Japanese perspectives on storage alternatives

Experts' Group on R&D Priority-setting and Evaluation (EGRD)
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Outline

1. Energy Storage and Demand Side Flexibility
2. Energy Management System Demonstration Projects in Japan
3. Summaries

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3. **Summaries**

Energy Storage and Demand Side Flexibility

- Energy Storage
  - Can shift time and/or location
  - Where ?
    - Supply side – distribution – demand side
- Demand Side Flexibility
  - Offers time location shift of energy usage
  - Demand response
    - Manual (indirect), automatic (direct)
    - Behavior

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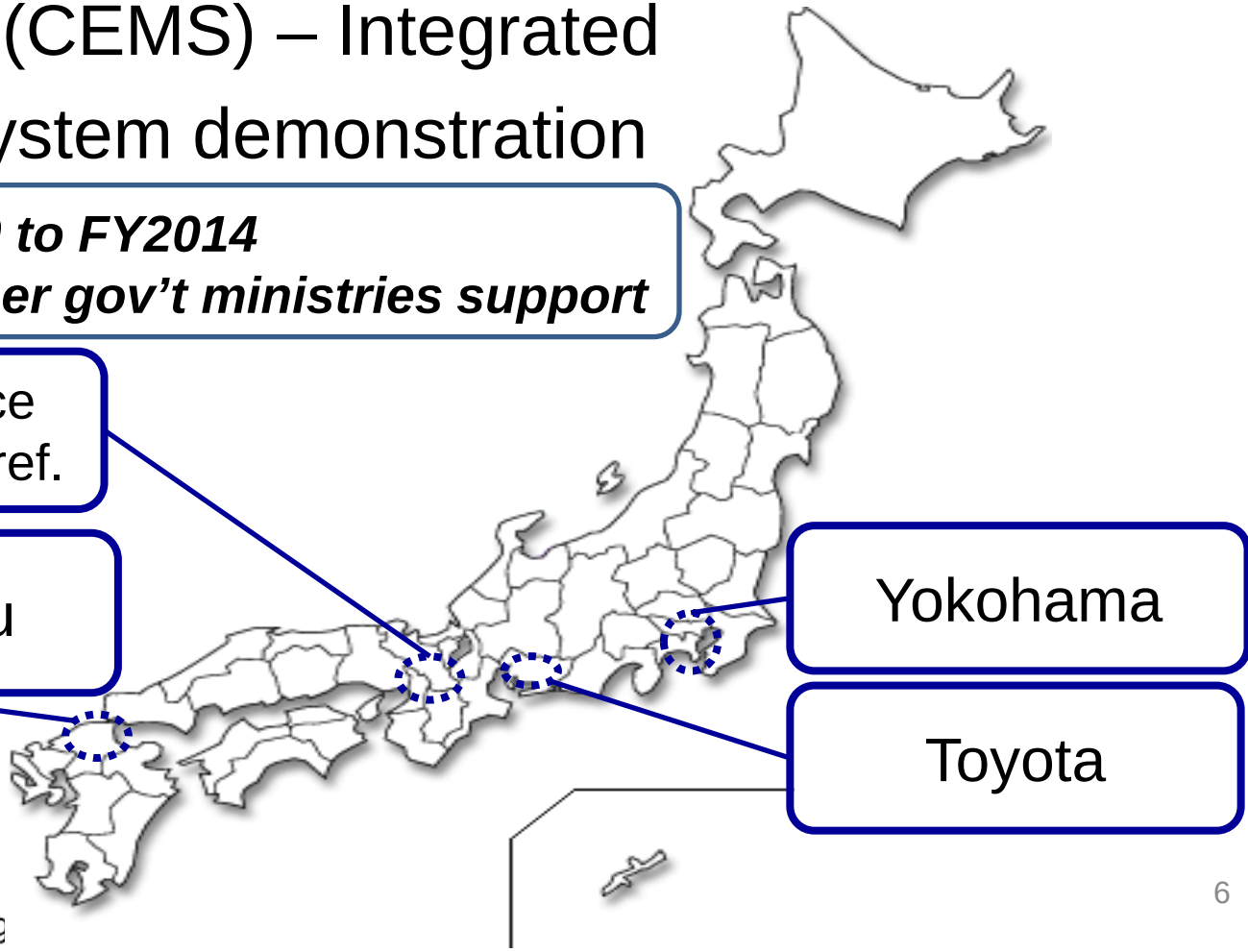
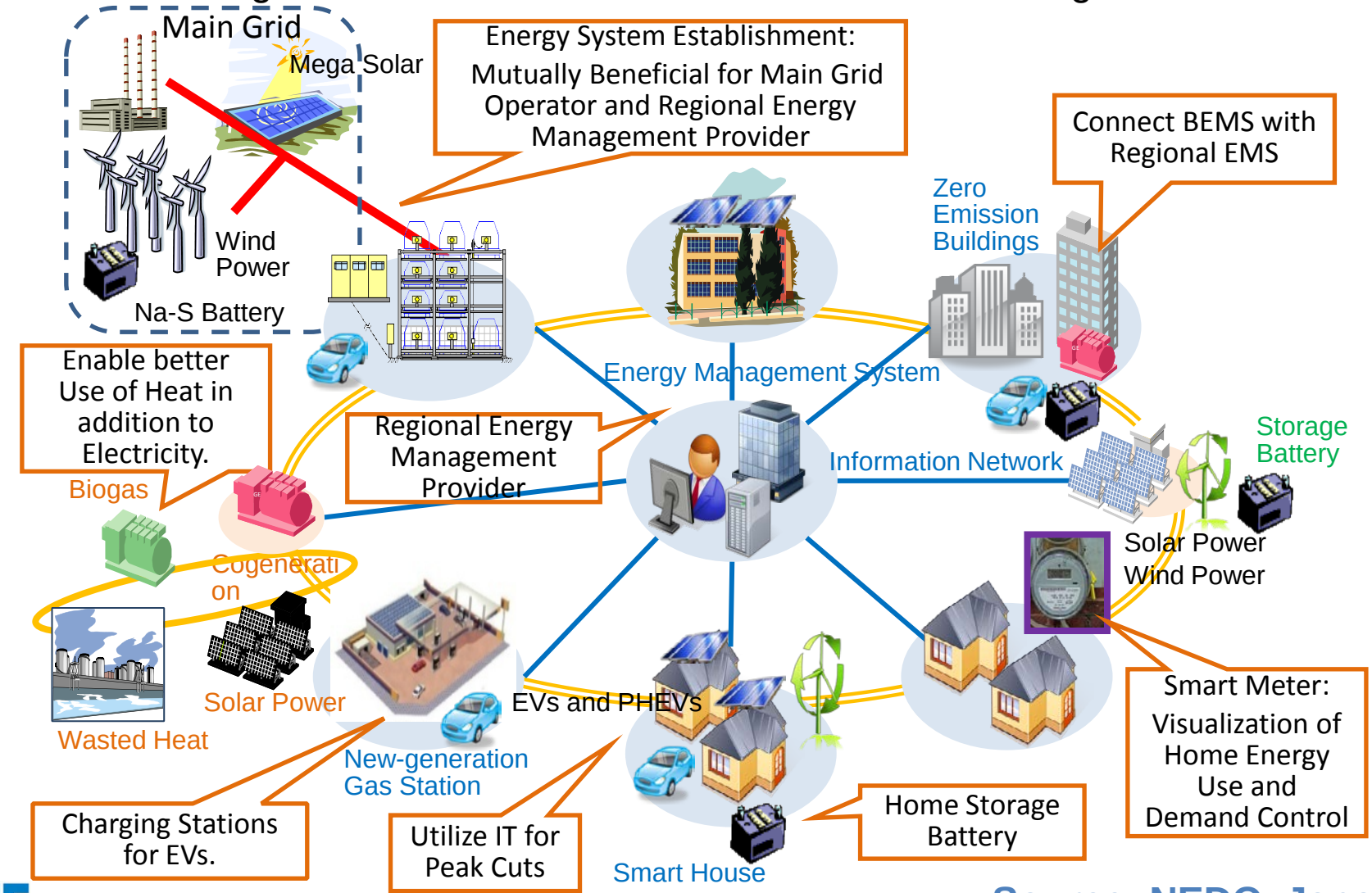
EMS Demonstration Projects in Japan

- Energy Management System (EMS)
  - Commercial or office Building (BEMS) Factory (FEMS), Home (HEMS)
  - Community (CEMS) – Integrated
- Large social system demonstration
  - ***From FY2010 to FY2014***
  - ***METI and other gov't ministries support***
- Many other initiatives



Concept of Smart Community Development

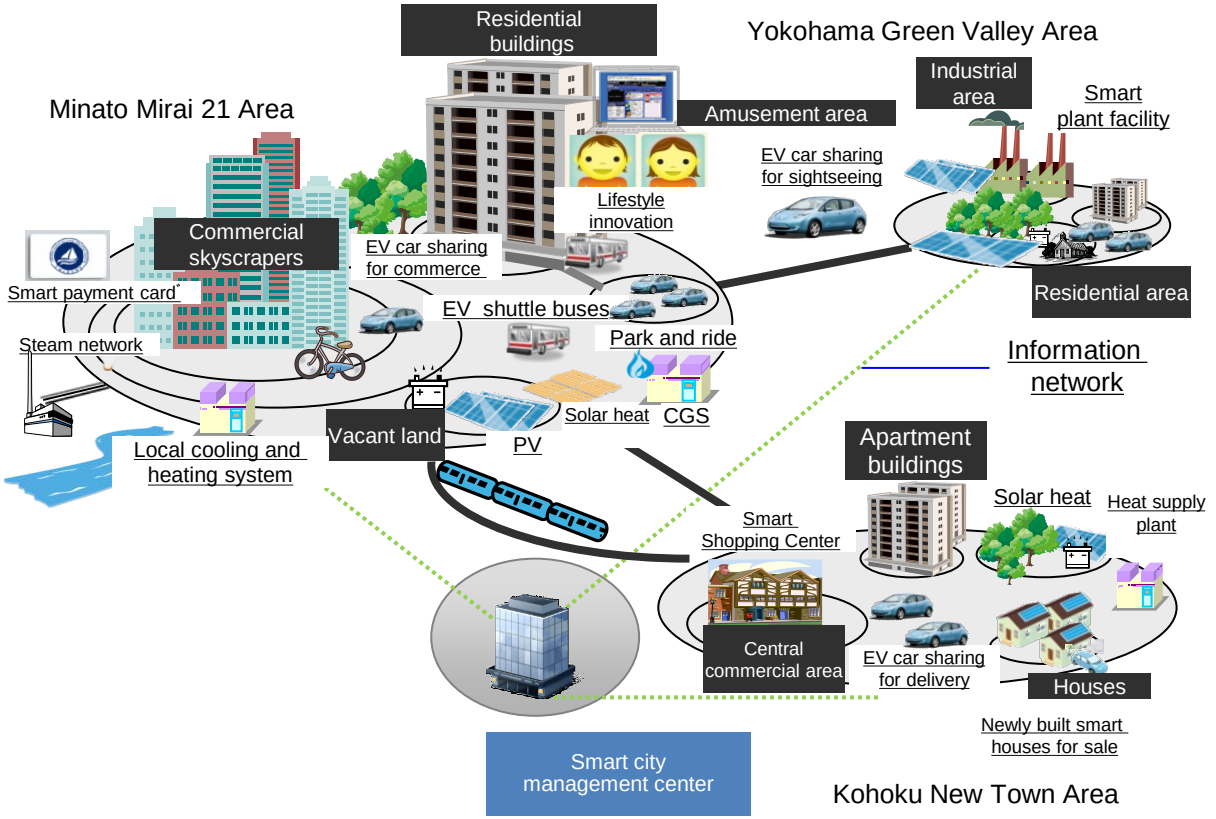
- Smart community is a new community utilizing advanced ICT with participation of citizens, and involves smart transportation, homes, office buildings and factories, while enabling the introduction of distributed renewable energies.



Source: NEDO, Japan

Yokohama City

- Integrated energy management in 3 areas (commerce, residence, industry), existing facilities
- Large-scale demand response and energy management programs



***Integrated virtual batteries**
***Fuel cell sharing**
(elec. & heat generated)
***Smart BEMS**
(with CEMS or multi. bldgs.)
***Fast EV charging**
(using integrated changing machine with stat. batteries)

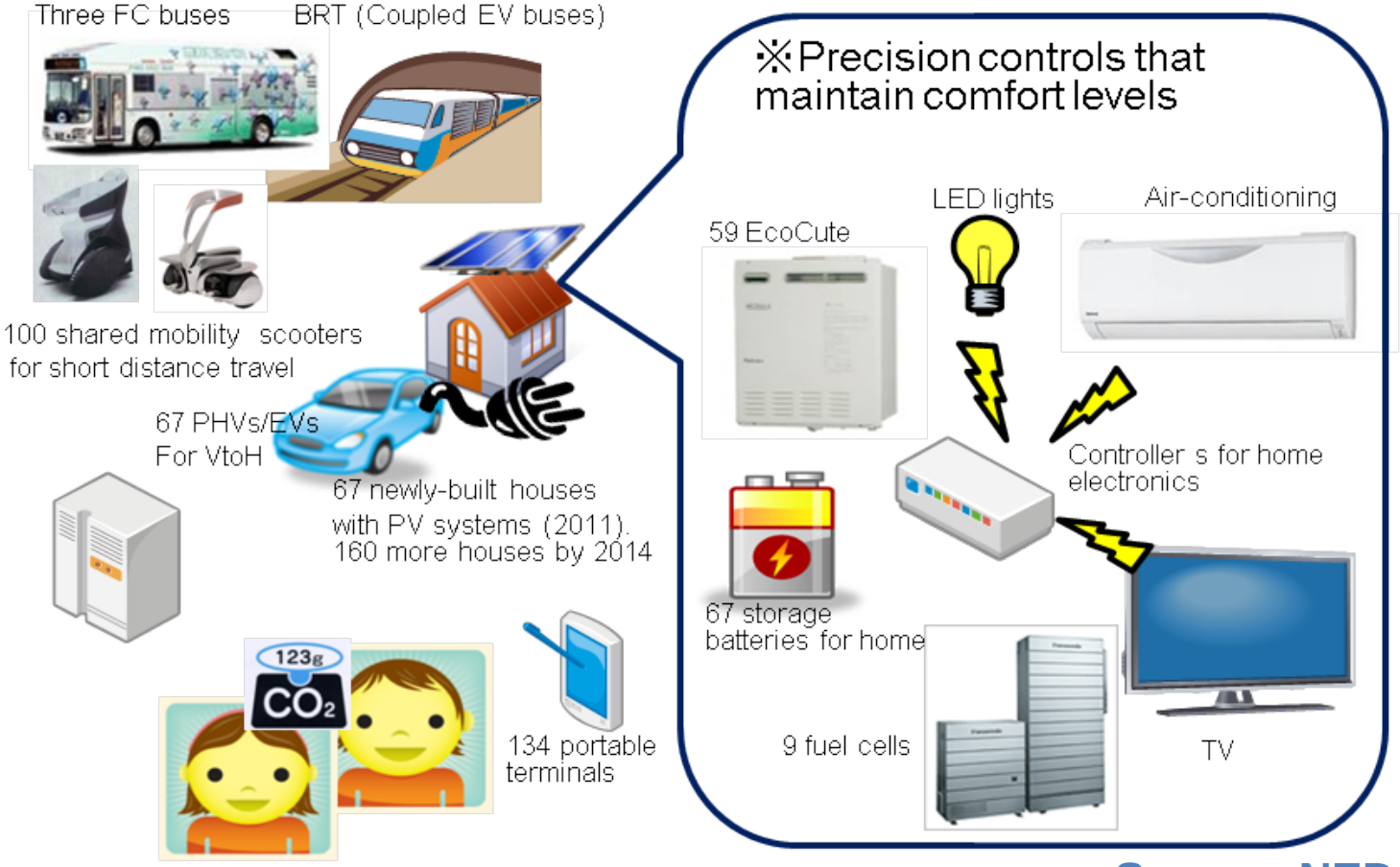
Goals:
- **HEMS: 4,000 households**
- **EV: 2,000 vehicles**
- **PV: 27 MW**

Source: NEDO, Japan

Toyota City

Focus on households & new-generation vehicles

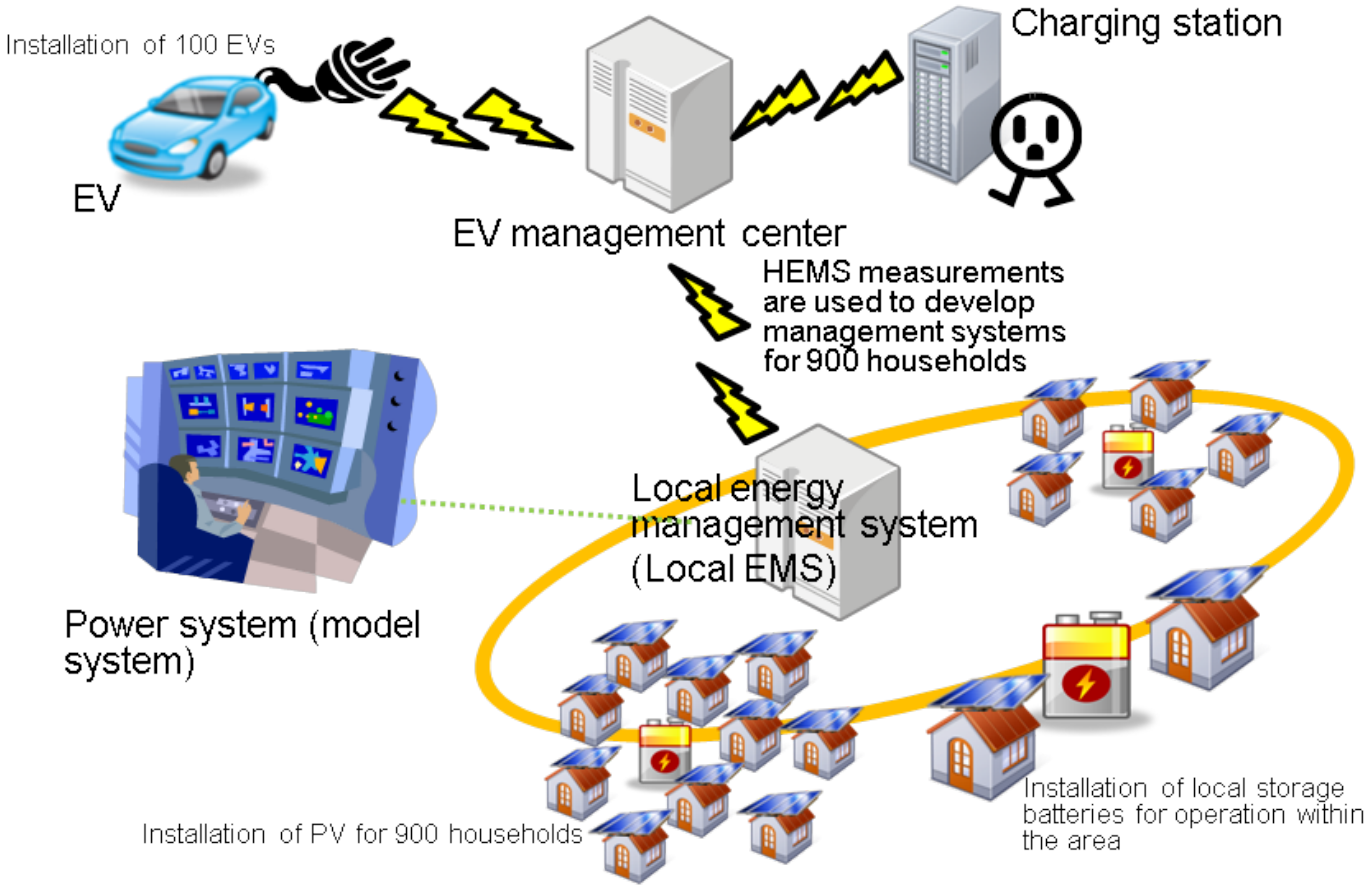
- PVs, fuel cells, stationary batteries for households
- Automatic control of air-conditioning, TV and illumination
- V to H (PHEV to home) – peak-cut and preparation for blackout
- Incentives for demand conservation



Source: NEDO, Japan

Kansai Science City (Keihanna)

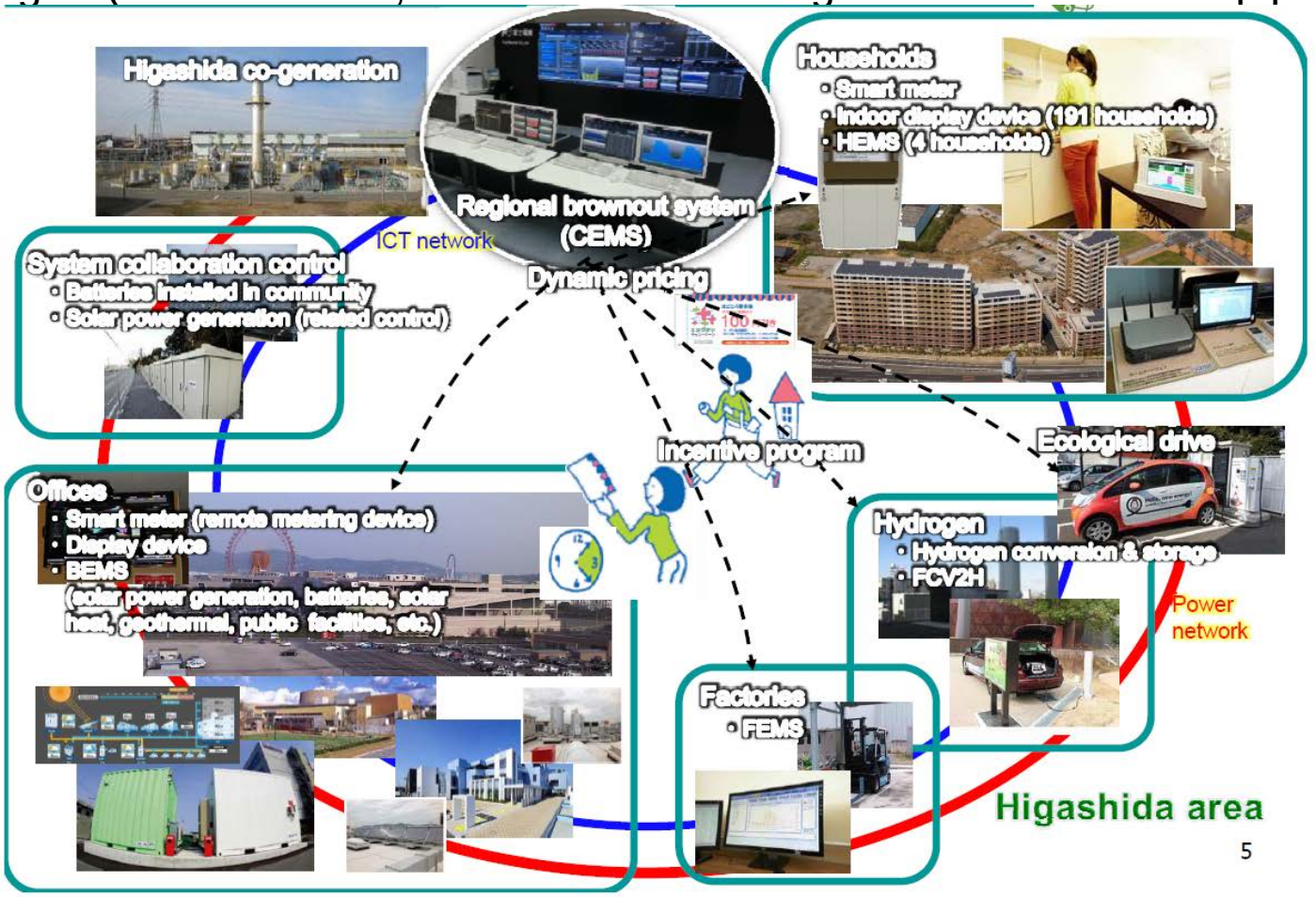
- About 600 households, DR by changing tariff
- Conservation consulting (e.g. new equipment info.)
- Optimal charging consultation system for each EVs.



Source: NEDO, Japan

Kitakyushu City

- Independent power supply by CHP, 230 households and 50 businesses
- CEMS delivers price and incentive information. Tariff DR experiments.
- Heat management of office buildings
- Hydrogen (FCV to Home, H2 from coke oven gas + H2 distribution pipeline)



Source: Ohga, Smart Community Summit 2014

Japan Smart Community Alliance

- The Japan Smart Community Alliance (JSCA) was established in April 2010.
- 324 members (as of September 2014) from industries, academia, local governments and non-profit organizations.
- JSCA interacts with overseas organizations, such as the Global Smart Grid Federation (GSGF).
- Latest Information can be found at Japan Smart City Portal website.

Electric Power Market in Transition

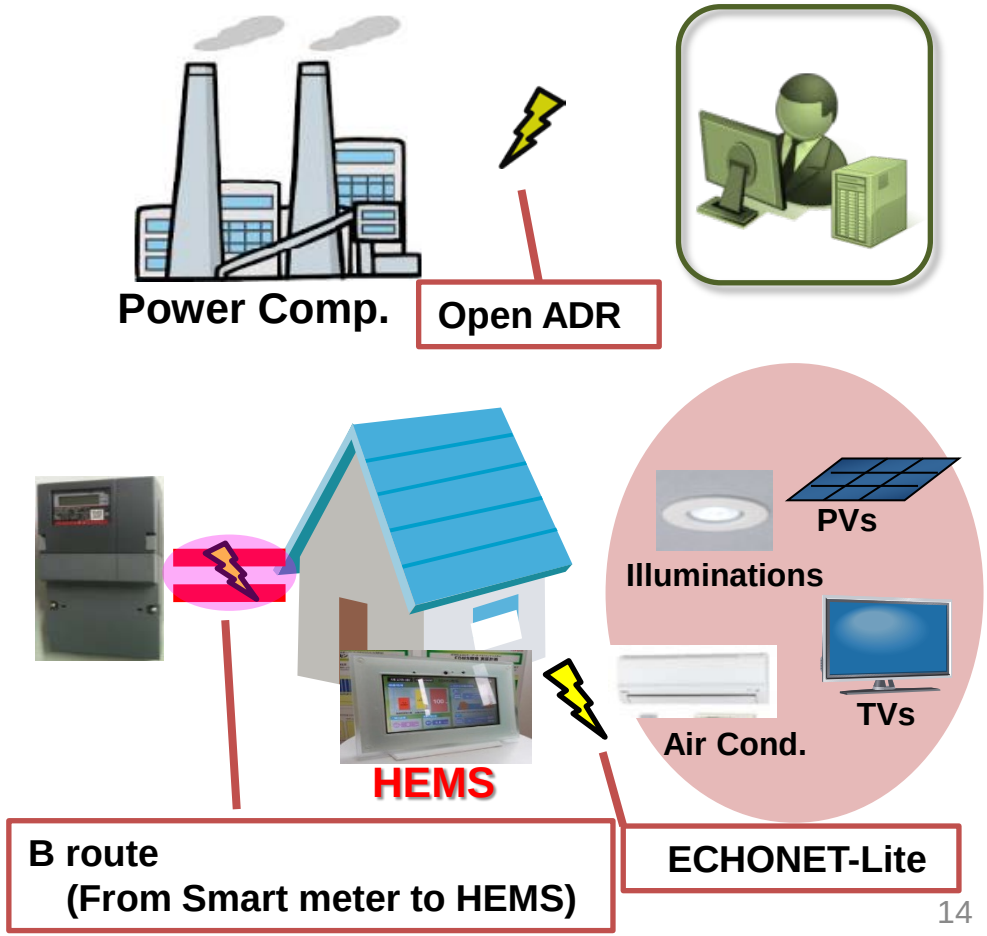
- Possible changes in the power market design
  - Smart meter installations will be accelerated.
    - Large customers : 100% by FY2016 (already started)
    - Small customers : 100% by FY2020 (already started)
  - New electricity market system (under planning)
    - Transmission system operator (TSO)(-2015)
    - Retail market deregulations for small customers (-2016, large customer market deregulated already)
    - Price regulation termination (-2020)
    - Unbundling of power supply structure (-2020)

Achievements of Social System Demonstration

- Community energy management system development
- Information exchange interface standards operations
  - Open ADR (automated demand response), Echonet-Lite (appliances, distributed power supplies, batteries, smart meters, etc.), B route (smart meter to HEMS)

Community energy management system (CEMS) in Kitakyushu demonstration

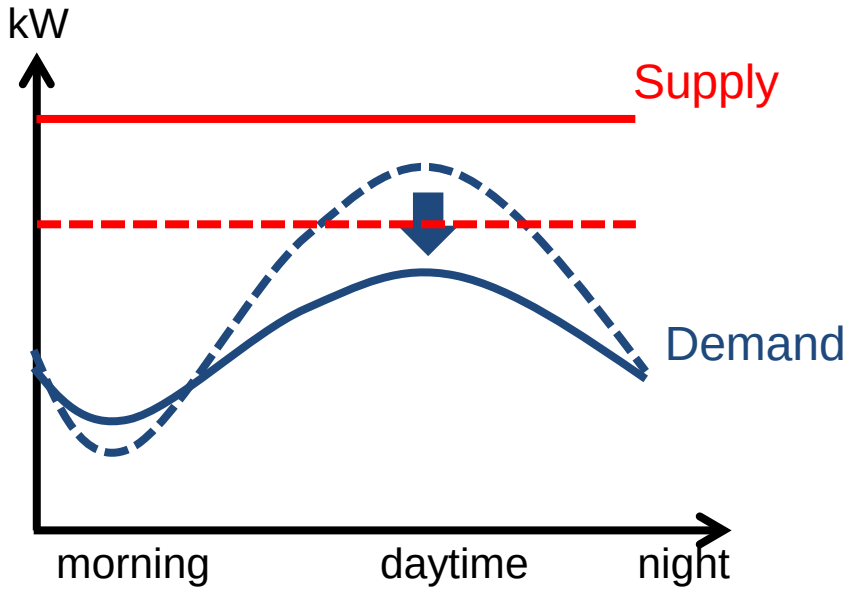
Source: Fuji Electric

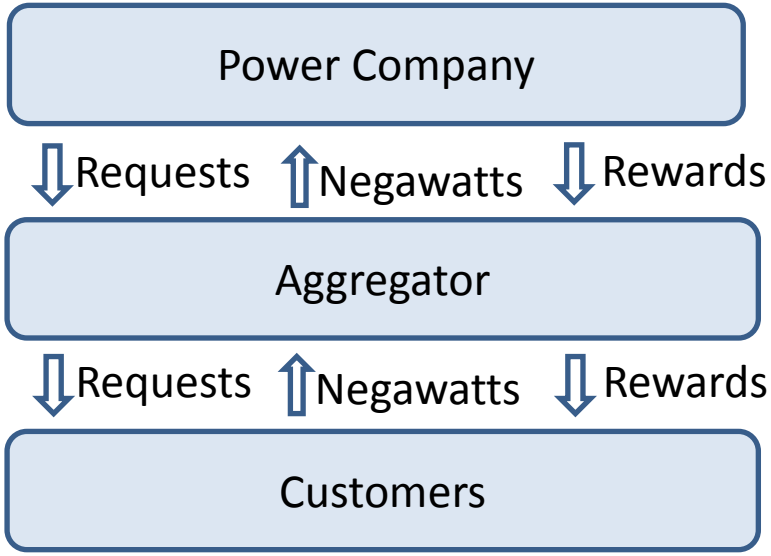


Source: METI

Achievements of Social System Demonstration

- Demand Response (DR)
  - Tariff based DR experiment – in progress
    - Time of Use (TOU) and Critical Peak Pricing (CPP)
  - Negawatt trading experiment though aggregator (planned)





Source: METI

DR response (1)

Kitakyushu DR

- Samples : 180 in FY2012, 178 in FY2013
- Summer peak hours : 13:00-15:00
- Winter peak hours : 08:00-10:00, 18:00-20:00
- CPP tariff for households, also costumers before CPP experiments. TOU effects cannot be evaluated.

Kitakyushu	Summer FY2012 (Jun-Sep)	Winter FY2012 (Dec-Feb)	Summer FY2013 (Jun-Sep)
Tariff			
TOU	Not evaluated	Not e evaluated	Not evaluated
+CPP=50JPY/kWh	-18.1% (#)	-19.3%(##)	-20.2% (##)
+CPP=75JPY/kWh	-18.7%(#)	-19.8%(##)	-19.2% (##)
+CPP=100JPY/kWh	-21.7% (##)	-18.1%(##)	-18.8% (##)
+CPP=150JPY/kWh	-22.2%(##)	-21.1%(##)	-19.2% (##)

(##)Significance level 1%, (#) 5%

Source: METI (2014)
(original information from Yoda, Tanaka and Ito)

DR response (2)

Keihanna DR

- Samples : 681 in FY2012, 635 in FY2013
- Summer peak hours : 13:00-16:00
- Winter peak hours : 18:00-21:00

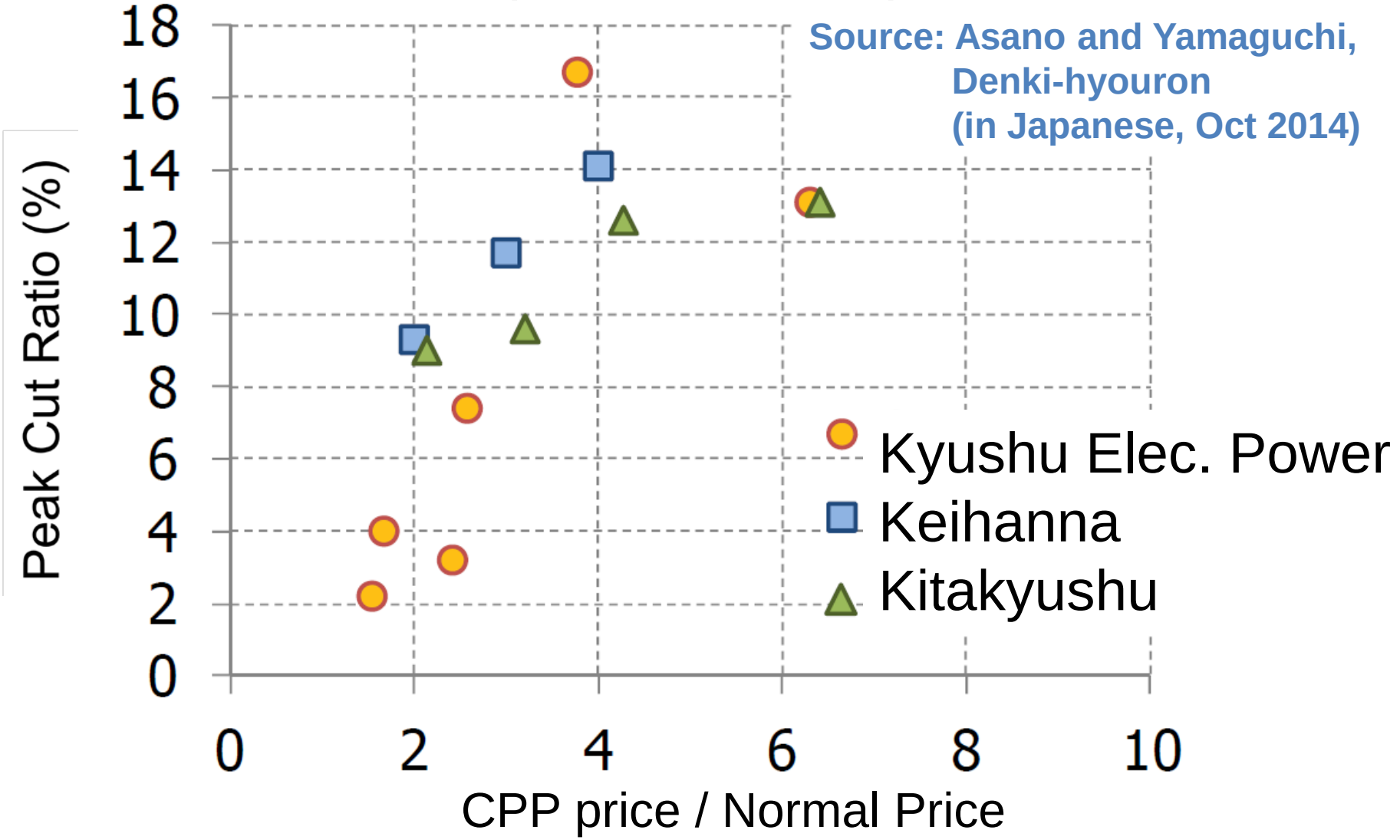
Keihanna	Summer FY2012 (Jul-Sep)	Winter FY2012 (Dec-Feb)	Summer FY2013 (Jul-Sep)
Tariff			
TOU(+20 JPY/kWh)	-5.9%(##)	-12.2%(##)	-15.7%(##)
+CPP(+40 JPY/kWh)	-15.0%(##)	-20.1%(##)	-21.1%(##)
+CPP(+60 JPY/kWh)	-17.2%(##)	-18.3%(##)	-20.7%(##)
+CPP(+80 JPY/kWh)	-18.4%(##)	-20.2%(##)	-21.2%(##)

(##)Significance level 1%

Source: METI (2014)
(original information from Yoda, Tanaka and Ito)

DR response – Sensitive to price level?

- Tariff based DR experiments comparison



Courtesy from Hiroshi Asano, CRIEPI, Japan

DR experiments - Discussions

- Tariff based DR
  - Peak cuts are observed in CPP experiments. Price sensitive? Announcement effect?
  - Role of information and consultation to stimulate behavior.
  - Conservation behavior change vs. weakening effects due to habituation. Automated DR (ADR) is needed?
  - Experiment design to ensure statistically significance.

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Summaries

- In the smart community demonstration projects, energy storage technologies in broad sense are included as important elements to enhance system flexibility.
- In addition, energy management systems play important roles through information exchange.
- Systems can be managed smartly through system learning (e.g. demand forecasting, virtual aggregation of storage devices, weather information based renewable power output forecasting and other operation experiences)
- We need more evidences to know pragmatic demand response effects.

Innovation Cool Earth Forum (ICEF)

In October 2014, First Innovation for Cool Earth Forum (ICEF) was held in Japan.

Innovation for Cool Earth Forum

Plenary Sessions:
- The Role of Innovation for Addressing Climate Change
- Strategies for Promoting Innovation

Concurrent Sessions:
- Solar Energy / Geothermal Power / Automobile Technology / Energy Efficiency / Smart Community / The Role of Public Sector for RDD&D / Cooperation between Developing and Developed Countries

TOP10 Innovations announcement

Objectives

World-leading researchers, business executives, and policymakers discussions
- Promotion of energy and environment technologies innovation
- Diffusion of technologies to address climate change
- Enhancement of the cooperation among academia, business, and government

Host:

The Government of Japan, NEDO

Date/Venue ICEF 2015

Date : October 6-8, 2015

Venue : Hotel Chinzanso Tokyo, Japan

See http://www.icef-forum.org