Solutions of Electric Power System Stabilization

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Fuji Electric Co., Ltd.
Overview of Fuji Electric’s Power System Stabilization

- Large power plant
- Sewage treatment facility
- Neighborhood facility
- Gas supply plant
- Building (BEMS)
- Fuel cell
- Distributed generator & Storage battery
- Factory (FEMS)
- Optimum supply and demand control
- Information network
- Heat network
- Electric power network
- Gas network

Community Energy Management System

- Gas cogeneration
- Gas cooperation
- House
- Optimum supply and demand control

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Save customers’ energy cost by highly efficient heat & power generation system to supply electricity, air-conditioning, and hot water, from various fuel sources.

Provide optimal power source such as fuel cell, gas engine, gas turbine, or diesel engine, depending on customers’ situation (installation environment, electricity & heat demand, etc.).

Improve customers’ power quality (outage, voltage drop, etc.) by various power stabilization technology. Provide total solution to not only supply side problems such as voltage fluctuation but also demand side problems such as harmonics.

Realize optimal balance of demand and supply, by high level operation control of integrated energy management system (heat and power supply optimal control system + energy management system).
Overview of Cogeneration System

Benefits of Cogeneration System:
- Energy Cost Saving
- Power Source Security when Grid Outage
- CO₂ Reduction

Grid Connection

Electricity

Chiller (Existing)

Chilled Water for Air Conditioning

Steam

Hot Water

Absorption Chiller

Boiler (Existing)

Factory

Gas

Cogeneration

Factory Processes:
- <Drying>
- <Steamed/Humidifying>
- <Calcination>
- <Concentrated>
- <Extraction>
- <Distillation>
- <Sterilization>
- <Wash>
When instantaneous voltage drop (outage) in the commercial power network from thunder occur, PC or control devices are affected such as suspension. Therefore, clients such as semiconductor industry who do not allow instantaneous voltage drop traditionally take measures such as to install UPS to individual loads. Recently, such cases are increasing as to introduce Instantaneous Voltage Drop Avoidance Device to protect total plant, or to introduce Cogeneration + High-speed Breaker for critical loads.

Power Stabilization Example (instantaneous voltage drop)

disconnecting the grid when voltage drop occurs within 20ms. (Only applied to 3.3/6.6kV grid.)

1 Cycle: 20ms at 50Hz
Achieving visualization, analysis, and optimization of energy by introducing FEMS

Drastically saving the power cost by optimizing the integrated operation and self-sustained operation of the grid power and cogeneration system

Drastically saving the fuel cost of the existing boiler system (for air conditioning) by utilizing effectively heat (steam) and electricity

Customer benefits: Avoidance of power risk (productivity improvement)

Reference Site: Fuji Electric Yamanashi Factory

Panoramic view of Yamanashi factory

Gas cogeneration system

Simple single-line diagram of the entire factory

Total efficiency of GE: 68.6%
The FEMS (Factory Energy Management System) model by the best-mix of electricity and thermal energy

- Electricity
- Cold energy
- Hot energy

**Conventional model**

- Grid power
- Chiller
- Cold water
- Production facility
- Boiler
- Steam chiller

**Optimal control**

- Grid power
- Chiller
- Fuel cell
- Gas engine co-generation
- Hot water Chiller
- Hot water
- Steam chiller
- Steam

Reference Site: Fuji Electric Yamanashi Factory
Fuji Integrated Energy Management System utilizes our sensing technology, ITC technology, and data analyzing technology, and realizes minimization of energy consumption by its high level analyzing support and energy-saving control, and optimization of supply/demand balance by advanced operation control of energy supplying facility.
Benefits of Cogeneration System

◆ **Energy Cost Saving**

The electricity purchased from Grid can be saved
- By using the electricity generated from the cogeneration system.
- By using the generated exhaust heat (hot water), and creating cold water for air conditioning through the absorption chiller, thus saving the electricity used in the existing chiller.

The gas used for the existing boiler can be saved
- By using the generated exhaust heat (hot water).

◆ **Power Source Security when Grid Outage**

The cogeneration can supply sustainable electricity, thus enhancing the business continuity of the Factory.

◆ **CO₂ Reduction**

Factory Promotion: Contribution to the environment
**Step 1  Check Conditions**
(1) Estimate Load (Electricity / Chilled Water / Hot Water / Steam)
(2) Purpose (Save Energy Cost / Secure & Stable Power Supply)

**Step 2  System Settings**
(1) Check the Current System
(2) Propose the New System
   (Capacity / Engine / Exhaust Gas Recovery Method)

**Step 3  Simulation**
(1) Energy Revenue & Expense Calculation
(2) Cost Calculation (Initial / Running / Fuel / Maintenance etc.)

**Step 4  Evaluation**
(1) Energy Saving Amount
(2) Environment Adaptation (NOx Regulation / Noise / CO2 Emission etc.)
   (3) Economics (Simple Payback Period)

**Step 5  Introduction Decision**
(1) Finalization of the System
(2) Cash Flow Calculation and Decision by the Customer
### Questions for Cogeneration Introduction

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Natural Gas Other ( ) ※Future plan for using Natural Gas? Yes / No</th>
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<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td>Contract power ( kW )</td>
<td></td>
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<tr>
<td>Receiving voltage (kV) /Frequency(Hz)</td>
<td></td>
</tr>
<tr>
<td>Available Space for Installation ( m² )</td>
<td>Indoor ( m² ) : Floor ( F ) Outdoor ( m² )</td>
</tr>
<tr>
<td>Measures for instantaneous voltage drop</td>
<td></td>
</tr>
<tr>
<td>Air Condition Type</td>
<td>Central Type Individual Type Other ( )</td>
</tr>
<tr>
<td>Boiler Use Status</td>
<td>Fuel Yes (Steam / Hot Water) No Ability: ( t / h )</td>
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Sample: CHP (Cogeneration) System

Conditions for grid connection will be discussed with Power Company.
Cogeneration installation example

Gas engine

Container type

Easy to install

Multiple installation example
Effective use of JCM

Reduction of the initial investment by the JCM (Ministry of the Environment)

1/2 of the initial investment cost will be subsidized.

- Facilitating diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions, and contributing to sustainable development of developing countries.
- Appropriately evaluating contributions from Japan to GHG emission reductions or removals in a quantitative manner and use them to achieve Japan's emission reduction target.

Countries: Indonesia, Vietnam, Cambodia, Laos, Bangladesh, Ethiopia, Kenya, Maldives, Costa Rica, Palau