



# Case Study: Smart Grid In Indian Utilities

June 5<sup>th</sup>, 2017

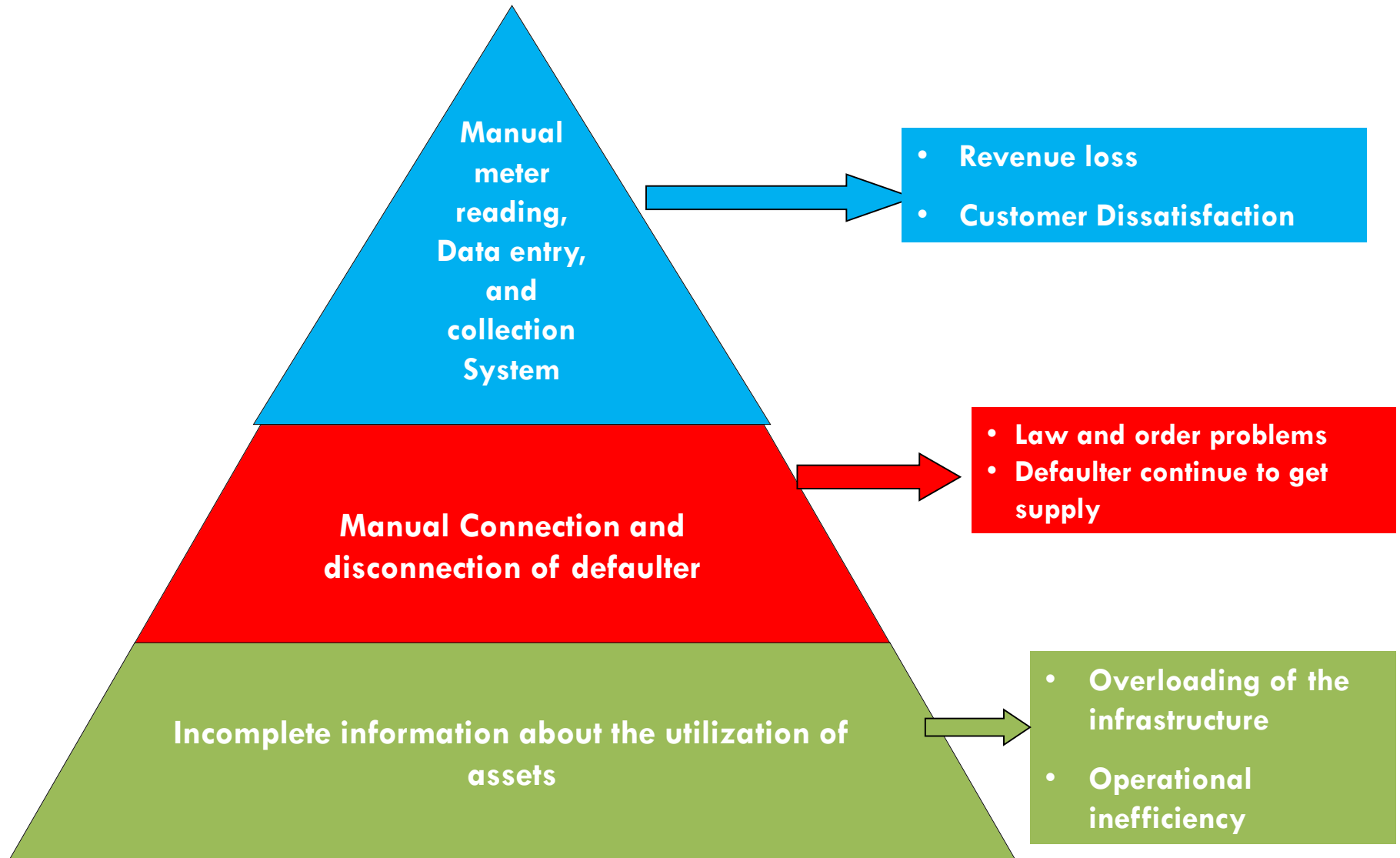


# Agenda

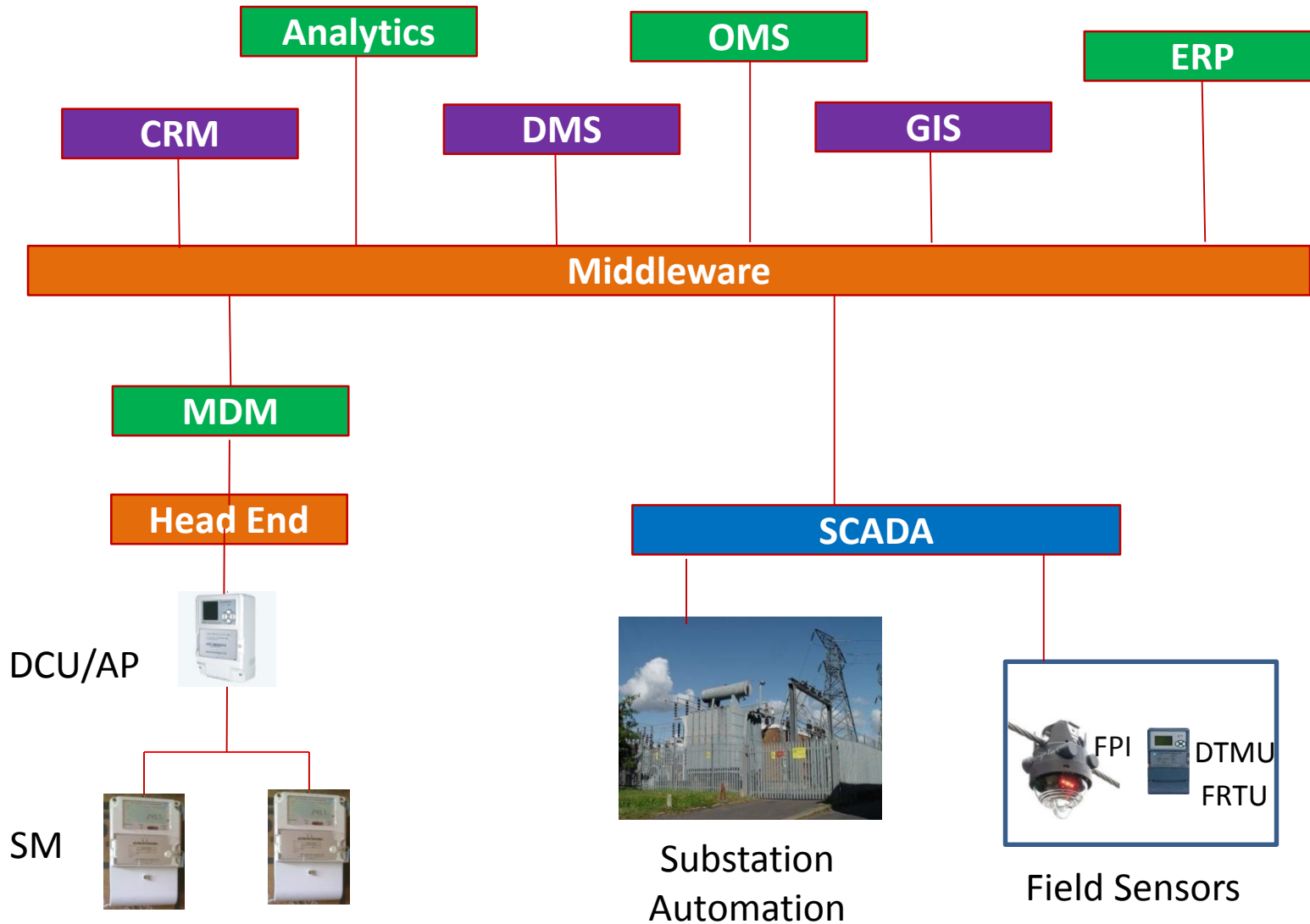


- Issues in utilities
- Solution
- Placement of sensors and communication
- Data analytics
- Process Change
- Benefits
- Capacity Building
- Challenges
- Enabling Measures
- Way Forward

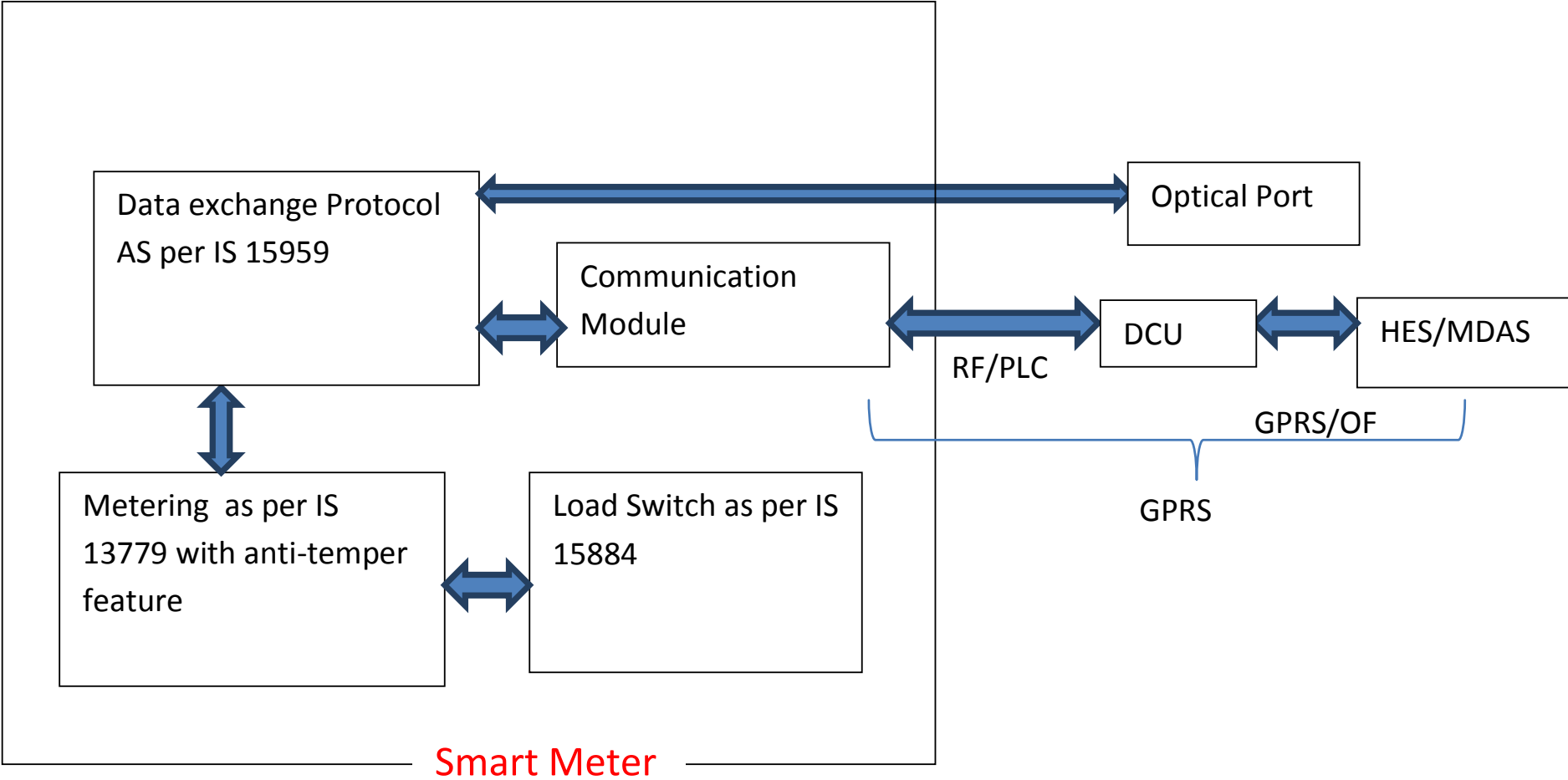
# Issues in Utility



# Solution Architecture



# Solution – Smart meter architecture

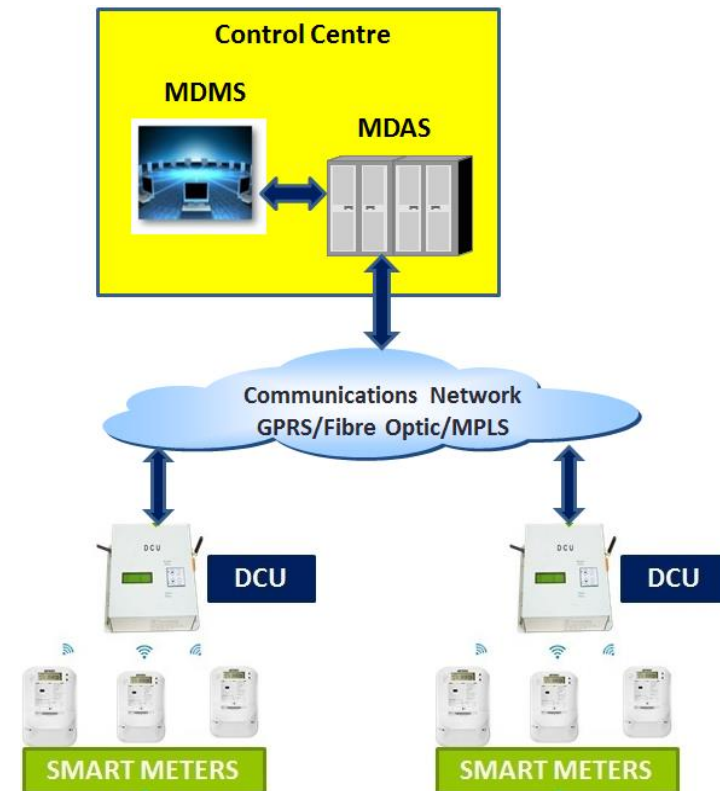


Indian Standard 16444

# Solution – Advanced Metering Infrastructure



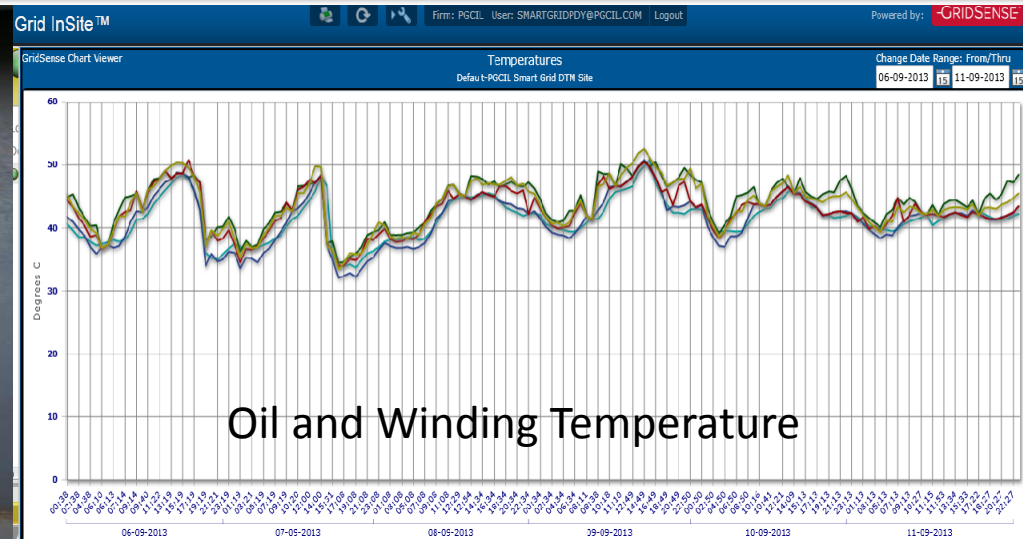
- Smart Meters connected to the control centre via a DCU. Facilitates real time:
  - Load curtailment – load switch in meter
  - Tamper alert
  - Push / pull of energy usage information
  - Remote firmware upgrade
- Smart Meters communicate to control centre using:
  - RF (free band 865-867MHz & 2.4 GHz)
  - PLC
  - GPRS





# Solution – OMS

- ✓ Distribution Transformer Monitoring Systems (DTMS) installed to monitor healthiness of the DTs
  - Oil temperature
  - Oil level
  - Winding Temperature
- ✓ Fault Passage Indicators (FPIs) (communicable / non-communicable) have been installed, receiving alerts at SGCC as well as mobile phones of maintenance crew



# Solution – Snapshot of Installation



Smart Meter



DT METER



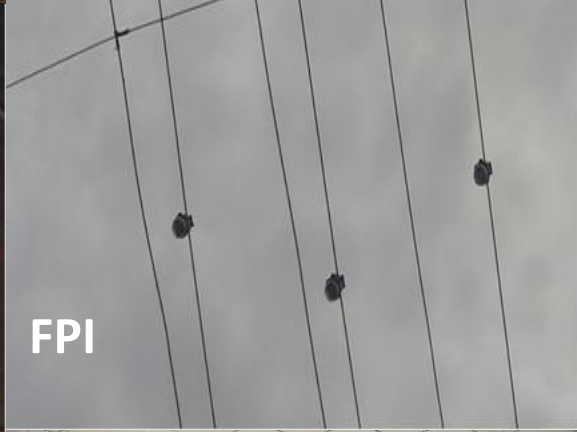
DTMU



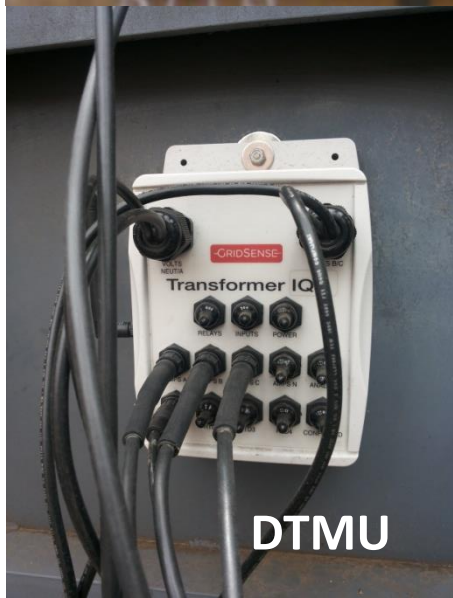
Street Light Automation



Gate way for FPI



FPI



DTMU



Solar power for FPI Gateway



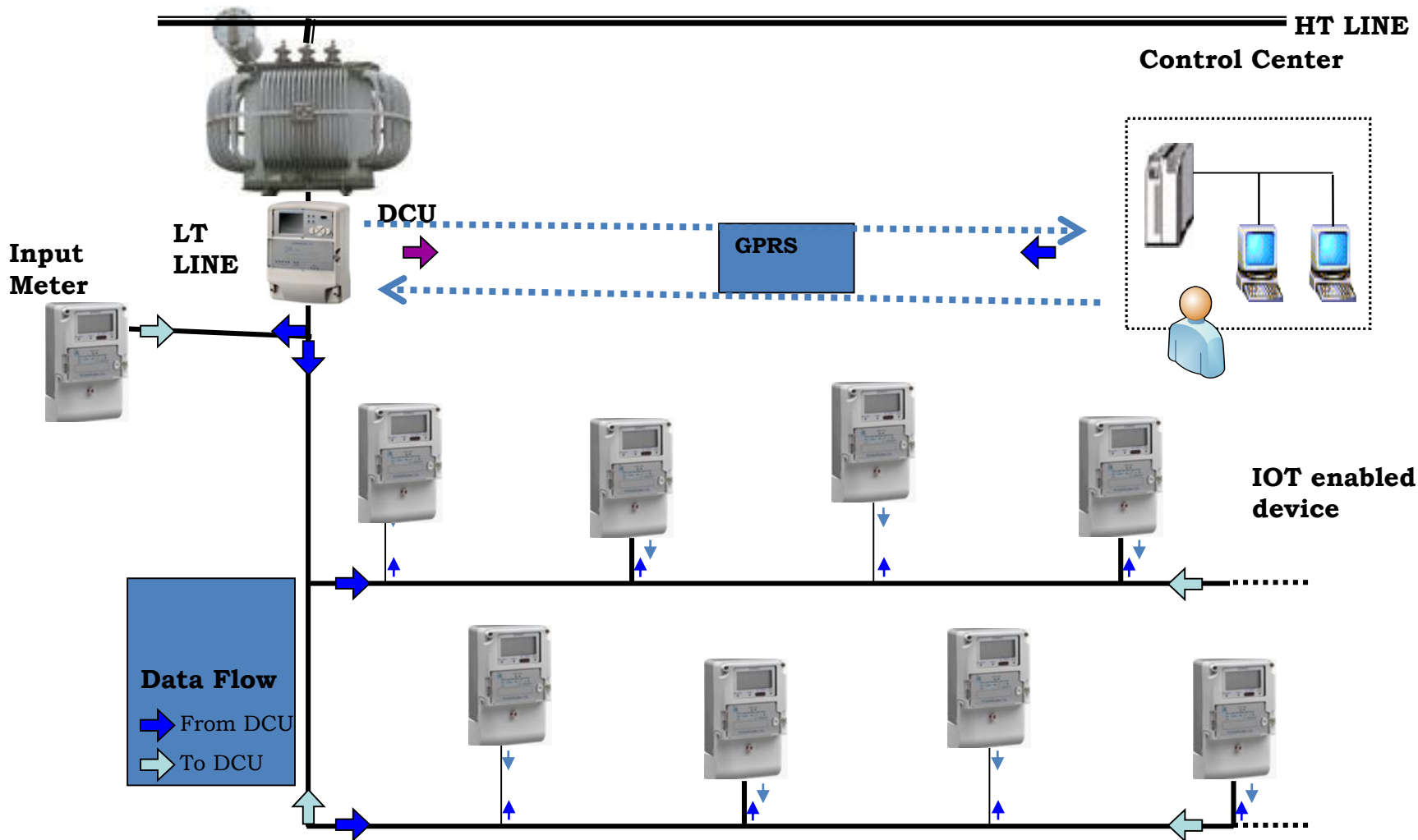
SGCC



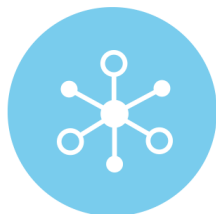
DCU



# Placement of sensors and Communication



# Data Analytics



Integrate



Analyze



Visualize

Dashboard Load Monitoring VEE Billing MDMS Services Alarms Management Analytics Reports DR Configure

AMI Status normal | 18921496 : LoadThroughEarth | 18921481 : LoadThroughEarth | 18921497 : LoadThroughEarth is tampered

## Load Monitoring

Marapalam 110 KV » Town 22KV » **DAT-1** » **M00810004**

Export to Excel Pdf Print

**Change Electric Location**

A2Z
Agnitio
AMITech
Capital
CG
HPL
iTron
JNJ
WinAMR

Today Hourly Week Month Year Billing

<< Prev Next >>

### 15-12-2013

Time Period	KWh
12:00 AM	0.35
01:00 AM	0.15
02:00 AM	0.15
03:00 AM	0.15
04:00 AM	0.15
05:00 AM	0.25
06:00 AM	0.20
07:00 AM	0.50
08:00 AM	0.45
09:00 AM	1.05
10:00 AM	0.80
11:00 AM	0.35
12:00 PM	0.20
01:00 PM	0.15
02:00 PM	0.15
03:00 PM	0.10
04:00 PM	0.05
05:00 PM	0.05
06:00 PM	0.40
07:00 PM	0.55
08:00 PM	0.20
09:00 PM	0.25
10:00 PM	0.15
11:00 PM	0.15

### Customer Details

Policy # 07-35-04-306A  
 Name Mr. Murugan.C  
 Address No.17,Middle Street,New Saram,Puducherry-605013

### AMI Status

	Total	Active	Disconnected
	44	44	

Marapalam 110KV » Town 22KV » DAT-1 » M00810004

	Today   16-12-2013	This Week	This Month
<b>Usage</b>	<b>4.3 kWh</b>	<b>11.5 kWh</b>	<b>94.1 kWh</b>

MD :N/A  
MD Timestamp : N/A

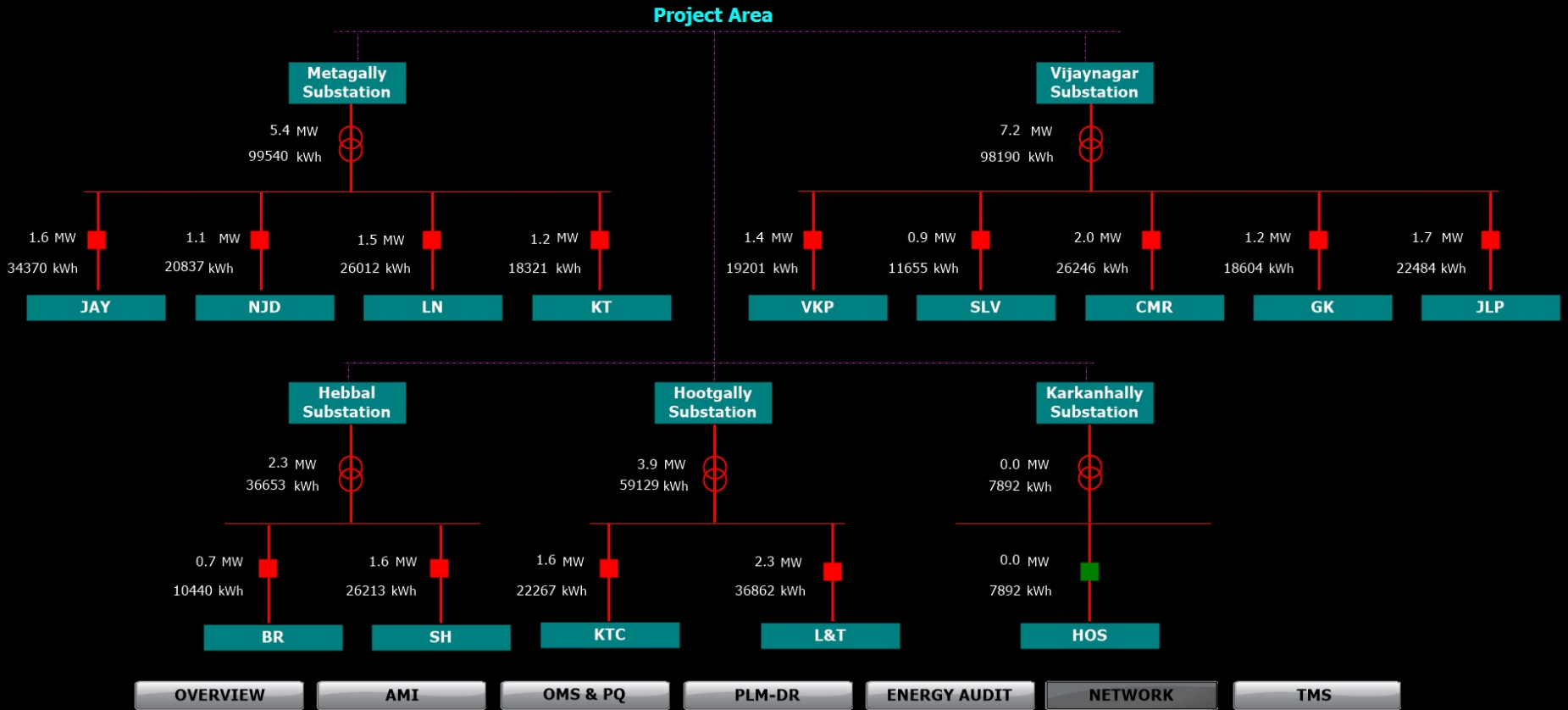
Power Status Normal

- Normal
- Under Curtailment
- Outage

# Data Analytics



## Network Hierarchy



Alarm Description	Time ON	Duration	Condition
Hosakote Feeder Tripped	30-12-2016 18:27:11		ON

# Data Analytics



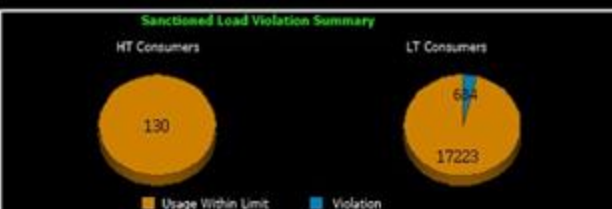
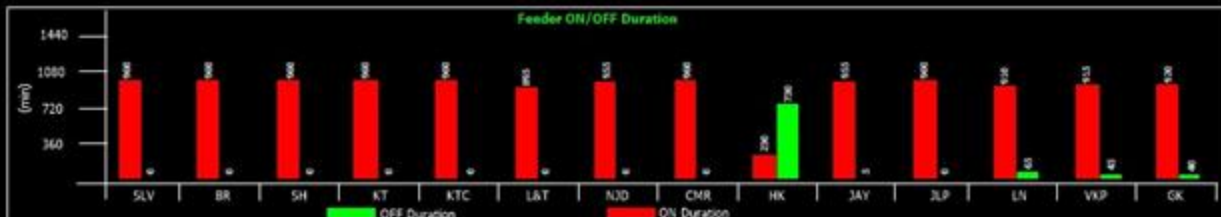
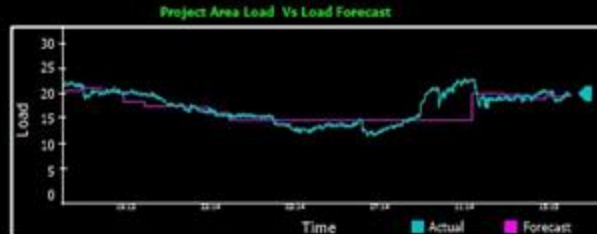
Movicon - [Run] - overview

SMART GRID, CESC MYSURU

25-03-2017

## OVERVIEW

Project Area	Today	Forecast	Yesterday
Load (MW)	20.7	20.6	---
Peak Load (MW)	23.7	---	25.9
Consumption (kWh)	271165	0	446565
Renewable Generation(Units)	0	0	0



- OVERVIEW
- AMI
- OMS & PQ
- PLM-DR
- ENERGY AUDIT
- TMS
- NETWORK
- REPORTS
- ALARMS

Alarm Description	Time ON	Duration	Condition
Hissabtu Feeder Tripped	25-03-2017 15:06:36	0.00:00:13	OFF
SLV Feeder Tripped	25-03-2017 15:06:05	0.00:00:33	OFF
SLV Feeder Over Current Fault	25-03-2017 13:58:55	0.00:00:02	OFF

25-03-2017 16:17:15 Cannot execute the script 'RTU\_DAILY\_ENERGY\_KWH\_JAY'. The script is already in execution or the maximum number of instances has been reached



# Process Change

- Billing Through Automatic Remote metering
- Better asset utilization – DT augmentation upward as well as downward
- Realistic up gradation of consumer sanctioned load
- Remote load connection disconnection
- Redeployment of meter reader

# Benefit to Utility



- Reduction of AT&C losses
  - ✓ Metering Efficiency increased by 14% through smart meter in one of the pilot location
- Online energy accounting & auditing, tamper detection and system load analysis
  - ✓ Online Energy Audit was conducted at distribution transformer level.
  - ✓ Better understanding of system load profile to design DR programs
- Improved Load Management
  - ✓ Optimal utilization of assets –deferment of capacity addition
  - ✓ Avoidance of blackouts & purchase of expensive peak power
- Improved Power Quality of supply
  - ✓ Average hourly power factor per day after VAR compensation: 0.99
  - ✓ Harmonic suppression

# Benefit to Utility



- Reduced outage time & frequency
  - ✓ Increased revenue
  - ✓ Improved quality and reliability of supply
- Crew and asset management
  - ✓ Faster Identification of fault
  - ✓ Speedy power supply restoration
  - ✓ Improved asset quality & life by remote monitoring of health & undertaking preventive maintenance
- Street light automation
  - ✓ About 57% saving in energy consumption in one of the pilot location
- Renewable Integration & Net Metering
  - ✓ Facilitate penetration of renewable energy in the grid
  - ✓ Net Zero energy: Facilitation for *prosumers* to inject renewable energy back to grid

# Benefit to Consumers



- Consumer Engagement & empowerment with greater control over their energy use and bill
- Improved quality & reliability of power supply
- Increased life of appliances and gadgets due to improved power quality
- No investment in power backup solutions like inverters and Gensets
- Rooftop renewable generation with facility to feed excess power into the grid – Net Metering
- Improvement in overall consumer satisfaction



# Capacity Building

*Delegates from the following organizations visited the pilot project:*

CESU, Odisha	TSSPDCL, Hyderabad	Asian Development bank
UGVCL, Gujarat	APSPDCL, Tirupati	CRISIL
BESCOM, Bengaluru	MoP, Gol	NIT Goa
GUVNL, Gujarat	MNRE, Gol	NIWE, Chennai
UHBVNL, Haryana	CEA	GERMI, Gandhi Nagar
WBSEDCL, West Bengal	CERC	University of Malaya, Kuala Lumpur
APDCL, Assam	BERC, Bihar	ENEL, Italy
TSECL, Tripura	KERC, Karnataka	SCS Consulting, USA
HPSEBL, Himachal Pradesh	OERC, Odisha	IEEE, USA
TANGEDCO, Tamil Nadu	Planning Commission	French Development Agency (AFD)
Andaman & Nicobar Electricity Deptt.	NITI AYO	Syracuse University, New York
MSPDCL, Manipur	NSGM	USAID

# Challenges



- Drafting of specification as per prevailing utility practice
- Getting the BIS marked smart meter
- Selection of communication architecture
- Interoperability
- Type testing of Meter
- Placement of DCU
- Consumer resistance
- Dynamic Nature of Distribution Network
- GPRS Signal
- Integration with Existing R-APDRP system
- Regulatory Issues

# Enabling Measures



- AMI functional specification released by CEA
- Standard for Smart Meter: IS 16444
- Standard for Communication: IS 15959 Part II
- Four NABL labs are ready for testing as per IS 16444
- Sufficient no. of manufacturers are available for smart meters

# Way Forward



- Mass Roll out
- Development of strong policy framework
- Development of enabling Regulation
- More consumer awareness program
- Development of self sustainable business model



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# Thank You

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