

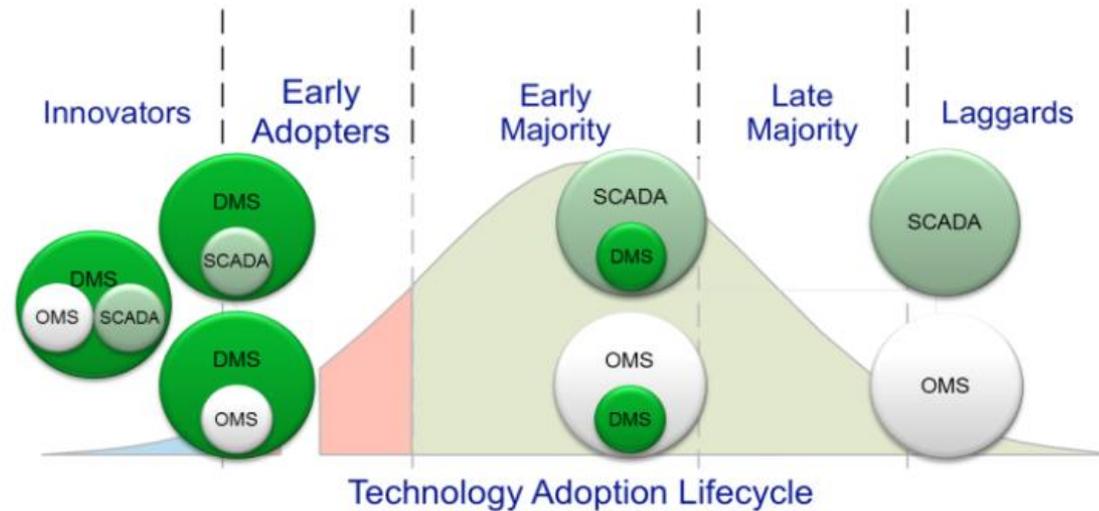
Using Advanced Functionalities for Automated Grid Control

From Situational Awareness
to Closed Loop Control

NREL – Energy System Integration
July 7, 2015



Evolution of ADMS



OMS solutions integrating with DMS solutions

OMS solutions expanding to include DMS

Re-architecture to support requirements of comprehensive DMS solution

SCADA solutions integrating with DMS solutions

SCADA solutions expanding to include DMS

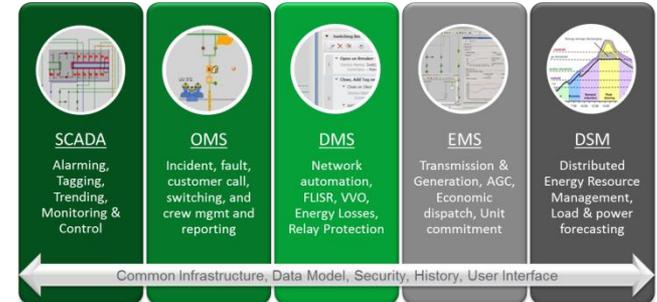
Modern Architecture

Requirements as basis for unified platform

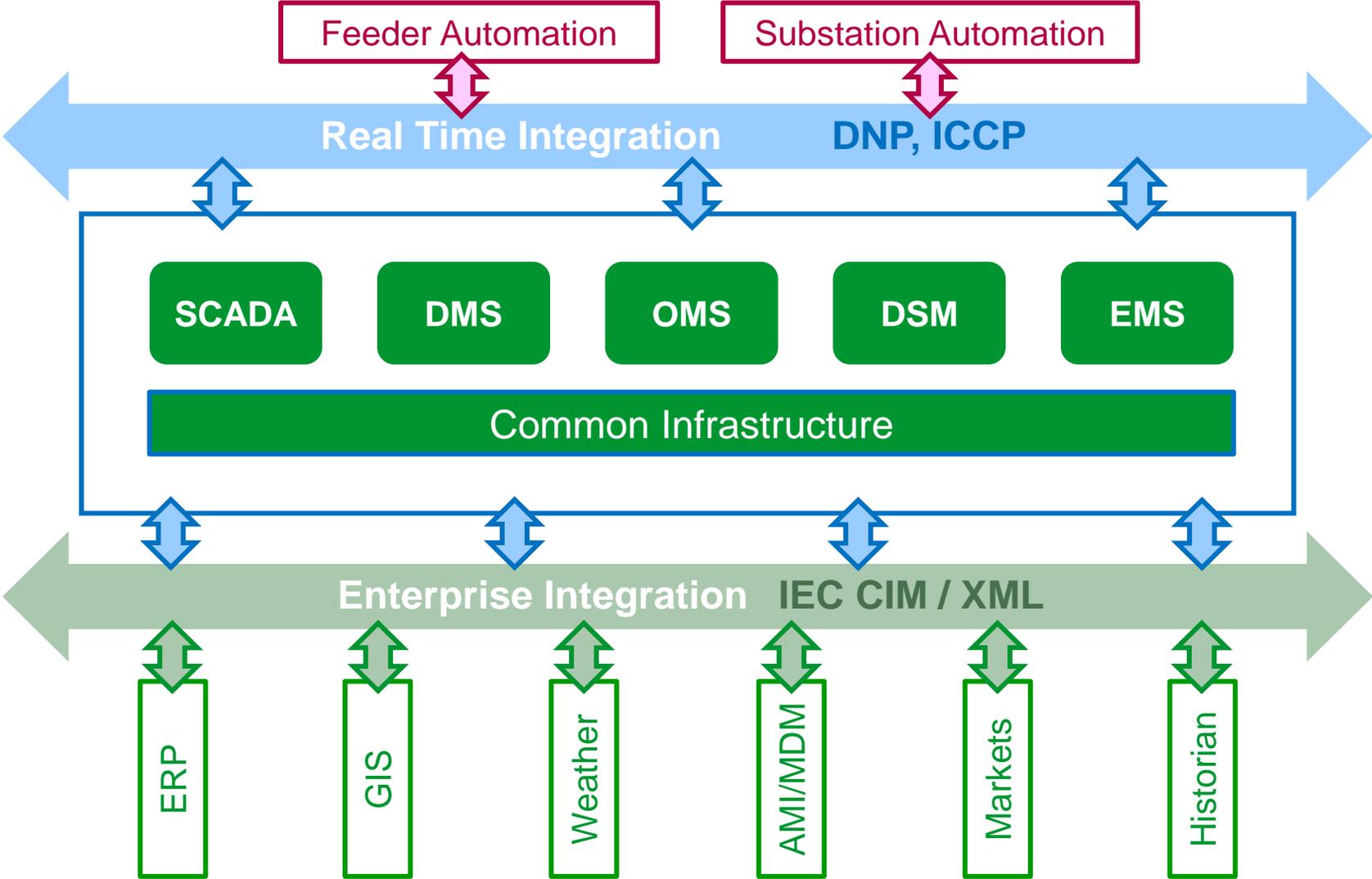
- **High performance** – in-memory database, parallel processing
- **High availability** – no single point of failure, seamless failover
- **Modern technology** – 64-bit, .NET, centralized data management
- **Integration** – standards-based web services (i.e. CIM)
- **Scalability** – small to extra large utilities (millions of data points)
- **Security** – infrastructure, replication, integration, etc.
- **Flexibility** – multi-site, multi-zone and phased deployments
- **Versioning** – real-time, planning, simulation, training, etc.
- **Multi-display** – geographic, schematic, station one-lines
- **Thin client** – web (outside control room) and mobile (field client)

Technology Trends

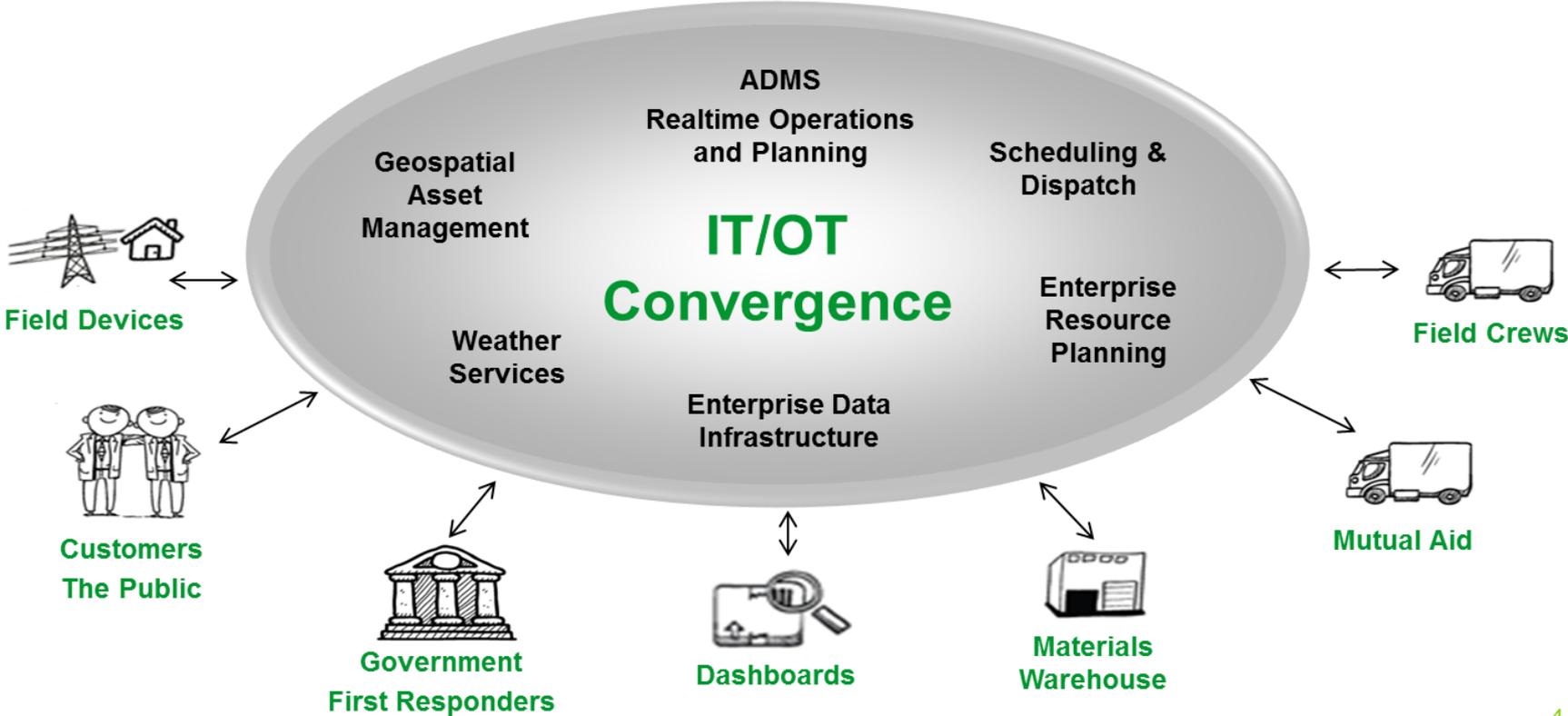
- **Consolidation** of technology
 - DMS -> SCADA -> OMS -> EMS
- **Convergence of IT & OT**
 - Corporate IT and Network Management
- **Enterprise integration and Mobility**
 - Industry standards to sharing data throughout the enterprise and the field
- **Big data** (from several new sources) and analytics
 - Intelligent devices, smart meters, data warehouse
- **Operational asset management**
 - Leveraging new data for efficient use of assets
- **Energy efficiency** throughout the value chain
 - Network optimization, generation/load control, demand response
- **Managing distributed renewable energy (DER)**
 - Increase in wind and solar with high intermittency



IT/OT Integration

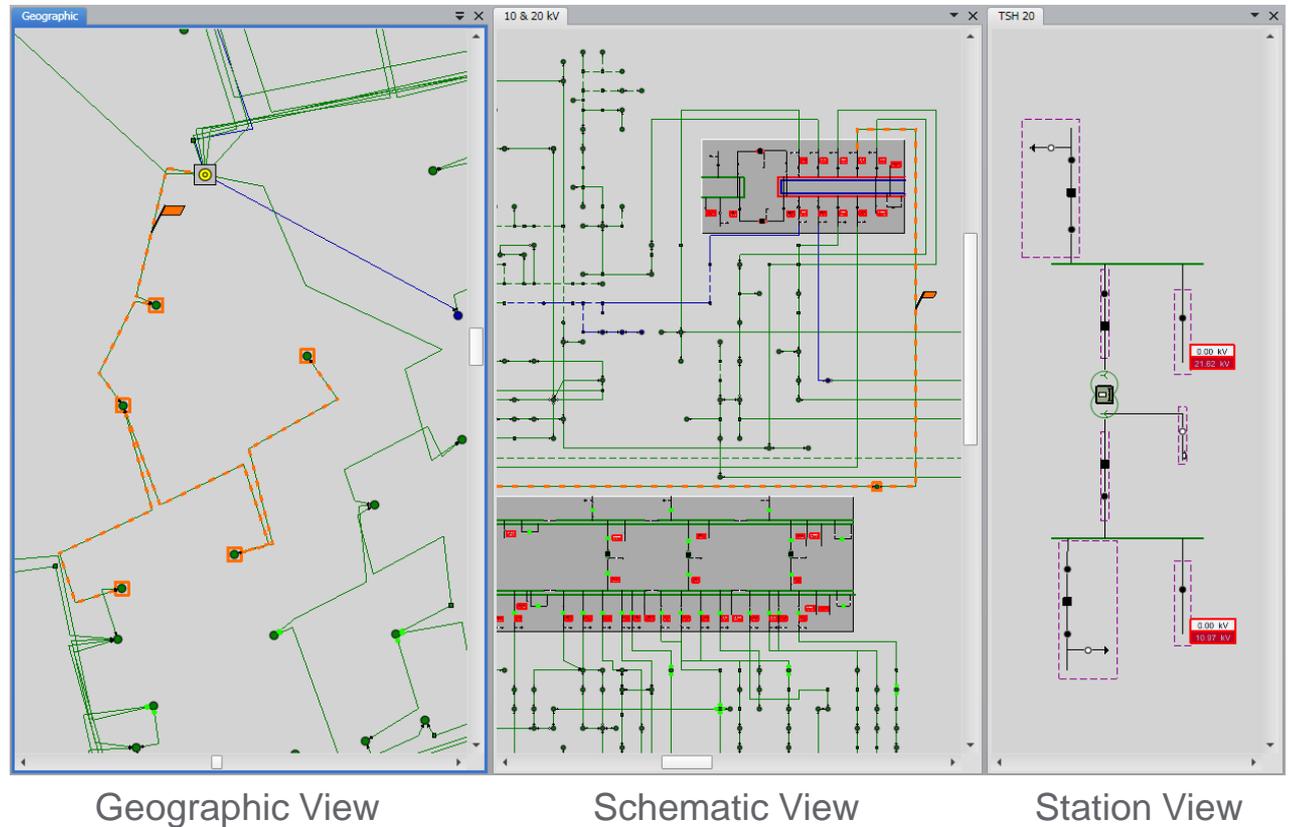


Enabling IT/OT Convergence

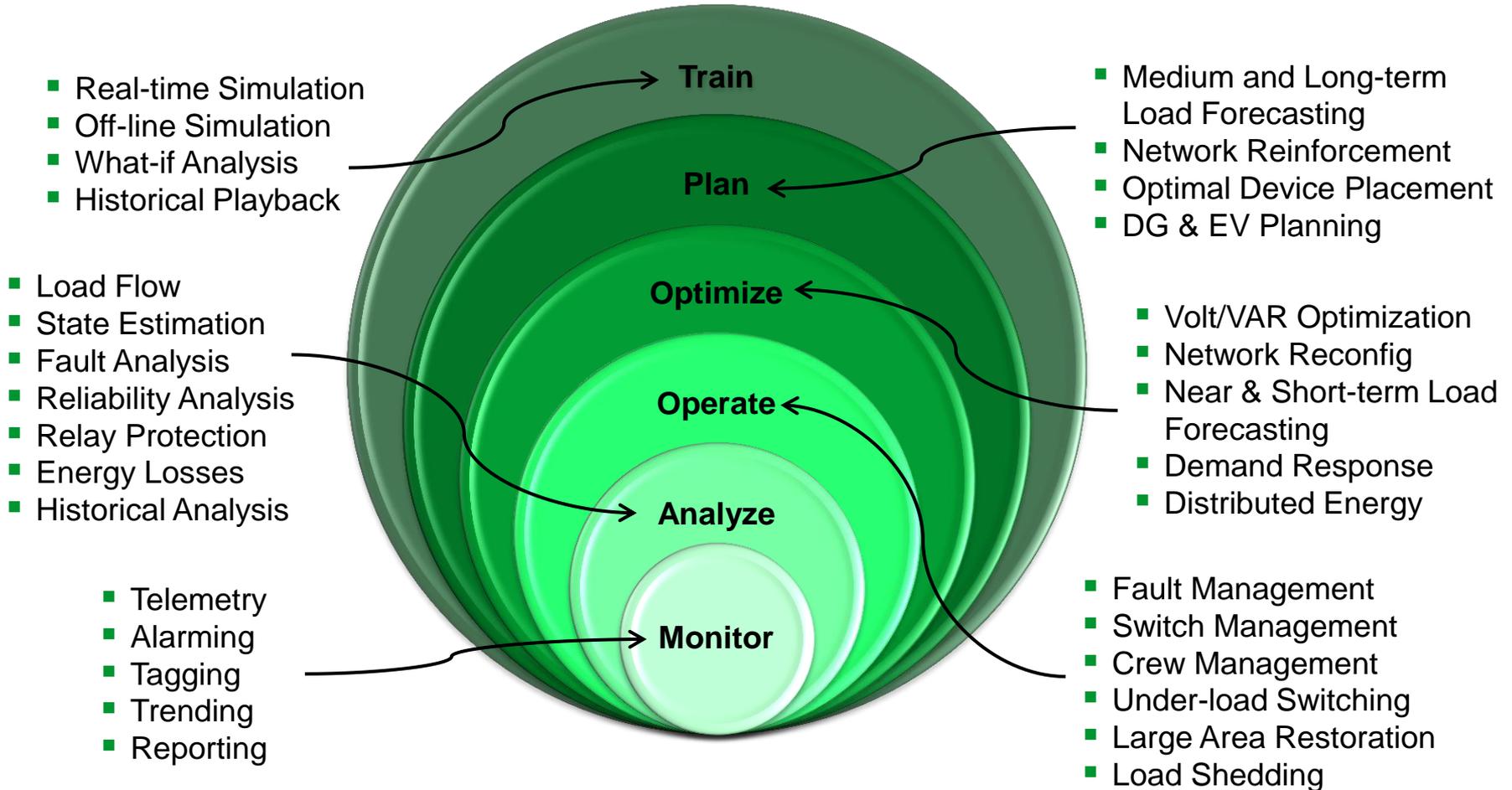


Situational Awareness

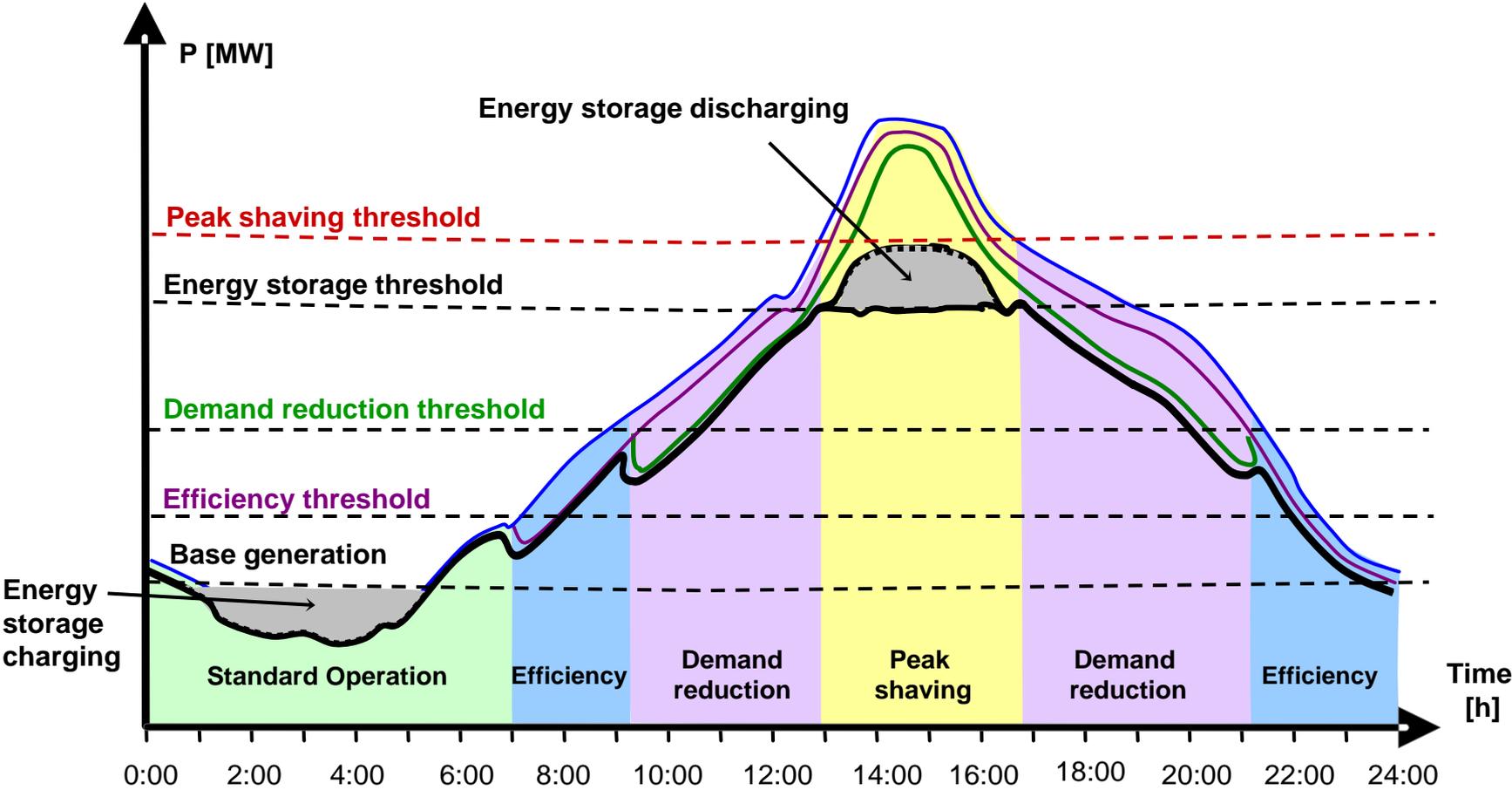
- Multiple map views
- Topology analysis
- Smart alarming
- Event filtering
- Load forecasting
- Simulations
- Historical analysis



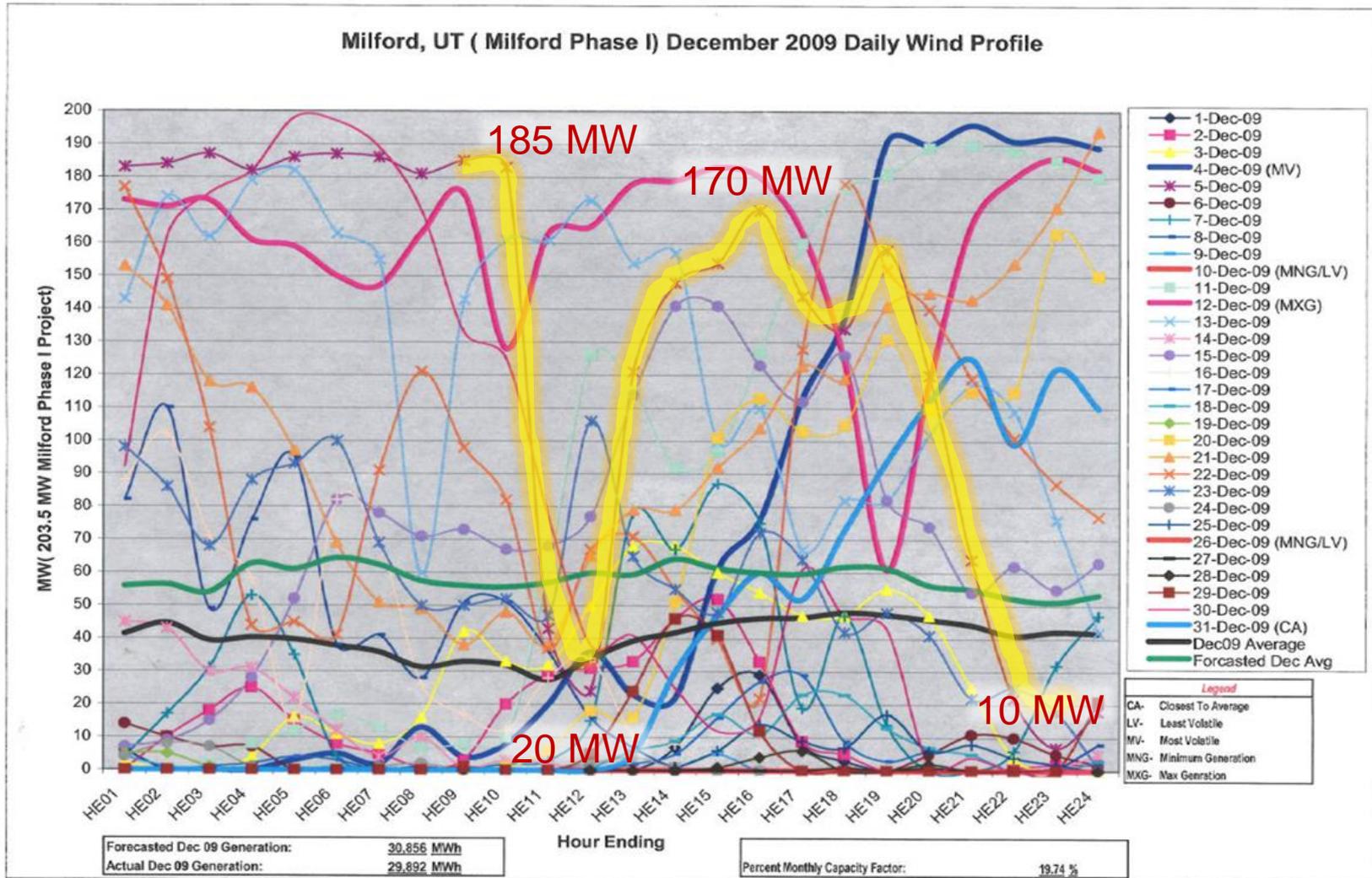
ADMS Functionality Examples



Demand Management Scenario



Renewable Resource Variability



Optimizing the Grid with DER Management

● Visualization and Monitoring

- Real-time awareness of DER activity
- Support operations and planning
- Conditions-based monitoring

● Reliability analysis and Network planning

- Near-term, short-term load/power forecasting
- Integrated weather data
- Predictive alarming
- What-if analysis in simulation mode

● Operations and Optimization

- Reliability and economic dispatch
- Shaping the daily load curve
- VVO and FLISR
- Microgrid islanding

Distributed Generator Dispatch

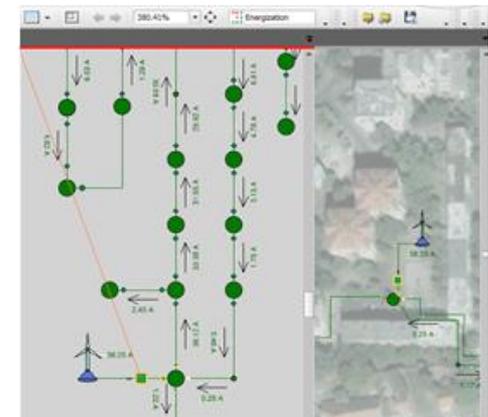
Circuit dispatch

Network selection...

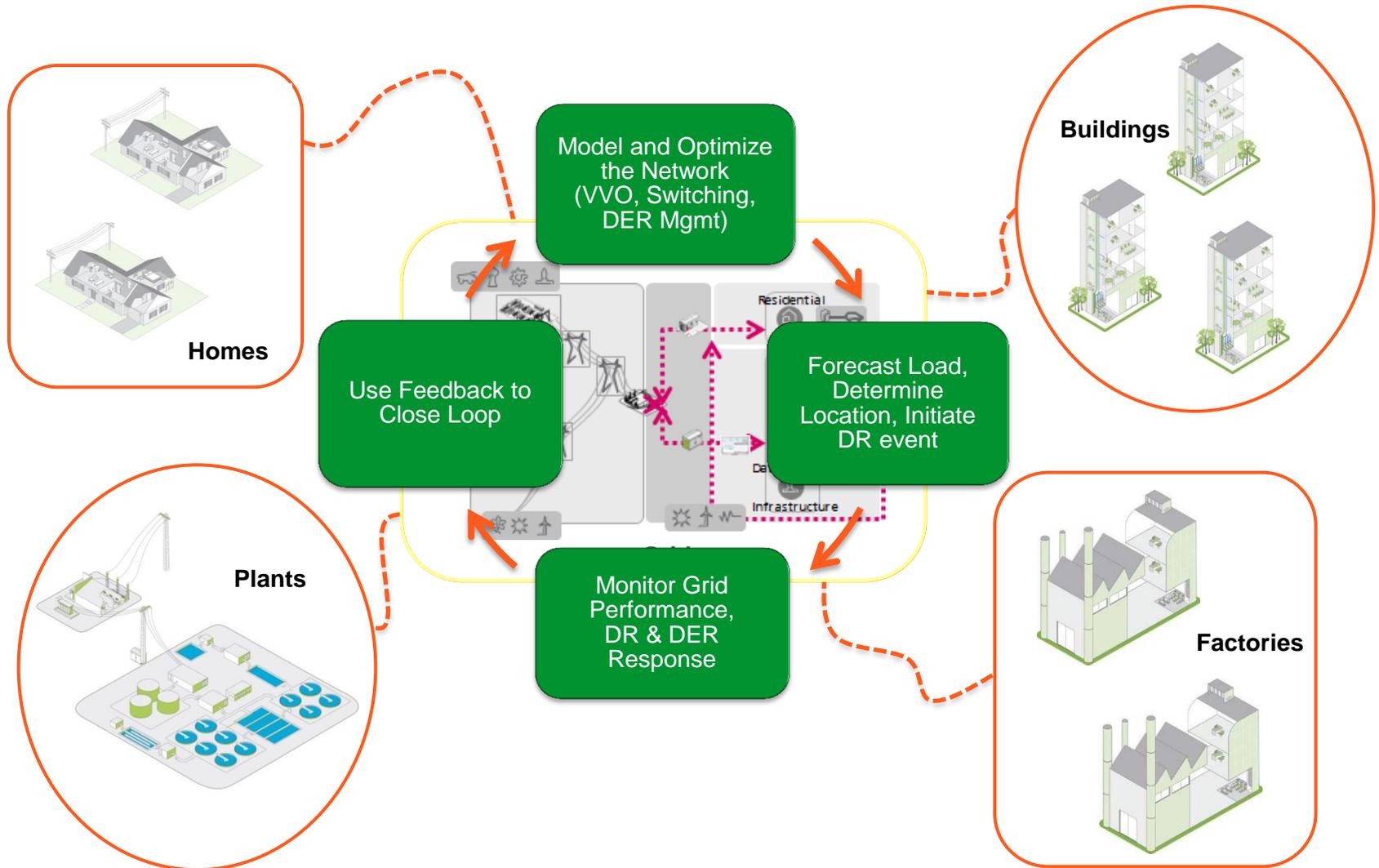
No	Area ID	Area Name
1	144396955110342802	Feeder_165

Hour	Fri 7 AM	Fri 8 AM
Weather Condition		
Weather	Sunny	Sunny
Temperature (°F)	27	28
Feels Like (°F)	21	23
Wind Direction	N	NNE
Wind Speed/Gusts (mph)	5	5
Dew Point (°F)	9	9
Humidity (%)	46	43

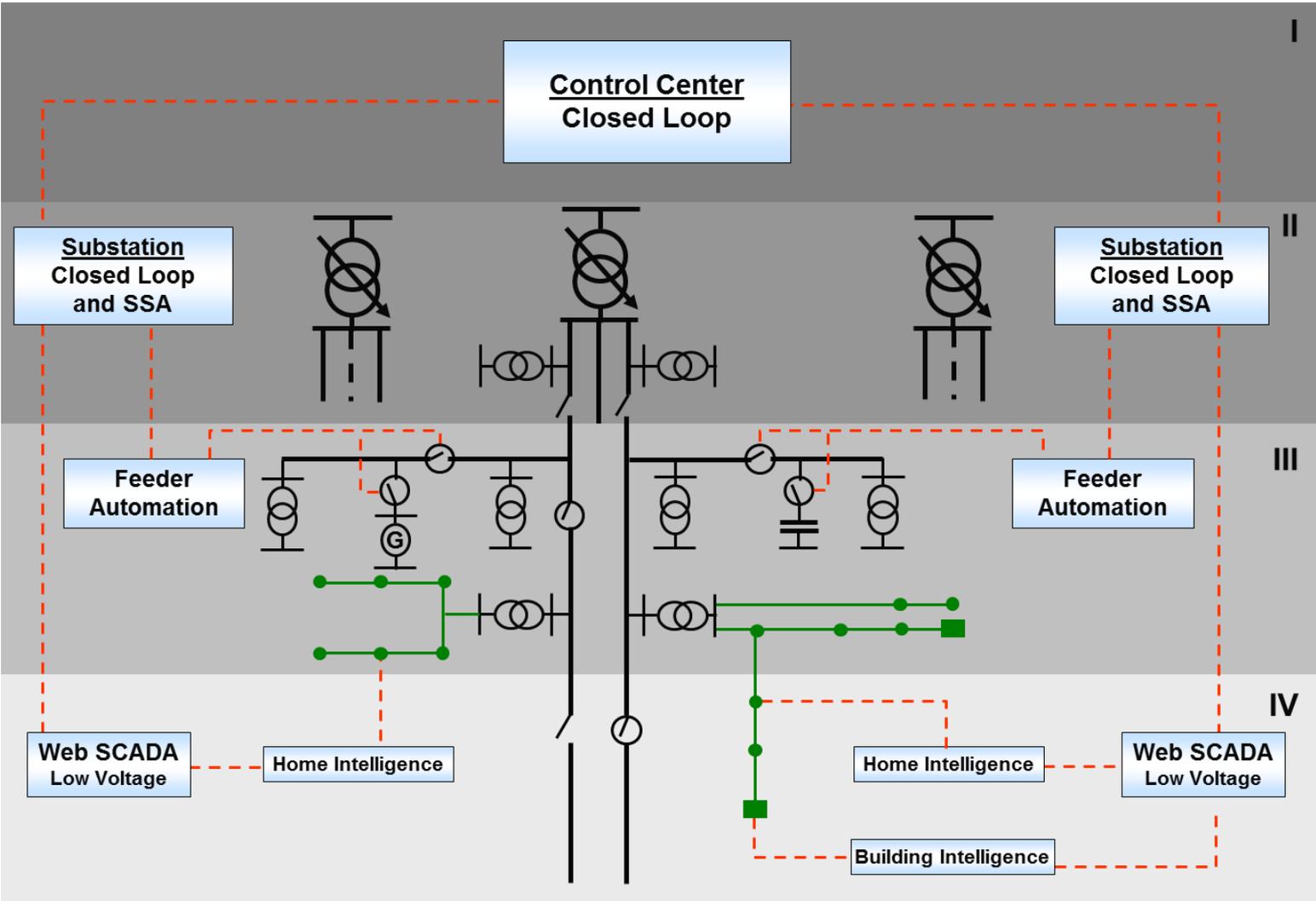
Object	Violation
Area_Kanapaha_New Tr 1	
Feeder_165	
WIND GENERATOR	
WIND GENERATOR	
WIND GENERATOR	
WIND GENERATOR	
Feeder_99	



Integrated Demand Response



Distributed Architecture



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