Micro-grid related activities in Japan

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Coordination with Policymaking Authorities

Combined Efforts of Industry, Government and Academia

**NEDO’s Mission**

**Promotion of national projects**
- Autonomous and advanced project management
- Promotion of technology development based on a flexible and agile project management scheme

- Addressing energy and global environmental issues through technology development and international collaborative demonstration projects
- Enhancement of cutting-edge industrial technologies
History of Micro-grid related activities in Japan

- AICHI EXPO Rinku-Tokoname
- Hachinohe Micro-grid
- Kyotango Micro-grid
- Sendai Micro-grid
- Shimizu Corporation Micro-grid
- Tokyo Gas Yokohama Techno Station
- Tokyo Gas Roppongi Hills

Private Micro-grid related Projects

- NEDO four Micro-grid Projects
- METI Supported Micro-grid Related Projects

- Hawaii Project “JUMPSmartMaui”
- Miyako Island Mega-Solar Dem. Project
- New Mexico Micro-grid Los Alamos, Albuquerque Building
NEDO four Micro-grid Projects in the early 2000
Aichi (EXPO & Rinku Tokoname) Micro-grid

Total Supply: 760kW
- PV systems 330kW
- NAS battery 500kW
- MCFC 270kW
- MCFC 300kW
- PAFC 800kW (200kW x 4 units)
- SOFC 25kW
- Methane fermentation system 4.8t/day
- Gasification system 20kg/h

- This system was constructed for demonstration in EXPO 2005.
- All resources were inverter based generation (PV, Fuel Cell, Battery).
- Establishing one day independent operation twice.
Total Supply: 760kW
- PV 130kW (10kW x 3, 50kW x 2)
- Wind turbine 20kW (4kW, 8kW x 2)
- Gas engine 510kW (170kW x 3)
- Battery[Lead-Acid] 100kW
- Wooden waste steam boiler 1.0t/h
- Steam boiler 4.2t/h

- Typical micro-grid with private distribution line (5.4km).
- Establishing one week independent operation.
- Introducing early stage smart inverter for compensating imbalance of 3-phase.
Daily operation of micro-grid (in Hachinohe)
Total Supply: 850kW
- Bio gas engine 400kW (80kW x 5 units)
- MCFC 100kW
- Battery (Lead Acid) 100kW
- Wind turbine 50kW
- PV 50kW (30kW + 20kW)
This Micro-grid operated as backup generator in the outage by earthquake on March 11, 2011.

### Sendai Power quality managing Micro-Grid

**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.
Private Micro-Grid related Projects
Tokyo Gas Yokohama Techno Station
Shimizu Institute of Technology
Roppongi Hills
Tokyo Gas Yokohama Techno Station
- In operation since July, 2006
- The largest micro-grid in Japan as of 2006
- Realization of transfer to islanding operation without an instantaneous power failure.
Tokyo Gas/ Test Facility at the Tokyo Gas Yokohama Techno Station

To verify the value of SEN (Smart Energy Network) using Gas Engine.
Electric power supply during emergencies
Miyako Island Mega-Solar demonstration project

- Miyako Second Power Station (Diesel) 40,000kW
- Miyako Gas Turbine Power Station 15,000kW
- Miyako Power Station (Diesel) 19,000kW

- Karimata area
- Existing Wind Turbine (600kW, 900kW x 2)

- PV 4.0MW
- Battery 4.1MW (NAS, LiB)
- Existing Wind Turbine (900kW x 2)

The Okinawa Electric Power Company, Incorporated
M. NEDO Supported Projects

Taos
Roosevelt
Las Cruces
Los Alamos
Albuquerque
Maui Island
New Mexico
NEDO’S Project in Maui Island “JUMPSmartMaui”

Making island smart with EV coexist wind power and solar energy

- Reliable power supply under high penetration of Renewables by managing EV charging etc.,
- 2011-2015


- Manage EV charge
  - Shift to midnight
  - Stop charging when unexpected Wind down ramp occurs etc.,
- 20 Quick Charging Stations

The Operation will start at the end of 2013.
NEDO’S Project in New Mexico

- The project is the first overseas smart Grid Project of NEDO.
- The project is being carried out in cooperation with U.S. national laboratories, which conduct research on advanced technologies for renewable energy and energy security.

State of New Mexico
Los Alamos National Laboratory (LANL)
Sandia National Laboratories (SNL)
Los Alamos County (LAC)
The University of New Mexico (UNM)
Public Service of New Mexico (PNM)
Mesa del sol (MDS)

Los Alamos County, LANL

Los Alamos
(Microgrid Demonstration in residential district)

Albuquerque
MDS (developer), SNL, PNM, UNM

Albuquerque
(Microgrid Demonstration in Commercial Areas)

(IV) Collective Research on Overall Project

(II) Smart House Demonstration
In addition to storage batteries for grids, control of renewable energy output fluctuations by using demand response of residential houses will be verified in a suburb-type distribution system located in a residential area. Moreover, Demand response demonstration is trying to operate.

Exploiting the advantages of the different batteries to produce hybrid control!!

11 different kinds of PV panel installed

Smart meters installed general users to demonstrate advanced DR options such as CPP, PTR, Opt-in and Opt-out
Smart Grid Demonstration in Commercial Areas in Albuquerque

Aperture center of Mesa del Sol

Plant yard

PV (solar panel) 50kW

BEMS

Air-Source Chiller 70kSRT

Absorption Chiller 20kSRT

Lead acid Battery (50kW/100kW)

Gas Engine Generator 240kW

Fuel Cell 80kW

Schematic diagram of the demonstration system
BEMS control results in interconnected mode

![Graph of power flow at PCC](image-url)

- **PV**: 50kW
- **Lead acid Battery**: 50kW/100kW
- **Fuel Cell**: 80kW
- **Gas Engine Generator (GE)**: 240kW

*Shimizu Corporation*
The purposes of Micro-grid:

1. Increasing the capacity of connectable renewable energy by establishing balancing control within small grid.

2. Enhancing reliability or adequacy of power supply by establishing independent operation capability.

3. Japan has developed micro-grid technology from early 2000s.

These can be applied to island grids.
If you want to know more, please attend IRED 2014 (Nov. 2014 in Kyoto, JAPAN)

Mahalo!