Load Management Systems
Critical Equipment for Successful CHP Projects

Presented by
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For successful CHP Projects LMS plays a very important role
Key LMS features are Loadshedding, local and remote HMIs for better plant operations, Historian, Sequence of events recorder
In a CHP design it is important to have bumpless transfers between the utility and generation and where utility permits close transitioning between buses.
Successful islanding means upon utility outage the CHP unit survives load swings and stays on line without shutting out the entire facility.
Integration into the plant existing system of any platform for example Siemens, delta V, Allan Bradley etc.
The following control are available through the HMI:

- Import / export control
- Emergency load shedding
- Under frequency load shedding
- Manually initiated automatic synchronization
- Automatic bus transfer
- Distribution system monitoring
The following controls are available through the HMI:

- Tap changer and protective relay control
- Spinning reserve calculations
- Topology management
- Communications
- General display functionality
- Alarm logging
• All the protective relays and Metering devices are connected to the LMS via Ethernet switch

• EtherNet/IP is used for communication between the LMS monitoring controller, local HMI, Generator control system, and the remote I/O rack.

• The LMS system communicates to various kinds of power meters over Modbus RS485 to report apparent power, active power, reactive power, power factor, voltages, currents, and frequencies

• Modbus is an open Master/Slave application protocol that can be used on several different physical layers. Modbus-TCP means that the Modbus protocol is used on top of Ethernet-TCP/IP. The LMS communicates to modern SEL/GE etc. devices through this protocol.

• The ControlNet network allows the monitoring and load shed processors to communicate with each other
Typical System Architecture

- LMS Monitoring Processor
- LMS Monitoring I/O Rack
- LMS Load Shed Processor
- LMS Load Shed I/O Rack
- Managed LMS Switch
- LMS Local Touchscreen HMI
- Fault Tolerant Communications Ring

ModbusTCP to Synchronizer

CampusEnergy 2019

CIHA
Synchronization

- Synchronizer can be a SEL 700GT or a CGCM (Combination Generator Control Module)
- One synchronizer can synchronize multiple breakers.
- Synchronization of multiple breakers can be achieved via drive relays and feed the synchronizer with the PTs associated to the synch. breaker.
- Sync Voltage High/ Low Limit (1 % Typical)
- Frequency Match Error Limit (+/- .04Hz Typical)
- Sync Frequency High/ Low Limit (.2 Hz/0.02Hz Typical)
- Timed Delay (5 Seconds Typical)
- Sync Phase High/ Low Limit (+5 Deg./-5 Deg. Typical)
- Phase Match Error Rate of Change Limit (1 Degree per second Typical)
Synchronization
• For Loadshed all the feeder breaker metering data is required.
• Loadshed happens once the facility is running in islanded operation.
• Loadshed can be frequency based or capacity based.
• The LMS will take into consideration the distribution topology so that loads that have been shed do not affect other loads on its partnered bus.

• The system topology allows the LMS to know the bus and electrical load distribution connection states.
• Various breaker statuses are monitored to determine the connection state of each load and bus.
• Loadshedding can be prioritized based on operator’s selectivity and operational requirements.
• During a load shed event the LMS reacts within 38 milliseconds to shed as many loads needed to retain the configured amount of spinning reserve.
## Load Shed Management

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<th>Device</th>
<th>Load kW</th>
<th>Priority</th>
<th>Enabled/Disabled</th>
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Load Shed MW =
(Loss of critical source MW + GEN Power Generated) – (GEN Capacity - Spinning Reserve)
Import Export Control

• The LMS controls the amount of import power from the utility. This utility import power is controlled by maintaining the power output of the Generator.

• The LMS compares the import power of the utility breaker with the configured deadband and will raise/lower the frequency and voltage of the Generator to regulate the import power.

• Raise and lower pulses will continue until the import power is within the specified deadband.

• In order for the raise and lower signals to control the genset, the genset must be in “remote” mode.

• Import control will not allow a kW setpoint to be less than 100 kW.

• The operator has the ability to select between import control and base-load control from the HMI. Base-load control will allow the operator to control the GTG at a constant load output.
Import Export Control Screen

**Generator Information**
- **Local Mode**
- **Voltage:** 0.00 kV, **Real Power:** 0.000 MW
- **Current:** 0.0 A, **Reactive Power:** 0.000 MVAR
- **PF:** 0.000, **Spinning Reserve:** 5000 kVAR
- **5.00 GTG Capacity (MW)**

**Import Control**
- **Utility Import:** 2.155 MW
- **Spinning Reserve Limit**
  - Manually-entered: 500.00 kW
  - % Spinning Reserve: 10.0
  - Manually-entered: 160.00 kW
  - Deadband: 0.00 kVAR

**Capacity Load Shed Parameters**
- **DISABLED**
- **Capacity Alarm Level (kW):** 4000
- **Capacity Shed Level (kW):** 4500
- **Capacity Alarm Percent:** 80.00
- **Capacity Shed Percent:** 90.00
- **Capacity Shed Time (s):** 10

**Underfrequency Load Shed Parameters**
- **DISABLED**
- **Underfrequency Load Shed Time (s):** 2
• LMS helps in the import/export control of Power between the grid and CHP facility.
• LMS helps in successfully islanding the Cogeneration facility by accurately calculating loads vs generation and decides if loadshedding is required or not.
• Calculation of available generation in comparison to facility using the generator capability curve, thus making the system very dynamic.
• Integration of Utility RTU and making the points available to be communicated to the RTU
• Serves as a local SCADA system for the operators
• One stop shop where all the information is available for the operators to make decisions and control critical equipment
• No worries of Arc Flash factor, since the operator is able to operate breakers at the LMS HMI located remotely.
Thank You.

For more information, please contact:

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