

Software Capabilities

DER Orchestration Platform

Generac Grid Services provides a distributed energy resource (DER) orchestration software platform that is transforming energy system operations. Generac's Concerto™ supports the evolving needs of grid operators, from advanced demand response programming to complete virtual power plant (VPP) and distributed energy resource management system (DERMS) solutions. Concerto's core enabling technology utilizes advanced software architecture to support multi-service engagement of DERs. Using telemetry, communication infrastructure and machine learning, Concerto provides a highly flexible approach to monitor, optimize and control entire fleets of DER assets in real-time.

Distributed Energy Orchestration Platform

Complete Virtual Power Plant & Distributed Energy Resource Management System Solution



Advanced Demand Response

- Demand response
- Peak demand reduction
- Energy shifting/arbitrage



Dynamic Dispatch

- Advanced DR, plus:
 - Primary reserve market
 - Secondary reserve market
 - Tertiary reserve market
 - Energy shifting/trading
 - Oversupply/PV curtailment
 - Renewable firming
 - Precharge



Distribution Optimization

- Dynamic Dispatch, plus:
 - Power flow management
 - Threshold control
 - Volt/VAR response
 - Technical loss minimization
 - Conservation voltage reduction

The Concerto Platform

Generac Grid Services' Concerto platform gives grid operators, distribution utilities, energy retailers, energy traders and large energy consumers the ability to harness the flexible capacity made available by the growing number of DERs interconnecting to the grid.





MONITORING

Concerto Enables the Monitoring of:

- In-front-of and behind-the-meter DERs
- Real-time energy consumption and production
- Asset, site and virtual power plant performance
- DER Portfolio Health
- Data backup and export solutions



OPTIMIZATION

Extract the Greatest Value from DER-driven Flexible Capacity with:

- Closed loop, transactive solution
- Accounts for need duration and magnitude
- Economic optimization based on cost-to-dispatch
- Hierarchical optimization for prioritizing local and system-wide value opportunities
- Context-aware dispatch
- Multiple optimization routine capabilities
- As fast as 3-second AGC compute cycle
- Based on active power, reactive power, energy, frequency, voltage and phase angle parameters



CONTROL

Remote Control of DER Devices Facilitates:

- Availability scheduling
- Dispatch of individual or aggregated portfolios of DERS
- Fast, autonomous control decisions
- Control within DER owner, manufacturer and utility constraints
- Meet local and system-wide objectives simultaneously
- Provision of multiple services for a single DER
- Response to economic signals and market opportunities, including
 - Real-time electricity prices
 - Tariffs and rate structures
 - Export and no-export requirements

Grid Services

- Demand response
- Energy control
- Power control
- Power factor control
- Threshold control
- Primary reserve
- Secondary reserve
- Tertiary reserve
- Reactive power control

Platform Capabilities

SCALABILITY

- Field-tested scalability to more than 25,000 assets; lab-tested scalability to more than 1 million assets
- Distributed architecture design
- Adaptable use cases and asset models to support evolving business needs

PERFORMANCE²

- Optimization and closed-loop control algorithms supporting 1-2 second AGC setpoints
- Real-time intra-event baseline calculations for > 99% accurate delivered capacity
- Support for sub-second monitoring telemetry for real-time distribution system optimization

RELIABILITY

- Standard uptime of 99.9%¹
- 24/7 on-call support for critical issues
- Phone, service desk portal and email assistance

SECURITY

- Industry standards and protocol support including:
 - OpenADR 2.0b
 - IEC 60870-5-104
 - OAuth 2.0
- Regular 3rd party penetration testing and audit
- California Rule 21 compliant
- All data traffic protected by strong encryption
- Blockage of non-authenticated data traffic
- Logging, monitoring and alarming functionality for all user activity

¹ Base uptime included in Advanced Demand Response packaging set at 99% but can achieve 99.9%. All other packages provide standard of 99.9%.

² Performance may vary dependent on DER device.

FORECASTING

- Smart, real-time forecasting across timescales from 48-hours to 5-minutes ahead.
- Concerto examines real-time data including:
 - DER technical constraints
 - DER economic constraints
 - Energy market prices
 - Weather
 - Current power system conditions (unplanned)
 - Grid and feeder switching actions or maintenance (planned)
- Adaptive algorithms learn in-situ DER operation characteristics

DIGITAL TWIN & SIMULATION FEATURES

Generac's digital twin technology is core to our optimization and forecasting capabilities. Digital twins build simulated models based upon:

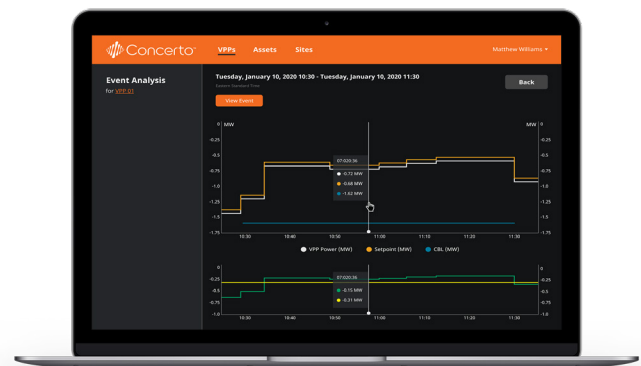
- Constraints
- Telemetry
- State
- Storage
- Ramp rates
- Energy rates
- Localized and system constraints
- Weather data
- Greenhouse gas data

USER INTERFACE & ACCESS PORTALS

The Concerto user interface provides a single pane-of-glass view to enable users to monitor, optimize and control DERs on their network. Concerto is accessible via internet browser from any standard browser platform.

Additional Concerto support portals include:

- C&I customer portal
- Program enrollment portal
- Program administrator portal



SYSTEM COMMUNICATIONS & INTEGRATIONS APPROACHES

- | | | | |
|----------------|----------------------------|---------------|------------------------------|
| • Modbus RS485 | • OpenADR 2.0b | • BACnet | • IEEE1547-2018 ⁴ |
| • Modbus TCP | • IEC 60870-5-104 | • GraphQL API | • IEEE 2030.5 ⁵ |
| • Modbus Plus | • IEC 60870-6 ³ | • Ethernet/IP | |

Built as a flexible platform that can evolve as new business models emerge, markets mature and asset technologies develop, Generac Grid Services seeks to provide tools and technology to facilitate the optimization of a broad ecosystem of DERs through Concerto. We offer three strategies for DER asset integration:

Grid Services

- Moderate performance
- Suitable for non-real-time applications
- 3rd party development, supported and maintained
- Leverages Open ADR 2.0b and IEC 60870-5-104

SDK

- High performance
- Suitable for real-time applications
- Formalized program offered by Generac Grid Services
- 3rd party development, supported and maintained















































Generac-Developed

- Highest performance
- Suitable for real-time applications
- Integrated to Generac development and roadmap
- 3rd party development, supported and maintained

Generac Grid Services serves as a trusted advisor to our customers and asset partners to achieve the goals of DER orchestration programs. We've developed a robust integration testbed for ongoing quality assurance and regression testing.

MIXED ASSET ECOSYSTEM

Generac Grid Services operates a vendor agnostic, mixed asset platform that supports the most extensive device library in the industry.

PV + Storage					
 			 	 	  
Generators		EV / EVSE		Thermostats	
  		 		   	
Load Control Switch				Building & Energy Management	
    				     	
Integrators & Management				RTUs	Other
   				 	  
Aggregators & Engagement					
      					

*Other partners may be available upon request.

Generac Grid Services provides our customers with services to extract the highest value out of the grid services provided by Concerto.

- Hardware solutions
 - Generac asset bundling
 - Dealer network support to aid with customer enrollment
- DER integration engineering services
 - Site and equipment audits
 - DER operations and flexibility analysis
 - DER enablement
 - DER commissioning
- Customer engagement and enrollment services
- Virtual power plant grouping
- Remote support of each network utilizing Concerto
- Activity and performance reporting
 - Data backfill and cleansing
 - Post event reports
 - Monthly reports
 - End-of-season reports
- Integration design and development



ABOUT GENERAC GRID SERVICES

Generac Grid Services is a group of Generac, a leading designer and manufacturer of energy technology solutions and other power products. Generac Grid Services is changing the way the world generates and uses electricity. From turnkey solar + storage solutions, to backup generators, additional distributed energy resources and virtual power plant software, Generac Grid Services is accelerating the world's transition to a cleaner, more reliable power grid.



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