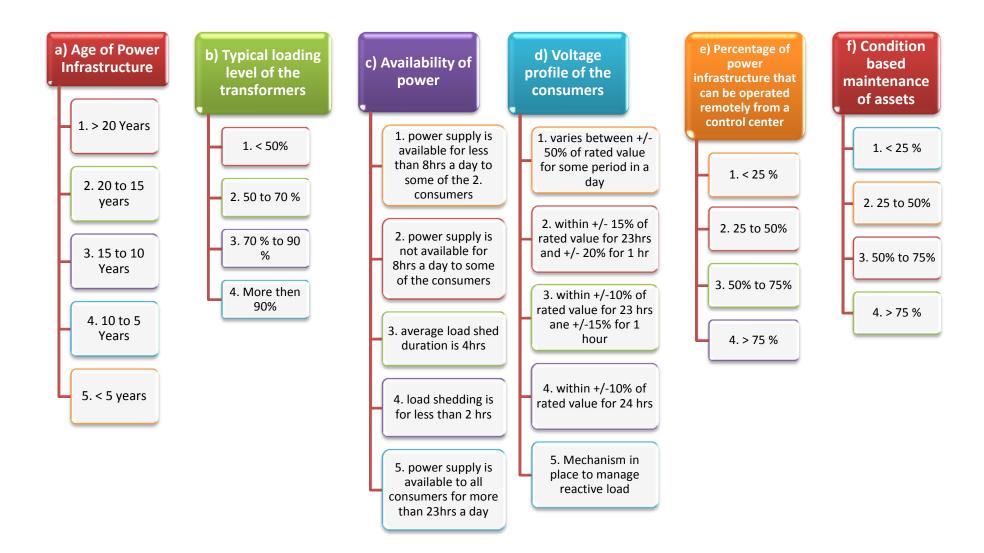
Transmission

Renewables

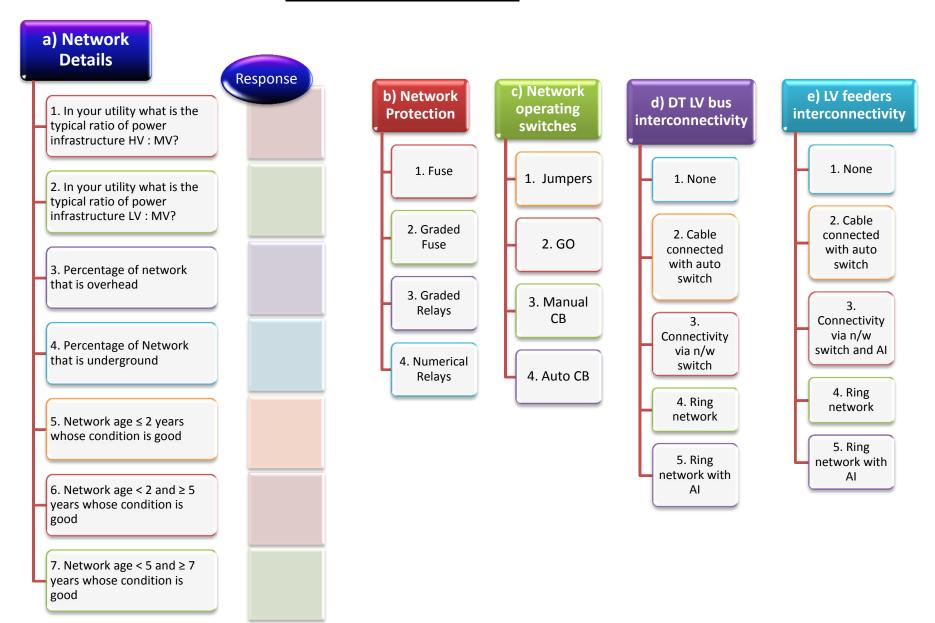
Infrastructure

1.1 Infrastructure

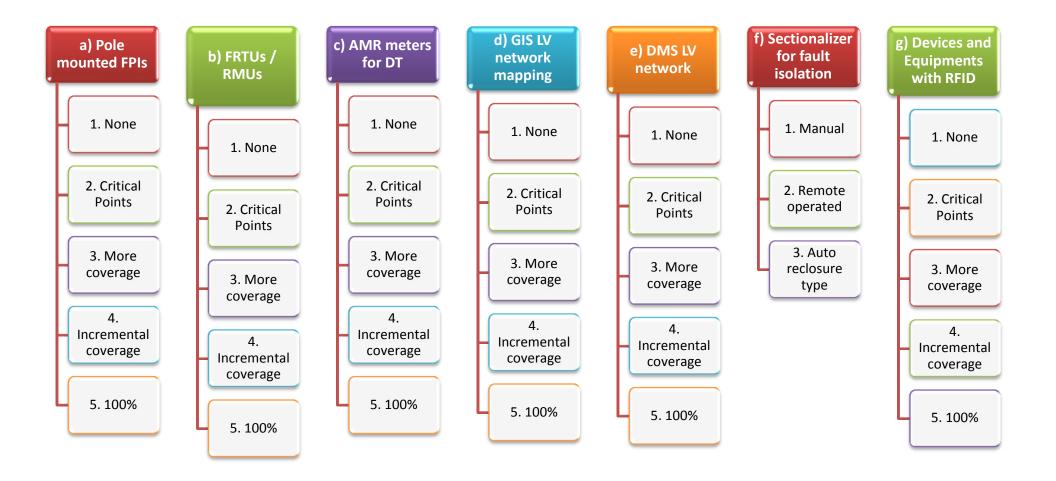
1.1.1 Power Infrastructure



1.1.2 Power Infrastructure

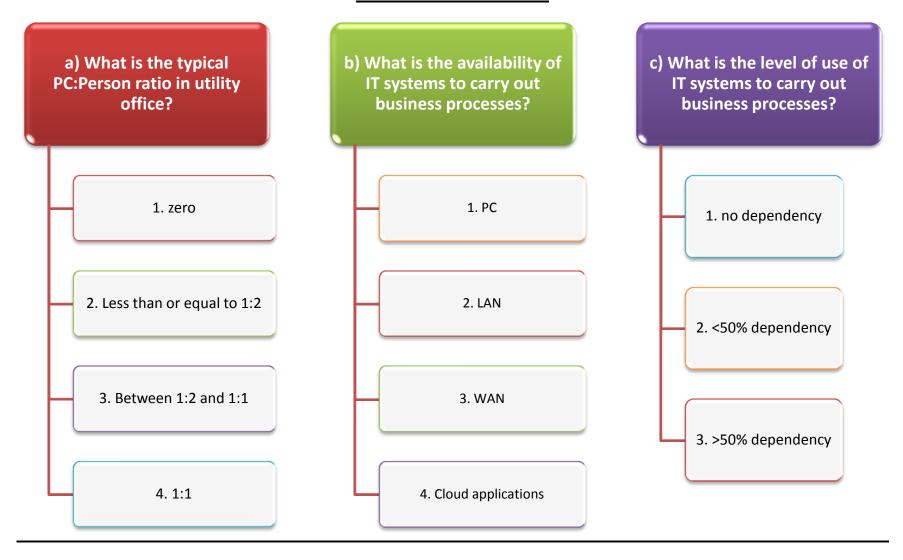


1.1.3 Power Infrastructure



1.2 Infrastructure

1.2.1 IT Infrastructure



Distribution

2.1 Distribution

a) Meter Reading

- 1. Basic meters which record the units of energy consumed. The meters are read physically by meter readers.
- 2. Automated Meter Reading (AMR) is deployed. All the meters are read via hand held units or drive-by vehicles, which transfer data to the control centre on synchronization.
- 3. AMI is deployed. All the meter readings are read regularly (say, every 15 min) remotely and the data is logged on a central server where it can be used for billing as well as supporting DR event in real time for'Negawatt' generation.

b) Tariff Schemes - Timeof Use TOU/Critical PeakPricing (CPP) etc.

- 1. A simple fixed flat rate tariff is used which is multiplied by the no. of units consumed to get the bill amount.
- 2. The consumption level is divided into slabs and the tariff rate changes as the slab changes
- 3. Basic time of use (ToU) tariff implemented with pre-defined time blocks in the day and the applicable tariffs known to users in advanced.
- 4. Along with the ToU, critical peak pricing (CPP) is also implemented and during the peak periods the prices are communicated to the consumer.
- 5. Time of Use (ToU), critical peak pricing (CPP) tariff mechanisms are implemented. The realtime time prices are displayed on the smart meter, based on which the consumer can resechdule the demands.

c) Power quality & Reliability - Power Quality Management (PQM)

- 1. No system
- 2. Voltage profile available for DTs
- 3. Voltage profile for all DTs and harmonics levels at select DTs
- 4. Corrective actions are taken manually on near real time basis
- 5. Automated system for quality control

d) Energy Accounting/Audit (EA)

- 1. No mechanism
- 2. Ring fencing done for energy audit
- 3. Energy Audit on periodic basis
- 4. Energy Audit to identify theft on regular basis
- 5. System established for real time energy audit that captures the network reconfigurations

2.2 Distribution

a) SCADA/Distribution Management System (DMS)

- 1. There is no SCADA center for the discom.
- Basic SCADA system is inplace and it is configured to receive the metering data from the field and display it accurately for monitoring.
- 3. The control feature is added to the SCADA system, where in the operator from SCADA center control room sends remote commands to reconfigure the distribution network.
- 4. The DMS system is integrated with SCADA system and the network is extracted from SCADA system to DMS for off-line planning and scheduling purposes.
- 5. SCADA and DMS systems are integrated and process the distribution network model in near-realtime. Measures to operate the system securely and reliably are defined from analysing the model and system is operated accordingly.

b) Outage Management System (OMS)

- Outage management is not implemented. The information about outage of any element is known to the operator when the customer complains.
- 2. The end consumer is mapped to the distribution transformer (DT) and feeder from where the supply is received. This helps in faster identification of outaged component.
- 3. The information of any outage event is extracted from the SCADA system and is processed by outage mangement system to quickly determine the outaged sections of the network.
- 4. Technologies such as auto-reclosures installed to restore power in case of minor disturbances. In case of persistent faults, the restoration workforce team is alerted for immediate action to initiate system restoration.
- 5. OMS system is fully implemented and integrated with the GIS, SCADA and DMS systems. Accordingly, the outage of any part of the network is known through the metering and suitable corrective actions are carried out.

c) Demand Side Management (DSM)

- 1. No Demand Side Management mechanism in place.
- 2. DSM based on day ahead forecasting and scheduling.
- 3. Utility signs agreement with user for remote control (cutoff supply during peak periods) of certain loads by utility(meters facilitated with remote connect/disconnect feature); superceding the load curtailment by user not allowed.
- 4. Utility controlled DSM. Superceding the load curtailment by user allowed.
- 5. Integration of DSM and operation of the distribution generation (DG).

d) Demand Response (DR)

- 1. There is no concept of DR.
- 2. Basic DR is implemented with utility announcing the prices during the peak hours and off peak hours.

 Accordingly the consumer is expected to shift load to off peak hours.
- 3. DR is automated and the smart meter at the customer premises receives the price signal and accordingly controls the home appliances.
- 4. More advanced version of DR is implemented where the effect of shifing of the loads on prices is also considered and the overall optimization
- 5. Full fledged DR system for the entire distribution grid, integrated to the SCADA and DMS system to identify the most optimal source of DR to use for stable and reliable operation of the grid.

2.3 Distribution

a) Load Forecasting

- No load forecasting.
 The expected load is predicted based on the similar day approach from historical data.
- 2. Basic forecasting tools such as time-series analysis, regression models are used to predict the load.
- 3. Forecasting methods to improve the accuracy, by integration of various other sources of data such as weather.
- 4. Forecasting methods incorporating error correction techniques.
- 5. Advanced load forecasting algorithms implemented, with long term and short term forecasing of the demand.

b) Connection Management

- 1. consumer physically goes to designated utility office to apply for connection
- 2. consumer goes to any of the utility's office physically to apply for connection
- 3. consumer can online apply and submit at the nearest convenient utility office.
- 4. consumer can submit applications online
- 5. consumer can select utility from where s/he wants connection

c) Asset Management

- 1. No proper asset management strategy.
- 2. Identifying the critical equipment items and systems.
- 3. Maintaining an updated database of all the assets and critical maintenance parameters.
- 4. Asset Management Database integrated with other system applications.
- 5. Proper Policies like Safety Policy, Inspection Policy, Maintenance Policy, Competency Policy in place.

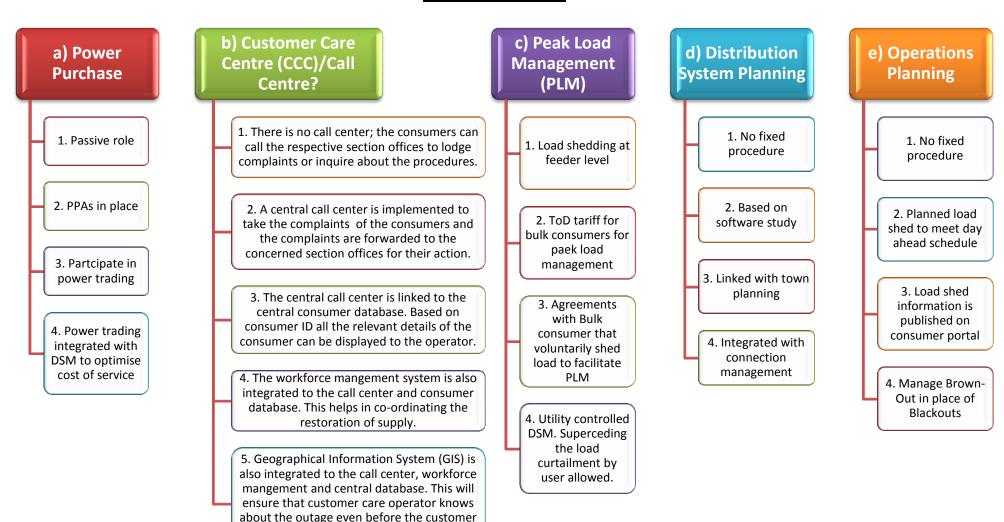
d) Field Work and Workforce Management

- 1. Manual registers
- 2. computerised MIS
 - 3. Web based applications
- 4. System generated alerts for field work and workforce management

e) Storage

- 1. No storage
- 2. storage associated with renewable generation
- 3. distributed storage that can be remotely controlled
- 4. EVs for storage and pumping energy into grid to manage peak load

2.4 Distribution



calls, and is able to mention when the supply can be restored.

End Consumer Perspective

3.1 End Consumer Perspective

a) Connection Management

- Consumer physically goes to designated utility office to apply for connection
- 2. Consumer goes to any of the utility's office physically to apply for connection
- 3. Consumer can go online to access application and submit the same at the nearest convenient utility office
- 4. Consumer can submit applications online.
- 5. Consumer can select utility from where s/he wants connection.

b) Commercialbilling and payment

- 1. Physically visit the discom and pay the bill at a cash counter.
- 2. Consumer can login to the discom secure website and view the current bill and the past few months bills.
- 3. Consumer can view and pay the bill online using various secure payment options.
- 4. The consumer can choose the billing cycle as per weekly, monthly or bi-monthly as per his/her convenience. The consumer can log-in, generate bill and pay.
- 5. Pre-paid payment of the bills, with meters equipped with remote disconnect and connect switch based on the amount of balance available.

c) Electricity supply reliability and Quality

- 1. There are no reliability or quality parameters assigned to the supply except for the minimum and maximum parameters.
- Reliability and quality parameters are identified and being calculated.
- 3. Stricter grid codes introduced with tighter limits on quality parameters such as voltage, total harmonic distortion (THD), flickers, dips etc.
- 4. Reliability indicies such as SAIFI and SAIDI (including load shedding), voltage profiles at DT are evaluated based on the historical data and reported from time to time.
- 5. The reliability and quality of supply are continously monitored in realtime and the stakeholder is alerted when a predefined quality parameter limit has been crossed.

d) Energy efficiencyand consumption pattern management

- 1. Consumer receives a monthly bill which is the only source of information on total units consumed, bill amount and due date.
- 2. Consumer gets detailed report of consumption at the end of the month.
- 3. Consumer gets weekly, daily, and even real-time consumption information on dynamic and secure webpages after logging in.
- 4. Consumer can buy / subscribe to various third party energy efficiency analytics applications to manage his/her electicity consumption for minimizing the bill.
- 5. When the consumer moves from one house to other house, s/he can retain the consumer ID and hence the past data follows to the new house and new meter.

3.2 End Consumer Perspective

a) Web Self Service

- 1. No Web Self Service facility.
- 2. The consumer can access a static website of the utility providing information about services and downloable forms.
- 3. The consumer can create an online account with unique ID where the consumption information of the consumer is shown securely.
- 4. The consumer gets a range of facilities for accessing and analysing the consumption data and other services.
- 5. Complete facility of online web-self service of all activities related to purchase, consumption, injection, metering, billing and payment, with out need for visiting any office.

b) Prosumers

- No facility for consumer to produce and inject power into grid.
- 2. Consumer can install renewable generation sources such as PV, fuel cell or Wind and start using for local consumption.
- 3. Installation of sufficient capacity of local generation and storage. Installation of metering and protection equipment to support bi-directional flow of power.
- Regulatory and commercial provisions in place for injection of power in to the grid at LV level.
- 5. Scenario where consumer fully becomes a prosumer and is freely able to generate power and on need basis exchange power with the grid.

c) Demand Response

- 1. No demand response. The end consumer does not participate in a DR.
- 2. Home automation system based on time of the day price signal/supply frequency received by smart meter from utility.
- 3. Facility for direct control of home appliances with signal from utility, based on predefined settings from consumer.
- 4. Building automation system to carryout demand response at building level, with scope of larger amont of DR capability.
- 5. Integrated operation of home automation system, building automation system, direct control of home appliances by utilities depending on predefined settings.

d) Electricity Purchase - contracts/Open Access : realtime purchase

- 1. There is no open access contract. The consumer gets power from the discom on a defined tariff.
- 2. The consumer has choice of buying power for the billing period between competing retail distribution companies.
- 3. The consumer can shift between the retail companies depending on the short term prices offered by all.
- 4. The consumer can make bilateral contracts with distant generators and the distribution company is paid only the power transmission service charges.
- 5. The consumer can enter contracts for purchase of power under open access through an online market platform.

3.3 End Consumer Perspective

a) Local Storage (Inverter/Battery)

- 1. The consumer does not have any storage.
- 2. The consumer has inverter & battery to meet household demand during power cuts.
- 3. The consumer has excess capacity of inverter & battery and can also supply to a few neighbours during power cuts.
- 4. The consumer can enter into contract with discom to supply stored energy back to the grid to meet the peak demand.
- 5. The consumer also adds local renewable generation to the inverter & battery to achieve self sufficiency and have limited exchange with the grid.

b) Load Research

- 1. The consumer only sees the total consumption as a single number in the electricity bill generated at the end of the month.
- 2. The consumer gets a detailed report of the daily / hourly consumption with the electricity bill.
- 3. The consumer carries out certain scheduling and planning activities based on the consumption pattern to reduce the bill.
- 4. The consumer receives realtime data of consumption pattern on an in-home display panel along with the meter.
- 5. The consumer runs realtime analytics on the consumption of power with objective of optimizing the energy usage of the household in a most cost effective way.

c) Electrification

- 1. Access of power to less than 50% of households.
- Various programs in implementation to extend electrification to remote areas in phased manner.
- 3. Use of micro grids and renewable sources for supplying remote villages far from grid.
- 4. Provision of connectivity of the isolated microgrids to the grid for increased reliability.
- 5. 100% elecrification of all villages and households with power supply for more than 22hrs each day.

d) Pre-payment

- 1. No facility of prepayment.
- 2. Pre-payment facility available for select consumers.
- 3. Pre-payment facility available for all consumers.
- 4. Switching between pre-payment and post payment options.
- 5. The consumer can pre-pay online and the smart meter monitors consumption against the balance and disconnects when the balance expires.

3.4 End Consumer Perspective

- a) Captive Power Generation Capacity Utilization/pump back into system
 - 1. No facility of bringing captive power to the grid. Captive power can only be used with in the consumer premises.
 - 2. Regulatory approval for pumping back of captive power into the grid. Installation of metering infrastructure for supporting bi-directional flow.
 - 3. Consumer can enter into contract with utility to sell excess power to the grid as per the availability of the power.
 - 4. Consumer can participate in demand response program where a certain capacity of captive power is allocated for providing DR functionality.
 - 5. The consumer can sell the captive power through online realtime market.

- b) Demand SideManagement (DSM)with DistributedGeneration (DG)
 - 1. No Demand Side Management mechanism in place.
 - 2. DSM based on day ahead forecasting and scheduling.
 - 3. Utility signs agreement with user for remote control (curtail supply during peak periods) of certain loads by utility(meters facilitated with remote disconnect feature); superceding the load curtailment by user not allowed.
 - 4. Utility controlled DSM.
 Superceding the load
 curtailment by user allowed.
 - 5. Integration of DSM and operation of the distribution generation (DG).

- c) Local Generation load balancing: near off grid
 - 1. No mechanism of load balancing of local generation and load.
 - 2. Basic infrastructure such as SCADA system in the large (industrial) consumer premises to monitor the load and generation scenario in realtime.
 - 3. Preliminary EMS functions to manage the local generation or load. Storage systems would be useful for such cases.
 - 4. The combined operation of generation facilities (typically from multiple renewable sources) and loads in the form of microgrid.
 - 5. Integration of local generation and load balancing system and market platform, with the utility distribution management system for automation to achive optimization at the discom level.

Bulk Generation

4.1 Bulk Generation

- a) System Planning and Project Management
 - 1. Manual System
 - 2. Computerised MIS
 - 3. Standalone computer application
 - 4. Web based application for team collaboration
 - 5. Integrated application with external inputs from external stakeholders

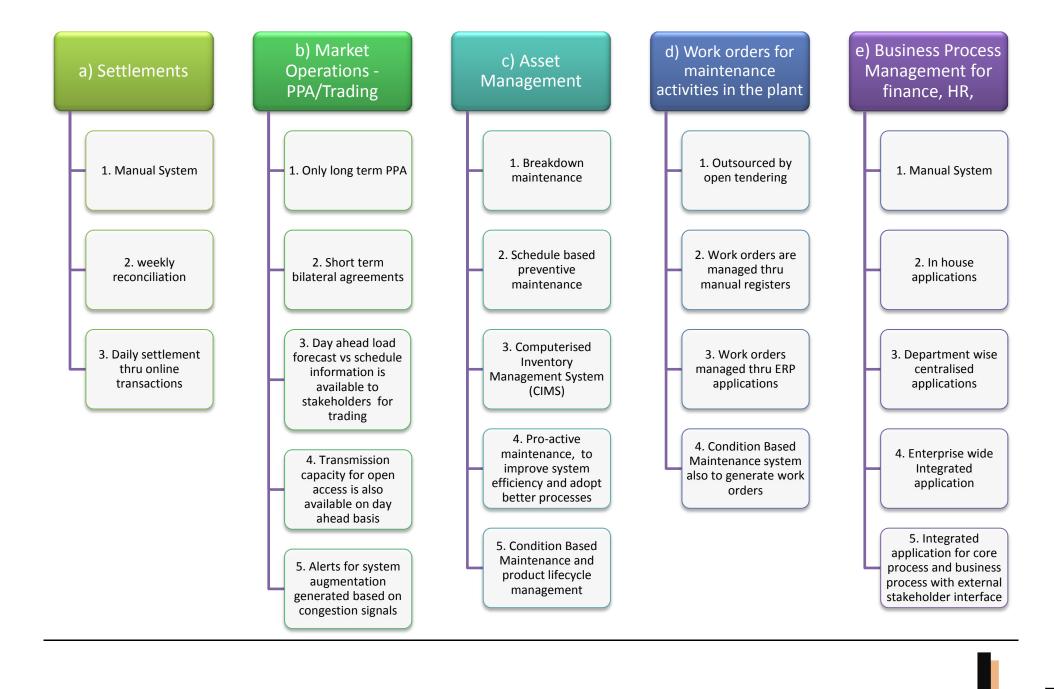
- b) Generation Management
 - 1. Generation is scheduled based on the availability of the generation unit and the fuel.
 - 2. Generation management done on the basis of cost to generate
 - 3. Generation scheduling is integrated with markets and scheduling and generation management is carried out with advanced analytics

- c) Generation Forecasting
 - 1. Manually based on past data
 - 2. IT application for forecasting
 - 3. BI tools for forecasting
 - 4. Integrated application with Weather forecasting inputs

- d) Plant Control System
 - 1. SCADA system in place in switchyard
 - 2. DCS/DDCIS in place
 - 3. All control systems are integrated with each other
 - 4. Centralised control system for the whole power plant
 - 5. Centralised Control system with ERP integration

4.2 Bulk Generation

a) Plant Performance b) Operationsc) Operation d) System Operation Scheduling **Management System** Planning 1. Based on the past 1. Carried out on the 1. PLF management 1. No scheduling data and forecasted basis of operator data. experience 2. Scheduling is based 2. Minimum target set 2. Carried out manually 2. PLF, Heat rate and on availabilty of by CEA, achieving on the basis of past efficiency management generation planned on maximum data day ahead basis 3. Monthly and annual 3. State estimation. 3. Carried out manually assessment of PLF, 3. Penalty mechanism voltage security on the basis of Specific oil in place for violation of analysis, contingency suggestions from the consumption, Auxilliary planned schedule analysis, recontrol system Consumption, Heat configuration for loss rate, Coal Quality reduction or reliability maximization 4. Scheduling based on 4. Carried out both real time basis with manually and 4. Cost to serve is optimisation of cost to automatically by the managed control system generate 5. Carried out 5. Cost to serve is automatically by the optimised with control system with an continuous option of manual improvements in override **Business Processes**



a) Operations Planning

- 1. On schedule basis including inputs from maintenance programmes
- 2. On schedule and real time basis
- 3. Planning and monitoring is automated, with manual control to exercise the plan
- 4. Planning,
 Monitoring and
 operation control is
 automated with
 provision for manual
 override
- 5. Follow merit order and conserve fuel by reducing or shutting down high cost generators including IPPs.

b) SCADA/Energy Management System (EMS)

- 1. There is no SCADA/EMS in place
- 2. Basic data
 acquisition system is
 in-place and it is
 configured to receive
 the remote data from
 the field and display it
 accurately for
 monitoring.
- 3. Both SCADA and EMS are in place, suggestions are received from the system for system control with operator exercising manual (telephonic) control.
- 4. SCADA/EMS in place with remote control facility to the operator
- 5. SCADA/EMS in place with software control along with remote control facility to operator

c) Sub- Station Automation (SSA)

- 1. All operations are manual
- 2. Auto reclosure is there
- 3. Breakers are controlled remotely
- 4. All operations are controlled remotely

d) Grid Stability

- 1. Manual system
- 2. SCADA system for monitoring
- 3. SPS for grid stability based on historical data
- 4. WAMS applications for optimal asset utilisation

e) Peak Load Management (PLM)?

- 1. Manual system
- 2. Under Frequency relays on transmission lines
- 3. Control like

 ABT

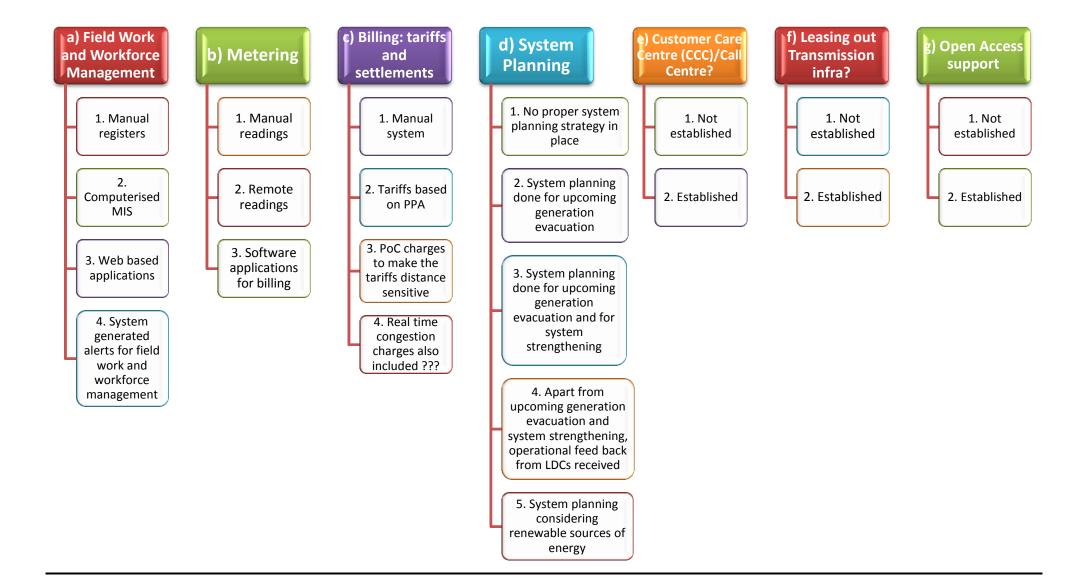
 mechanism

 for self

 regulation

f) Asset Management

- 1. No proper asset management strategy.
- 2. Identifying the critical equipment items and systems.
- 3. Proper Policies like Safety Policy, Inspection Policy, Maintenance Policy, Competency Policy in place.
- 4. Maintaining an updated database of all the assets and maintenance parameters .
- 5. Asset
 Management
 Database integrated
 with other system
 applications.



nellewable ilitegration

6.1 Renewable Integration

- a) Forecasting and scheduling?/storage
 - 1. Unpredicted
 - 2. Prediction accuracy less than 50%
 - 3. Prediction accuracy less than 70% and more than 50%
 - 4. Prediction accuracy more than 70%
 - 5. Generation and storage optimised to meet forecast prediction for more than 70% accuracy

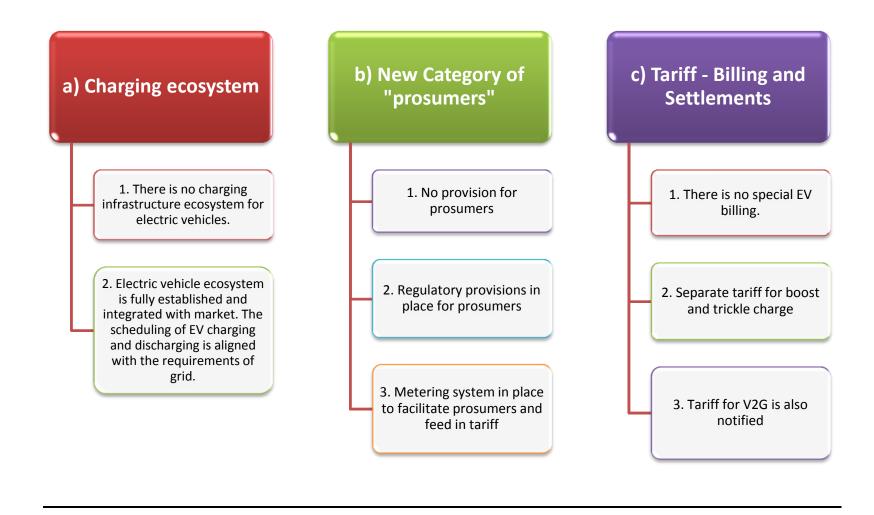
- b) Integration of Bulk and Distributed Generation -Network Stability
 - 1. Unmanaged
 - 2. Network Stability managed thru PMU based advanced analytics
 - 3. Network Stability managed by mapping the unpredictability of renewables thru precise load control via DSM

- c) Tariff schemes and incentives
 - 1. No tariff

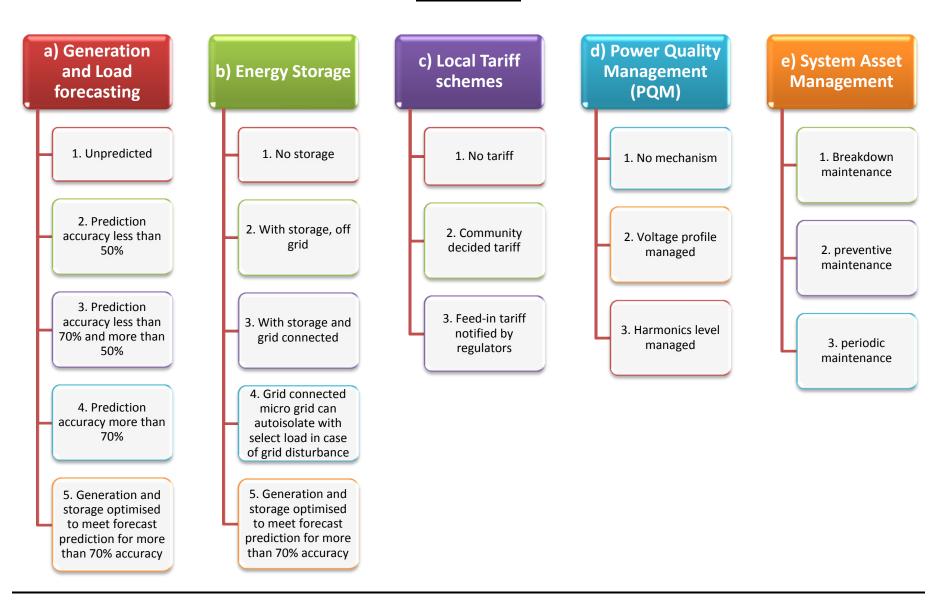
2. Feed-in tariff notified by regulators

6.2 Renewable Integration

Electric Vehicles



Micro-Grids



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