Electrical network monitoring & control solution

Task of ENMC Systems

Avoiding blackouts in industrial plants!

- Power Sharing
- Load Shedding
Operational Drivers for ENMC Systems

Critical Loads
- Limited In-plant Generation
- Insufficient reliability of grid supply

Several Generators
- Power Sharing with other plants/grids

Generator Modes and Operation
- Transformer Control and Monitoring
- Circuit Breaker Operation
- Connection to other plants/grids

Bus-Tie operation

Load Shedding
Power Control
Object Control
Synchronization

Functionality of ENMC Systems

- Load Shedding
- Re-acceleration and Re-Starting
- Active and Reactive Power Control
- Synchronisation
- Supervision, Control and Data Acquisition (SCADA):
  - Generator and turbine
  - Transformer and tap changer
  - Circuit breaker, disconnector and earth switch
  - Motor
ControlIT AC 800M Hardware

- AC 800M
  - Built in redundant Ethernet
  - Very low power consumption
  - Communication & fieldbus interfaces
  - Hot swap of communication- and I/O modules
  - Local and remote I/O options
  - Industry quality hardware with excellent EMC and MTBF properties

800xA System Architecture for ENMC Systems
Load Shedding: The types

- Fast Load Shedding on Loss of Power Resources
- Load Shedding on Frequency Drop
- Slow Load Shedding on Overload
- Slow Load Shedding for Peak Shaving
- Manual Load Shedding
Load Shedding: Keywords

- Fast
- Exact
- Flexible
- Co-ordinated
- Deterministic
- Security and Reliability
- Accurate Event Logging
- Operator Guidance
- Independent Back-up System

ABB’s starting-point for Load Shedding

- Secure electrical power to critical loads
- Minimal disturbance to plant operation
- No spurious operation
Capability Diagram

[Diagram showing operating limits and performance capability of a turbogenerator, including minimum and maximum excitation levels, Q-lag, Q-lead, minimum and maximum PF-leading and lagging, minimum stator heating, rotor heating, and MVA circle.]
Turbine Control

- Primary Turbine Controller
  - Droop or isochronous
- ENMC provides:
  - Manual control (Droop)
  - Manual MW setpoint
  - Automatic frequency control
  - Automatic setpoint control (MW sharing)
  - Automatic mode change:
    - CB trip
    - Turbine trip etc.

Generator Control

- Primary AVR:
  - Droop or voltage control
- ENMC provides:
  - Manual control (Droop)
  - Manual setpoint control (setpoint is PF)
  - Automatic Voltage Control (AVR receives raise/lower from ENMC)
  - Automatic setpoint control (MVar sharing)
  - Automatic mode change:
    - CB trip
**Active and Reactive Power Control**

- Power Exchange optimization (Power Demand Control)
- Avoid component overloading
- Spinning reserve optimization
- Standby optimization
- NOx constraints
- Participation factors
- Achieve stable operation
- Power Factor optimization

**Integration with Protection & Control Units**

- Protection
  - Measuring of U,I,E, calculation of P & Q
  - Monitoring & Control
  - Interlockings
  - Alarm annunciation
  - Event Time Tagging
  - Disturbance Recording
  - Local storage of trip-events
  - Communication to ENMC
Sequential Restarting

- Triggered by Load Shedding or Undervoltage
- Individual motors
- Priority per motor
- Max. allowed time delay per motor
- Network configuration check
- Network restoration

![Graph showing sequential restarting process]

Re-acceleration  Sequential restart
No loss of production  Limited production loss

Synchronisation

- Automatic Synchronisation
- Manual Synchronisation
- Adjust voltage magnitude
- Adjust voltage frequency
- Adjust voltage angle
- Rough adjustments by ENMC
- Fine tuning by a Synchroniser
- Close the breaker by the Synchroniser
ENMC Systems Application Areas

- Offshore Platforms & FPSO
- Refineries
- LNG Complexes
- Large Industrial Complexes

Named Customer References

- bp
- Petrobras
- ExxonMobil
- Statoil
- Reliance
- Growth in Life
- ConocoPhillips
- Hellenic
- Qatar Petroleum
- ABB
- Thailube
ABB delivers Industrial IT solution to the Statoil Hammerfest, Norway LNG Plant

ABB Helps Statoil Set New Records with Europe’s First LNG Facility

A competitive multi-scope delivery by ABB that seamlessly integrates Automation and Safety system, Power Distribution Control system, Power Management system, Electrical Equipment, Field instruments, and Analyzers. ABB’s Industrial™ systems and equipment put Statoil operators and engineers in complete control of the new energy efficiency benchmark for LNG plants.

Client: Statoil
Location: Melkoya island, Norway
Scope of Work: Safety and Automation System, Power distribution control system, power management systems, operator and engineer stations, training simulator

"Competitiveness is a matter of keeping your price at the most competitive level, but also demonstrating the capacity and skill set, competence, and solutions to provide us with a professional deliver. We felt comfortable with ABB’s ability."

Ole Haasen, Senior Advisor for Statoil’s Hammerfest LNG plant

ABB delivers Industrial IT solution to the Sakhalin II LNG Plant, Russia

ABB Leads Telecom and Electrical Project for World’s Largest LNG Plant

The world’s largest LNG processing plant is being built in an extreme environment with a multicultural work force, under complex regulations. But ABB’s experts are used to such challenges. That’s why SEIC chose ABB to provide the telecommunications and electrical distribution systems.

Client: Sakhalin Energy Investment Company Ltd.
Location: Russia’s Far East – Sakhalin Island
Scope of Work: Telecommunication and Electrical distribution equipment, engineering, installation, testing

“ABB is responsible for all telecommunications equipment for the project on a turnkey basis... ABB has always remained focused and dealt with the challenges, and in the process has forged successful partnerships with Russian companies.”

Ian Johnston, Telecommunications Project Manager, SEIC  “We were able to win the client’s confidence because we provided one window for them to all of ABB’s global abilities and responded with fast feedback on any inquiries they had.”

Hugh Clayton, Vice President of Process Automation at ABB K.K.
Conclusion

- ABB has in-depth knowledge of the electrical process and 20 years experience in ENMC implementations across the world
- ABB ENMC is based on flagship control system 800xA & proven technology
- ABB ENMC could achieve outstanding performance (e.g.: fast response time in load shedding)

Benefit from our experience!