Power System Flexibility and DERMS

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aspentech

Outline

- Transformation of Power Grid & The Dual challenge
- Power System Flexibility & DERMS – Integra DERMS
- DER Registration - AspenTech Cimphony & Grid Apps
- Integra DERMS - Case studies

Digital Grid Management

Transformation of Power Grid & The Dual challenge

The Traditional Grid – Good Old Days !

Power Flow → Unidirectional

Generation | **Transmission** | **Distribution**

Centralized generation

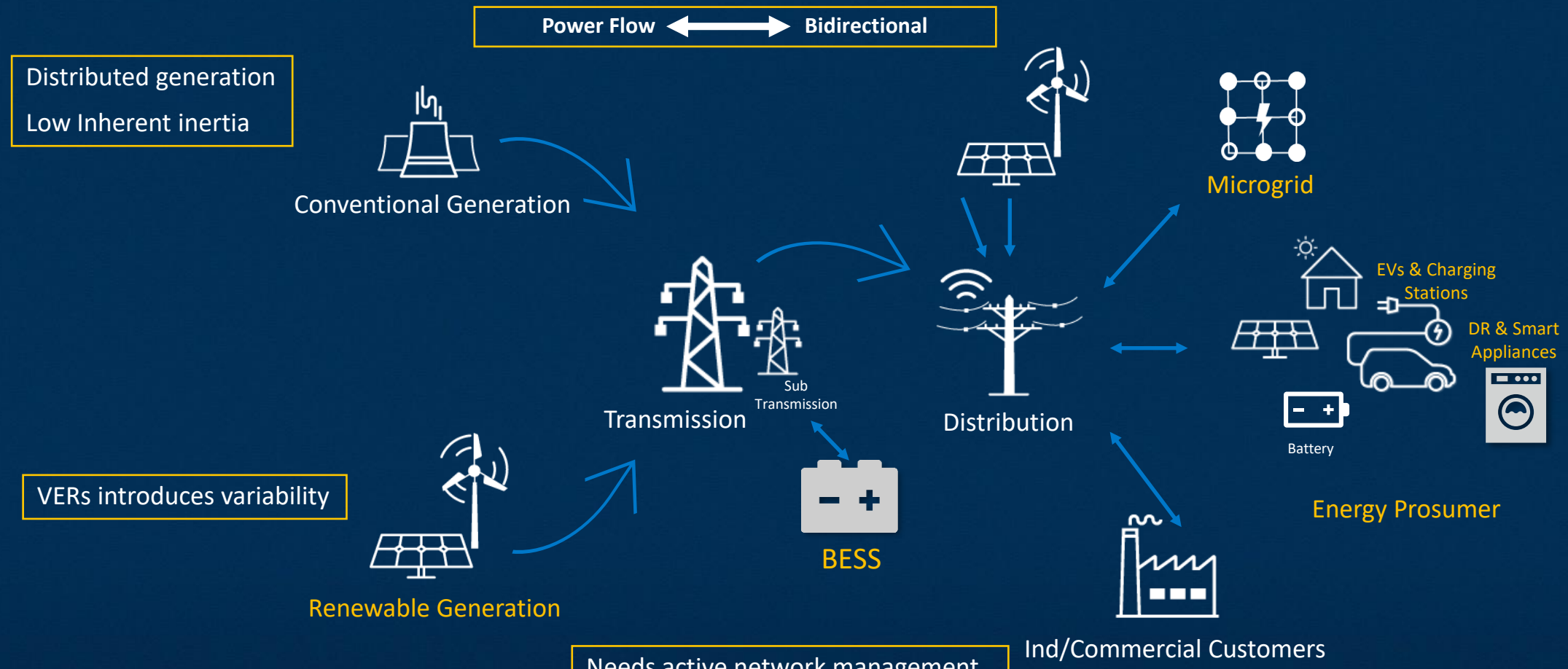
Inherent inertia of generators

Deterministic governor control

Load patterns - relatively stable & predictable

Minimal cybersecurity risks

Modern Electric Grid



The Energy Transition Challenge is Both Huge and Accelerating

Decentralize & Electrify	Expand & Modernize	Decarbonize	Extreme Weather	Cybersecurity Threats	Workforce Skill Gaps
2.6x	**2x**	**65-91%**	**63**	**2x**	**50%**
Growth in electricity generation by 2050[1]	Increase in size of electric grid globally by 2050[2]	Share of renewables in global power mix by 2050[3]	# of billion-dollar weather-related disasters globally in 2023[4]	Increase in utility cyber attacks (2022 vs 2020)[5]	Of utility workforce eligible for retirement in 2025[6]

The scale of transformation is massive, and the pace of change is accelerating

Macro-Trends in Energy – Dual Challenge

MEET GROWING DEMAND…

50%
Global energy demand growth by 2050[1]

8.0B (2022) **9.7B** (2050)
Global population[2]

770M
people with no electricity today[3]

600%
Growth in lithium and cobalt by 2035[4]

…WHILE ADDRESSING SUSTAINABILITY GOALS

x3
Renewable growth by 2050[8]

Net Zero
by 2050[5]

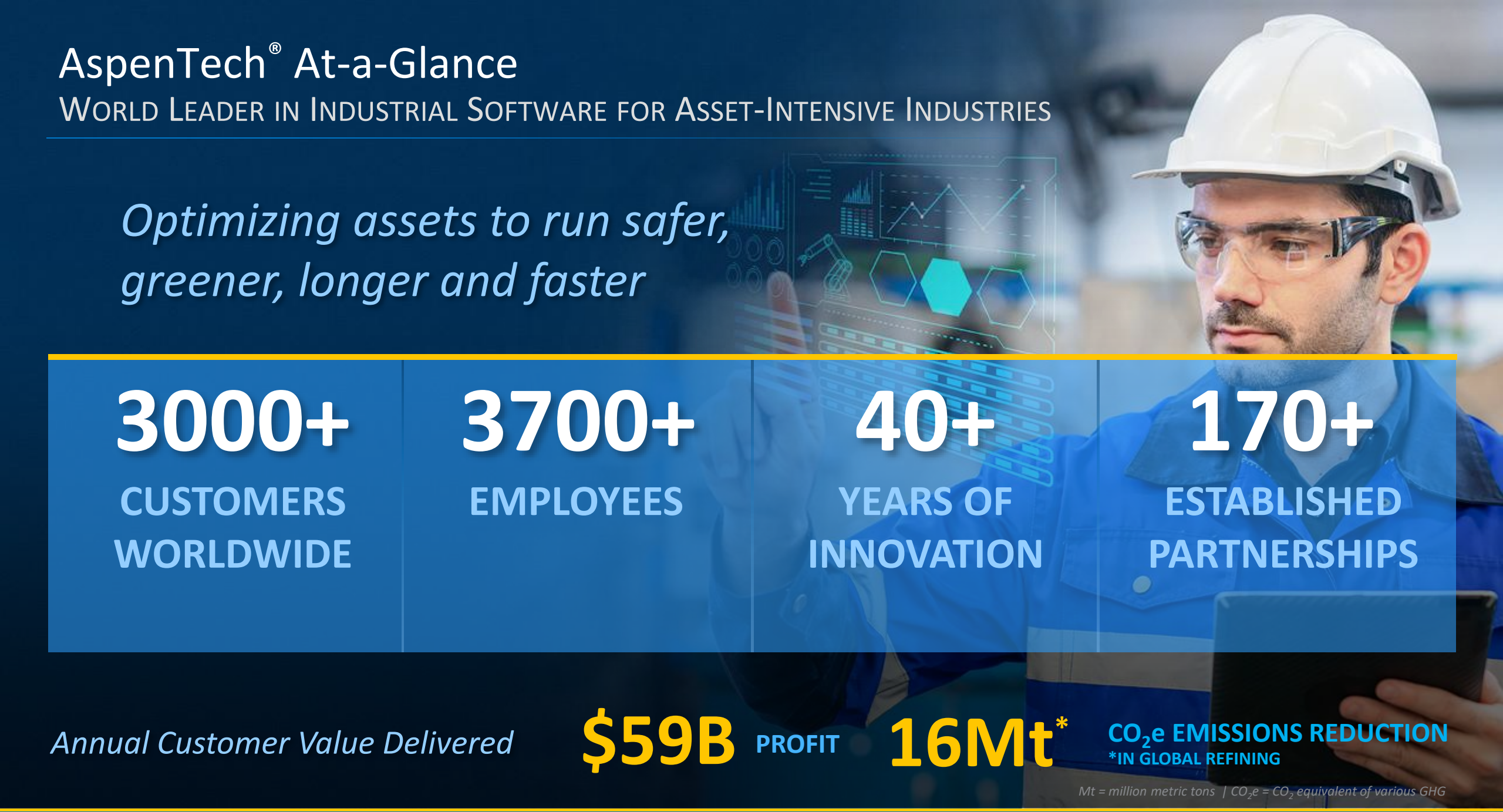
83%
Fossil fuel contribution of global CO_2 emissions today[6]

91%
Renewable share of electricity generation by 2050[7]

1. *EIA projects nearly 50% increase in world energy usage by 2050, International Energy Outlook 2021*
2. *International Institute for Sustainable Development, SDG Knowledge Hub, Aug 2020*
3. *EIA "access to energy 2022*
4. *Benchmark Mineral Intelligence*
5. GHG emissions reduction by 2030 from 2010 level - COP 26 Nov 2022
6. The net-zero challenge: Accelerating decarbonization worldwide, McKinsey and Company, Jan 2022
7. World Energy Transitions Outlook 2023, IRENA
8. Global Renewables and Energy Efficiency Pledge, COP28

AspenTech® At-a-Glance

World Leader in Industrial Software for Asset-Intensive Industries



Optimizing assets to run safer, greener, longer and faster

3000+	3700+	40+	170+
CUSTOMERS WORLDWIDE	EMPLOYEES	YEARS OF INNOVATION	ESTABLISHED PARTNERSHIPS

Annual Customer Value Delivered **$59B** PROFIT **16Mt*** CO_2e EMISSIONS REDUCTION *IN GLOBAL REFINING

Mt = million metric tons | CO_2e = CO_2 equivalent of various GHG

AspenTech Product Portfolio

Performance Engineering

Manufacturing & Supply Chain

Asset Performance Management

Subsurface Science & Engineering

Digital Grid Management

Industrial Data Management

Field Proven Solutions – Sample User Community – AspenTech DGM

AspenTech DGM
India and Asia Pacific Footprint

India

- Grid India :
  - NLDC (National Load Dispatch Centre)
  - SRLDC (SLDCs for TN, Kerala, AP, Telangana & Puducherry)
- REMC (Southern: Karnataka, Andhra Pradesh, & Tamil Nadu)
- REMC (Northern: Rajasthan, NLDC, & NRLDC)
- CESC Limited, Kolkatta , India
- Adani Electricity, Mumbai, India
- TATA Power, Mumbai, India
- India Power Corporation Limited (IPCL)
- KPTCL, Karnataka, India
- BESCOM, Bangalore , India

Asia / Pacific

- Vietnam Electricity, Vietnam
- Sabah Electricity, Malaysia
- Malaysia Airports (KLIA), Malaysia
- Metropolitan Electricity Authority, Thailand
- Snowy Hydro, Australia
- ElectraNet, Australia
- Jemena, Australia
- Sydney Trains, Australia
- TasNetworks, Australia
- Powerco, New Zealand

Digital Grid Management

Power System Flexibility & DERMS – Integra DERMS

Flexibility of the Grid & Role of DERMS

Power System Flexibility :

Ability to dynamically balance **supply & demand**

Handles variability from **VERs** & Ensures **stable power delivery** to a **dynamic load**

DERMS is an advanced software platform that enables utilities and grid operators to **monitor, control, and optimize** DERs

DERMS play a critical role in enhancing flexibility by **optimizing** the use of DERs

The Role of DERMS in Power System Flexibility:

DERMS provides a **centralized digital intelligence** that integrates DERs into grid operations:

- **Real-time Monitoring**.
- **Automated Control**.
- **Interoperability**.
- **AI-Driven Optimization**.
- **Cybersecurity & Resilience:** Protects against cyber threats, ensuring secure grid operations.

AspenTech Solutions for Power & Utilities Industry

OSI portfolio is now the Digital Grid Management Product Suite

monarch™

POWER & UTILITIES VALUE CHAIN

GENERATION | TRANSMISSION | DISTRIBUTION

GAS TRANSMISSION & DISTRIBUTION

Security

CHRONUS Historian

DERMS — Virtual Power Plant

Outage Planning | Switch Order Management | Mobile Field Crew App

GMS
- Production Planning
- Deregulated Energy Markets
- Real-time Operation
- After the Fact Evaluation
- Generation Model

EMS
- Planning
- Network Analysis
- Dynamic Security Assessment
- Dynamic Ratings
- Transmission Model

ADMS
- Distribution Management
- Outage Management
- Distributed Energy Resource Management
- Distribution Network Model

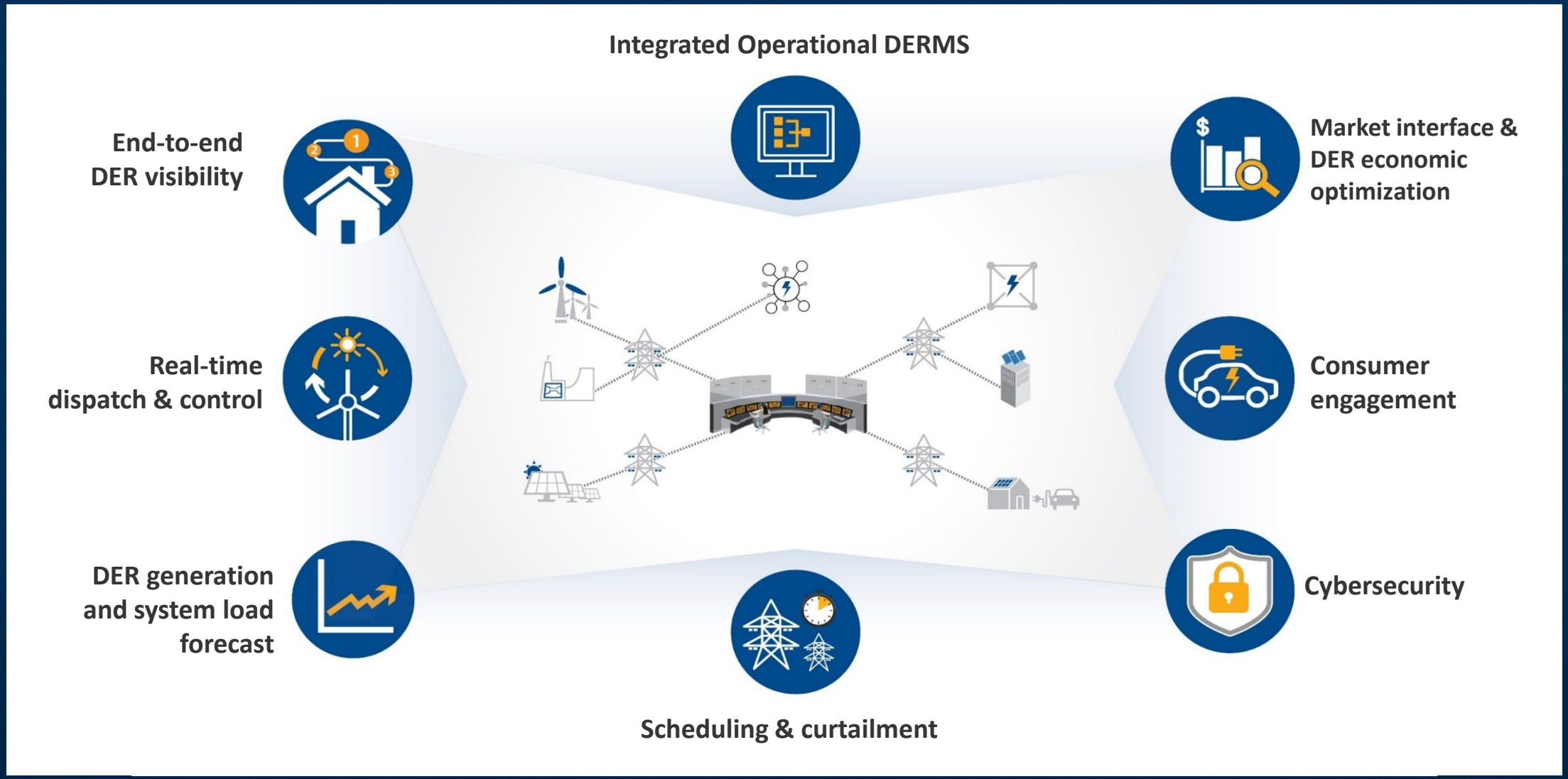
Gas Pipeline
- Data Applications
- Safety Applications
- Predictive Applications
- Pipeline Connectivity Model

monarch™ Core Platform

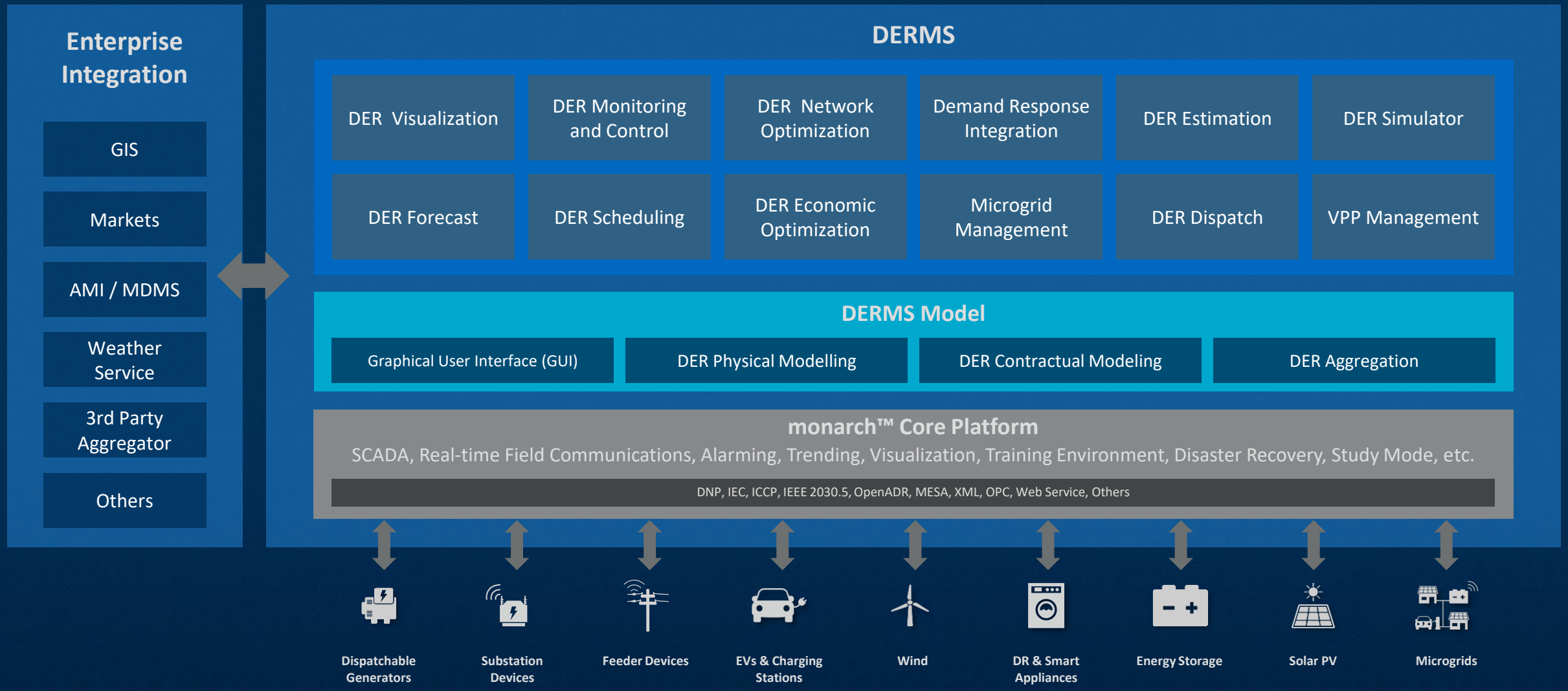
SCADA, Real-time Field Communications, Alarming, Trending, Visualization, Training Environment, Disaster Recovery, Study Mode, etc.

Dispatchable Generators | Substation Devices | Feeder Devices | EVs & Charging Stations | Wind | DR & Smart Appliances | Energy Storage | Solar PV | Microgrids | O&G Devices

Solving Challenges Through DER Management – Integra DERMS



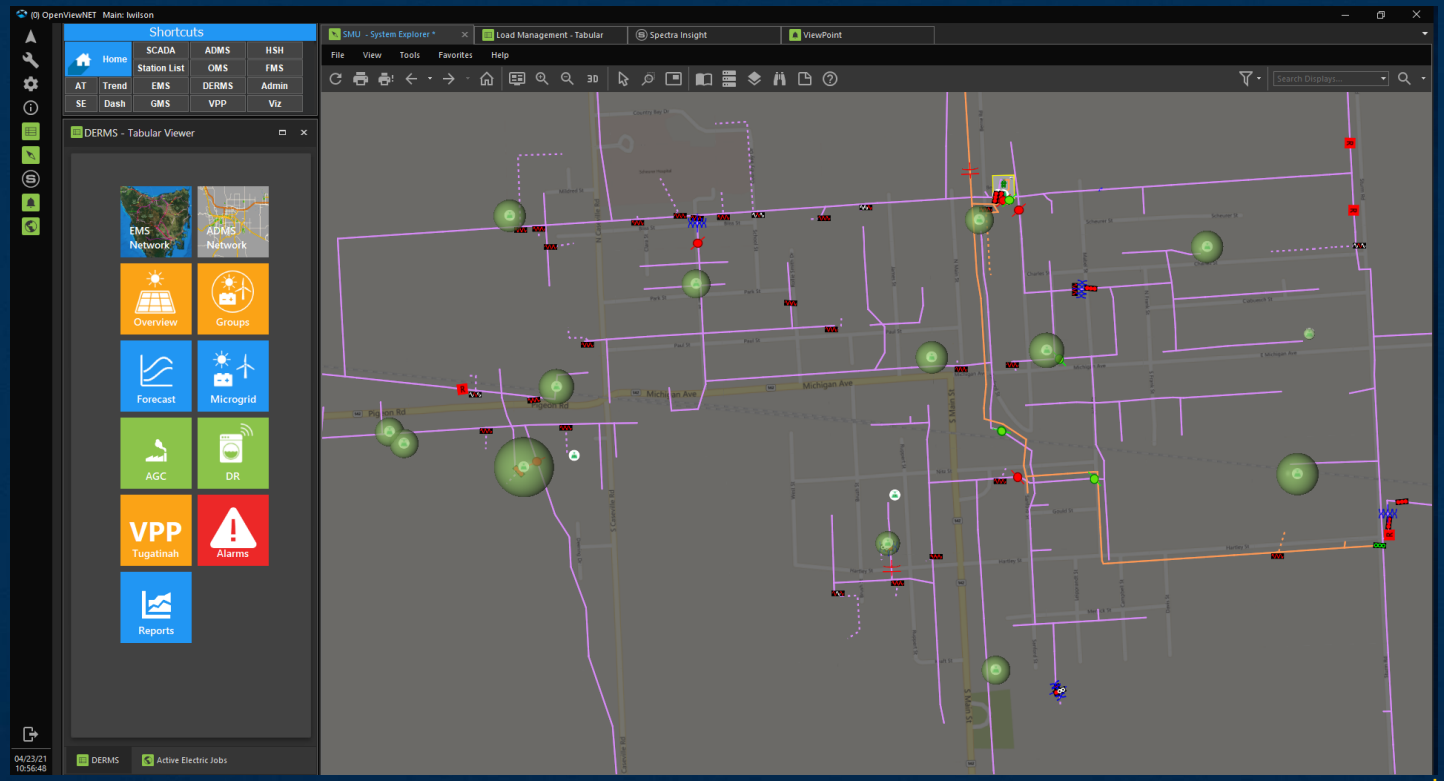
AspenTech Integra DERMS Architecture



Leverage Situational Awareness for Improved Performance

Visualization & Monitoring

- Enable control room awareness of all DER types on the network
- Assess impacts of DERs on Network in real-time
- Ensure network reliability is being maintained
- Navigate quickly to loads downstream from a DER

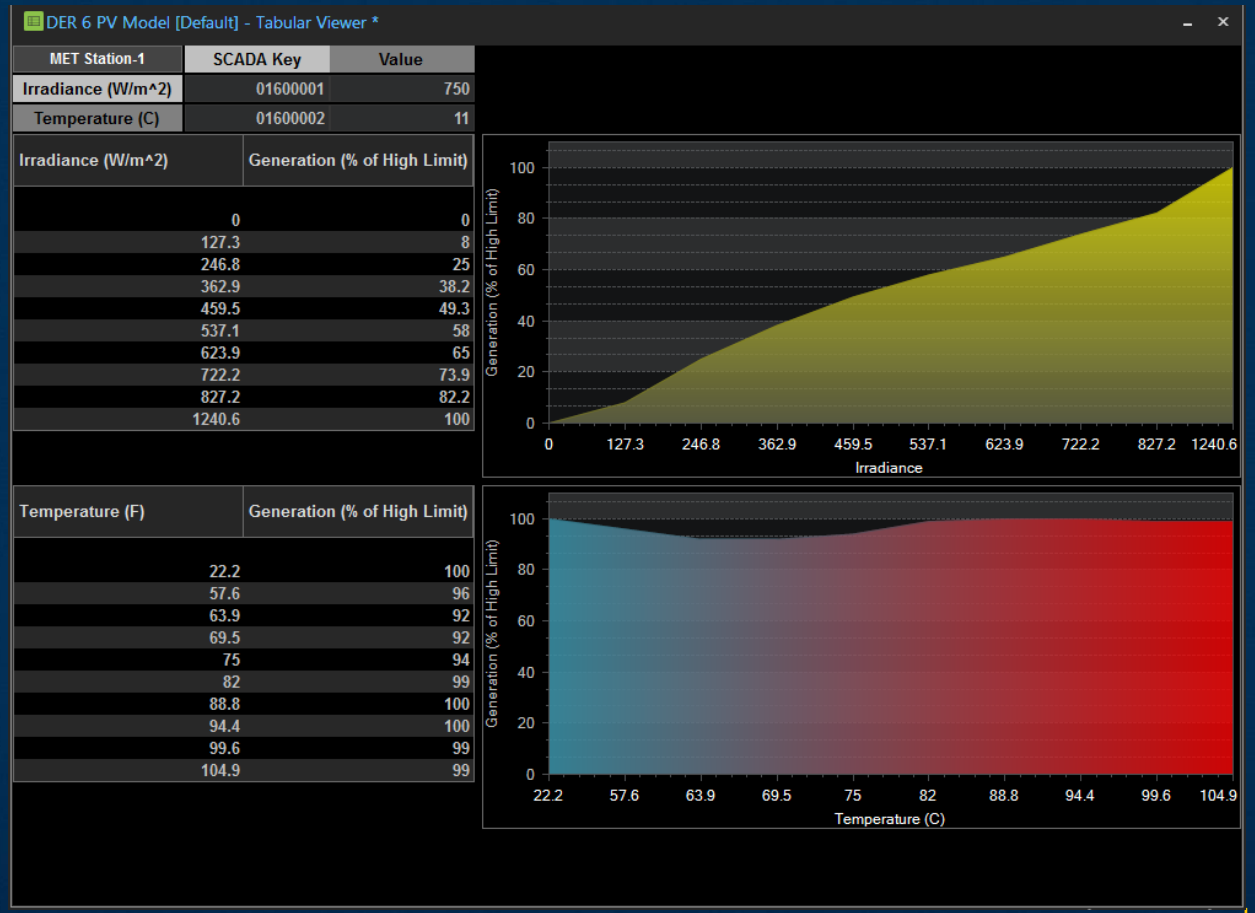


Complete Network Situational Awareness

Enable Network Operators to Support Intelligent Control

Estimation & Forecasting

- Equip operators with current and future load and DER forecasts
- Provide complete picture of all DERs with or without telemetry
- Inform operators of future DER-caused impacts to network
- Enable intelligent control of DERs at aggregate or sub-aggregate levels

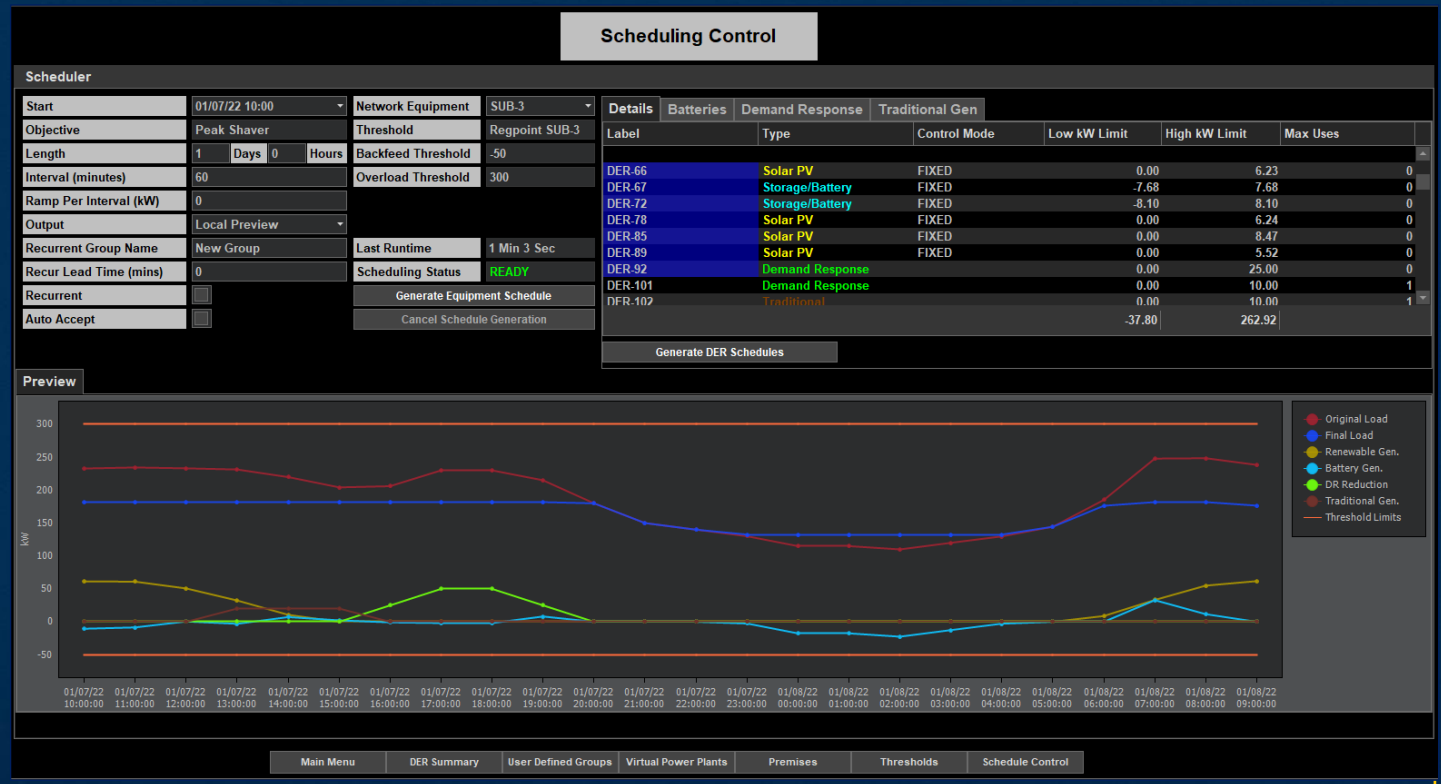


Advanced Real-time Estimation of DER Outputs

Optimize Network by Enabling Coordinated Strategy Execution

Scheduling & Control

- Better manage output leveraging current and future forecasts
- Avoid or shave peak loads
- Reduce costs through economic optimization
- Avoid impacts of reversed power flows

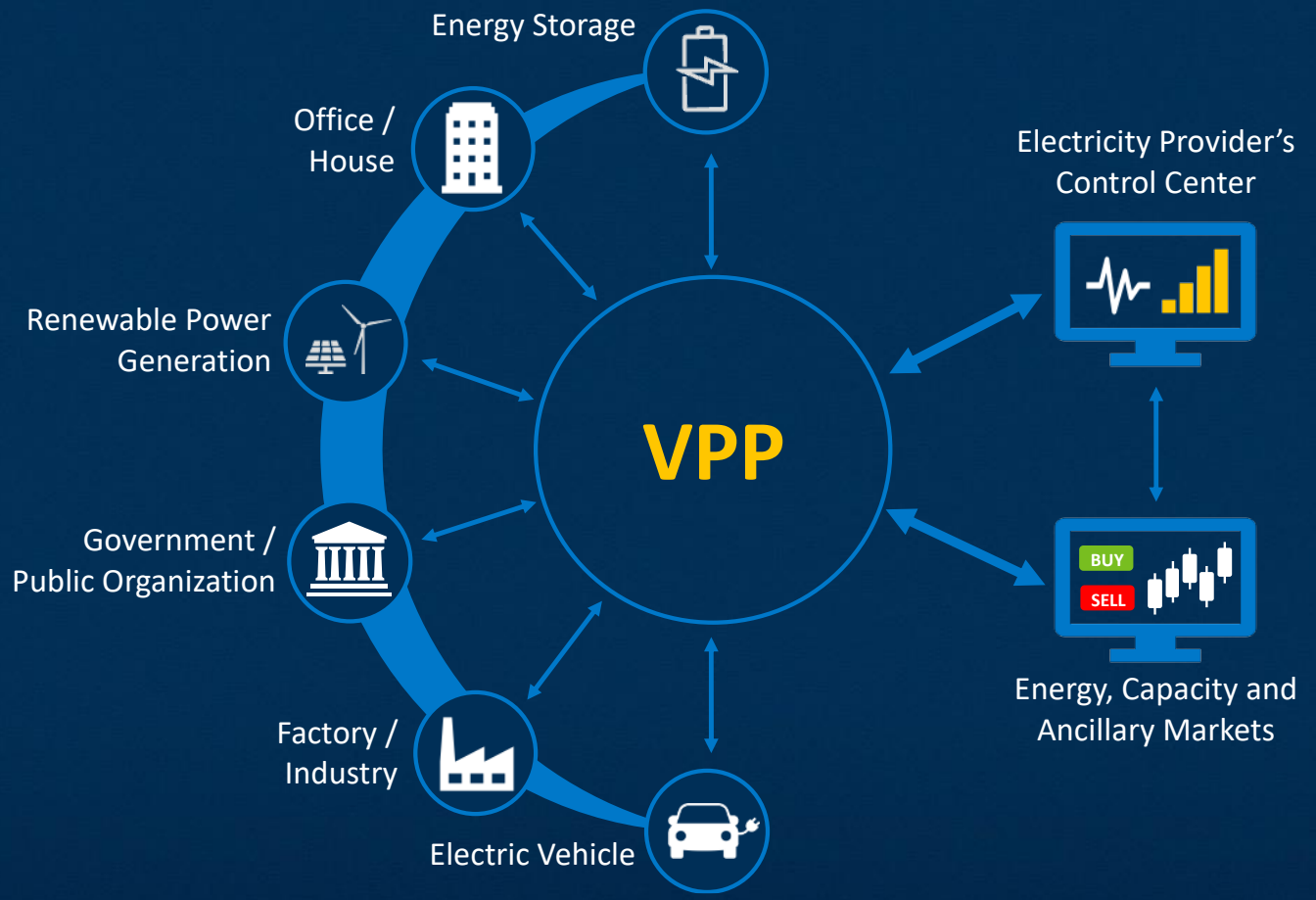


Intelligent Scheduling & Control of DER Outputs

Maximize Financial Performance through Market Engagement

Virtual Power Plants (VPPs)

- Enable aggregated DERs to improve profitability
- Maximize financial objectives by creating new revenue streams
- Solve complex grid issues through precise VPP operations
- Enhance overall performance with System of Systems Approach



Incorporate DERs into a VPP and Interface with Markets

DERMS Product Differentiators

Fully Integrated Solution

Integra DERMS is the only DERMS on the market with native integration into the DMS/GMS/EMS

Low Total Cost of Ownership

Integra DERMS can ensure safe, reliable, and efficient operations while significantly reducing the total cost of ownership

As-Operated Network Model

The DERMS model is real-time network aware, updating DER groups dynamically to instantly reflect current state of network

Efficient User Experience

Ease of operations and system-wide optimization by integrating legacy and third-party aggregators into a single pane of glass

Easiest to Maintain/Update

Periodic upgrades are achieved faster and easier than any DERMS in the industry through a product-driven solution

Digital Grid Management

DER Registration
AspenTech Cimphony
& Grid Apps

Transform Customer Experience with Customer-facing Applications based on model-driven data

Outage reporting

- Crowd source outage and damage reporting

Visibility

- Provide visibility to network demand and generation capacity maps

DER Registration

- Self-serve DER registration and connection requests

Engagement

- Share real-time utility network data to enable new business capabilities

Enable real-time bi-directional data sharing between customers and an Enterprise Network Model management solution

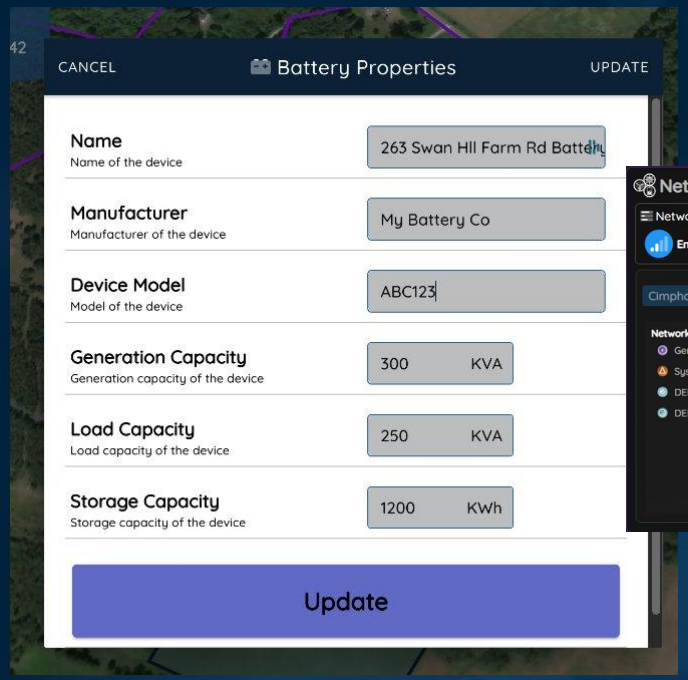
AspenTech Grid Connections

Customer self-service DER Registration with Enterprise DER Database

Capabilities

- Allow customers to define connection requirements and parameters of connected equipment
- Automatically identify the feeder supplying the selected location
- Integrate electrical network data with existing network models
- Create Enterprise DER database

Update real-time network model instantaneously as DER registration received



Product(s):
AspenTech Grid Apps

AspenTech Grid Apps – Automated Electrical Model Creation

Accelerate interconnection request response times while reducing analysis costs

Capabilities

- Exposing network data, capacity information and geographical data allows for automatic feeder selection
- Customer-defined routing and connections results in the process creating electrical network models
- Planners do not have to build a model before conducting analysis

Conduct interconnection analysis quickly and easily through automation

Product(s):
AspenTech Grid Apps

Digital Grid Management

AspenTech DERMS
Case studies

Meeting Aggressive Clean Energy Goals with Affordable, Renewable Power Across 900 Square Miles

SMUD®

> By having an integrated DERMS and ADMS, our operators can take advantage of advanced ADMS applications with visibility to manage DERs so that they don't cause any grid constraints
> - Hashim Khan, Distribution Operations Engineer, SMUD

Improved satisfaction for 650,000 Customers

CHALLENGE

- Providing power to 650,000 customers over a 900-square mile service territory
- Meeting California's nation-leading clean energy standards
- Proliferation of DERs:
  - 20,000+ solar PV systems producing over 280 MWs
  - 6,500 EVs
  - 129 energy storage units
  - Demand response for 16 MW worth of commercial and 83,000 residential customers

SOLUTION

- Spectra DMS, including eMap with GIS interface for network model, situational awareness, and study mode
- Enhanced ADMS applications, DOPF, VVO, FLISR
- Integra DERMS™ with forecasting and AMI Interface, network optimization and scheduling modules, economic optimization and market interface

Product(s):

OSI Monarch SCADA, CHRONUS, DMS, DERMS

Operating Vertically Integrated Electric Utility Generation, Transmission and Distribution Management for over 1 Million Customers

> OSI has been our partner since 2006 in reliable and secure electric operations and in enabling grid modernization technologies such as distributed energy resource management
>
> - Salt River Project, Arizona

Reliable Power Provision with major renewable energy to over 1 Million

CHALLENGE

- Effectively manage a vertically integrated generation, transmission and distribution network
- Serve more than 1,090,000 customers with reliable electricity
- Provide visibility and management over a network covering 2800 square miles
- Enable significant distributed energy resource growth including eVehicles, residential solar, batteries and more

SOLUTION

- Transmission management (EMS)
- Automatic Generation Control and Dispatch (GMS)
- Distribution Management (DMS)
- Outage Management (OMS)
- Distributed Energy Resource Management (DERMS)
- Operator Training Simulator (OTS)
- Test bed for advanced study

Product(s):

OSI Monarch SCADA, GMS, EMS, DMS, OMS, DERMS