**APEC EGNRET 46, Taichung, Chinese Taipei**

# Development of Distributed Energy and New Energy Technologies in Japan

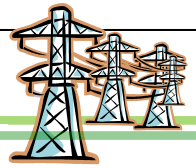
April 13-14th, 2016

Takao Ikeda
The Institute of Energy Economics, Japan
(IEEJ)

- Smart Communities
- Micro Grid Projects – Island, Factory

# Definition of Smart Community and Smart Grid

- A smart grid is an electricity network system that uses digital technology to monitor and manage the transmission of electricity from all generation sources to meet the varying electricity demands of end users. Such grids are able to co-ordinate the needs and capabilities of all generators, grid operators, end users and electricity market stakeholders in such a way that they can optimise asset utilisation and operation and, in the process, minimise both costs and environmental impacts while maintaining system reliability, resilience and stability. (source ; IEA (2011), Technology Roadmap: Smart Grids)
- Smart Community is an initiative aiming at efficient energy utilization that is achieved by using certain technology, e.g., IT and accumulators, ***adequately combining distributed energy sources (distributed energy systems)***, e.g., cogeneration systems and renewable energy, and managing energy in an area-wide manner.



**Smart grids**

Smart meters

HEMS

Secondary cell

EV

Efficient use of electricity based on IT technology and secondary cells

**Smart communities**

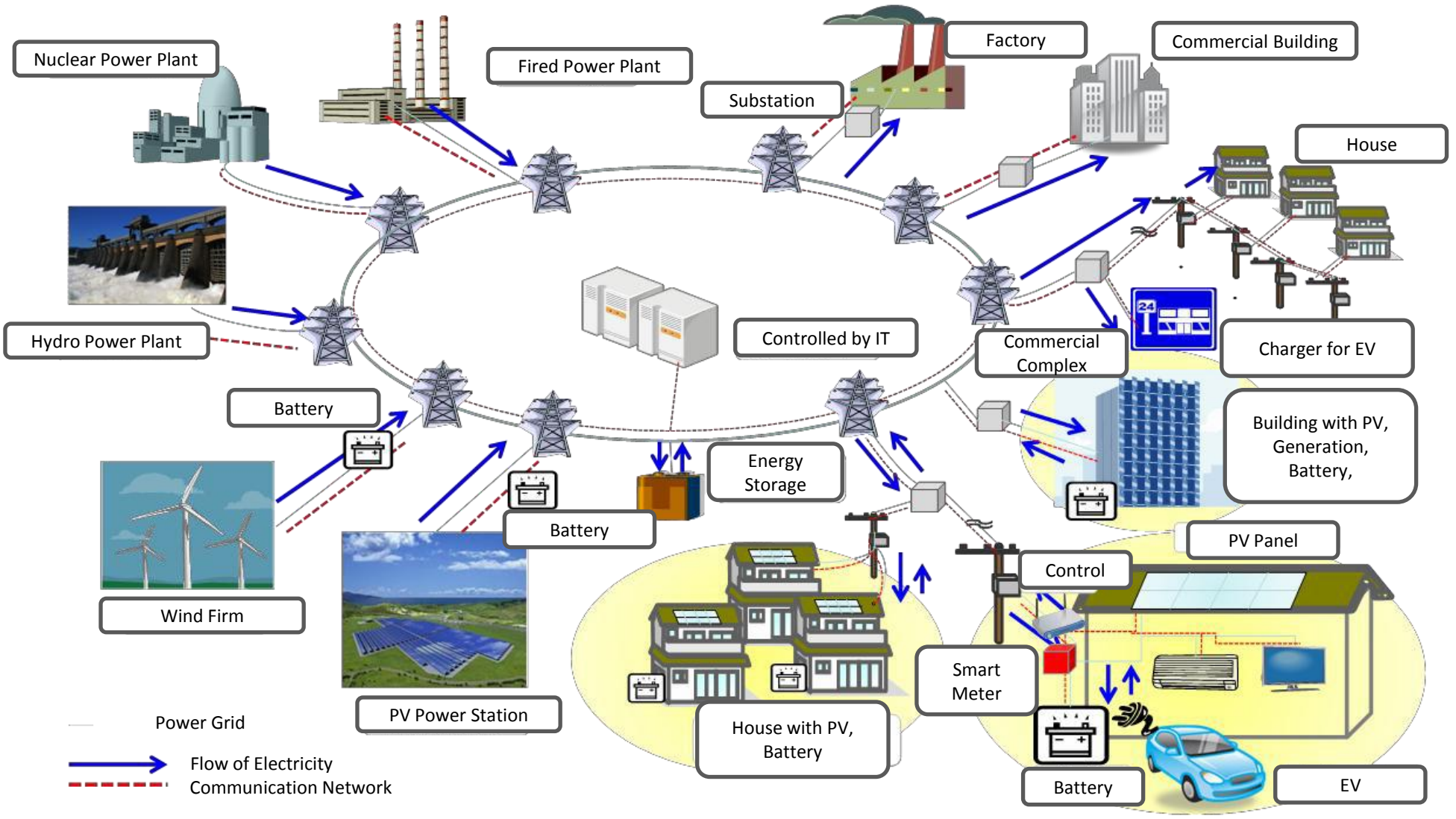
Co-generation

Fuel cells

Car sharing

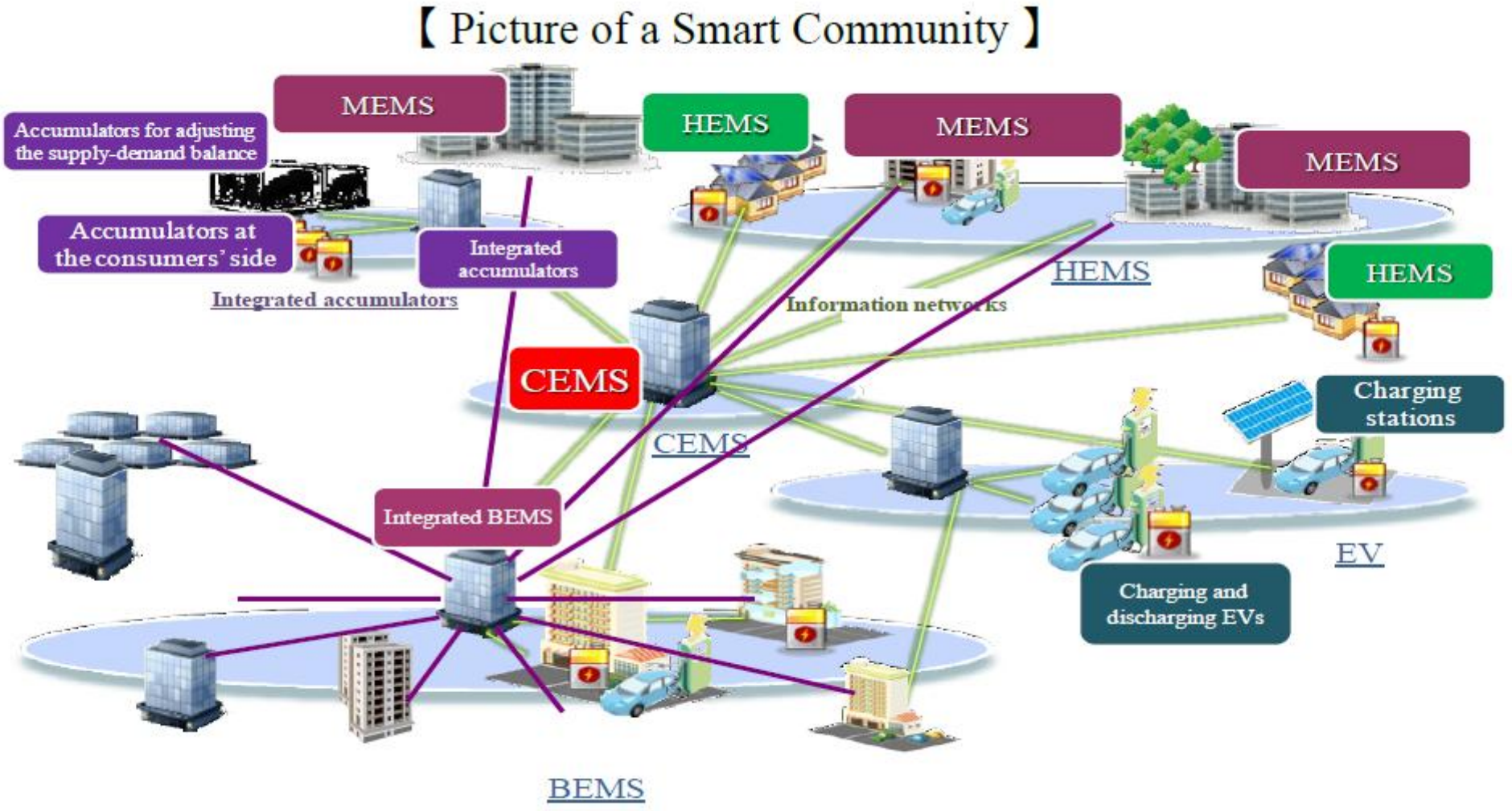
Efficient use of energy that includes electricity, heat, and transportation

# Image of Smart Grid



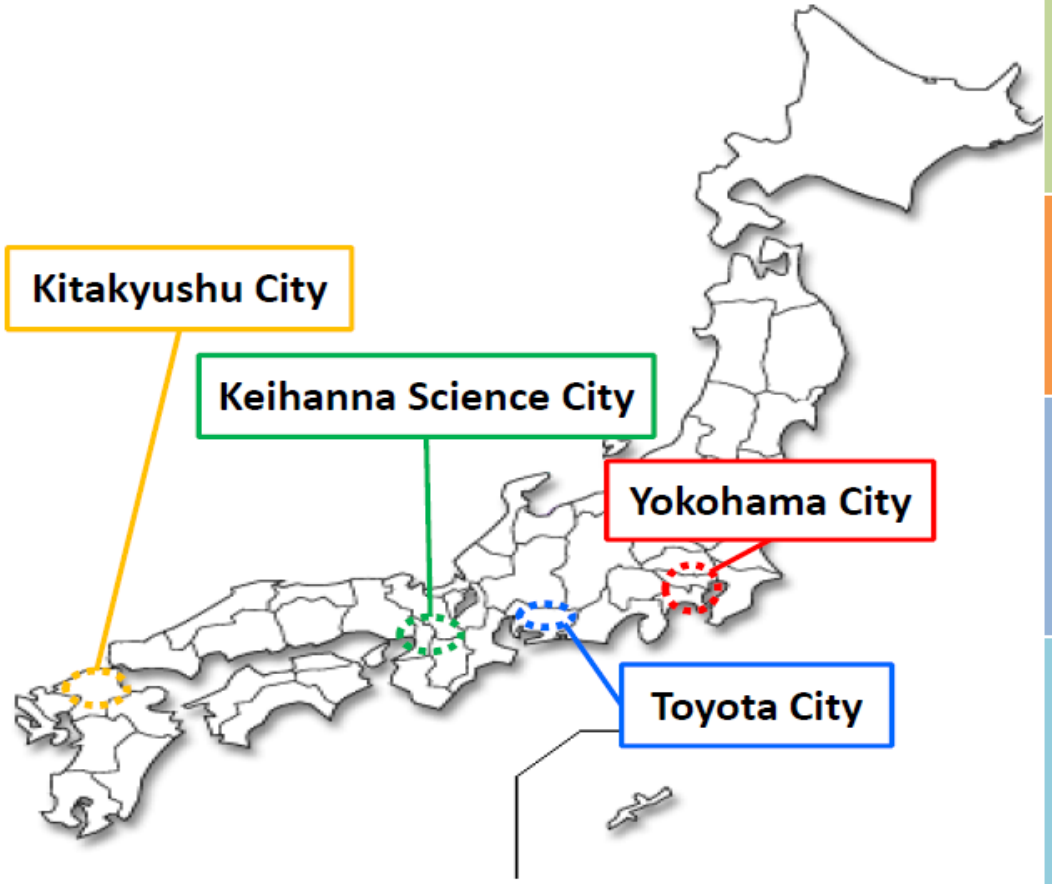

Source: METI(2010) Report of the study group on the international standardization of next generation energy system

# Image of Smart Community



# Smart Community Demonstration Projects(FY2011-FY2014)

■ Starting in FY2011, large-scale smart community demonstration projects have been ongoing in 4 regions across Japan. Those constitute representative examples of various patterns, based on participation by many residents, local governments, and corporations.




| | |
|---|---|
| Yokohama City | Wide-area metropolis<br>Introduction of an energy management system for an existing wide-area metropolis. As the sample number is high (4,000 households), demonstration using a variety of hypotheses is possible. |
| Toyota City | Separated housing<br>Automatic control of home appliances in 67 households. Secondary cells equipped in vehicles are used to supply energy to households. Approaches for drivers to alleviate congestion. |
| Keihanna | Housing development<br>Demand response demonstration based on a point system is being implemented for general households (approximately 700 households) where PV or HEMS automatic control has not been introduced. |
| Kitakyushu City | Designated supply area<br>In an area where power is supplied by Nippon Steel Corporation, a pricing system where the power price fluctuates for 2 hours afterwards in accordance with the state of supply and demand of energy for the day, applicable to 50 business establishments and 230 households, is being implemented. |

# Other Demonstration Projects

## <Next Generation Technology Demonstration Projects>

- (1)Kashiwa City, Chiba Pref.: “Kashiwa no Ha” Smart City
- (2)Hitachi City, Ibaraki Pref.: EV bus operation
- (3)Mie University, Mie Pref.: Smart Campus
- (4)Osaka City, Osaka Pref.: Advanced usage of the heat generated in Garbage Incineration Plant
- (5)Tottori City, Tottori Pref.: Smart grid town & Green vegetable plant with LED
- (6)Fukuyama City, Hiroshima Pref. : Seaside smart community project for disaster prevention
- (7)Sasebo City, Nagasaki Pref. : “Local produce & local consume” energy in “Huis Ten Bosch” resort.
- (8)Minamata City, Kumamoto Pref.: Utilization of local resources of Agriculture, Forestry and Fishery

## <Smart Community Introduction Projects in disaster area (of Great East Japan Earthquake)>

- (1)Aizu-Wakamatu City, Fukushima Pref.
- (2)Kesen numa City, (3)Ishinomaki City, (4)Yamamoto Town, (5)Ohira Village of Miyagi Pref.
- (6)Miyako City, (7)Kamaishi City, (8)Kitakami City of Iwate Pref.

## <Environmental Future City vision in disaster area (of Great East Japan Earthquake)>

- (1)Ofunato City, Chikuzen Takata City, Sumita Town of Iwate Pref.
- (2)Kamaishi City, Iwate Pref.
- (3)Iwanuma City, Miyagi Pref
- (4)Higashi Matsushima City, Miyagi Pref.
- (5) Minami Soma City, Fukushima Pref.
- (6) Shinchi Town, Fukushima Pref.

# Major Output of Demonstration Projects

# From Demonstration(実証Jissho) to Implementation(実装Jisso)

## ➢EMS (Energy Management System)

Establishment basic technologies on EMS*. Balancing supply and demand of electricity is controlled from supply side traditionally. Using EMS technologies, the balance can be controlled from the demand side, too.

*HEMS: Home Energy Management System, BEMS：Building Energy Management System, CEMS: Community Energy Management System, FEMS: Factory Energy Management System, AEMS: Area Energy Management System, etc

## ➢Demand Response

There were two types of demand response in demonstration projects. One is driven by high electricity rate in the peak time among variety of electricity retail prices. About 20% reduction of electricity demand was achieved in the projects.

Another type of demand response is so called “Negawatt power” which reduce electricity demand by financial incentive during peak time.

## ➢ Telecommunication system for automated demand response

Establishment of ISO standard of telecommunication system (ECHONET Lite) between electricity utilities through smart meter, HEMS(home Energy Management System) and various home appliances in the houses.

## ➢New Business Opportunities

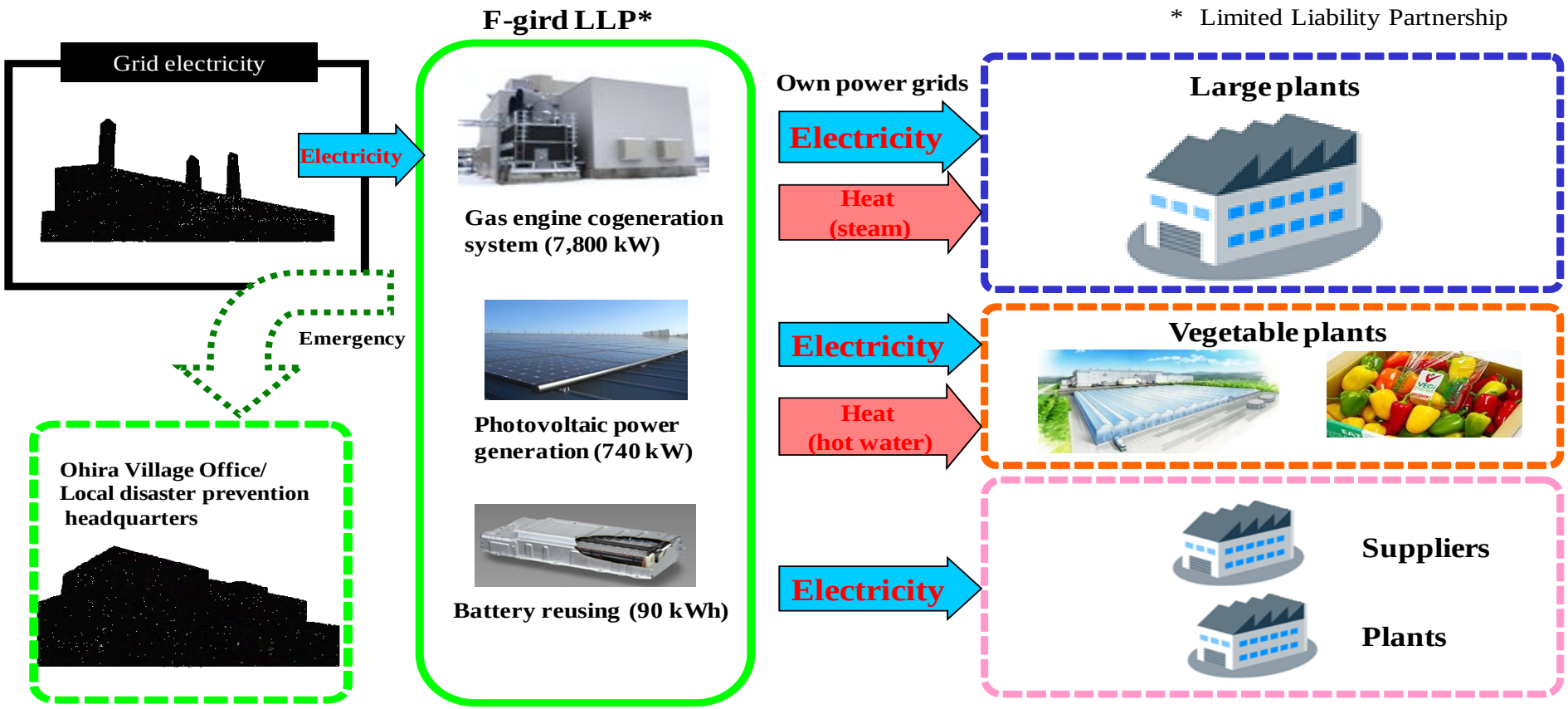
Possible new business opportunities are found in the projects. For example, a discount coupon of shopping mall during the peak time can reduce electricity demand in the area.

◆Smart Communities

◆Micro Grid Projects – Island, Factory

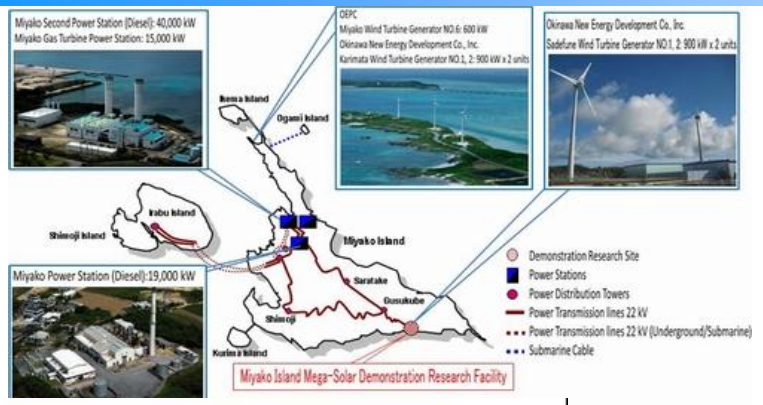
# Example : Regional Micro Grid system--- Industrial Park

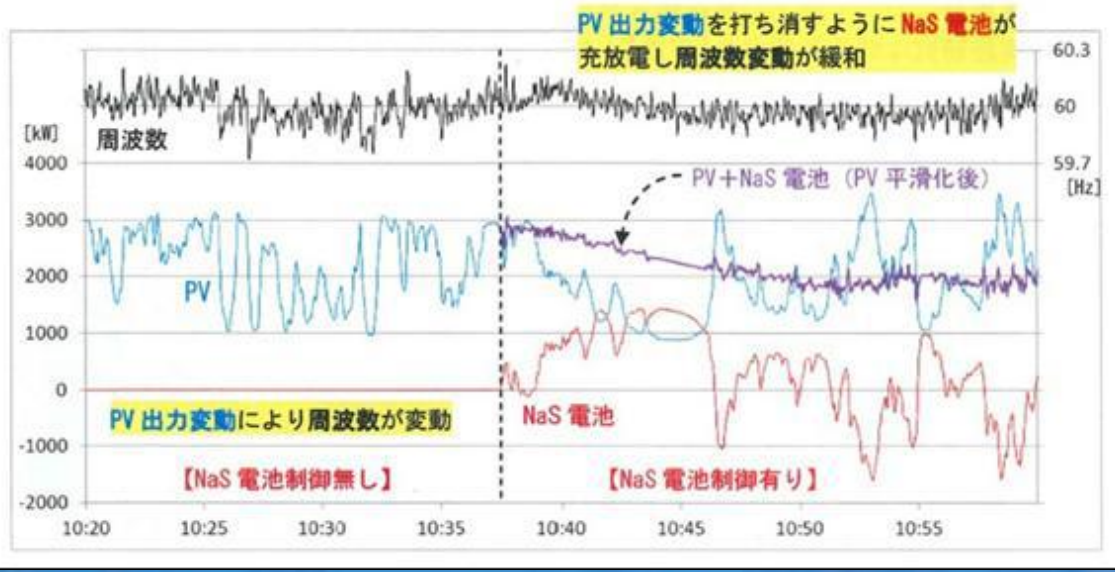
- The organization utilizes a CEMS (Cluster/Community Energy Management System) to control and optimize a cogeneration system in its plant as well as electricity and heat produced by photovoltaic power generation, and efficiently provides consumers with energy.




Source: Prepared by ANRE based on publicized materials about Ohira Village Project in Miyagi Prefecture

# Micro Grid Demonstration Projects
# (Miyako-jima Island /Kurima-jima Island-100% Renewable Energy Island)



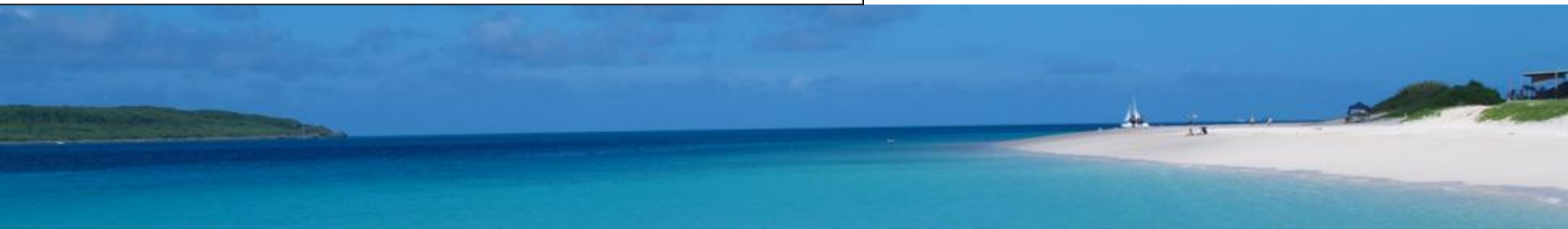




<Miyako-jima Island>

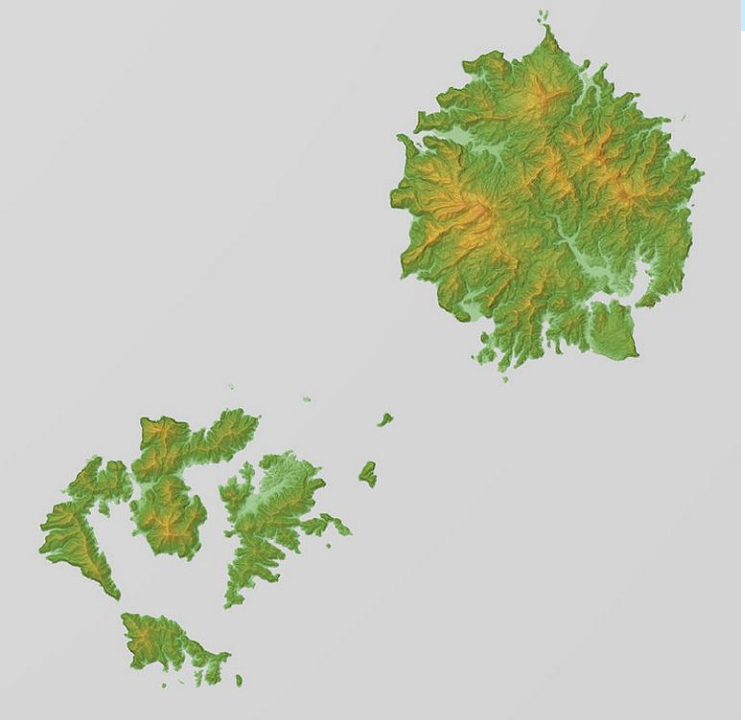
- ➢Peak demand: Around 50MW
- ➢Wind:4.2MW, PV:4.0MW, NAS:4MW
- ➢Roof top PV:13.6MW
- ➢Controlled 60Hz±0.3Hz.
- ➢EMS covers whole island
- ➢EV & E10 is also deployed

<Kurima-jima Island>

- ➢PV:380kW,
- ➢Lithium Battery :352kW
- ➢100 % Renewable Energy Island



# Micro Grid Demonstration Projects
## (Oki Hybrid Project: Hybrid Battery demonstration at Oki Islands Micro Grid)



<Major Purpose>

- Stabilization of the power quality in Oki Islands Micro Grid
- CO2 reduction through the replacement of Diesel Power Generation by renewable energy

<Oki Hybrid Battery System demonstration Project>

- NAS Battery:4.2 MW/25,200kWh
- Lithium Ion Battery：2MW/700kWh
- EMS

<Current Situation and Target of Oki Islands>

- **Minimum Electricity Demand：Approx. 10MW**
- Current Power Plant：
  - Saigo Thermal Power Plant : 25.32 MW(Diesel)
  - Kuroki Thermal Power Plant: 7.38MW(Diesel)
  - Wind Power:1.8MW
  - Small Hydro:0.3MW (0.1MW, 0.2MW)
  - Approx 3MW of Renewable Energy in Total

- **Renewable Energy Installation** in the near future
  - PV: 5.5MW (2MW, 1.5MW, 1.5MW, 0.5MW)
  - Wind Power: 2MW
  - Approx. **11MW** in Total

Thank you for your attention!