Grid Solutions

POWERNODE: LOAD SHEDDING

PowerNode is GE Vernova's advanced industrial electrical solution for industrial and power generation sites. With the ability to trigger load shedding in less than 15ms, our cost-effective solution optimizes generation; it increases a plant's reliability, availability, maintainability, and performance (RAMP) in a flexible, integrated monitoring and advanced automation solution.

Industrial load shedding enables facility electrical system stability in critical situations such as a sudden loss of available power, to balance load power consumption due to grid power restrictions (Demand Response) or to limit power consumption during peak hours (Peak Shaving).

PowerNode offers a variety of applications that can be adapted to existing or new installations including Fast Load Shedding, Electrical Stability Load Shedding, Demand Response and Peak Shaving.

Facility Challenges

Industrial facilities often have multiple sources of power to support their operational needs which can include on site generation, as well as, power being supplied by the utility. When a plant experiences a loss of one of these power sources, the remaining power generation may not be able to support the existing plant loading, and result in an unplanned shutdown. These unplanned shutdowns can have a very significant impact in the plant's productivity and availability, causing significant losses in revenue when they occur.

Additionally, cost reduction, financial incentives, and/or grid compliance can require a facility to shed loads. Participating in Demand Response scenarios or limiting the Peak energy consumption of a facility can have financial implications for plant operations.

GE Vernova's PowerNode: Load Shedding Solution

GE Vernova's PowerNode: Load Shedding (LS) solution is a real-time operations platform to combine all load shedding functions together with advanced monitoring and control.

PowerNode: Fast Load Shedding

- Trigger load shedding in less than 15ms
- Shed minimal amount load needed to compensate for lost generation (Dynamic)
- Supports up to 128 load shed groups
- System Scalable to 1000's individual loads
- Utilizes IEC 61850 GOOSE to achieve high-speed operation

OPERATING MODES

- Dynamic Load Shedding
- Static Load Shedding

Secondary Load Shedding

- Under-frequency Load Shedding
- Under-voltage Load Shedding
- Overload Load Shedding
- Demand Response
- Peak Shaving

Solutions & Services

- System study of plant load characteristics
- Development of Load shedding system
- System validation and Hardware-in-the-loop (HIL) testing
- Site Integration and commissioning
- Customized operator HMI
- Cybersecurity evaluation & deployment
- Long term maintenance and support

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Key Benefits

- **Reduces Unplanned Downtime:** With operating times of less than 15ms, GE Vernova's Load Shedding solution significantly reduces unplanned downtime, associated loss of production, potential equipment damage, and environmental impact.
- **Scalable:** Can be utilized in a wide range of installations - from systems with a single sheddable load through to facilities consisting of thousands of different loads. Utilizing up to 128 different groups of loads, GE Vernova's LS solution can support changing the load shed priority of these groups to match current plant conditions.
- **Flexible:** Utilizing the embedded HMI, local operators can easily monitor and change the priority of any load group in real time.
- **Vendor Agnostic:** GE Vernova's Load Shedding solution uses IEC61850 GOOSE messages and other standard protocols available in existing protection and control relays to minimize installation time and cost of the overall solution.
- **Easy Future Expansions:** Additional loads can be easily added to GE Vernova's Load Shedding solution to accommodate future facility or system expansions.
- **Cybersecure:** System is designed to follow IEC 62443-4-2 cybersecurity guidelines.

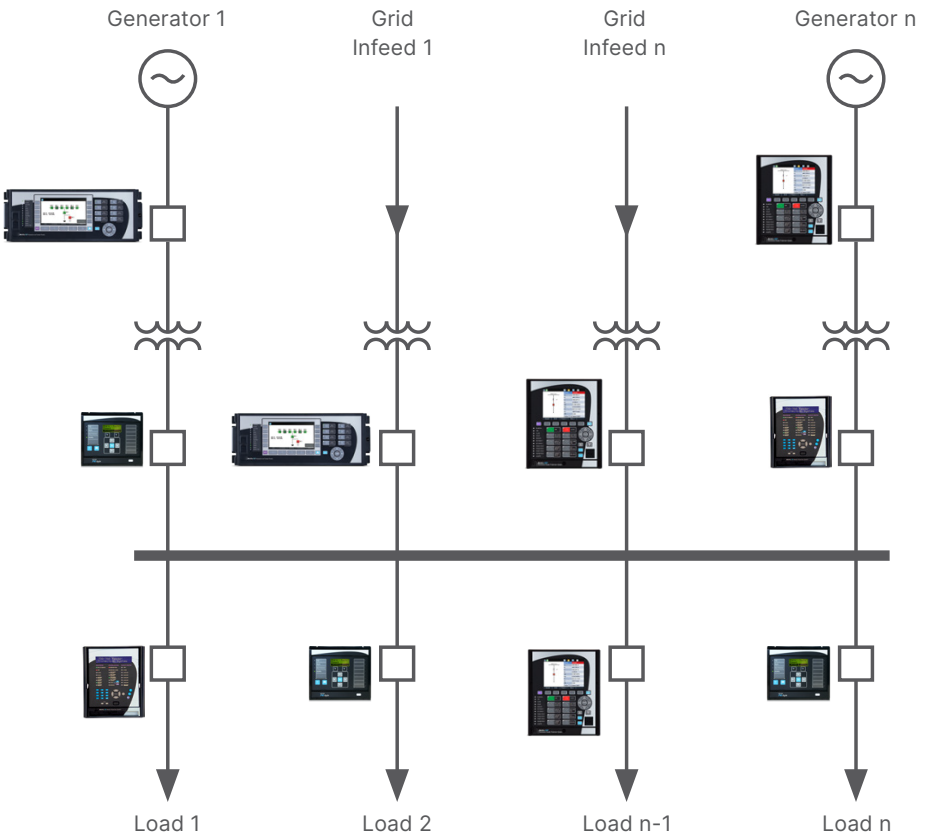
PowerNode: Fast Load Shedding Solution

GE Vernova's PowerNode: Fast Load Shedding (FLS) solution will maintain electrical system stability after a plant experiences a loss of one or more of its generation or utility sources. Pulling real-time information from the plant loads and generation sources, GE Vernova's FLS solution can detect a generation contingency and trigger actions that will shed the minimal amount of load needed to compensate for the lost generation. Using IEC61850 GOOSE messages, GE Vernova's FLS can initiate load shed actions within 15ms of the contingency detected.

GE Vernova's FLS solution utilizes existing protection relays distributed across the facility.

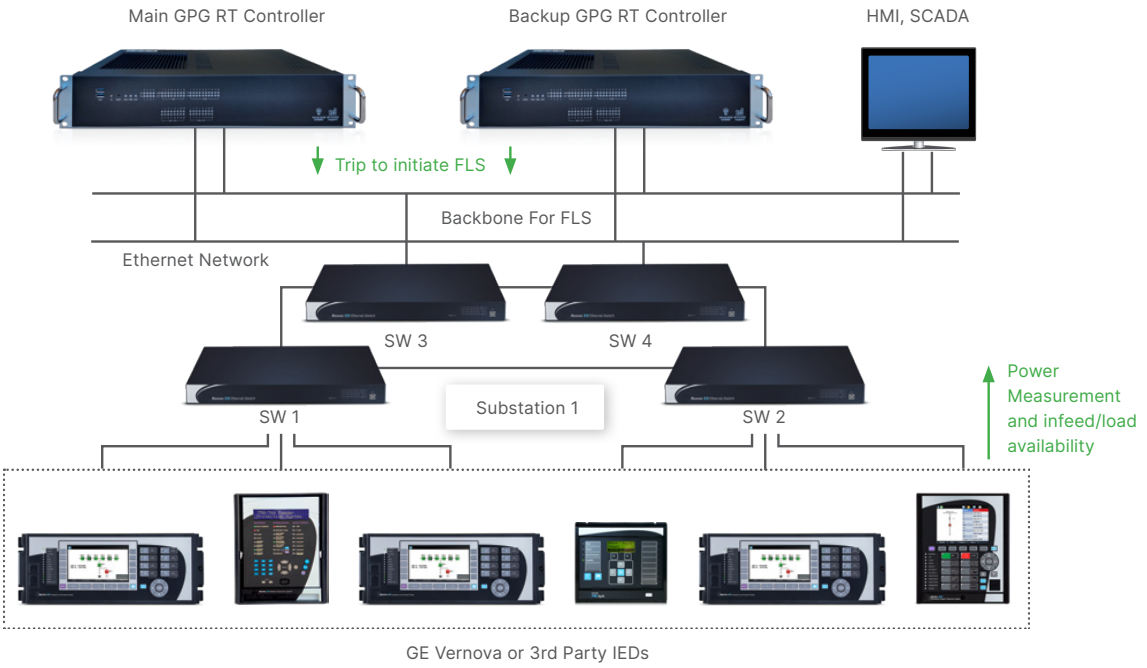
Facility Protection Relays are used to:

- Monitor the availability of all infeeds
- Measure the power input of all infeeds
- Supervise the status of all loads
- Calculate the amount of power consumed by each load
- Transfers information to Load Shed controller using Ethernet communications - no hard wiring required
- Execute local tripping command provided by the Load shed controller



Fast Load Shedding Solution Operation

- P&C relays send load/infeed power measurements and their availability to the Load Shedding controller using IEC 61850 GOOSE messages or other legacy protocols.
- GE Vernova's Load Shedding controller receives notification of a loss of an infeed from the P&C relays using IEC 61850 GOOSE messages.
- Based on the priorities set by the operator, the FLS algorithms will dynamically shed only the loads groups needed to match the amount of generation lost.
- GE Vernova's proven algorithms have been verified and validated to operate in under 15ms from the time the loss of infeed has been detected.
- For additional reliability, redundant Load Shedding controllers can be used.



GE Vernova's Fast Load Shedding solution is a Protection Relay based system that uses high-speed communications to minimize cost of deployment and maximize the scalability and flexibility of the system.

PowerNode: Secondary Load Shedding Solution

In addition to Fast Load Shedding, the GE Vernova's Load Shedding controller can also accommodate other secondary shedding requirements.

Secondary industrial load shedding is focused on:

- **Electrical Stability:** Customized load shedding solutions based on power, frequency or voltage moving out of acceptable limits. Scenarios executed by the Load Shedding controller can operate with times from 100ms to several seconds after the power instability was detected by the protection relays.
- **Demand Response:** Due to the increasing instability of the grid caused by renewable integration, grid operators are increasing the pressure on industrial consumers to participate in load demand control scenarios. Demand Response solutions can help facilities generate revenue through market participation as well as comply with grid requirements.
- **Peak Shaving:** Focuses on intelligently limiting utility peak power consumption to reduce a facilities electricity bill.

The GPG RT Controller makes load shedding decisions and issues shedding commands to the relays

Protection relays are used to measure frequency, voltage and power outside their normal operation values

GPG RT Controller

The GPG RT Controller is a real-time controller that hosts GE Vernova's Load Shedding solution and other power system control applications. The GPG RT Controller has been designed to be compliant with IEC 61850-3, which is an international hardware standard for communication networks and systems in power substations. Supporting international cybersecurity standard, the GPG RT Controller is the backbone of GE Vernova's industrial power solutions that ensure reliable and secure operation for improving the reliability of industrial power networks.

Hardware Specifications

- Certification: IEC 61850-3, IEEE 1613, CE, FCC Class A, UL, CCC
- -20 to 70 degree Celcius operating temperature
- Mounting: 2U/19" Rack mount
- System Design: Fanless, with no internal cabling
- OS Support: RTOS VxWorks and Windows Embedded.
- Power Supply: Redundant 100 ~ 240 VAC (47 ~ 63 Hz)
  DC: 100 ~ 240 VDC DC: 48VDC
- PRP & HSR Ethernet redundancy.
- Two expansion slots to increase serial and Ethernet port types and quantity.

Communication Protocols Supported

- IEC 61850 Server/Client Ed.1 and Ed.2 (MMS and GOOSE)
- C37.118 and IEC61850-90-5 Synchrophasor Protocol.
- IEC 60870-5-101/104 Server/Client.
- DNP3 Master/Slave RTU and TCP
- IEEE 1588, Irig-B and NTP client time synchronization
- Modbus RTU/TCP Master/Slave.
- IEC 6070-5-103 Master.
- OPC DA & AE Server/Client.
- OPC UA Server
- EGD Producer

For more information, visit
gevernova.com/grid-solutions

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