Smart Community in Japan
Kitakyushu Demonstration Project

5th March, 2015
Fuji Electric Co., Ltd.
Fuji Electric is Lead Manager of Kitakyushu Smart Community Project owned by METI
Fuji Electric provides CEMS, FEMS, BEMS, and REMS for this demonstration.
Kitakyushu Smart Community Creation Project

1. Implementation body
   Kitakyushu Smart Community Council
   (Kitakyushu and about 70 companies / organizations)

2. Area of implementation
   Higashida district, Yahata-Higashi area
   (Approximately 1.2 km²)

3. Period of implementation
   FY2010 - FY2014
   (5 years)

4. Project scale
   38 projects
   15 billion yen
   (USD 150M)
Features of Kitakyushu Smart Community Project

Large-scale power system

Linkage and coordination with large-scale system
- Power quality management
- Stabilization of new energy output
- Protection equipment of Power system interconnection

Local Power Generation
- Wind
- PV
- Fuel cells (Hydrogen)
- Generation using waste heat

Community Energy Management System (CEMS)
- Power storage system
- Consumers

Participation of Consumers
- Home or building EMS (energy management system)
- Smart metering
- Demand response
Features of Kitakyushu Smart Community Project

- Regional supply from the power source independent from large-scale power system (New Asian city type smart grid)
- Practical use of unused energy including factory waste heat
- Use of hydrogen energy (Kitakyushu Hydrogen Town)
- Regional energy management system that users take part in
- Verification of smart metering and demand response
CEMS makes the optimized plan for supply and demand of electric power, heat and gas (hydrogen). In case of supply-demand imbalance, supply-demand adjustment or demand response will be implemented via each EMS.

CEMS makes the optimized plan for supply and demand of electric power, heat and gas (hydrogen). In case of supply-demand imbalance, supply-demand adjustment or demand response will be implemented via each EMS.
New energy systems (soar and wind power) are not stable.
Variation in electric power generated by the new energy systems cause the supply and demand imbalance.
Demand for new energy is increasing significantly. A reverse power flow poses the voltage rise problem.
CEMS plays a key role in solving these problems.

Key features
- Prediction of power generated by new energy (PV and Wind Turbine Generator)
- Optimized planning and control of supply and demand, and frequency control by utilization of storage batteries.
- Demand response service for balancing the load
- Smart meters for consumers

Extendibility
- Multi-languages (Japanese, English and Chinese)
- Control several regions by a single system
- All in one package
Community Installed Storage Battery

◆ Role of smart PCS
Smart PCS plays a key role in controlling fluctuation of frequency and voltage caused by increased electric power generation by renewable energy.

- Electric power generation equipment
- New energy equipment for generating electric power
- Customers

◆ Advantageous functions
- Communicating with EMS, stabilizing loads by two-way communication and providing reserved capacity in an emergency
- Reducing instantaneous frequency variations by high-speed frequency control
- Governor-free function
- Controlling voltage by reactive power
- Stand-alone operation with variable frequency control

New lead acid batteries and lithium ion batteries
## Fuel Cell

### Pure-hydrogen gas-fed

<table>
<thead>
<tr>
<th><strong>Type</strong></th>
<th>Pure-hydrogen gas-fed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated output power</strong></td>
<td>AC 105kW</td>
</tr>
<tr>
<td><strong>Output voltage / frequency</strong></td>
<td>210V or 220V/ 50Hz or 60Hz</td>
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<tr>
<td><strong>Electrical efficiency</strong></td>
<td>48% [LHV]</td>
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<tr>
<td><strong>Total efficiency</strong></td>
<td>99% [LHV], 113kW [When 60 deg C water is used] If 90 deg C water is used, then 68kW</td>
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<tr>
<td><strong>Exhaust gas</strong></td>
<td>NOx, SOx, dust: None</td>
</tr>
<tr>
<td><strong>Consumption of fuel</strong></td>
<td>74m³/h (Normal)</td>
</tr>
<tr>
<td><strong>Volume</strong></td>
<td>W x L x H 2.2m (W) x 5.6m(L) x 3.4m(H)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>14 tons</td>
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</table>
Smart Meters for Demand Response

◆ Role of smart meter
With the smart meter, CEMS performs automated meter reading. In order to stabilize loads and balance supply and demand, the smart meter provides CEMS’s request for demand response, and also shows watt-hour usage.

◆ Advantageous functions
- Wireless bilateral communication with the home display
- DR and DP information on the home display
- Customers can see watt-hours usage, which will prompt them to save energy.
- 30-minute watt-hours and data for 44 days
- Controlling electric power supply in an emergency
- Amendment of electric power contract by service breaker function
Example of CEMS Screen

Forecast of demand/supply and renewable power generation

The screen of demand forecast results
You can switch results of Demand forecast of whole community and each consumer.
Forecast results of several methods are displayed, and operators can select the best method.
Example of CEMS Screen

The screen for calculation results of power generation plan
Graphs of demand forecast, renewable energy generation prediction, and operation plan of generators and batteries are displayed.
Smart Grid Project with City of Kitakyushu

City of Kitakyushu Smart Community

India: Panipat Smart Grid

Andhra Pradesh

Vietnam: HaiPhong Industrial Estate

Thailand: PrachinBuri Industrial Park

Myanmar: Dawei complex development

Malaysia: Iskandar urban development

Indonesia: Suryacipta Industrial Estate

Indonesia: Surabaya Industrial Estate

Indonesia: South Tangerang urban development

Kitakyushu Asian Center for Low Carbon Society
Panipat City, Haryana State, India

City Subdivision of Panipat
Peek Demand : 42MVA
Feeders : 8
DTs : 539
AT&C Losses : 23.15%
Consumers : 31,623

UHBVN
(Uttar Haryana Bijli Vitran Nigam)

Panipat
90km
New Delhi
Chandigarh

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Challenge of India Power Distribution Companies

[Challenge]
1. Outage Management
2. Peak Load Management
3. Smart Meters
Energy Management Systems for Smart Capital of AP State

CEMS (Cluster Energy Management System)

Step 2.2
CEMS Preparation

Step 3
CEMS Visualization

Recharging System of Community Installation Type (Smart PCS)

Step 4
Battery Information

Monitoring Equipment for BEMS

Step 1
BEMS Preparation

Step 2.1
BEMS Visualization

Electrical diagrams
# Proposed Implementation steps

<table>
<thead>
<tr>
<th>Step</th>
<th>Date</th>
<th>Fuji Electric preparation</th>
<th>Andhra Pradesh State preparation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kick-off</td>
<td>Apr. 2015</td>
<td>Project Structure System Diagram</td>
<td>Target Area (city) Target Building</td>
<td>Demonstration Project Definition</td>
</tr>
<tr>
<td>Step 1</td>
<td>May 2015</td>
<td>BEMS preparation Monitoring Equipment</td>
<td>Electricity Diagrams Equipment Setting</td>
<td>Building Detail Information</td>
</tr>
<tr>
<td>Step 2</td>
<td>Jun. 2015</td>
<td>BEMS Visualization CEMS preparation</td>
<td>Demand/Supply data PV/Wind firm data</td>
<td>Basic Information for CEMS</td>
</tr>
<tr>
<td>Step 3</td>
<td>Jul. 2015</td>
<td>CEMS simulation</td>
<td>Weather / Weather Forecast Information</td>
<td>EMS related Information</td>
</tr>
<tr>
<td>Step 4</td>
<td>Aug. 2015</td>
<td>Battery Information</td>
<td>PV/Wind Firm Future Direction</td>
<td>Cost issues Finance</td>
</tr>
<tr>
<td>Step 5</td>
<td>Sep. 2015</td>
<td>Draft Proposal for Smart Capital/City/Community</td>
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<td>Next step</td>
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</tbody>
</table>
Utilizing water resource more effectively and improving water environment of the surrounding areas through establishment of water recycling system within CETPs (Common Effluent Treatment Plant) in India

Supplying recycled water at an affordable price than ever before by use of technology for reducing water desalination cost such as extension of maximum life-span of RO membrane, reduction of operating pressure, increase of hydraulic permeability

After establishment of water recycling system

- **Biological treatment**
  - Dissolving organic sludge by bacteria which has higher ability than the conventional bacteria in biological reactor.
- **Solids removal**
  - Removing solids (organic/inorganic) by MF/UF membrane filtration, sand filtration.
- **Filtration treatment by RO membrane**
  - Removing salt, metallic ion by using RO membrane and produce recycled water for industrial use.

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Fuji Electric Project in INDIA

- **Smart Grid in Panipat, Haryana State**
- **Water Recycling System, Maharashtra State**
- **Energy Management System, Andhra Pradesh State**