

# Session 2: Foundational Technologies for Grid Automation and Digitalization

# PART A: Operational Technologies (OT)

## Session Content:

- SCADA/EMS/DMS/ADMS
- Geographical Information System (GIS)
- Distribution Automation (DA) and Sub-station Automation (SA)
- Advanced Metering Infrastructure (AMI)
- Wide Area Monitoring Systems (WAMS)
- Robotics
- DERMS

## Speaker:

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- Advisor - ISGF and GSEF
- Executive Chairman, Biosirus, Canada

# Energy Transition Underpinnings

## Climate Change

- Reduce Fossil Generation
- Increase Clean DER Generation
- Create Flexible Capacity

## Grid Optimization

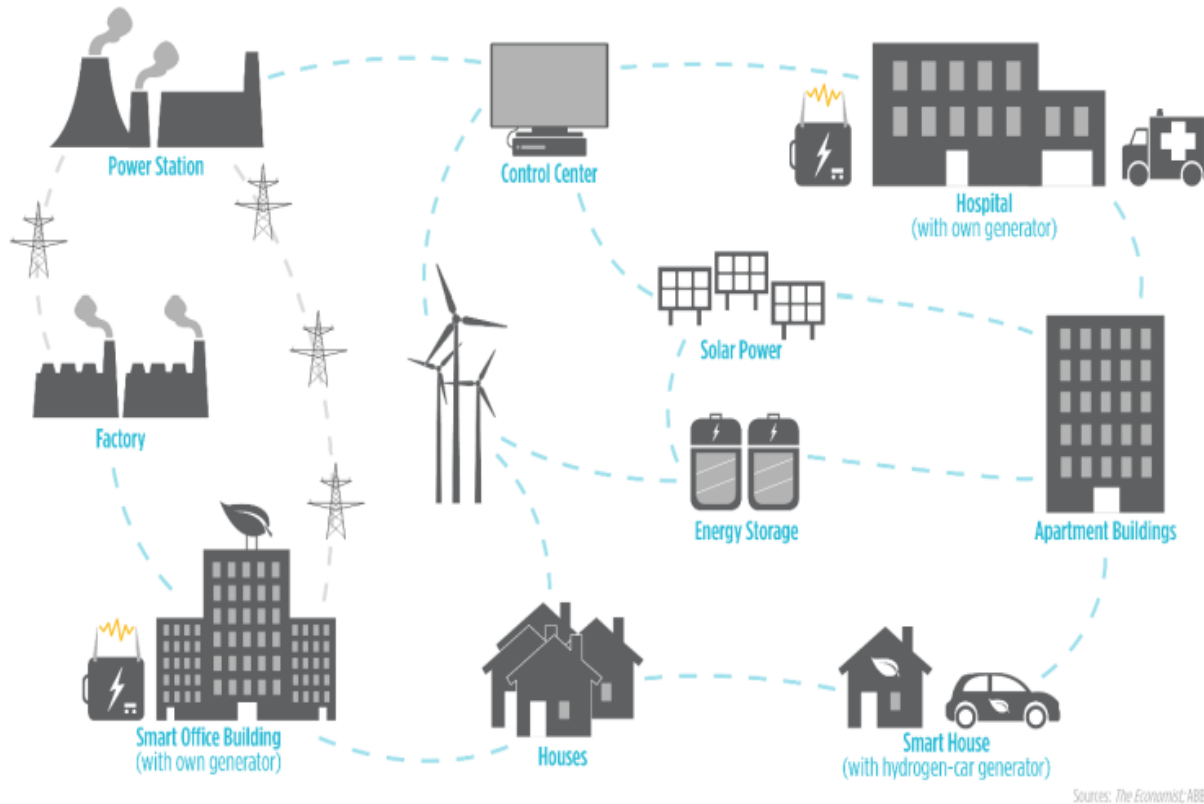
- Defer investments
- Seek non-wires alternatives
- Improve Reliability and Power Quality
- Manage VRE with Load Management

## Customer Service

- Reduce Service Costs and Tariff
- Enable Economic Development
- Promote Clean Energy Use

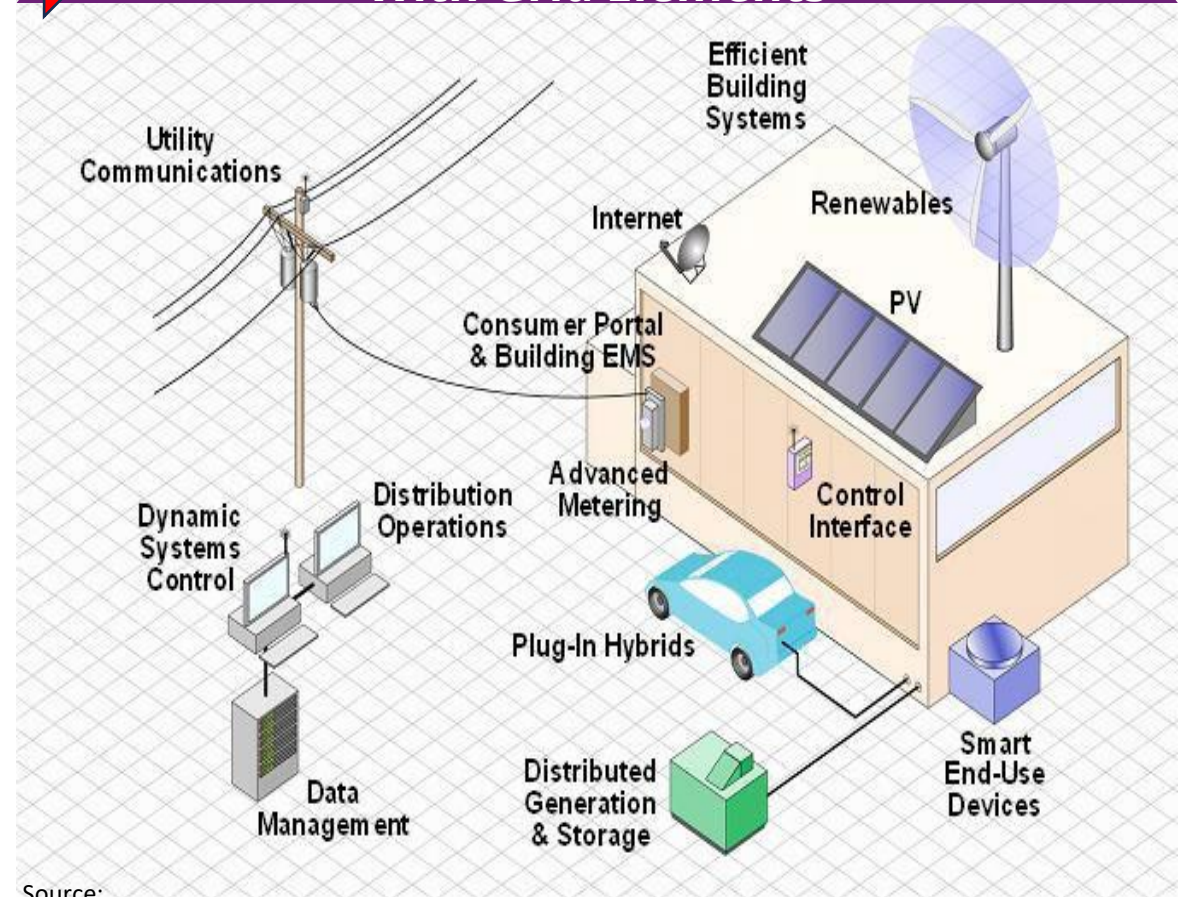
# Transformation Challenge

**Utility of the Future**  
Decarbonization – Decentralization – Digitalization



**Maximum Asset Utilization**  
Reliability – Climate Resilience – Easy Restoration

**Technology Interactions**  
With Grid Elements



Source:  
[www.electricalacademia.com](http://www.electricalacademia.com)

**Maximum Asset Interaction**  
Connectivity – Scalability – Automation

# Examples of Digital OT Platforms Needed for Improved Utility Performance for Energy Transition

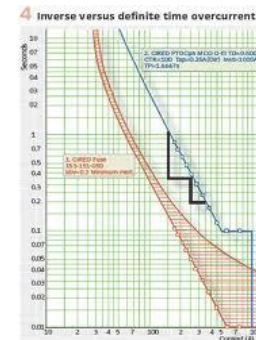
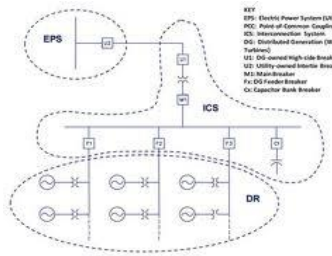
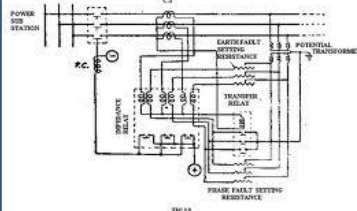
# 1. DMS / ADMS

## Real-time Control of Connected Assets

### Situational Awareness (Real-time Forecast)

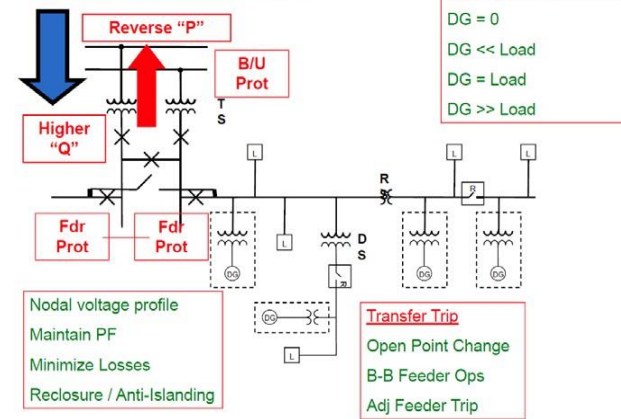


### Adaptive Protection & Controls (Dynamic Set Points)



### Reliability & System Stability (Load-Generation Balance)

#### System Issues



Daily Gen-Load balance  
 DG = 0  
 DG << Load  
 DG = Load  
 DG >> Load

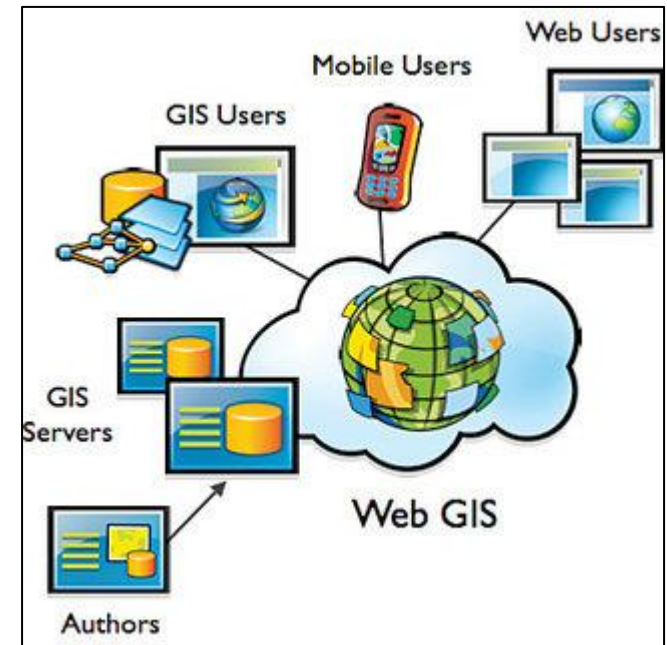
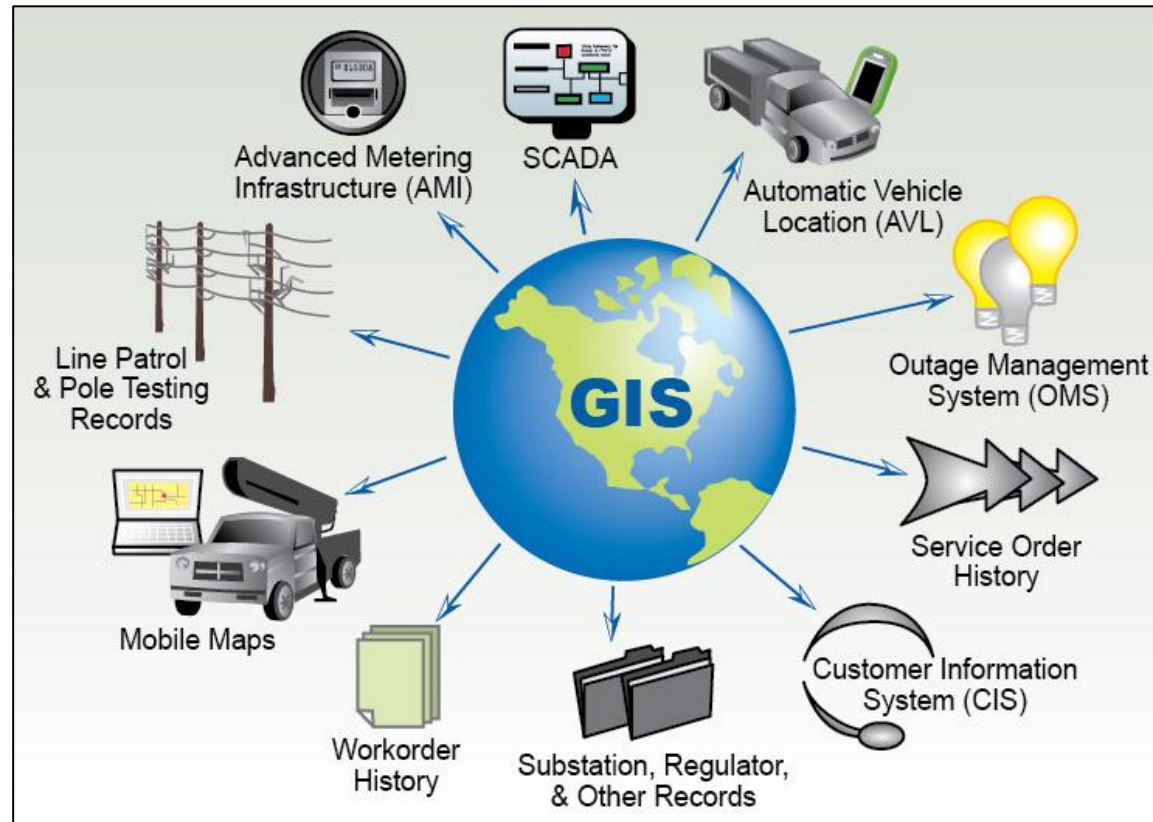
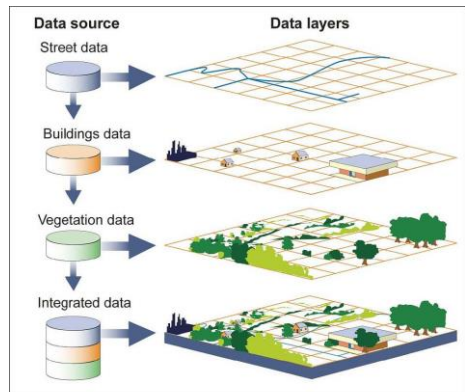
Nodal voltage profile  
 Maintain PF  
 Minimize Losses  
 Reclosure / Anti-Islanding

Transfer Trip  
 Open Point Change  
 B-B Feeder Ops  
 Adj Feeder Trip

# 2. Geographical Information System (GIS)

Capturing, storing, checking, and displaying asset data related to positions on Earth's surface.

- Notes**
- Accuracy of GIS data
  - Update frequency
  - Data Access (IT, OT, BU)

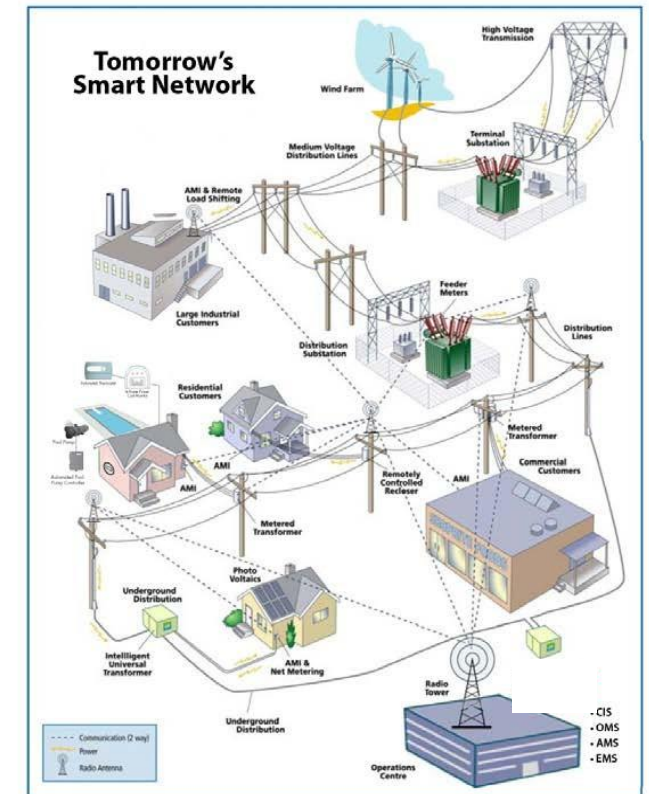
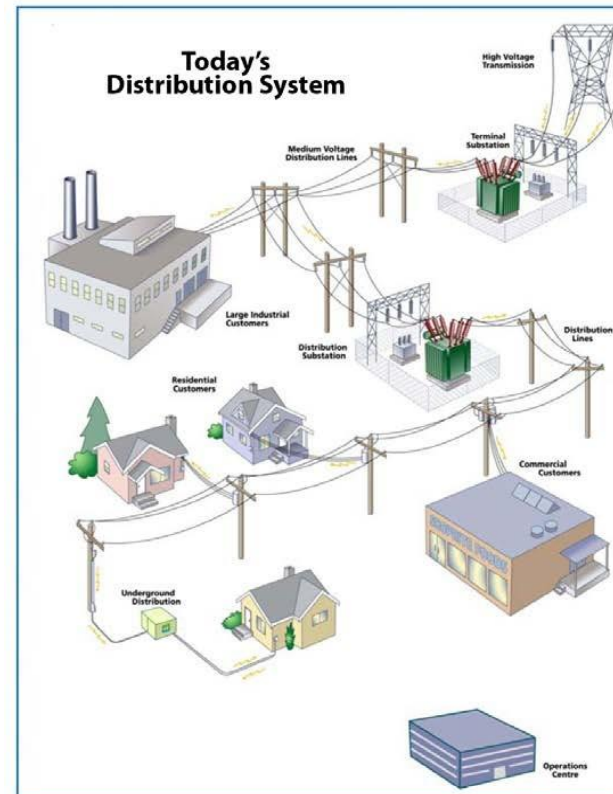
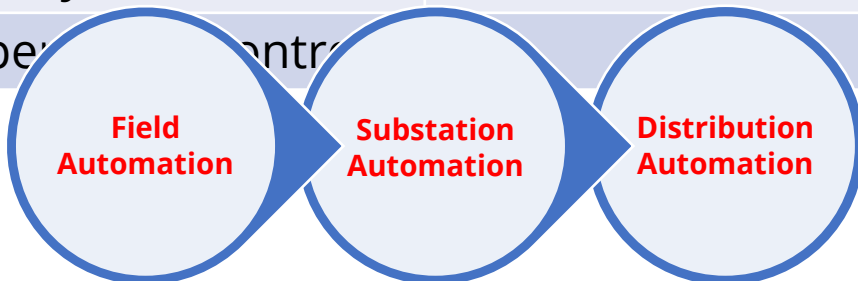


Source: GAO.

# 3. Distribution Automation (DA) and Substation Automation (SA)

Monitor, coordinate and automatically operate distribution components in real-time from remote locations.

Dx Automation	S/S Automation
Voltage/VAR Regulation	Feeder Fault Isolation
Area Load Balancing	Capacitor Switching
Load Management	Load Tap Changers
Manage Power Quality	Auto Reclosure/Switch
Superconducting	Control





# 4. Advanced Metering Infrastructure (AMI)

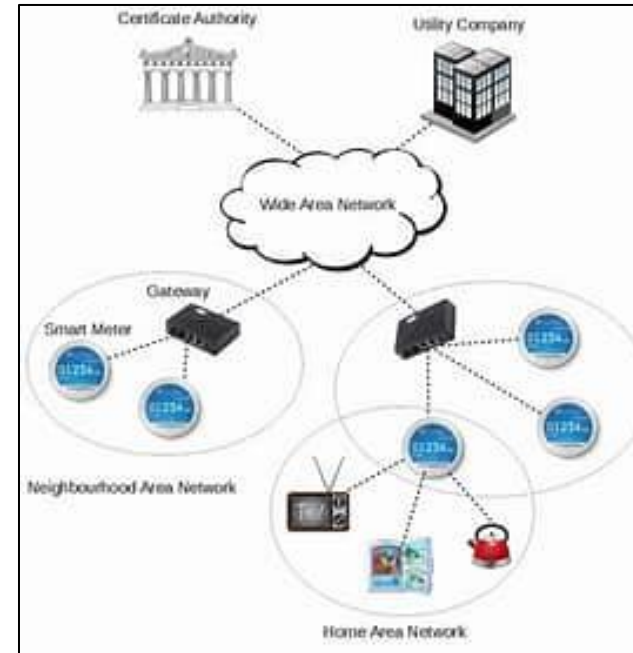
Poll, capture and store near real-time energy consumption data of consumers and IPPs from many smart meters.

## Utility

- Monitor and manage energy demand
- Detect and pinpoint outages
- Monitor bi-directional flows with RE generation
- Provide dynamic pricing

## Prosumer

- Detailed time-of-day energy usage
- Analyze consumption patterns
- Conserve energy and reduce bill



# 5. Wide Area Monitoring (WAMS)

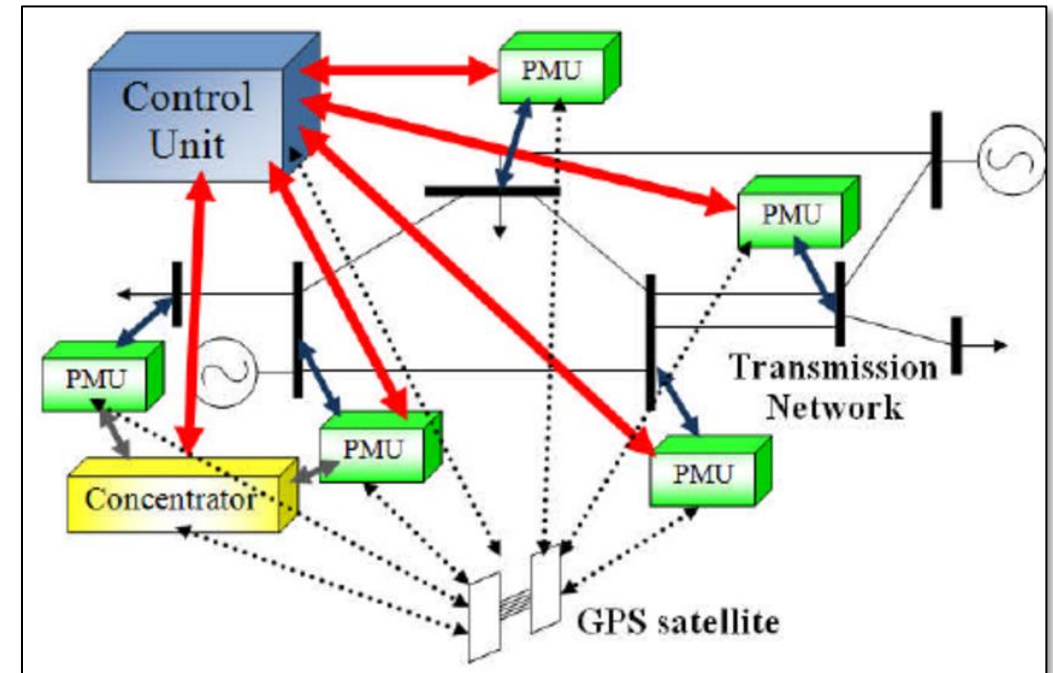
Collect real-time phasor measurements from geographically dispersed Phasor Measurement Units (PMU) over a large network area to detect inter-area oscillations and stability.

## Transmission

- Interconnection Stability
- Inter-area stability
- Relative Oscillation - Long transmission lines

## Distribution

- Long Feeders connected to RE generation
- Power Quality Monitoring



# 6. Artificial Intelligence (AI) and Robotics

**AI:** Mining of large data sets, machine learning and analytics to improve service

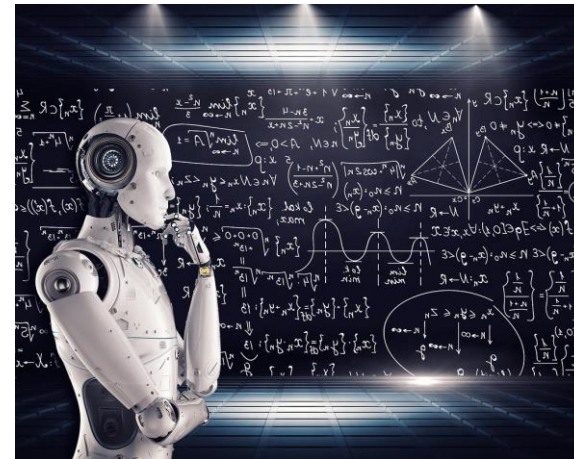
**Robotics:** Intelligent machines performing valuable tasks more safely and efficiently

## Artificial Intelligence

- Enhance customer engagement
- Digital Marketing
- Power theft prevention
- Predictive maintenance improvement
- Identify trends and anomalies

## Robotics

- Intelligent machines trained to “see”, “read”, “sense”
  - Drones - powerline integrity; vegetation growth
  - Robots – use in unsafe areas; surveillance

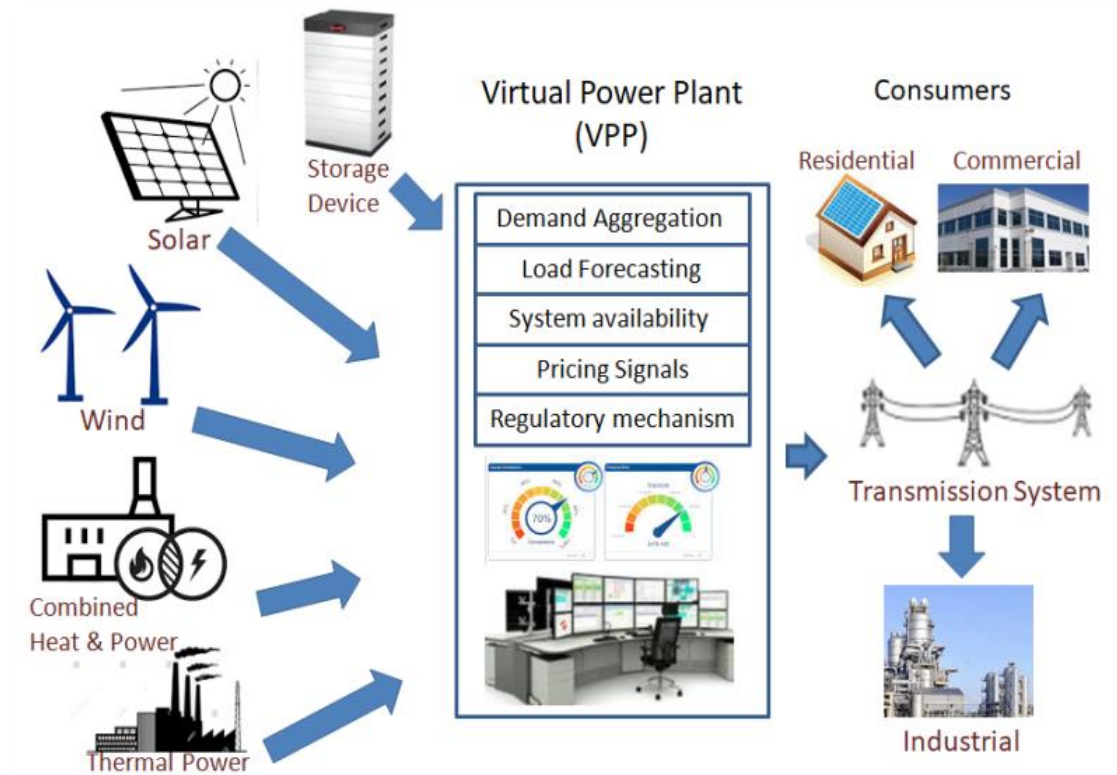


# 7. Distributed Energy Resource Management (DERMS)

Manage and optimize Distributed Energy and Grid Edge Assets in conjunction with the Utility

## DERMS

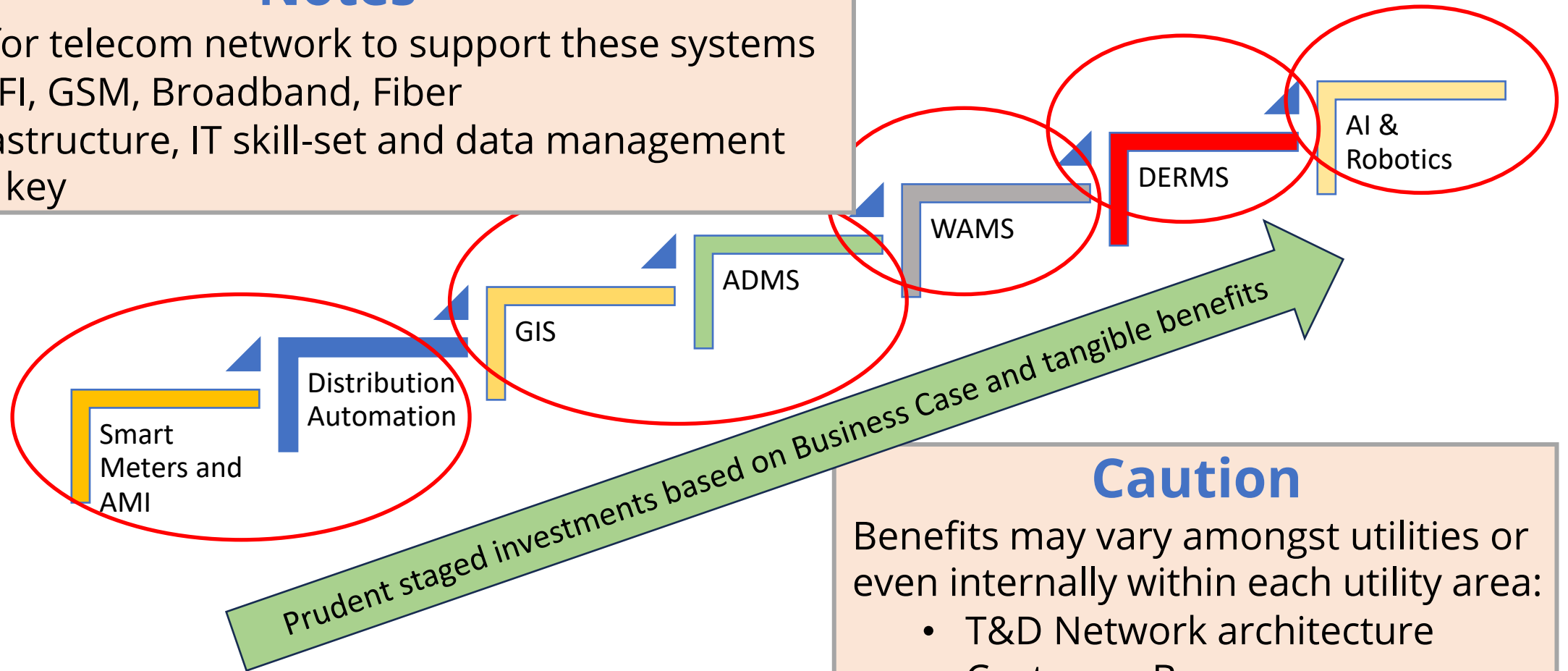
- Manage/optimize distributed energy assets (DER)
  - EV, Energy Storage, RE, CHP
- Interface with the utility
- Communicate across DERs
- Enable retail energy trading
- Offer Virtual Power Plant (VPP) benefits
- Allow for better management of the grid with less energy wastage



# Key Takeaways / Recommendations

## Notes

- Need for telecom network to support these systems
  - WIFI, GSM, Broadband, Fiber
- IT infrastructure, IT skill-set and data management will be key



## Caution

Benefits may vary amongst utilities or even internally within each utility area:

- T&D Network architecture
- Customer Base
- Policies and regulation

**Thank You**  
  
Any questions?

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