Load Flow and State Estimation

GE Energy's Load Flow and State Estimation application tremendously improves the users’ visibility of the distribution network, allowing them to protect against critical performance, reliability, and security risks, without the extensive investment in expensive remote monitoring equipment.

The benefits of DMS Load Flow

As a result of the high-infrastructure costs for remote monitoring, the network visibility offered to users by SCADA Systems is generally limited to the equipment inside the substation and to selected locations on the feeders. The GENe DMS and at its root, the Load Flow calculation module, significantly improves this visibility.

The GENe Load Flow and State Estimation application computes and presents individual phase voltages, currents, and losses on the entire distribution network. This data is based on the estimated load profiles at customer-distribution points as well as bus voltages and other SCADA measurements within the substation and along the feeder. The enhanced visibility offers benefits such as improved detection of system problems including voltage violations and accurate assessment of system losses.

Load Flow and State Estimation produces a real-time, unbalanced single-, two-, and three-phase solution that is presented within system displays providing a high-level of visibility to the system beyond that normally available by SCADA. These accurate Load Flow calculations also provide the information needed by other GENe DMS optimization and restoration functions.

Load Flow calculations can be presented as permanent results on Feeder displays or by simply hovering over a selected device.
The importance of an integrated presentation

The presentation of Load Flow calculations is seamlessly integrated into the network geographical and schematic displays and allows users to view any level of information detail to support their activities. Calculations are performed immediately upon system events—such as switching operations—so that the updated results are presented on the display instantaneously. This ensures that the user is able to quickly view and assess critical situations with all available information presented in an easy-to-read format. Making quicker and more accurate assessments improves the security and reliability of all operations.

Not all DMS applications are created equal. GE Energy’s DMS is field-proven for all substation, feeder, and transformer configurations, ensuring the highest level of accuracy possible.

Detailed information displays show the full three-phase unbalanced Load Flow calculation results, including the computed network losses. The user can immediately and intuitively access this information by selecting the corresponding devices from network diagrams.

Regional Demand, Station, and Detailed Feeder Load Flow summaries are updated in real-time and available at the click of a button.
A highly accurate load flow and state estimate is critical to ensure that your Smart Grid distribution automation tools provide the most value.

**Improved alarm functionality**

Load Flow-based alarm conditions ensure that unreliable or insecure operational conditions are avoided before they occur. Enhanced alarm functions against Load Flow results, such as low voltage at the end of the feeder, are provided as part of the GENe System.

**The most advanced computational features**

For Load Flow calculations to meet your required level of accuracy, the following computational features are required to be included with the GENe DMS:

- Unbalanced single-, two-, and three-phase networks.
- Radial and meshed configurations.
- Support for partial-phase loops.
- Estimation of common voltage adjustment devices.
- Support for all commonly used primary and secondary transformer winding configurations, including Star (grounded, ungrounded, and impedance grounded), Delta, and auto-transformer.
- Complex loss calculations, including transformer copper and core loss.

Lowering the transformer tap at the substation causes a low-voltage violation at the end of a feeder (feeder is shown in red on the above geographical network diagram). The voltage-sensitivity factors defined on loads result in a reduction of power at each load point when the voltage is reduced.
Field equipment is often error-prone leading to bad measurements; therefore, it is imperative to filter these out to avoid erroneous calculations. The State Estimation function includes an error-detection algorithm that provides this filtering and extends the principles of State Estimation to the DMS network. Specific filtering includes:

- Summation of bus in/out flows
- Consistency of measurements at specific locations
- Branch line consistency
- Consistency of measurements with network topology

Contact us for more details on this mature, performance-proven, and fully integrated application as part of our GENe DMS portfolio.