Real-time microgrid and DERMS control using the PI System and PXiSE Advanced Control Technology

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PXiSE Energy Solutions, LLC

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PXiSE Energy Solutions

A Modern Grid Control Solutions Company

Located in San Diego, CA

Backed by Sempra Energy and Mitsui

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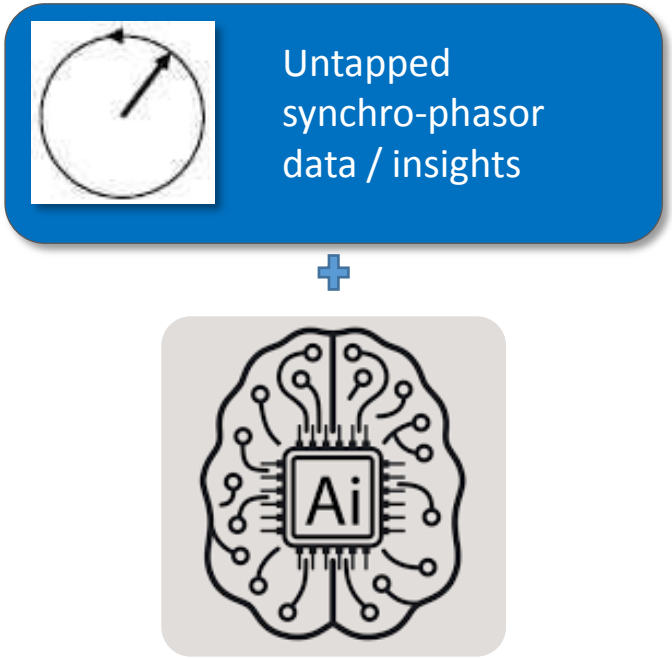
PXiSE utilizes bigger data and artificial intelligence



- Adapting high resolution data 60 samples per second for MRI-like visibility and precision control
- GPS time-synchronized “State” measurements provide powerful real-time insights
- Advanced neural network technology for event detection
- Clustering technology for forecasting
- On-line control system tuning
- Adaptive control technology

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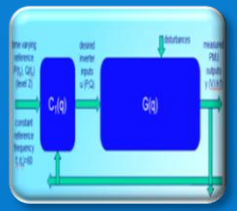
PXiSE brings new intelligence and autonomy to grid control

Insightful high-speed phasor data



Multi-level system feedback control

System model, optimization, & artificial intelligence

OSIsoft PI data technology

Intelligent software in common hardware

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PXiSE Advanced Control Technology (ACT)

Software

- PXiSE ACT 3.0 control
- PI 2017 server
- Windows 2016 server

Hardware

- 64 bit computer
- Substation hardened, or
- VM on premise or cloud server
- Existing sensors (*PMUs from relays)

*Users should not be confused with PMUs application in transmission system, time-synchronized phasor data from a few PMUs offer new insights for modern grid control

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The problems we solve

Operate grids with any percentage of renewables supported by a battery energy storage system (BESS)

Coordinate any mix of energy resources

Cost-effective and reliable grid control solutions

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What we do

- Advanced SCADA and grid control automation
- Renewable generation output performance control
- Microgrid controls (islands, remote communities, comm./industrial)
- Autonomous DERMS with optimization

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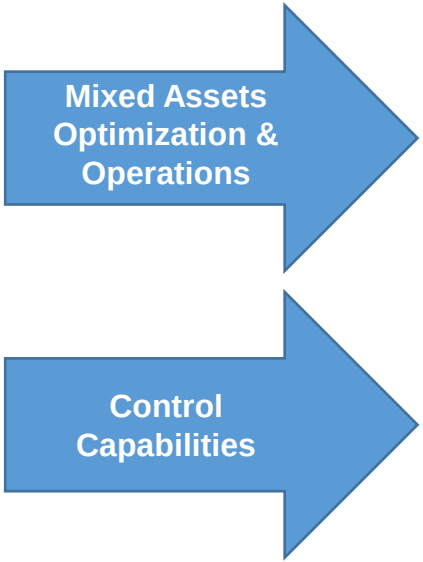
How we are different



Legacy Control

Results differ from claims:

Energy management and dispatch focus

Slow response to changes

Operate few devices

Logic-based, inflexible to operate as system conditions change

Higher cost (low assets use)

Low performance

PXiSE Advanced Control

Delivers differentiating benefits:

- A real control system with multi-level feedback
- Fast and adaptive software configurable
- Designed for 1000's devices

- Optimization-based, fast and adaptive to real-time conditions
- Lower (optimal use)
- Higher performance cost

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Who's using PXISE ACT?

- Auwahi Wind Farm (24 MW, 11MW/4.4 MWh Battery Energy Storage System)
- Copper Mountain Solar Farm (58 MW, Grid-tied)
- Silver Oak Winery microgrid (200+ kW Solar and 120kW/420kWh Battery Energy Storage System)
- Sempra Headquarters microgrid (Solar PV, EV Chargers, and 250kW/625kWh Battery Energy Storage System)
- Great Valley Solar Farm (200 MW with Switching Capacitors, Grid-tied)

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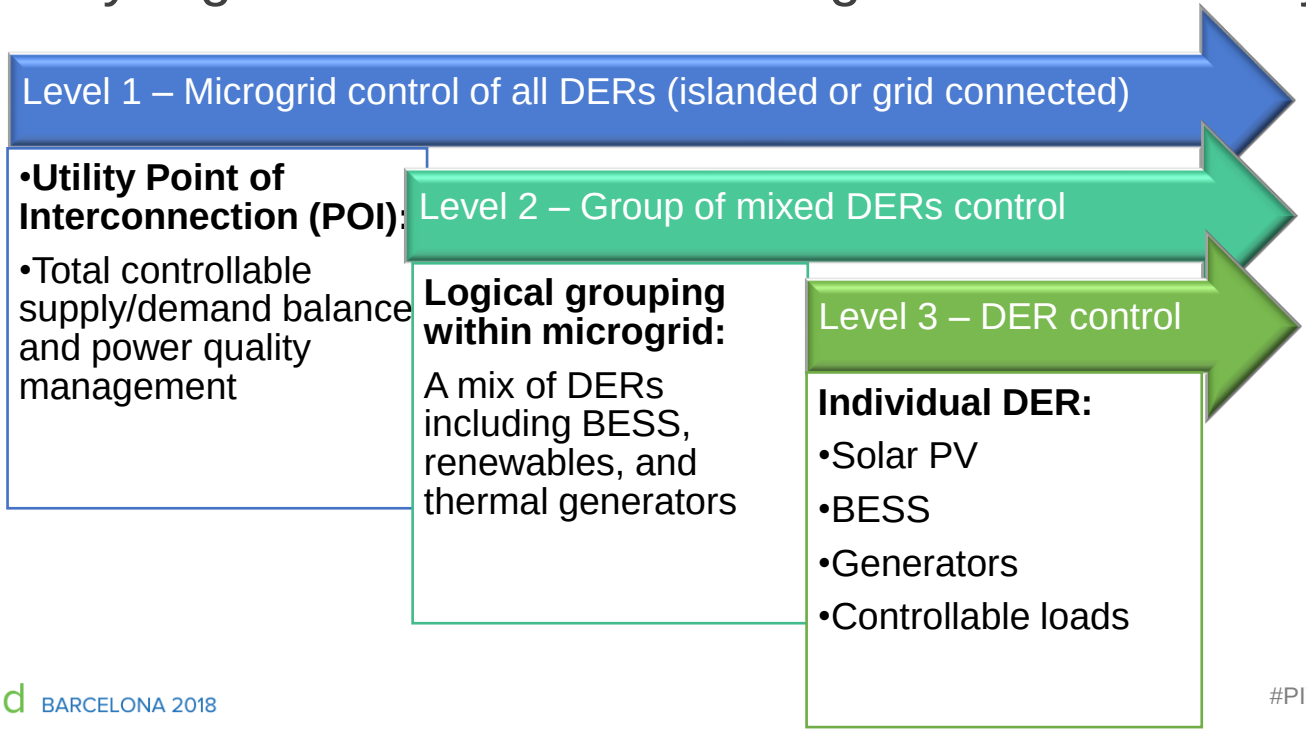
PXiSE ACT application in microgrids

A comprehensive solution to manage and control all DERs logically organized within the Microgrid in an hierarchy



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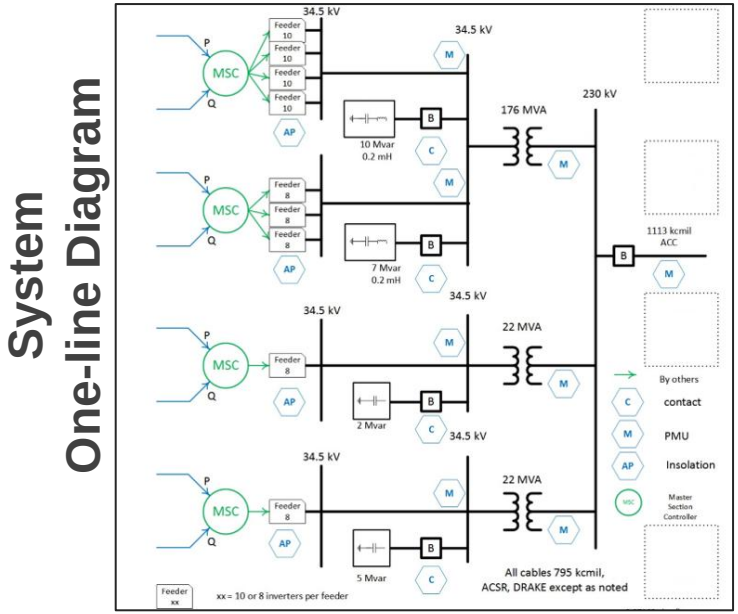
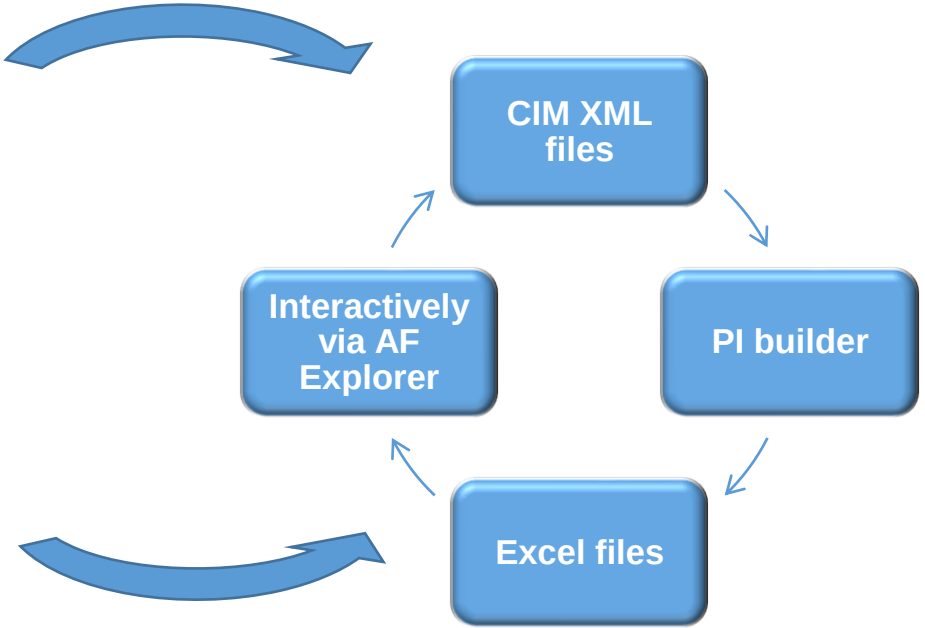
Flexible data input and configuration





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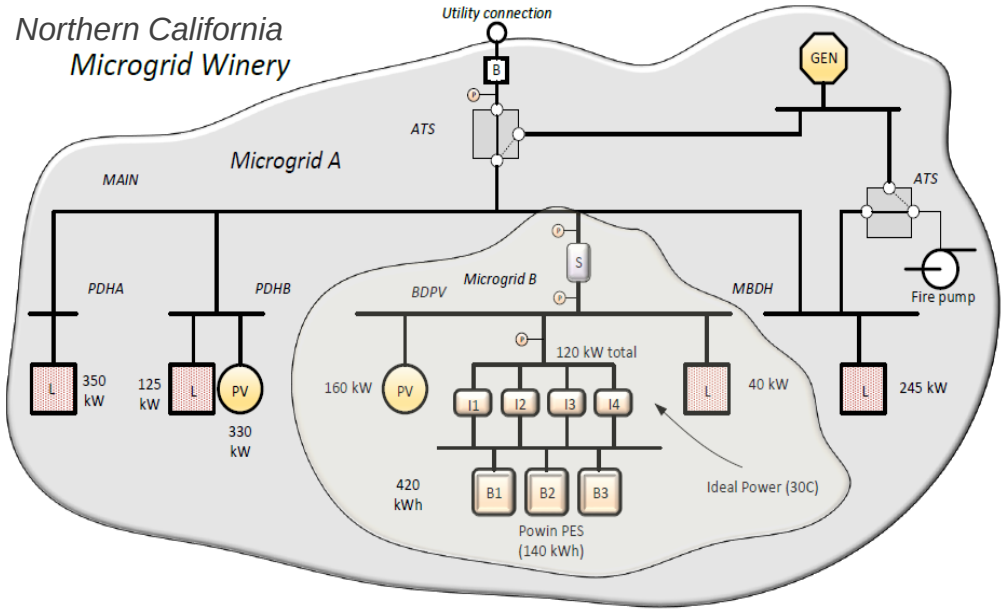
User configurable microgrid software for many DERs



120kW / 420kWh Battery
600kW Solar PV
2 Microgrids

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PXiSE ACT winery microgrid

- Control system dashboard is flexible to accommodate local needs
- User configurable and interactive display
- Powered by industry standard PI Vision

Controlled by PXiSE 8 Solar Inverters, 4 Energy Storage Inverters and 1 ASCO Switch

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High-rise building microgrid

Same hardware and user configurable software advantages by OEM PI functions

120kW / 615kWh battery
50kW solar PV
EV charging
3rd floor microgrid

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Configured to achieve maximum energy bill savings

Flexible control configured for one BESS, solar and EV chargers benefited by PI AF structure and import functions

Controlled by PXiSE

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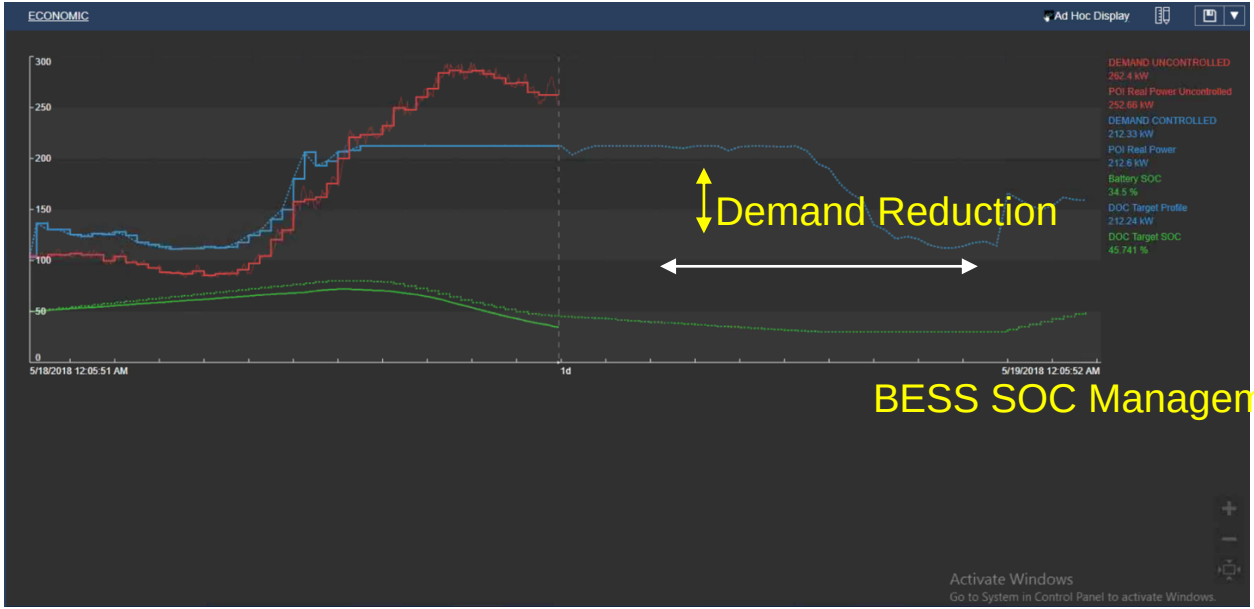
Optimization included forecasting of resources and load

Non-linear optimization of assets using real-time conditions far better than hard-coded logic of other solutions



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PXiSE display screens can be customized by users

- PI Vision screens
- PXiSE add-ins
- Standardized displays for solar, wind, and microgrid applications

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Standard faceplate for real-time monitoring and control

- Manual
- Auto
- Auto-remote
- Real power control
- Reactive power control
- Demand control targets

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Differentiated PXiSE disturbance mitigation improves power quality

- High data rate and fast inverter control by PXiSE cancels disturbances in the grid
- Supported by high resolution data in PI

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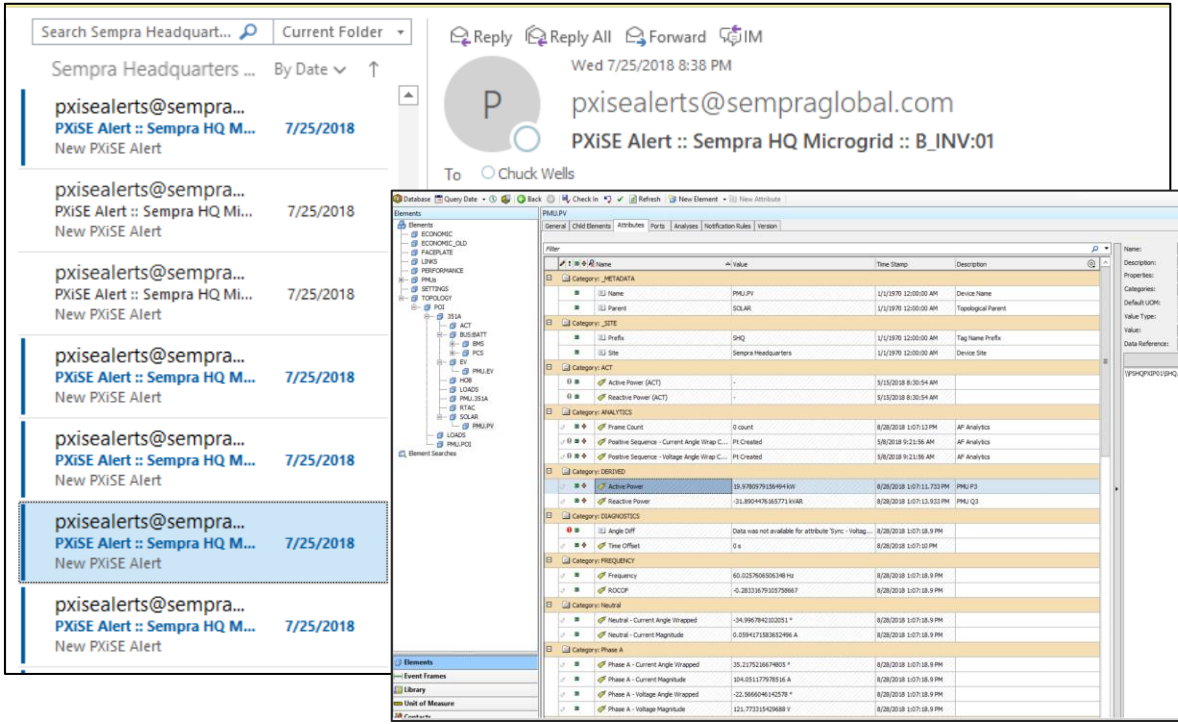
AF database for connected distributed energy resources

Built-in notifications and alarms



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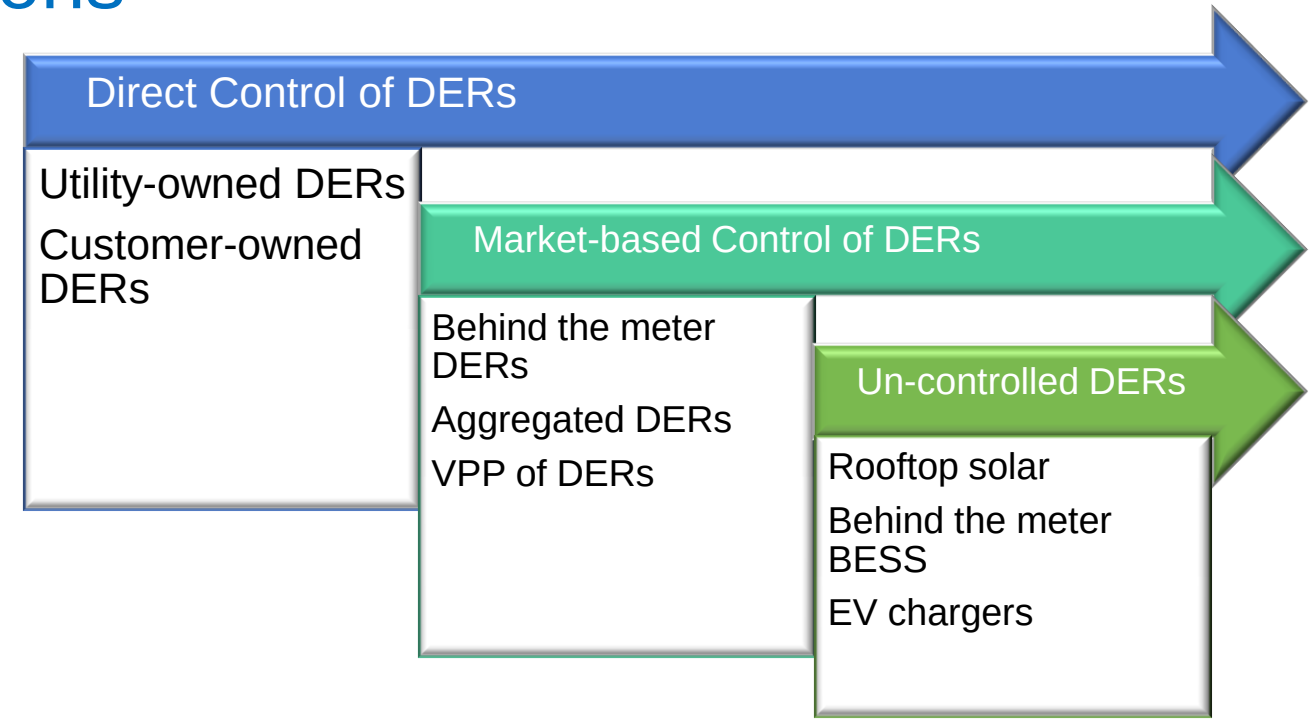
PXiSE ACT is a complete solution for modern grid operations

A comprehensive solution to manage and control all DERs logically organized as microgrids, VPPs, and aggregated resources



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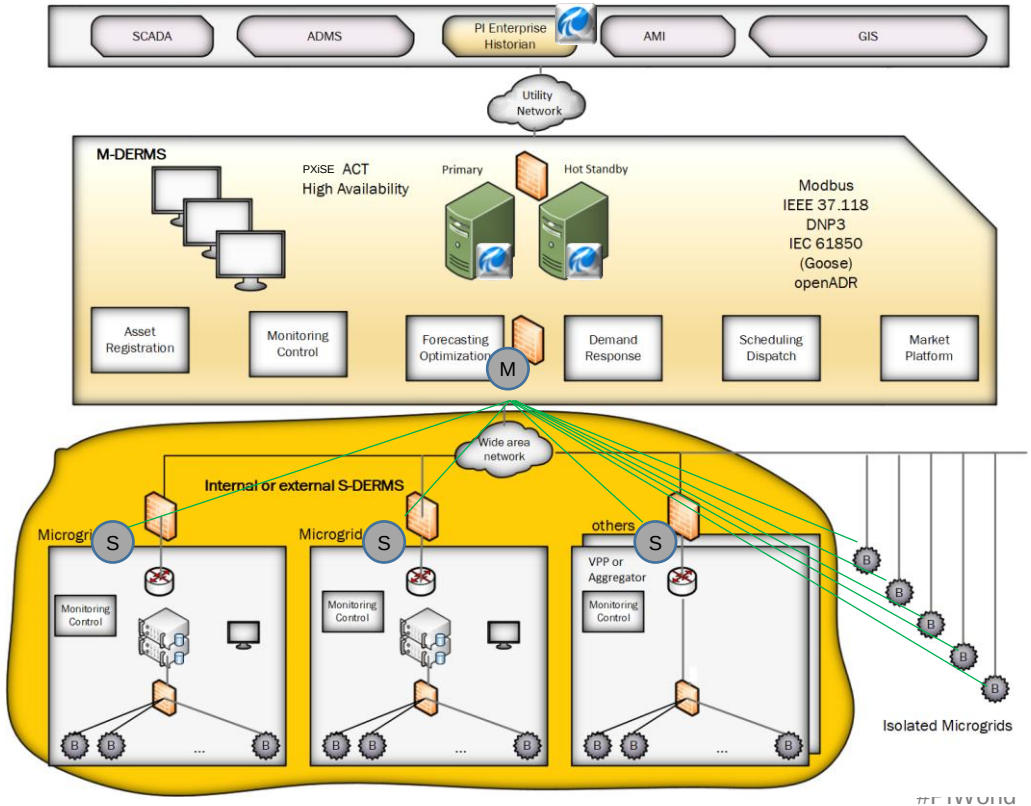
PXiSE DERMS multi-level control architecture

- Master controller
- Supervisory microgrid or virtual power plant (VPP)
- Controllable DER or an aggregated resource



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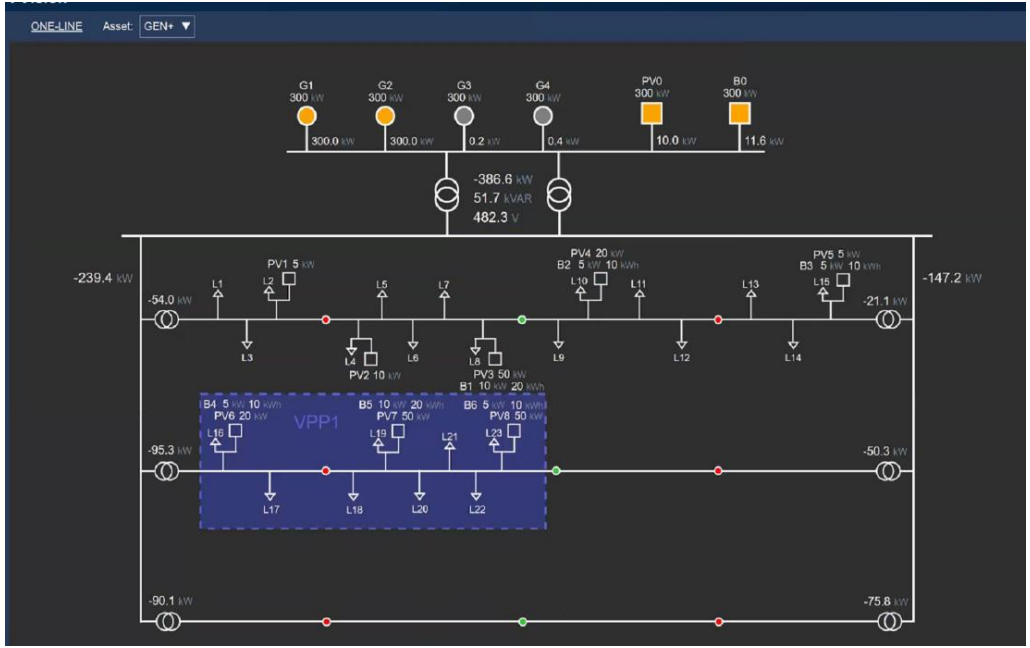
PXiSE DERMS - a real “control system” for 1,000s of DERs

- Extensive use of PI AF
- Coordinate real-time switching and control of DERs
- Control of Virtual Power Plants
- Control of Aggregators
- Optimization of a mix of energy resources



Comprehensive design: control directly managed DERs, market response DERs, and accounting for unmanaged DERs

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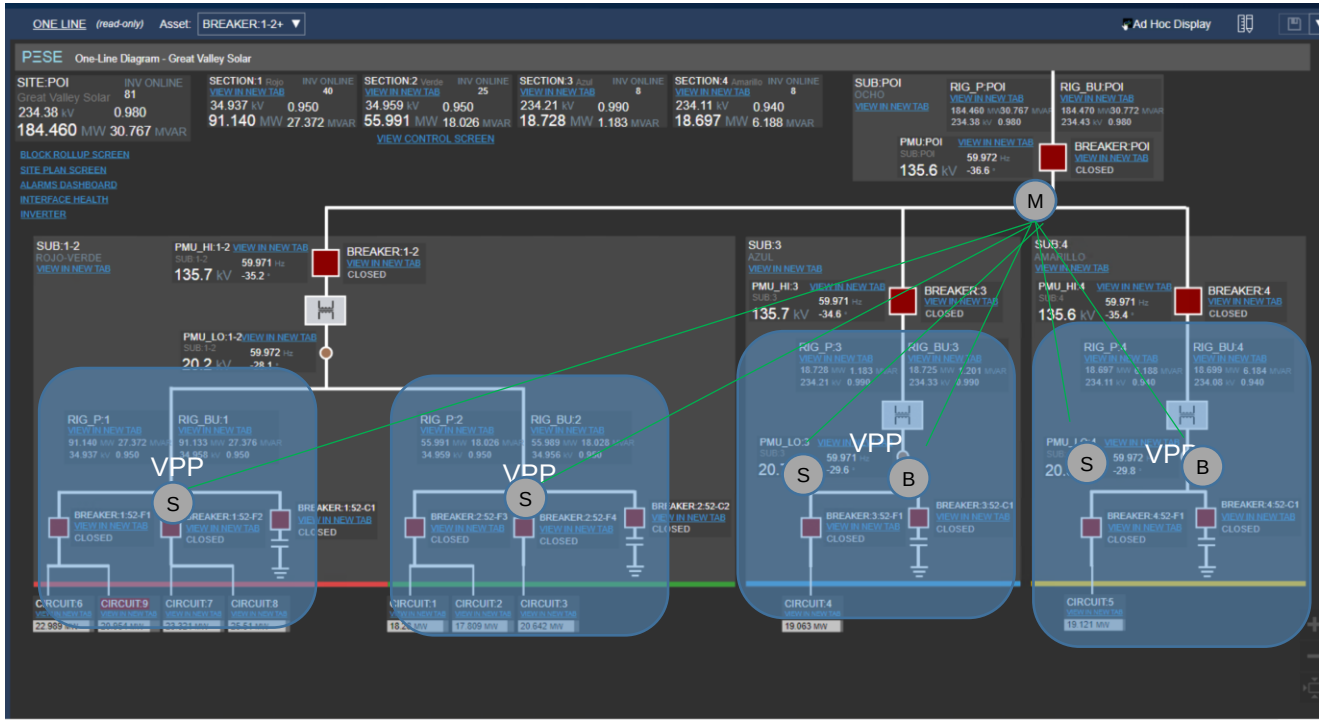
Software implemented at large solar farm (same architecture as DERMS control)



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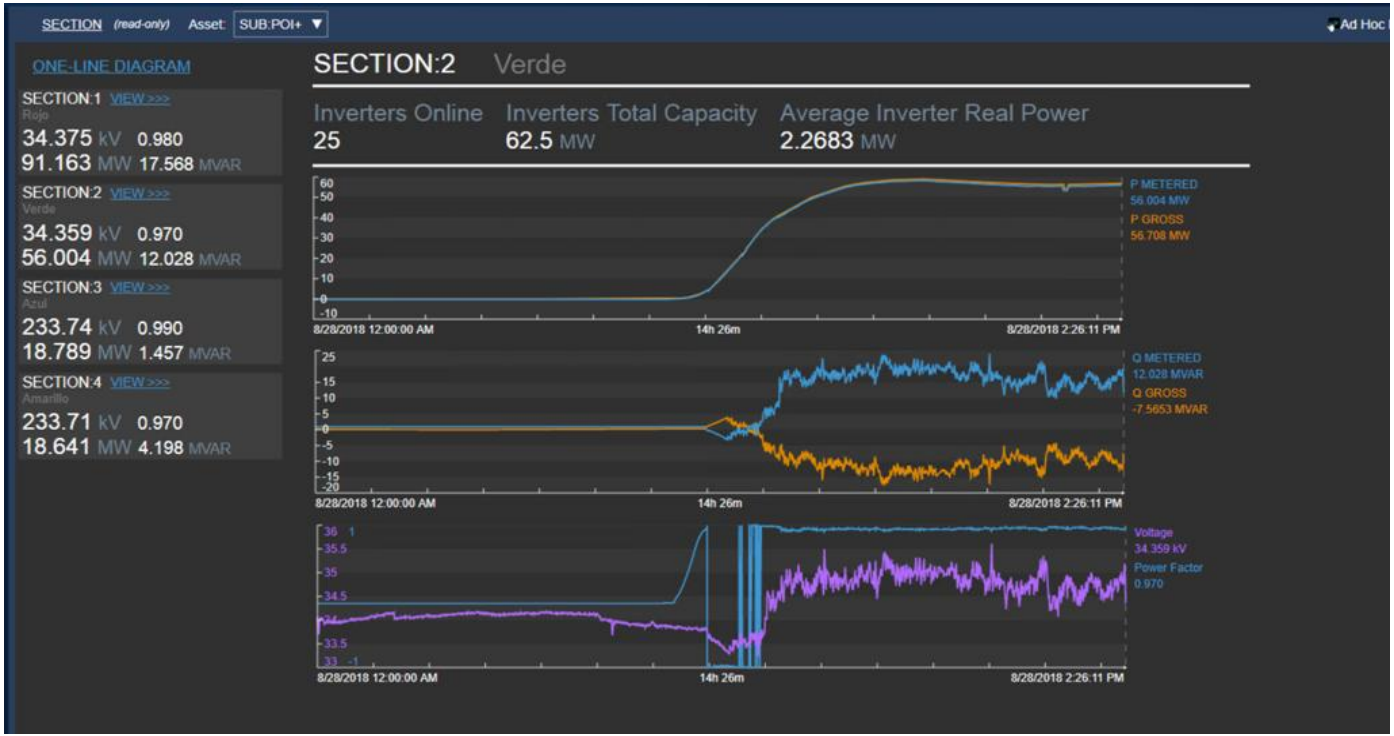
Large solar section display



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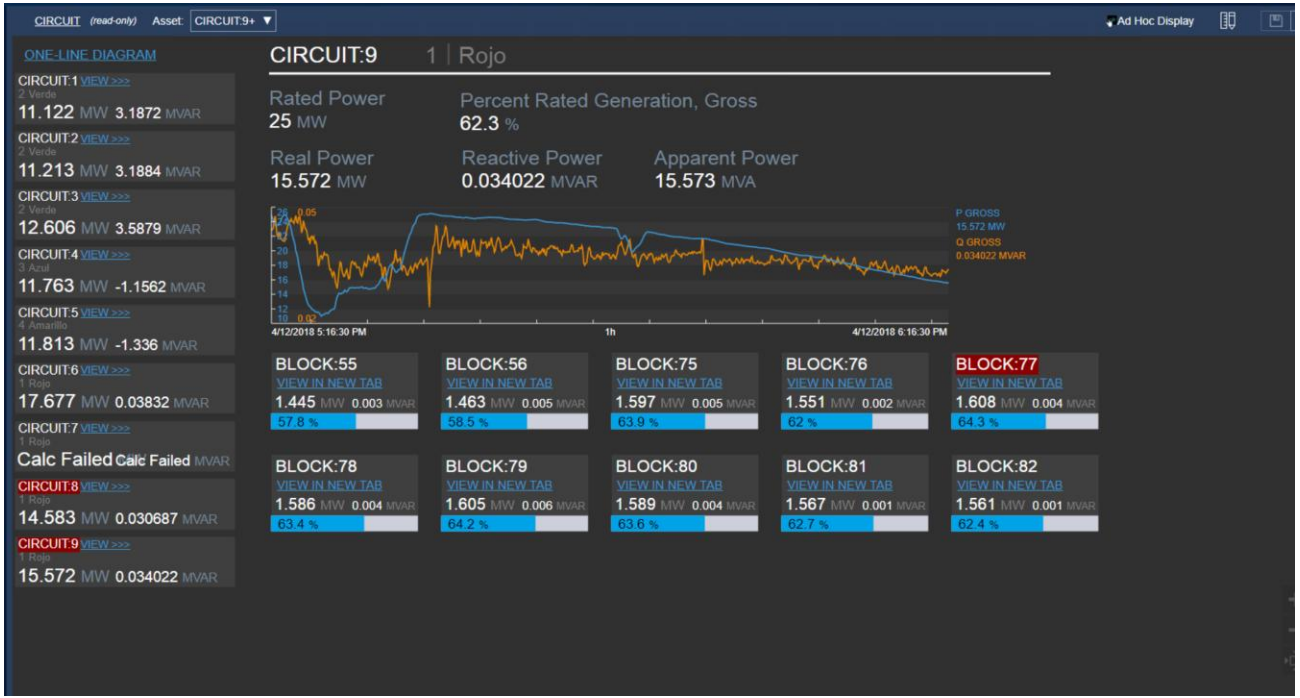
Display and control of individual controllable inverters



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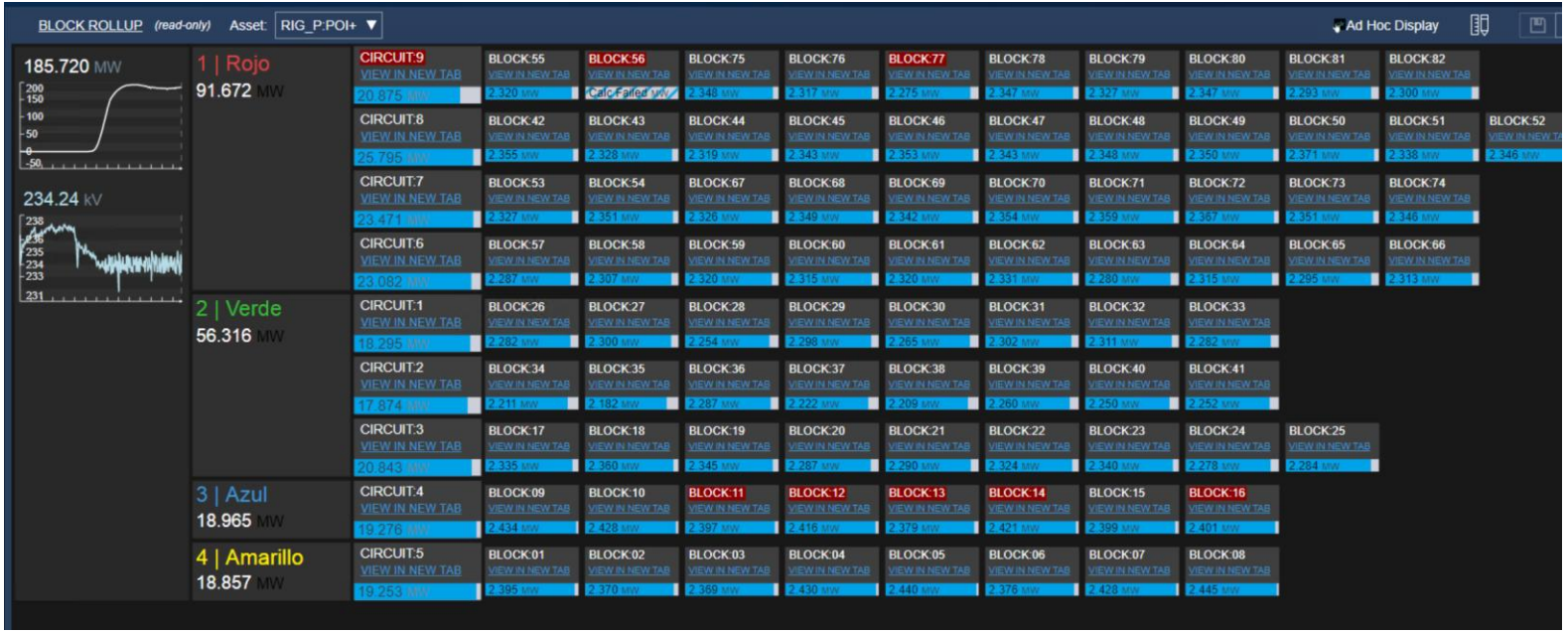
Circuit display in a Solar section – “like aggregated DERs within the VPP”



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Summary

Important to select the right microgrid and DERMS solution in a modern grid

Better accuracy of DER control

Faster response to dynamic changes

Better sensors and data (Bigger data)

System level intelligence with AI

Commonly available industrial hardware

Proven data platform (OSIsoft PI)

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