Micro-grid technologies in smart community projects by NEDO

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NEDO DEMONSTRATION PROJECTS
Grid-Connection related Projects in NEDO

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NEDO project facility served a hospital in the period of blackout by the earthquake

Utility system is stopped, CB will be open.

Integrated power quality backup system

Gas engine 350kW*2
MCFC 250kW
PV 50kW
Series compensator 200kVA
Series compensator 600kVA
DC/DC converter

6.6kV AC bus

High Quality A
No Interruption.
Compensating voltage at a wave level.
High Quality B
Removing interruption within 15 micro-sec.
Standard Quality C
Interruption is usually removed within 1 minute.
DC
No Interruption. DC supply.

Those demands are supplied electricity without any interruption.
Balancing
Establishing balancing between demand and supply, by EMS function

Voltage compensation
Establishing competition of voltage from several voltage problems (outage and sag).
“MICRO GRID” IN “SMART GRID”
Definition of Micro-Grid

- Small grid which is managed by local EMS (CEMS) for keep responsibility to balancing.

- Usually, it is connected on to larger grid. In this case, micro grid should control of tie-line power flow for keep responsibility of balancing.

- Sometime, it is operated as independent grid.

- From the view point of wide definition, each customer which is controlled by EMS (HEMS, BEMS or FEMS) may be understood as small Micro-Grid.
Micro Grid seems a human body

EMS = Brain

Smart Meter = Sensor

AMI = Nerve

Demand, Distributed generator, Energy Storage = Muscle

Communication between grids = language

Utility side EMS

User side EMS

Communicating
Why Micro-grid is key element of Smart-grid

Structure of Smart grid consists of combination of Micro-grid like operating distribution system and smart customers.

They can be thought as Micro-Grid.
# Japanese experience on Micro-grids

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<th>Country</th>
<th>Utility</th>
<th>NEDO Microgrid</th>
<th>Microgrid-owner</th>
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<tbody>
<tr>
<td>JAPAN</td>
<td>Mostly integrated</td>
<td>Hachinohe Aichi Sendai</td>
<td>Microgrid owner – Demand side</td>
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<tr>
<td>USA</td>
<td>Wholesale deregulated (Not completely deregulated on the retail side)</td>
<td>Two Micro Grids in New Mexico</td>
<td>Microgrid owner – Distributed Utility Duplicated Micro Grid with user side houses and buildings</td>
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<td>EU</td>
<td>Fully deregulated (Both wholesale and retail)</td>
<td>Task 2 of Lyon project (France)</td>
<td>Microgrid EMS is separated into two different types (regulated utilities, competitive utilities)</td>
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Outline of Demonstration Project for Regional Power Grids Utilizing Various New Types of Energy (Hachinohe Project)

This is Micro Grid experienced one week independent operation from utility grid.
Micro grid Demonstration in Los Alamos

This is duplicated Micro Grid.
Contents of Task 2 in Lyon project

- Local management system
  - Trying to keep balance between PV generation and EV charging

- EV charging system includes:
  - Billing management system
  - Charger authentication
  - Car sharing service

- PV remote management system includes:
  - Generation monitoring
  - Synchronization of PV generation and EV charging
  - Fault detection

This system consists of virtual micro-grid
Thank you for your attention