WEBINAR

Maximizing utilization and performance of renewable energy through smart technology and energy storage systems
Speakers

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WHAT IS GEMS?

AN INTEGRATED SOFTWARE PLATFORM THAT WÄRTSILÄ ENERGY STORAGE & OPTIMIZATION (ES&O) DEVELOPED FOR INTELLIGENTLY OPERATING LARGE POWER PLANTS, DISTRIBUTED ENERGY RESOURCES AND ISLAND MICROGRIDS.
GEMS PPC
- Dispatch Optimization
- Tertiary Control
- Secondary Control
- Emergency
- Local HMI
- Load Forecast
- Renewable Forecast

GEMS FLEET DIRECTOR
- Weather Forecast Subscription
- Data Storage and Analytics
- Remote O&M
GRID CONTROL, INTEGRATION AND OPTIMIZATION

Boosts wind penetration from ~20% to 33% with addition of energy storage and GEMS control system.

Will eliminate the dependency on HFO; fuel consumption decreased by 5%.

Delivers both economic and environmental benefits; CO₂ emission decreased by 8%.

Dispatch optimization, solving unit commitment.

Tertiary control, secondary control.

Spinning reserves compliance (N-1).

Load forecasting, renewable forecasts.

Grid forming battery inverters.

ESS rated power less than average island load.

The existing power plant is running on 5 HFO engines, 3 back up diesel engines.

The 6 MW/6 MWh energy storage system includes batteries, inverters and power electronics.

Integrates 13 wind turbines while simultaneously optimising multiple generation assets.

Spinning reserves, automatic (un)curtailment of renewables, and automated engine dispatch for the island of Bonaire, population ~19,000.
GRID CONTROL, INTEGRATION AND OPTIMIZATION

Boosts renewable energy consumption
Will eliminate the dependency on 17,000 liters of diesel per month
Delivers both economic and environmental benefits
Dispatch optimization, solving unit commitment
Tertiary control, secondary control
Spinning reserves compliance (N-1)
Load forecasting, renewable forecasts
Grid forming battery inverters
Capable of operating grid without diesel gensets running

The Graciosa Hybrid Renewable Power Plant will enable 1 MW of solar, 4.5 MW of wind power and 6 MW / 3.2 MWh energy storage

Integrates renewable energy sources while simultaneously optimising multiple generation assets

Enabling 100% renewables for the island of Graciosa, population ~4,000.
MINIMUM LOADING AND REACTIVE POWER REALITIES

Consider a few scenarios:

1: Historical
2: Moderate renewables, providing unity PF at site
3: Moderate renewables, producing reactive power proportional to real power, in line with load PF
4: High renewables

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Microgrid Stacked Power Plot

- **Load Meter AC Real Power**
- **Battery Power Plant AC Real Power**
- **Wind Power Plant AC Real Power**
- **PV Power Plant AC Real Power**
- **Diesel Power Plant AC Real Power**

**Axes:**
- **Y-axis:** 0.0 MW to 2.0 MW
- **X-axis:** 06:45 to 07:15
**Voltage**

- **BPP Voltage Meter 1 AC Voltage**
- **Micro Grid AC Voltage Setpoint**

Voltage Range:
- 15200.0 V
- 15160.0 V
- 15140.0 V
- 15120.0 V
- 15100.0 V

Time Range:
- 06:45
- 07 AM
- 07:15
- 07
GRID FREQUENCY AND VOLTAGE MAINTAINED BY ALL GRID FORMING ASSETS (DIESEL GENERATORS AND VSG CAPABLE GRIDSOLV UNITS IN DROOP MODE)

**ROBUST CONTROL ARCHITECTURE OF:**
- Primary Control (droop) to rapidly stabilize Frequency and Voltage
- Secondary Control to maintain F and V targets
- Tertiary Control to optimize dispatch, curtailment, and battery SOC
Energy Transition Lab
A glimpse of the future
Wärtsilä Energy Transition Lab

wartilsa.com/energy/transition-lab

Free tool to analyse COVID-19 impact on European power systems

Based on ENTSO-E data
High-level view of Germany

Share of renewables: ▲10%
CO₂ emissions: ▼29%
High-level view of Germany

- Import/export balance
- Day ahead market price
20 April:
Germany could have been powered by renewables only
Q&A
CONTAINER STANDARDIZATION

A cost-effective solution for meeting customer energy needs while adequately protecting their hardware assets.

The standardized storage enclosure consists of one ISO 40’ unit and includes:

- Batteries
- Safety system
- Fire Safety System
- Power distribution
- Air conditioning system
GEMS UI features

Real-time visibility at one second intervals
• Global Fleet
• Plant
• Equipment

Historian and data reports

Alerts and push notifications

Automation configurations

Machine learning monitoring
TERTIARY CONTROL: ENGINES + STORAGE + RE

GEMS OPTIMIZATION MODULES SOLVES:
- Economic Dispatch Problem
- Unit Commitment Problem

ENGINE SCHEDULING BASED ON ROLLING 24-HOUR FORECASTS

5-MINUTE SCHEDULE UPDATE INTERVAL
FEKOLA PROJECT:

GEMS OPTIMIZATION MODULES SOLVES:

- Economic Dispatch Problem
- Unit Commitment Problem

ENGINE SCHEDULING BASED ON ROLLING FORECASTS, E.G. 12-HOURS AHEAD

5-MINUTE RESOLUTION SCHEDULING
GEMS HIGHLIGHTS

**SINGLE SW PLATFORM** for energy storage, wind, solar, engine and hybrid power plant operations—it is an OS

**INTELLIGENT OPERATIONS** by combining industrial control with modern machine learning

**HARDWARE NEUTRAL PLUG-IN ARCHITECTURE** for equipment including batteries, PCS, and engine generators from different vendors

**DISTRIBUTED COMPUTING** by combing **ON-SITE** Power Plant Controls with **OFF-SITE** solution cloud

**PLATFORM AS ASERVICE** natively supports application extensions, customization and system integration