

International Symposium: REvision2015

**Session 1: Global Renewable Energy Expansion and Japan**

# **Current Situation and Future Prospects for Photovoltaic Power Generation in Japan**

**March 4, 2015**

**Japan Photovoltaic Energy Association**

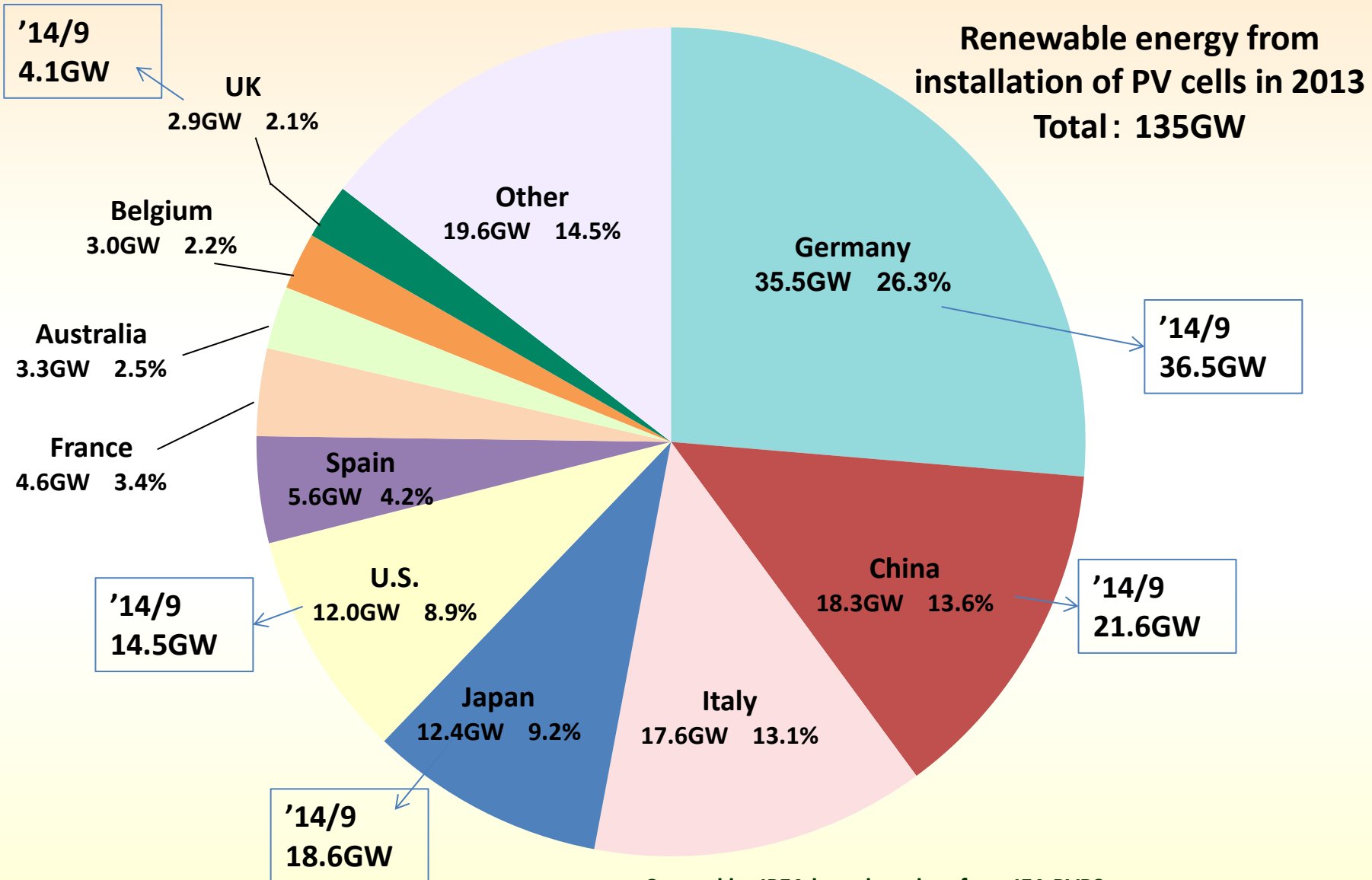
**Unofficial Translation**

# 1. Market Trends for Photovoltaic Power Generation

- Shipment trends in Japan
- Status of facility certification
- Installation status of photovoltaic systems
- Future outlook of facility certification and installation of photovoltaic systems

# Installation of Photovoltaic (PV) Cells by Country

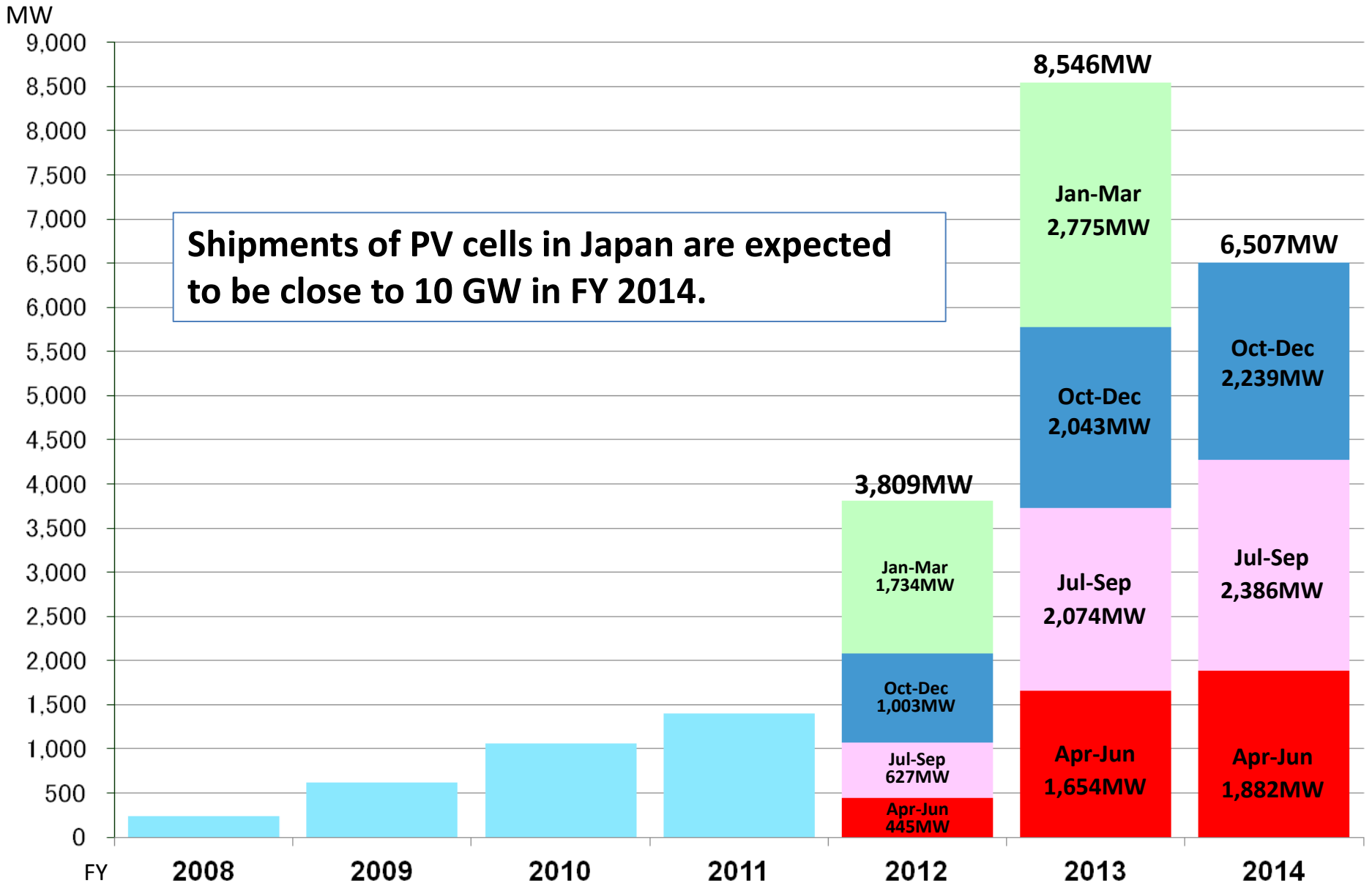
(as of the end of 2013)



Created by JPEA based on data from IEA PVPS  
\*Japan: Calculated from values in the METI News Release.

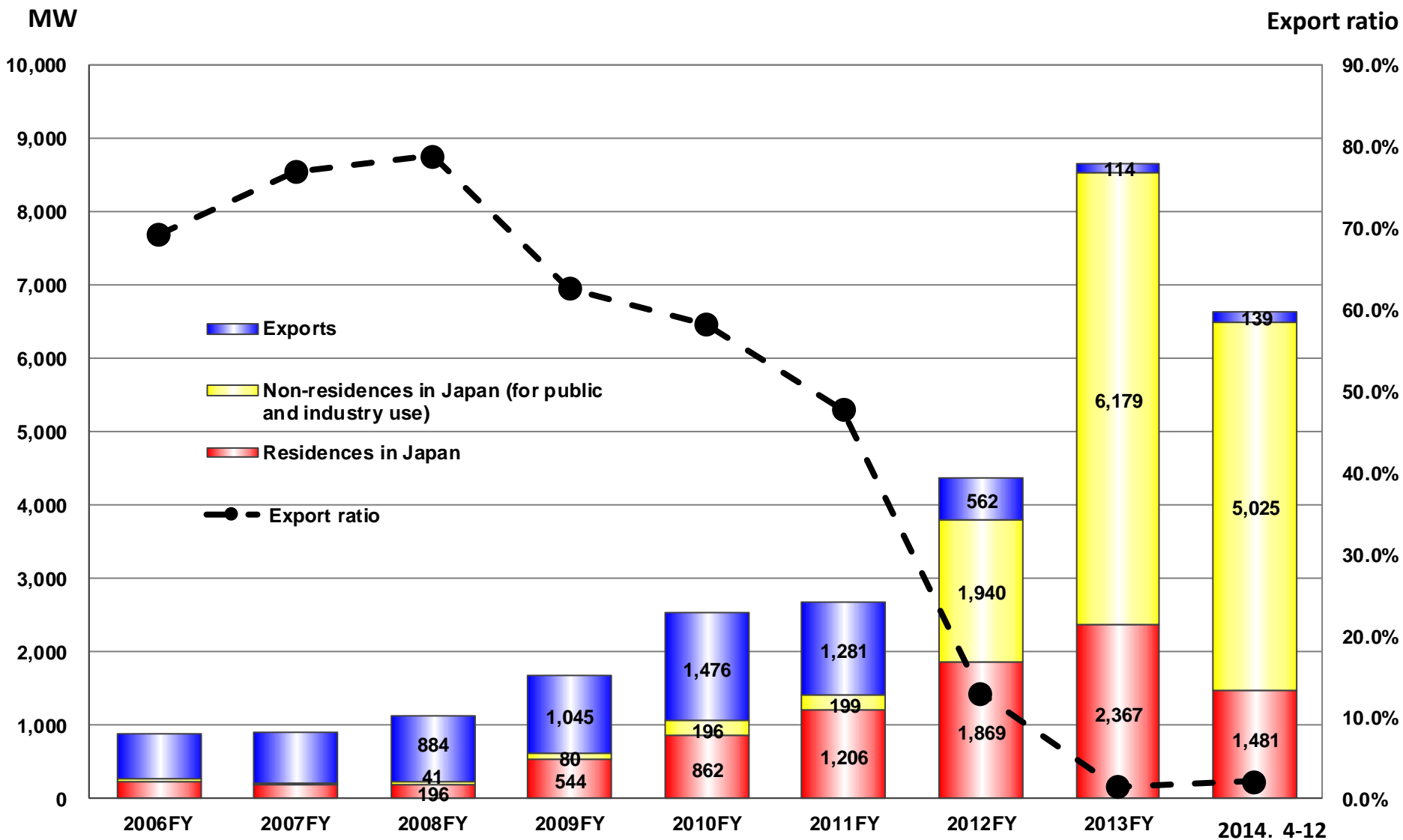
Unofficial Translation

# Changes in Shipments of PV Cells in Japan



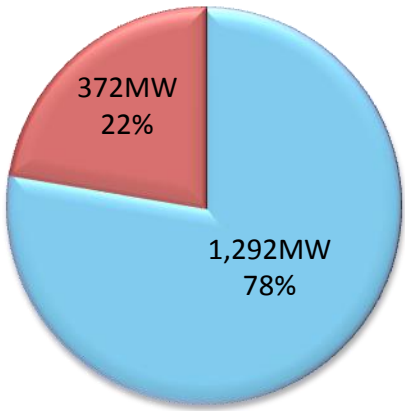
Unofficial Translation

# Changes in Shipments of PV Cells

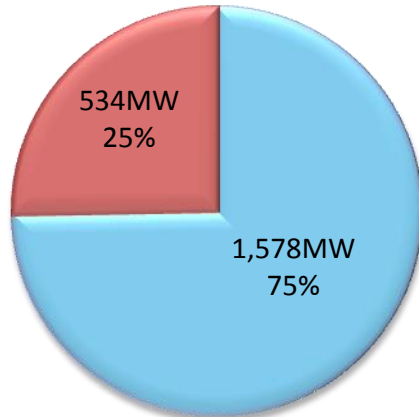


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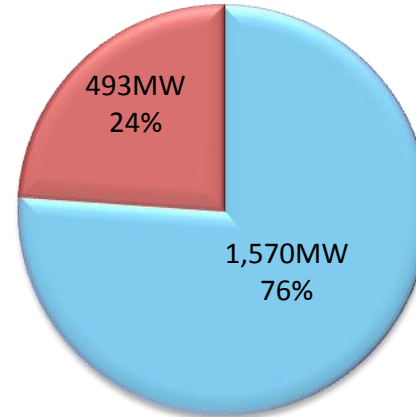
# Ratio of Japanese and Foreign Companies in Total Shipments of Modules



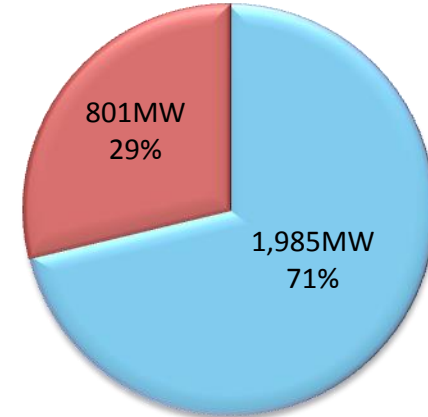
First quarter of FY 2013



Second quarter of FY 2013

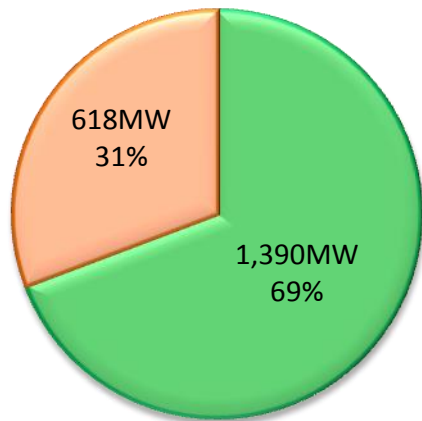


Third quarter of FY 2013

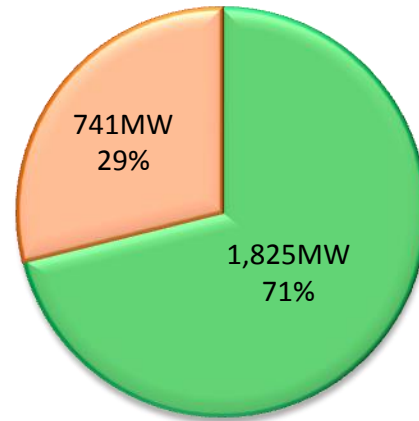


Fourth quarter of FY 2013

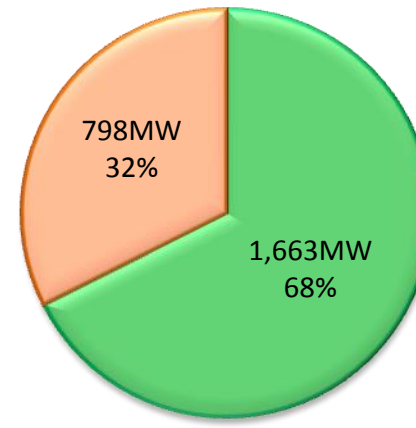
■ Japanese companies
 ■ Foreign companies



First quarter of FY 2014



Second quarter of FY 2014



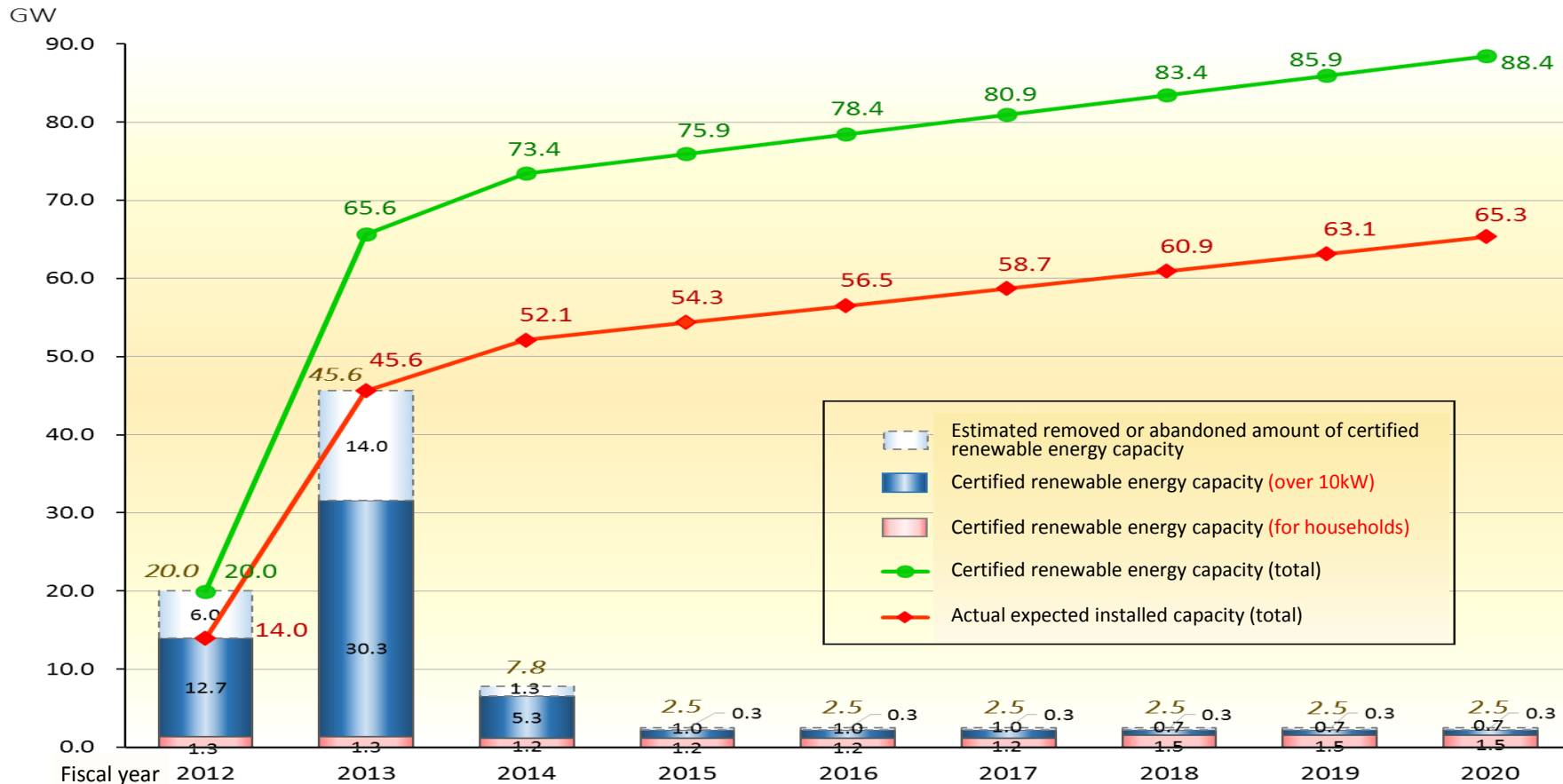
Third quarter of FY 2014

■ Japanese companies
 ■ Foreign companies

Unofficial Translation

# Changes in Certified Renewable Energy Capacity and Calculations on Actual Expected Installed Capacity (total by fiscal year)

- In FY 2012 and FY 2013, actual expected installed capacity was calculated by estimating the “removed or abandoned” amount of certified renewable energy capacity.
- From FY 2014, actual expected installed capacity will be calculated by applying a fixed rate of retraction.

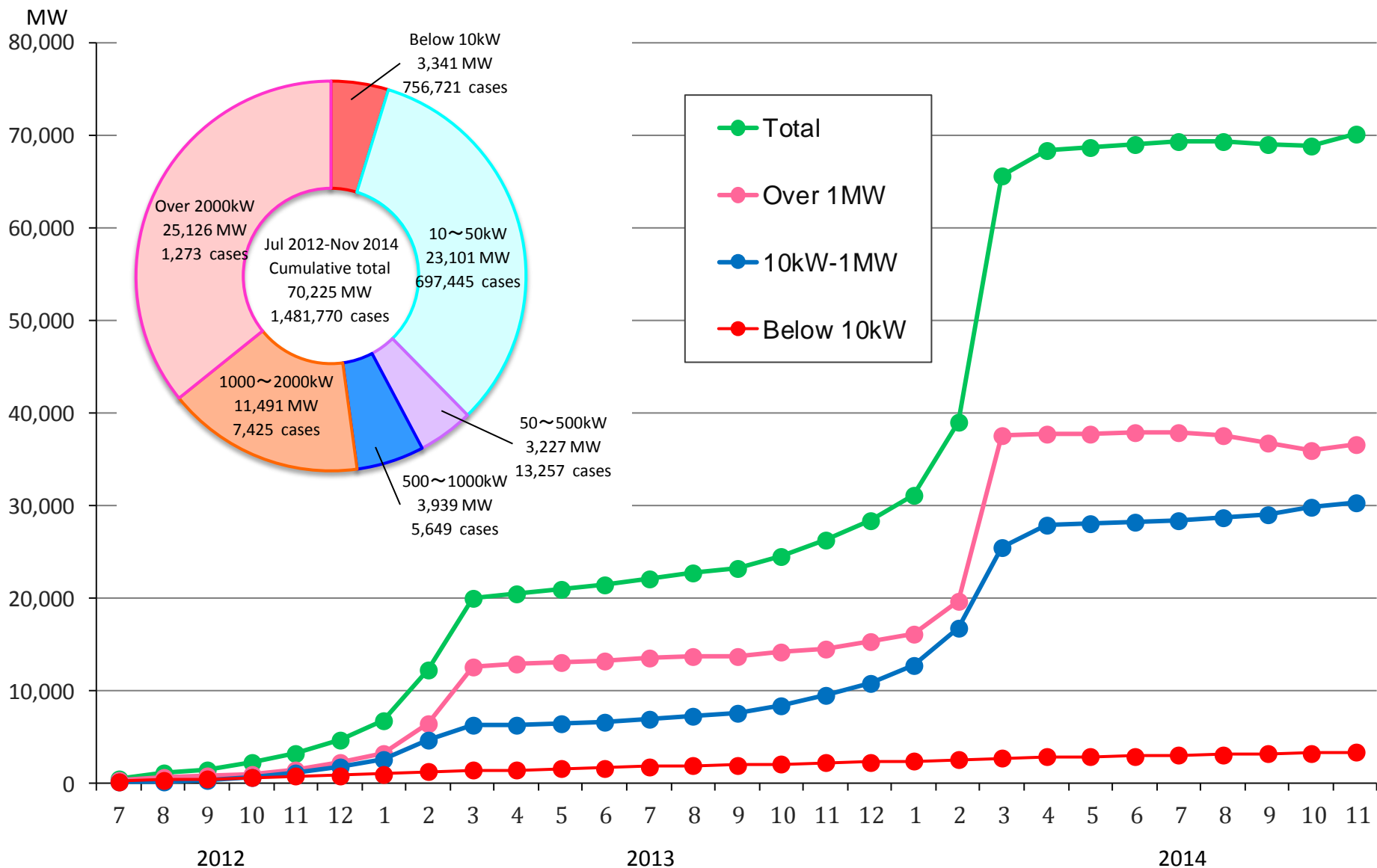


<Prerequisites for estimated removed or abandoned amount>

- Renewable energy that is below 10kW is not calculated as removed or abandoned.
- Calculations were carried out on the total component ratio of “abandoned facilities” and “facilities discontinued or withdrawn after collection” in a collection of reports on certified facilities in FY 2012. The removed or abandoned amounts were estimated by multiplying these numerical values by the certified renewable energy capacity in FY 2012 and FY 2013, and the expected installed capacities were calculated.
- From FY 2014, certified renewable energy capacities will be calculated within JPEA. Of that amount, the expected installed capacities will be calculated by applying a fixed rate for removal and abandonment (cancellation rate for past subsidies).

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# Certified Renewable Energy Capacity by Scale as of the End of Nov 2014



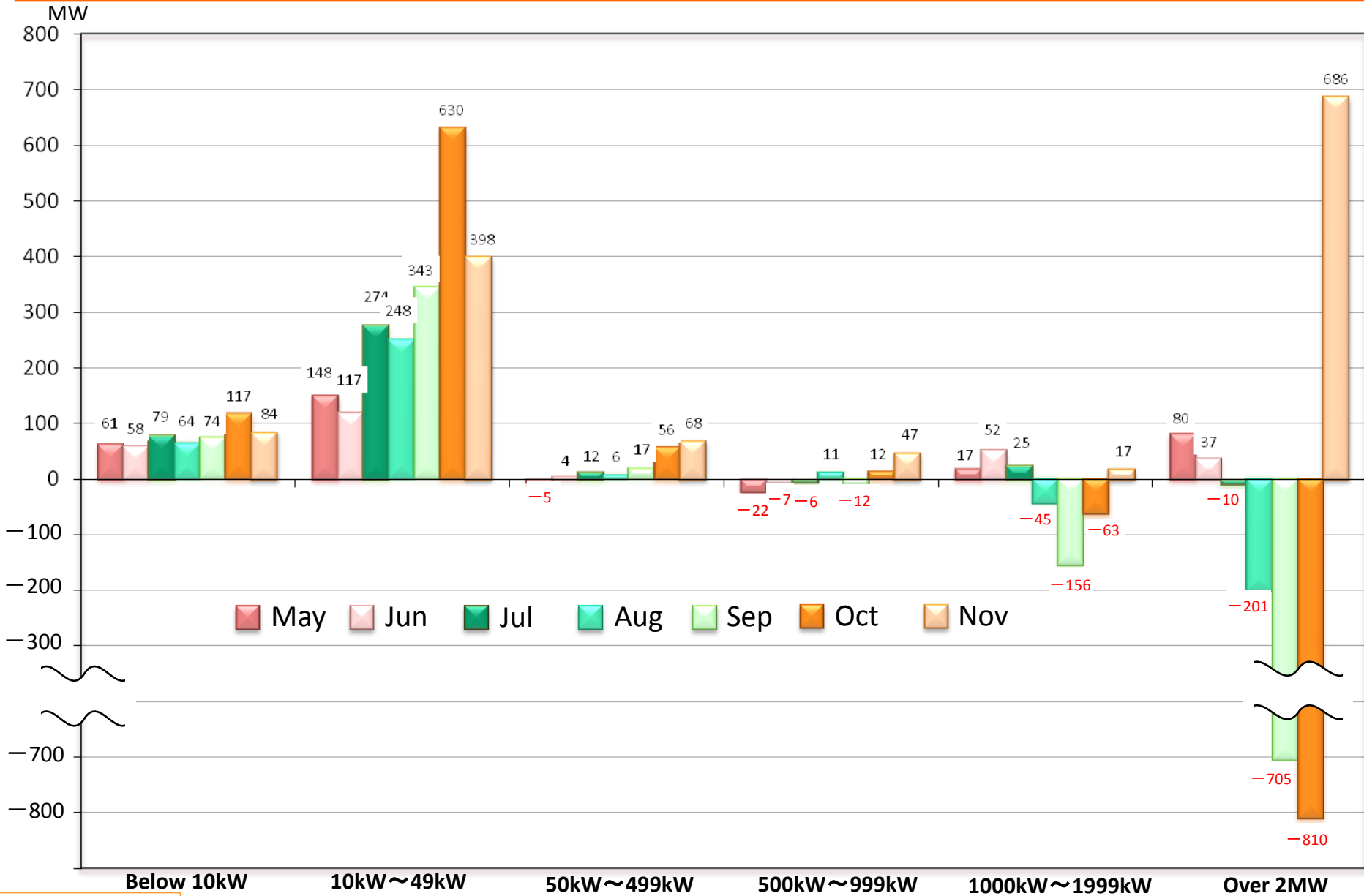
Unofficial Translation

Source: Created by RTS Corporation based on materials on the status of the installation of facilities (METI website, *Nattoku saisei kanou enerugi* (Understanding Renewable Energy)).



# Changes in Certified Renewable Energy Capacity by Month

(May-Nov 2014)

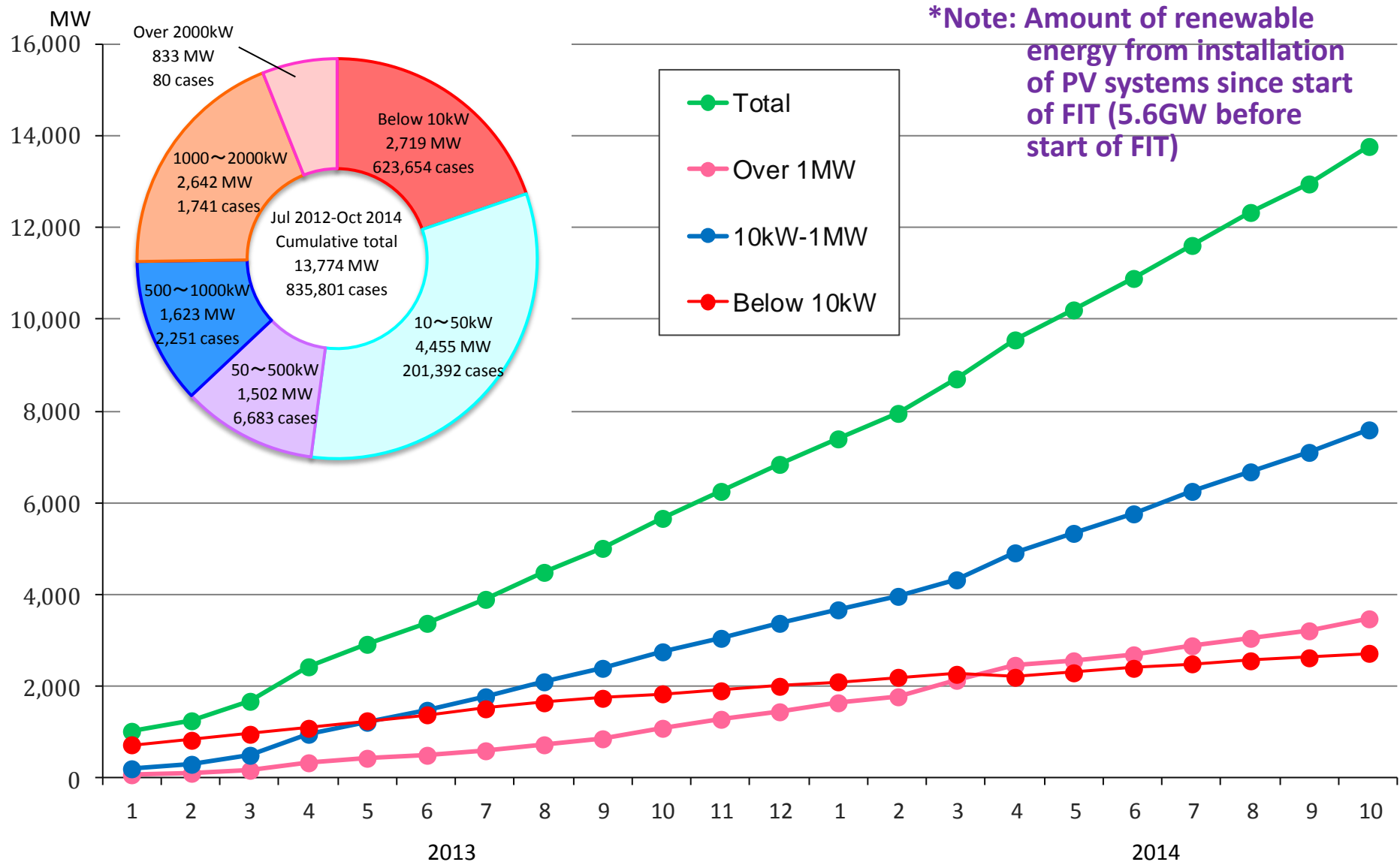


■ May 
 ■ Jun 
 ■ Jul 
 ■ Aug 
 ■ Sep 
 ■ Oct 
 ■ Nov

Unofficial Translation

From METI News Release  
 \* METI's method of publication for certified renewable energy capacity changed from the end of April 2014. Detailed capacity data was created from May.

# Amount of Renewable Energy from Installation of PV Systems by Scale as of the End of Oct 2014



Unofficial Translation

Source: Created by RTS Corporation based on materials on the status of the installation of facilities (METI website, *Nattoku saisei kanou enerugi* (Understanding Renewable Energy)).

# Status of Photovoltaic Power Generation in Facility Certification (Jul 2012-Oct 2014)

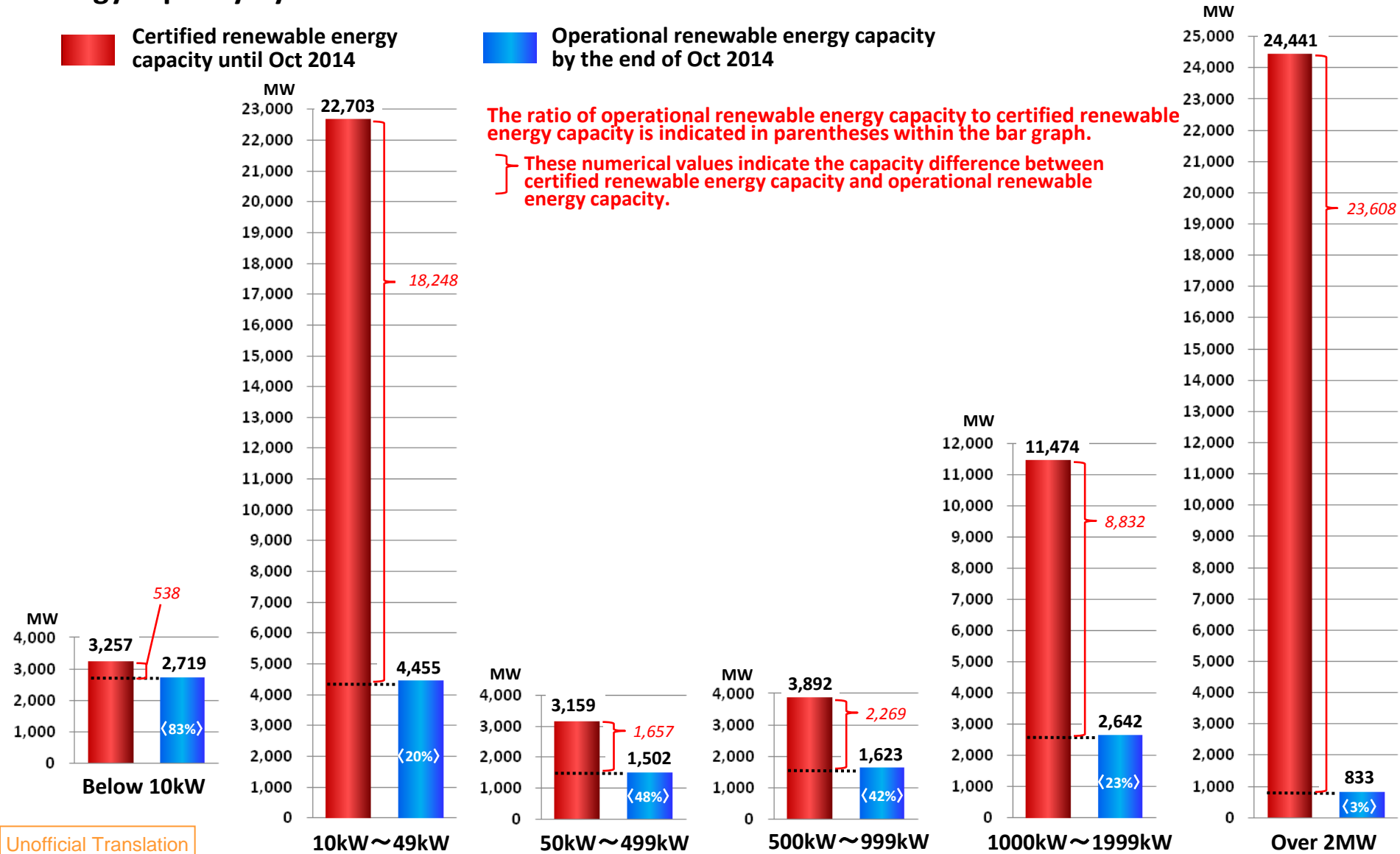
Certified renewable energy capacity until Oct 2014 and, of that number, operational renewable energy capacity by Oct 2014

**Certified renewable energy capacity until Oct 2014**

**Operational renewable energy capacity by the end of Oct 2014**

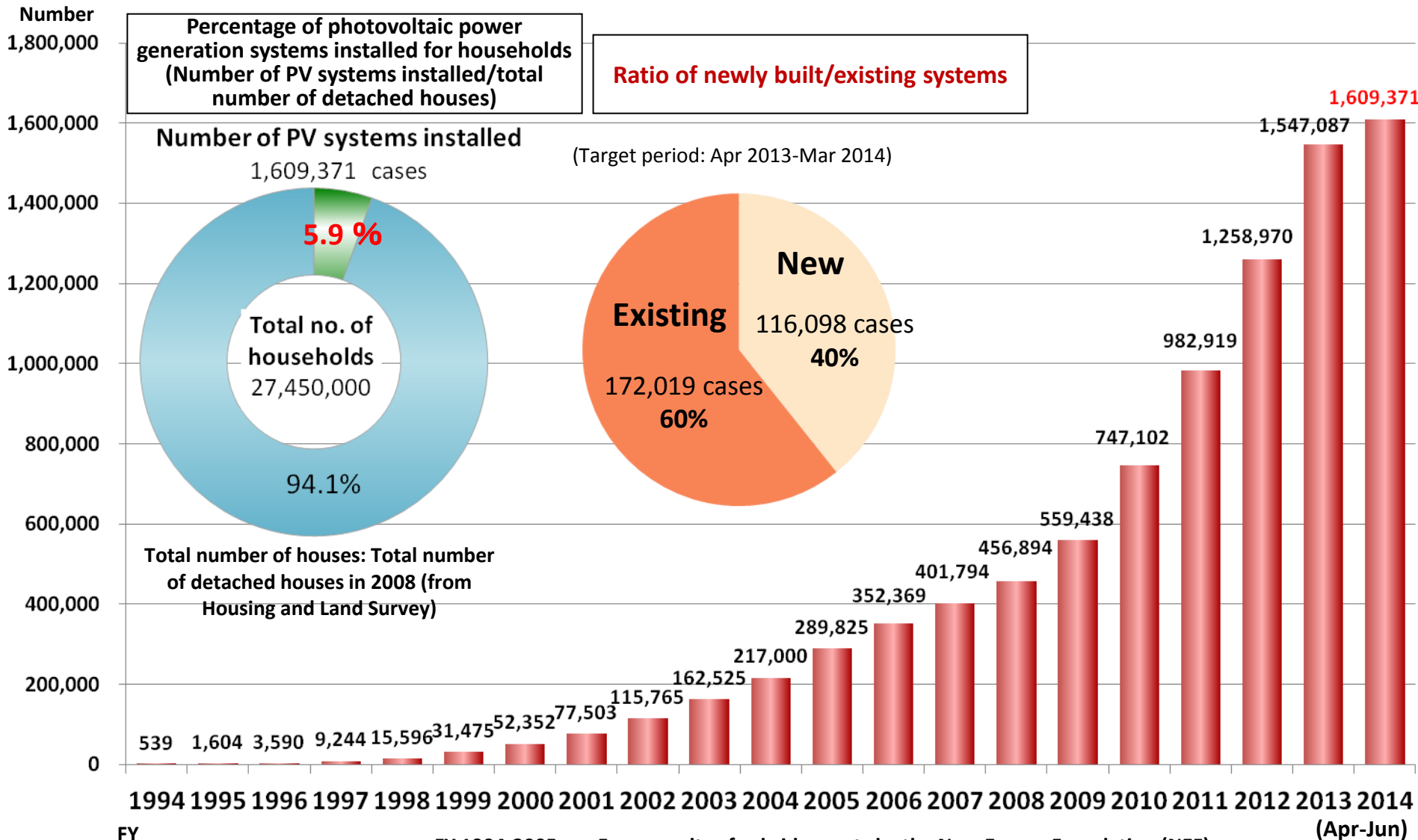
The ratio of operational renewable energy capacity to certified renewable energy capacity is indicated in parentheses within the bar graph.

These numerical values indicate the capacity difference between certified renewable energy capacity and operational renewable energy capacity.



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# Number of Photovoltaic Power Generation Systems Installed for Households (Total)



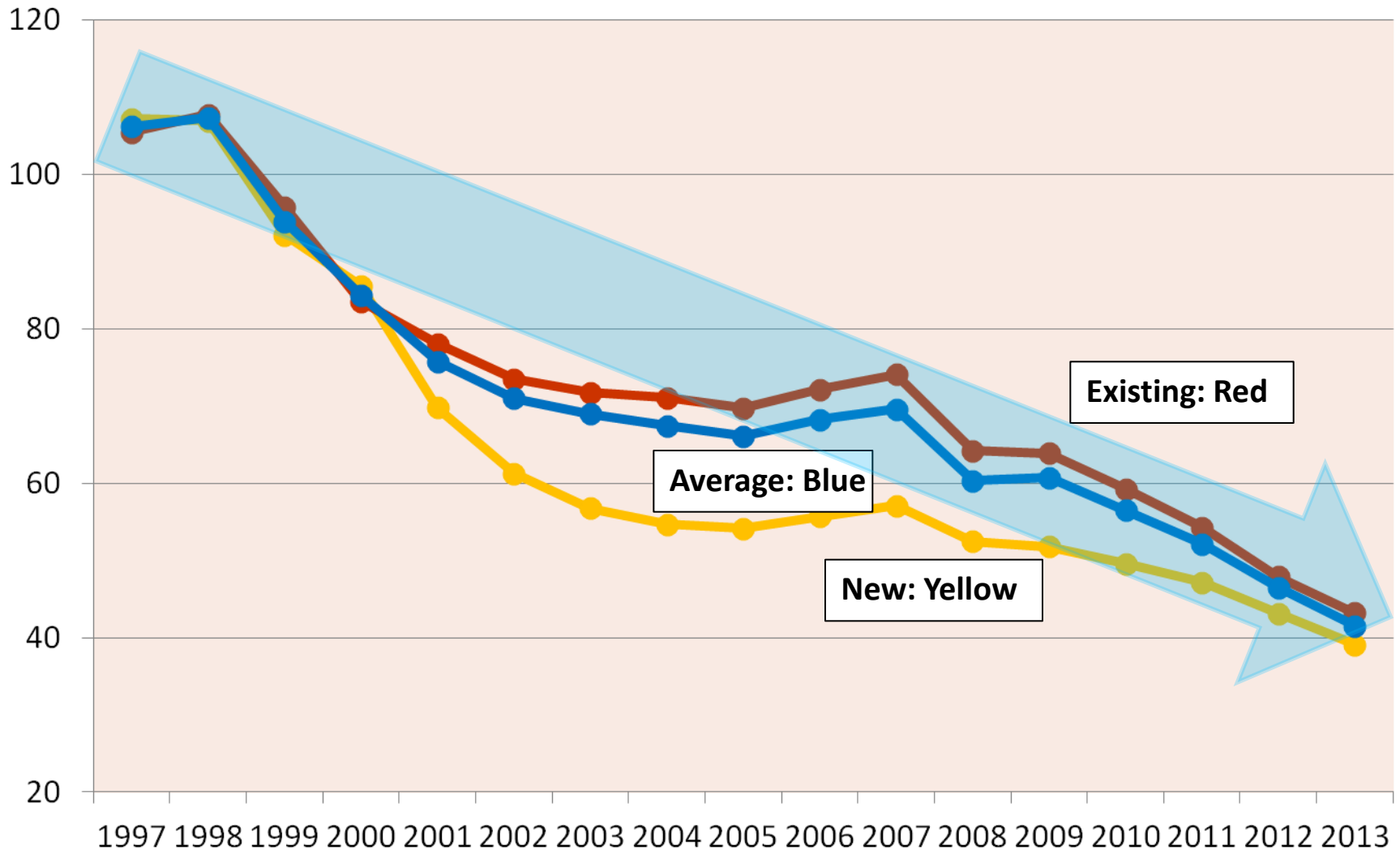
FY 1994-2005: From results of subsidy grants by the New Energy Foundation (NEF)  
 FY 2006-2008: From studies by the New Energy Promotion Council (NEPC)  
 FY 2008-present: From the number of subsidy grants determined by the Japan Photovoltaic Expansion Center (J-PEC) Calculated by JPEA

Unofficial Translation

# Pricing Changes for Photovoltaic Power Generation Systems for Households



JPY 10,000/kW

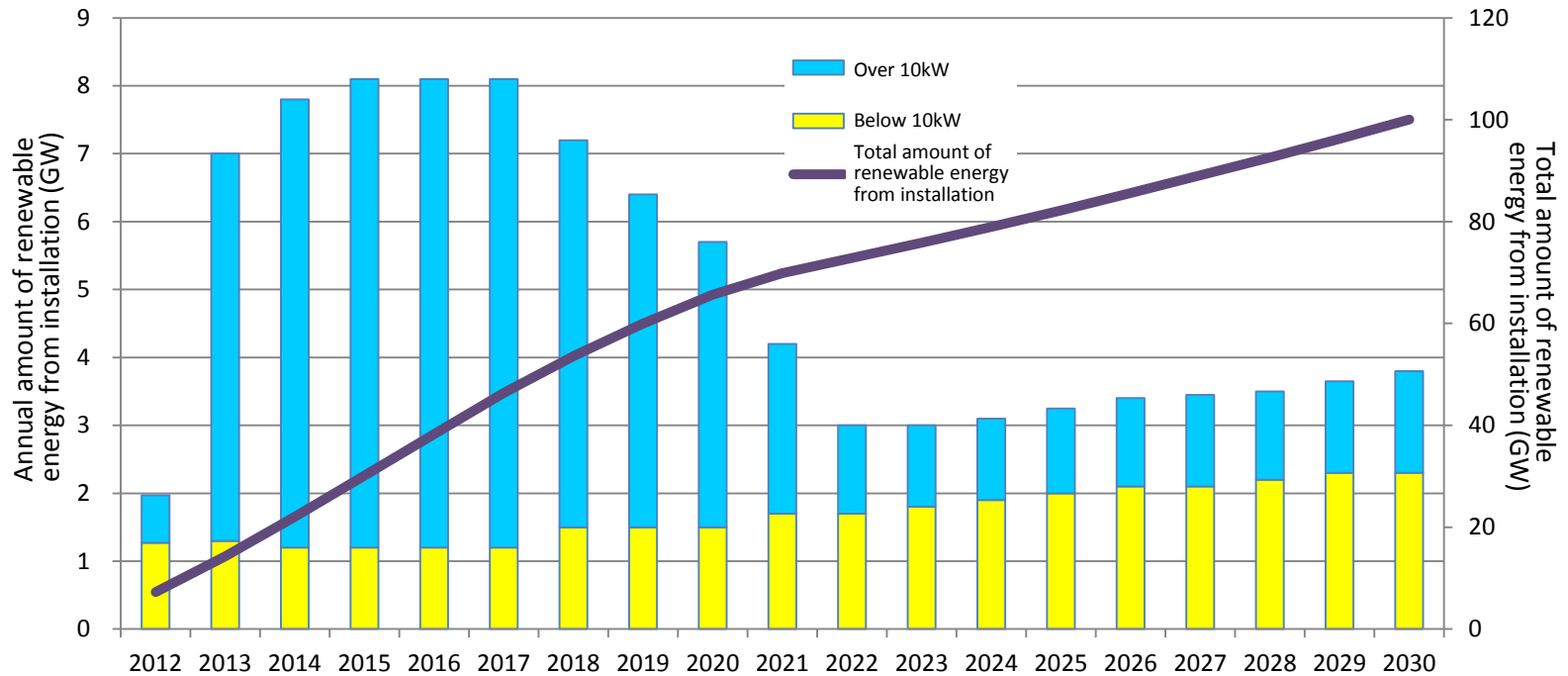


Unofficial Translation

Source: Created by JPEA based on results of field test projects by NEF and NEDO, and materials from J-PEC.

# Calculations by JPEA on the Amount of Renewable Energy from Installation of PV Systems by 2030

Result of calculations by JPEA on the amount of renewable energy from the installation of PV systems prior to implementation of various measures (using the current certified renewable energy capacity as a base): → In 2020, 66GW / In 2030, 100GW



<Prerequisites for calculations on the amount of renewable energy from installation of PV systems by fiscal year>

- Calculations are performed on limits in the amount of renewable energy from the installation of PV systems by the seven electric companies in Japan that were referred to at the 8<sup>th</sup> New and Renewable Energy Subcommittee in Dec 2014. These limits are calculated as the limits for the amount of renewable energy from installation until 2020.
- In three electric companies other than the above, the expected amount of renewable energy from installation each fiscal year was calculated based on the expected installed capacities, excluding removal and abandonment, within the certified renewable energy capacities in FY 2012 and FY 2013.
- From FY 2014, the upper limits of construction capacity, which is the largest obstacle to installation, will be calculated as the upper limit for installation for the fiscal year. Calculations will be performed by JPEA from the following fiscal year based on the amount of construction experience and using the results of interviews with major photovoltaic power generation companies. The upper limit for construction capacity in FY 2014 was 110% compared with previous years, and 105% after FY 2015, compared with 2014.

## **2. Current Issues and Measures for Expansion**

- **From the perspective of the best energy mix**
- **Problems with restrictions of system connection and power system innovations**
- **About the Feed-in Tariff (FIT) Scheme**

~ Effects created from the mass expansion of photovoltaic power generation systems ~

**< Component ratio for all electric power = 2020: 7% / 2030: 11% >**

- 1. Secure domestic power and energy to reduce dependency on overseas sources**
  - Expand energy self-sufficiency rate. Contribute to safe and secure living environment for residents and energy security for Japan.
- 2. Contribute to environmental protection in Japan and around the world through the reduction of GHG emissions**
- 3. Help activate Japanese economy by expanding the creation of industries and markets**
- 4. Offer opportunities for technological innovation, including electric power systems and EMS**
  - Contribute to the development of new system infrastructure of which Japan can be proud.
- 5. Lay the groundwork for the creation of almost complete zero cost energy in 20 years**
  - As a true legacy to the children of the future



## <Changes to FIT scheme since Jan 2015>

1. Introduction of output control system to expand the amount of potential connections
  - (1) Revision of output control targets
  - (2) Shift from “units of days” to “units of hours”
  - (3) Removal of upper limits for output control  
(Also, remove upper limits for the amount of potential connections)→Electric companies using the designated electricity utility system
  
2. Revision of application for facility certification under FIT Scheme
  - (1) Adjustment of procurement costs applied to photovoltaic power generation
  - (2) Prevention of “bogus possession” where connection framework is available, but operations have not started
  - (3) Smooth facilitation of site location (prevention of local problems)

## ◆ Measures to expand the amount of connections in the future: Announcement by METI

### 1. Reexamine the amount of potential connections

- Consider energy mix and reexamine the amount of potential connections by checking the situation of supply and demand for electricity.
- Consider reinforcement of systems in the area and cooperation between areas; put plan into effect.

### 2. Official announcement of expectations for connection control periods

- Designated electricity utilities are required to issue preliminary announcements of expectations for output control. They will issue detailed simulation values within this fiscal year after conducting a number of simulation patterns.

### 3. Revision of interconnection rules (currently under consideration; operations to start in April)

- Changes to rules for fixed capacity use throughout this current fiscal to every thirty minutes.
- Changes to rules to allow reserved use for PV installers.

### 4. Easing of output control for small-scale photovoltaic power generation, such as for household use

- Currently, Kansai Electric Power, Chubu Electric Power, and Tokyo Electric Power are exempt from output control.
- Output control for photovoltaic power generation of more than 10kW will be prioritized.
- If output control is performed for photovoltaic power generation below 10kW, only the surplus output generated over the output for private consumption will be subject to output control.

## ◆ Important points regarding future expansion policies for system connections

### 1. Reexamine the amount of potential connections

**Time-series forecast in anticipation of realistic roadmap for restart of nuclear power plants and restart ratios.**

### 2. Official announcement of expectations for connection control periods

- **Creation of effects from hourly units and real-time remote output control**
- **Simulation for output control (curtailment) based on the time-series forecast in 1 above.**
  - **Output control is standard at around 10%**
  - **JPEA plans to announce the results of independent simulations.**

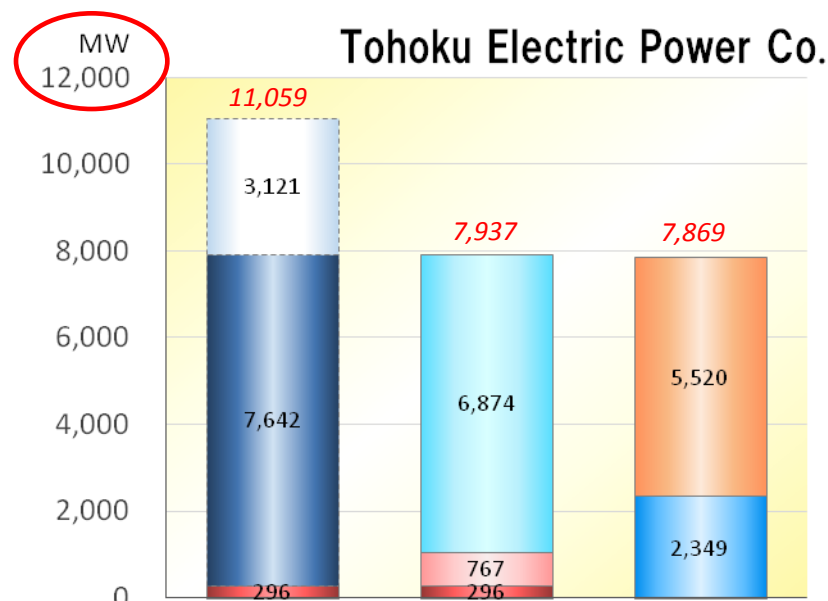
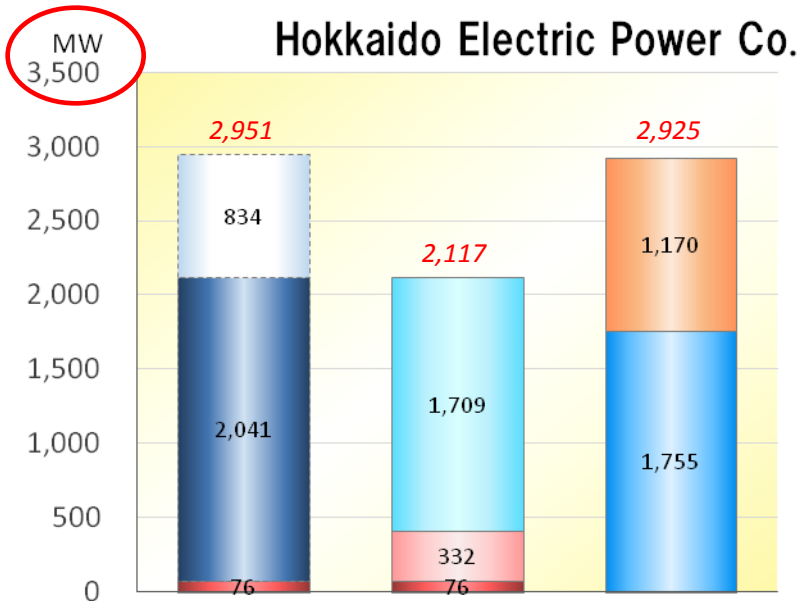
### 3. Revision of interconnection rules









- **Possibility for early conveyance of produced electricity to Kansai Electric Power and Chubu Electric Power from Kyushu Electric Power , Chugoku Electric Power and Shikoku Electric Power, and to Tokyo Electric Power from Hokkaido Electric Power and Tohoku Electric Power.**

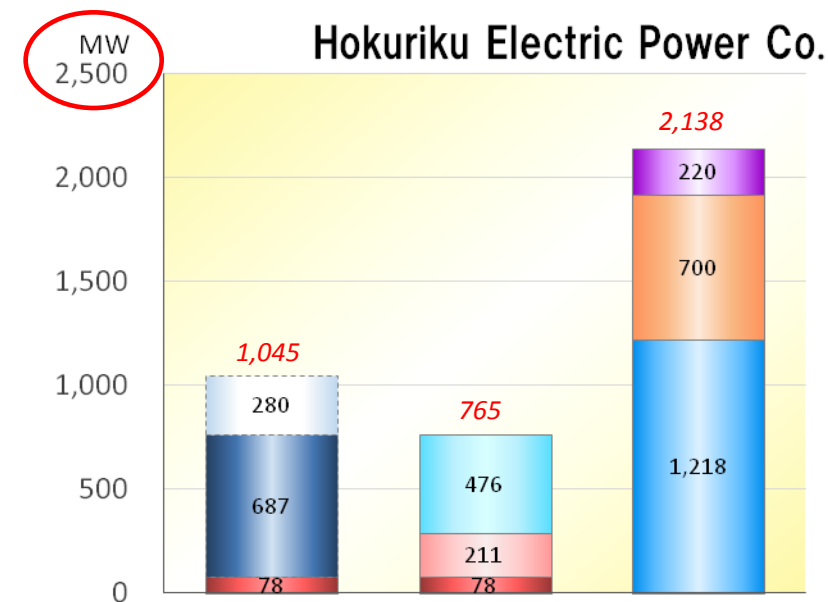
### 4. Easing of output control for small-scale photovoltaic power generation, such as for household use

- **Key to future expansion is in housing (below 10kW) with minimal output control.**

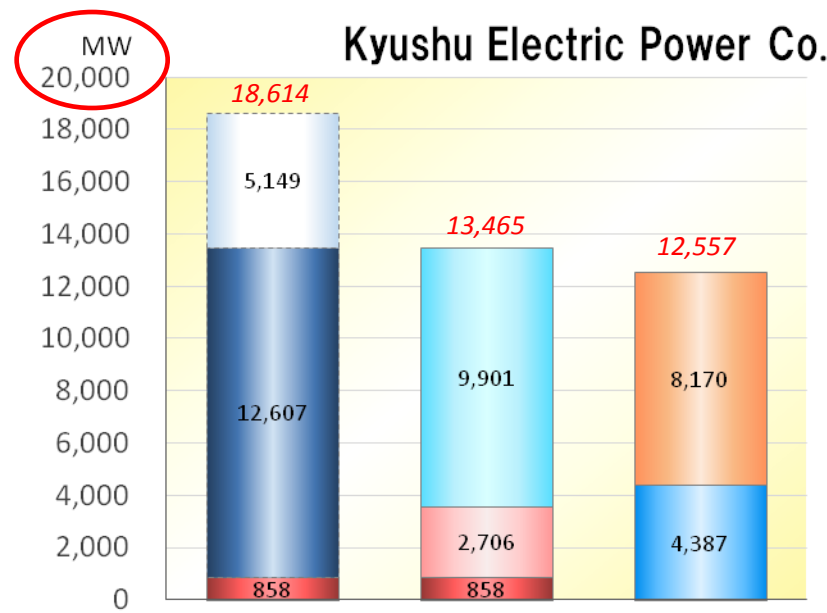
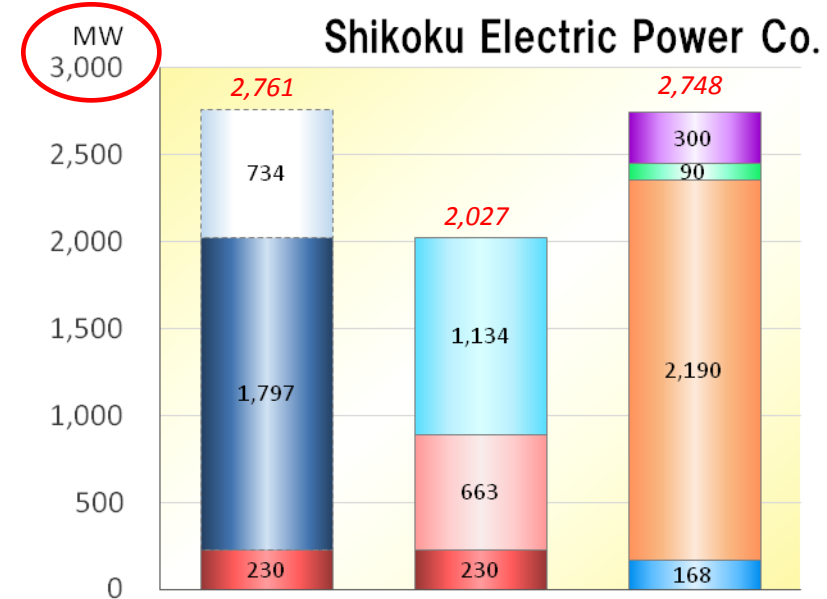
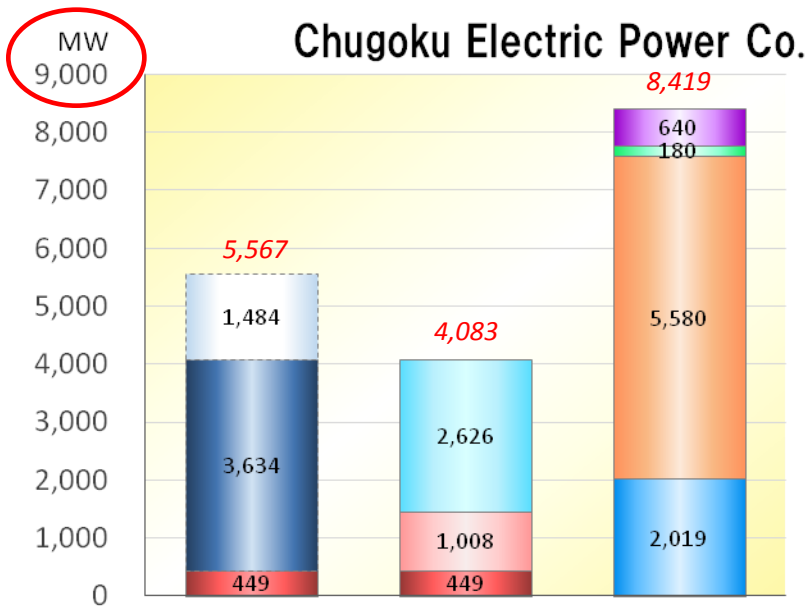
# Calculations on the Amount of Potential Connections by Power Company I











-  Certified renewable energy capacity (Upper tiers are estimated amounts of removed or abandoned renewable energy) «as of the end of Oct 2014»
-  Installed capacity prior to enforcement of FIT «as of the end of Aug 2014 (=the end of Jun 2012) »
-  Installed capacity after enforcement of FIT «as of the end of Aug 2014»
-  Facility certification completed, capacity not yet installed «as of the end of Oct 2014»
-  Amount of potential connections for each power company
-  Expanded scope for output control rules and target power sources (removal over 500kW)
-  Time management for output control rules (daily⇒hourly)
-  Average capacity factor for the past 30 years before nuclear disaster, multiplied by the installed capacity



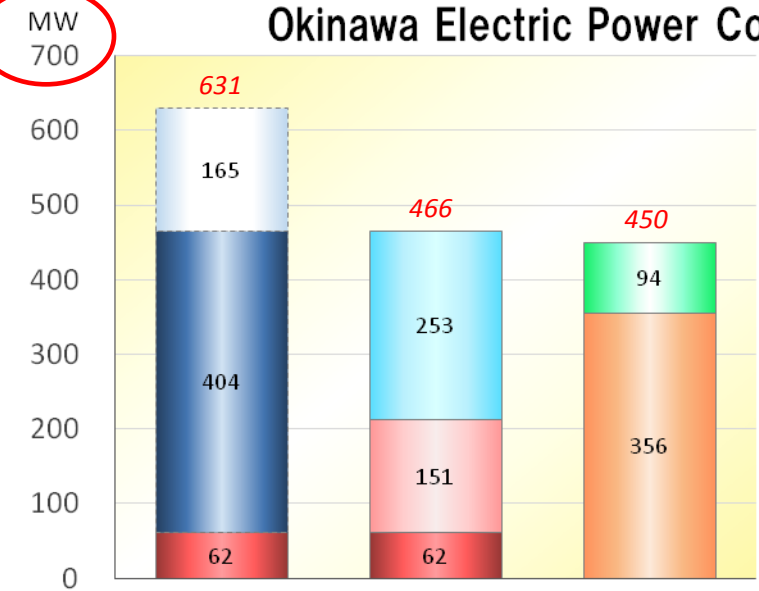
# Calculations on the Amount of Potential Connections by Power Company II











-  Certified renewable energy capacity (Upper tiers are expected amounts of removed or abandoned renewable energy) «as of the end of Oct 2014»
-  Installed capacity prior to enforcement of FIT «as of the end of Aug 2014 (=the end of Jun 2012)»
-  Installed capacity after enforcement of FIT «as of the end of Aug 2014»
-  Facility certification completed, capacity not yet installed «as of the end of Oct 2014»
-  Amount of potential connections for each power company
-  Expanded scope for output control rules and target power sources (removal over 500kW)
-  Time management for output control rules (daily⇒hourly)
-  Average capacity factor for the past 30 years before nuclear disaster, multiplied by the installed capacity

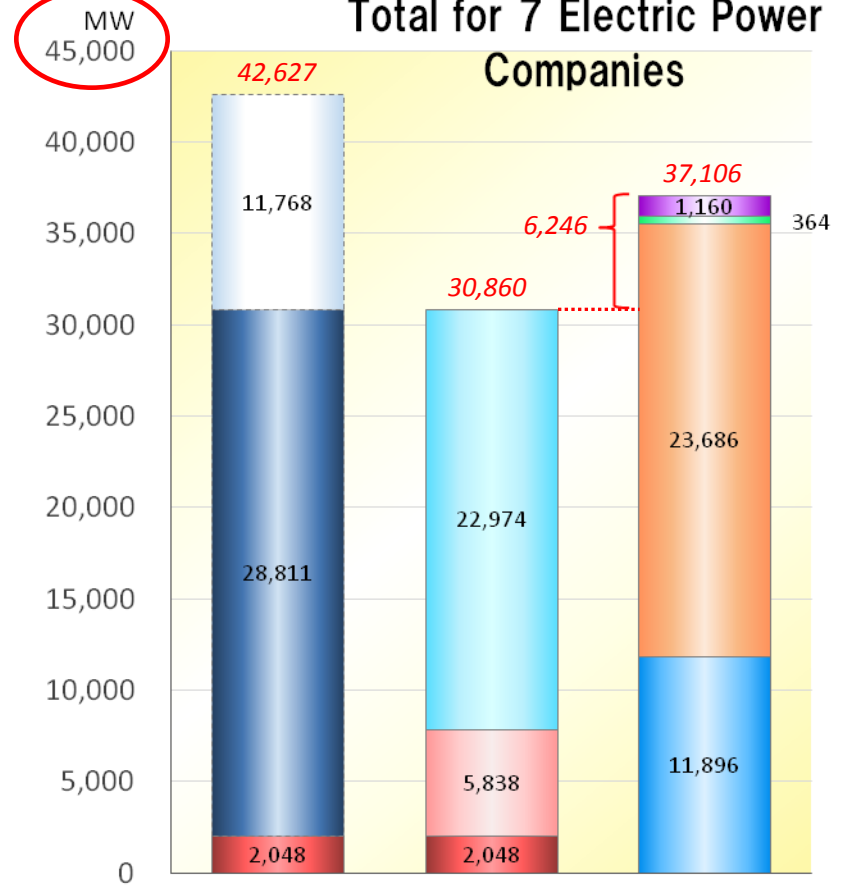
# Calculations on the Amount of Potential Connections by Power Company III

**Okinawa Electric Power Co.**



-  Certified renewable energy capacity (Upper tiers are expected amounts of removed or abandoned renewable energy) «as of the end of Oct 2014»
-  Installed capacity prior to enforcement of FIT «as of the end of Aug 2014 (=the end of Jun 2012)»
-  Installed capacity after enforcement of FIT «as of the end of Aug 2014»
-  Facility certification completed, capacity not yet installed «as of the end of Oct 2014»
-  Amount of potential connections for each power company
-  Expanded scope for output control rules and target power sources (removal over 500kW)
-  Time management for output control rules (daily⇒hourly)
-  Average capacity factor for the past 30 years before nuclear disaster, multiplied by the installed capacity

**Total for 7 Electric Power Companies**



## <Introduction of output control systems to increase the amount of potential connections>

### ◆ Revision of targets for output control

Expand output-controllable power sources to small-scale facilities (below 500kW) (Note 1)

### ◆ Shift from “daily units” to “hourly units”

Raise upper limits for output control from daily units (30 days/year) to hourly units (360 solar hours/year, 720 wind power hours/year).

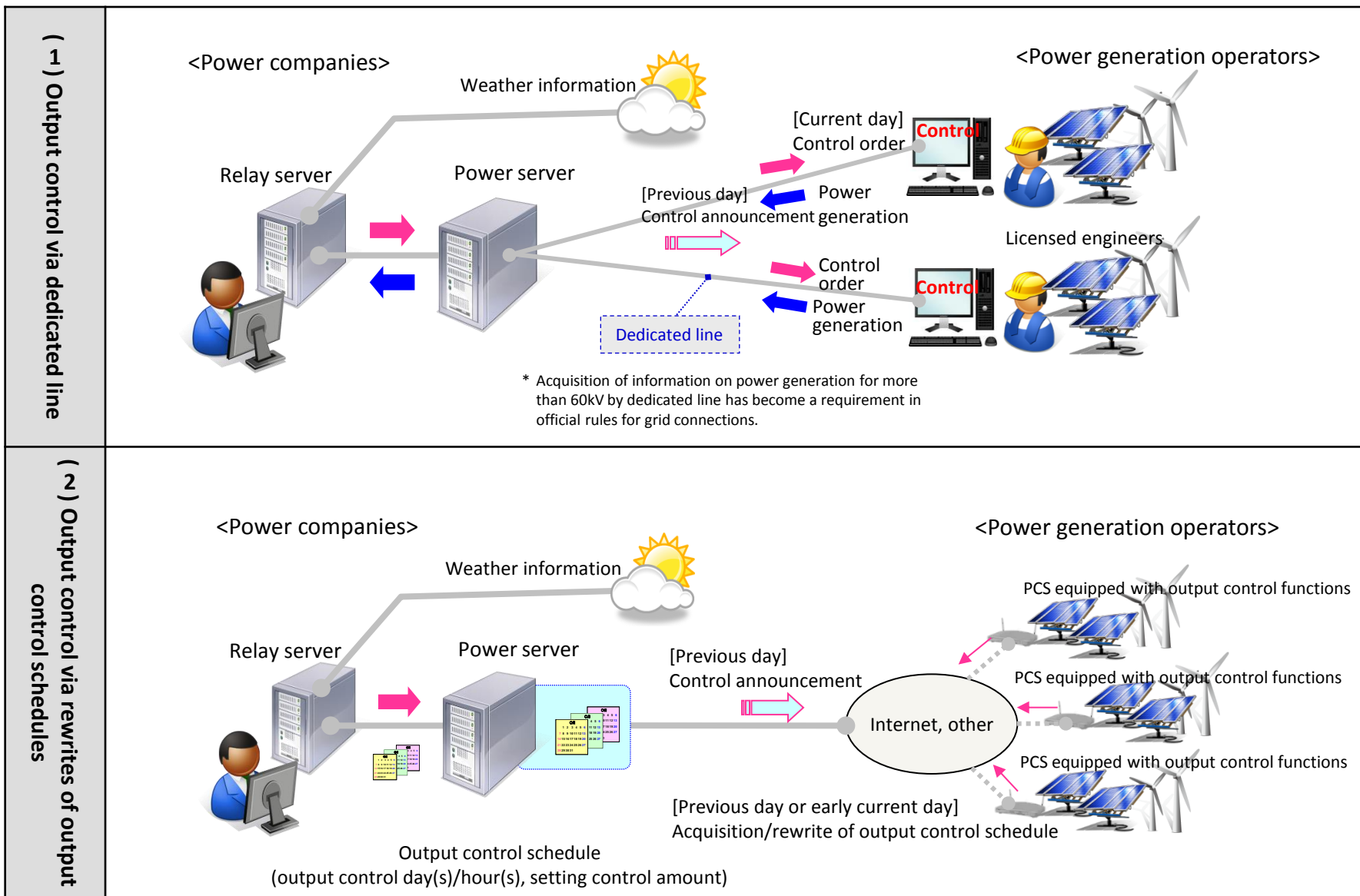
### ◆ Eliminate upper limits for output control

Implement output control by hourly units under the designated power utility system, including for small-scale facilities. (Note 2)

Note 1: Output control for systems over 10kW is prioritized. Output control for systems below 10kW will be put into effect if output control for systems over 10kW is not sufficient.

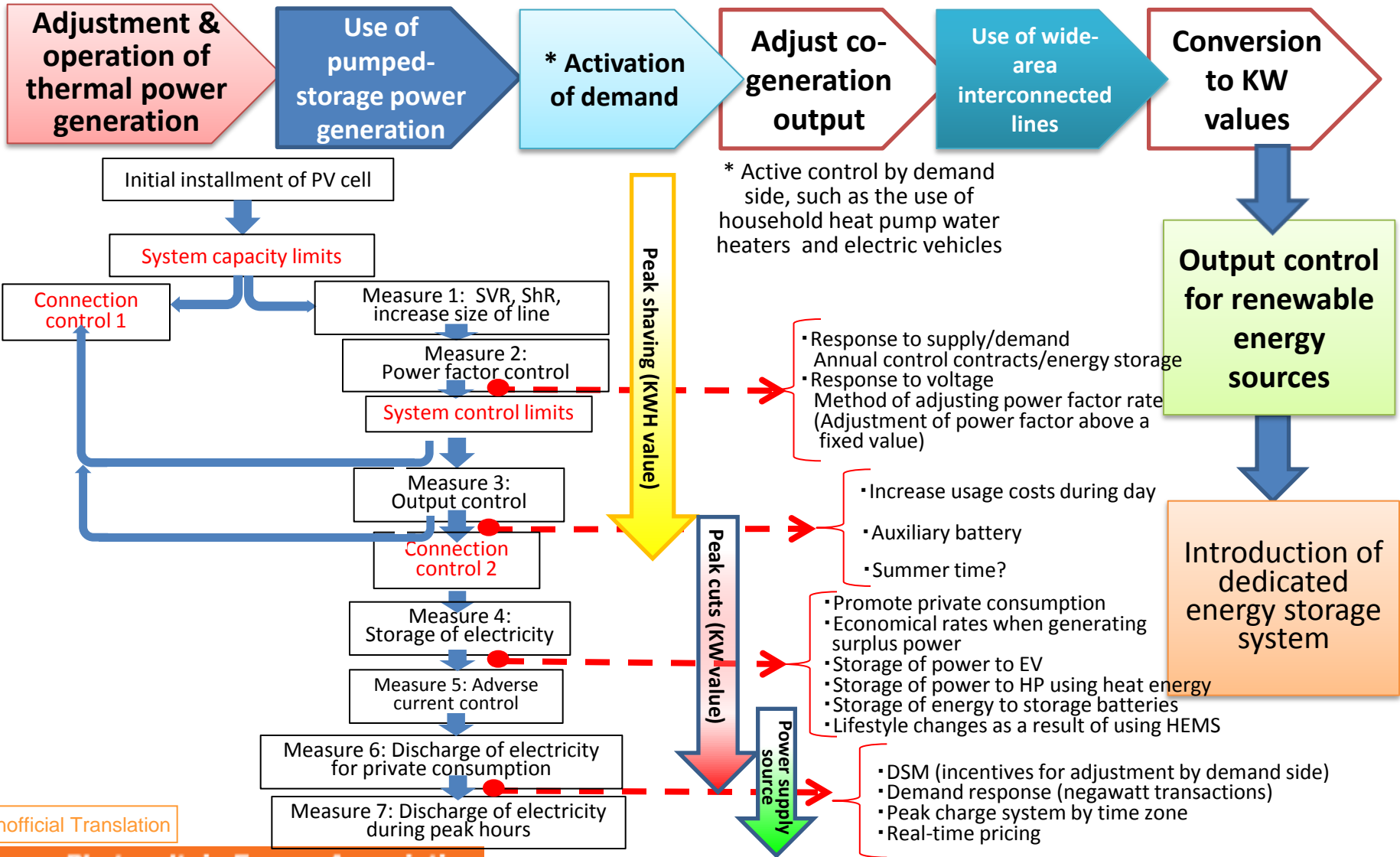
Note 2: The construction of a control system is expected to take 9 to 18 months. For the time being, the system is connected after reducing the installation of equipment required for control.

# <Outline Figure of Output Control System>





## Balance of supply/demand and measures for frequency fluctuations & their order of priority



Unofficial Translation

## ◆ Important perspectives

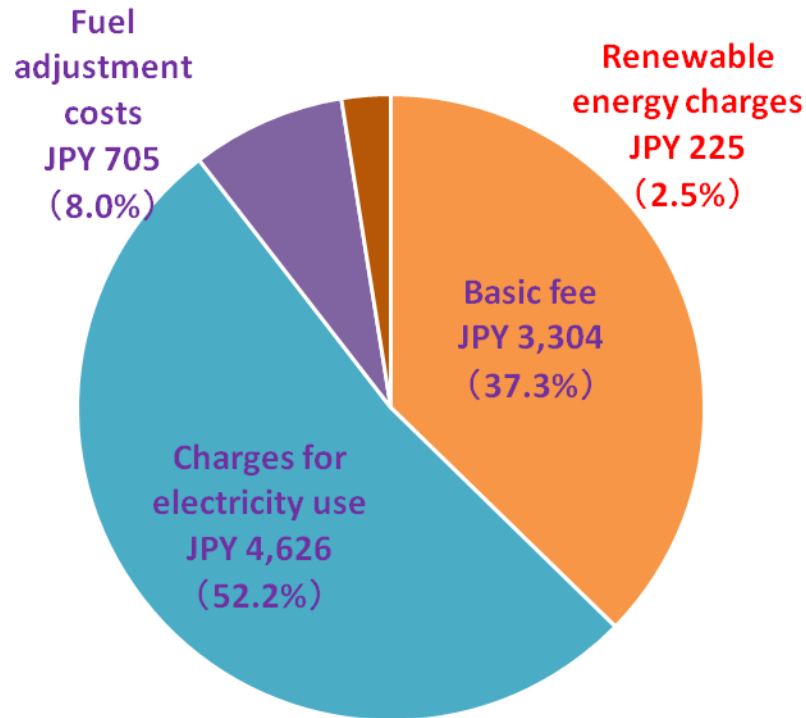
### 1. Stable upkeep of systems and promotion of steady cost reduction

- Mission of FIT (strong turn of that first wheel) will bring about major success.
- Costs and technology, not only the expansion of scale, will create steady results.
- Stable upkeep is necessary for basic principles and structures, as well as improvement of system operations in the future.

### 2. Assessment of levies and public financial burden → Considered to never be excessive.

- Requires identification of the actual installations, not the face value of certified renewable energy capacity.
- Must be calculated by appropriate avoidable costs
- Requires evaluation of amount of contribution to electric power companies (electricity charge moderating effect)
- Requires calculations for effects from reduction of fossil fuel costs
- Development of systems and increased costs are not only for the introduction of renewable energy. It is also viewed as an investment in the advancement of infrastructure (as well as the development and improvement of bullet trains and highways) required in the future in Japan.
- The purchase period is not only 20 years. The effects in the 10 to 20 years after purchase are finished should also be taken into account (creation of energy produced domestically at almost zero cost).

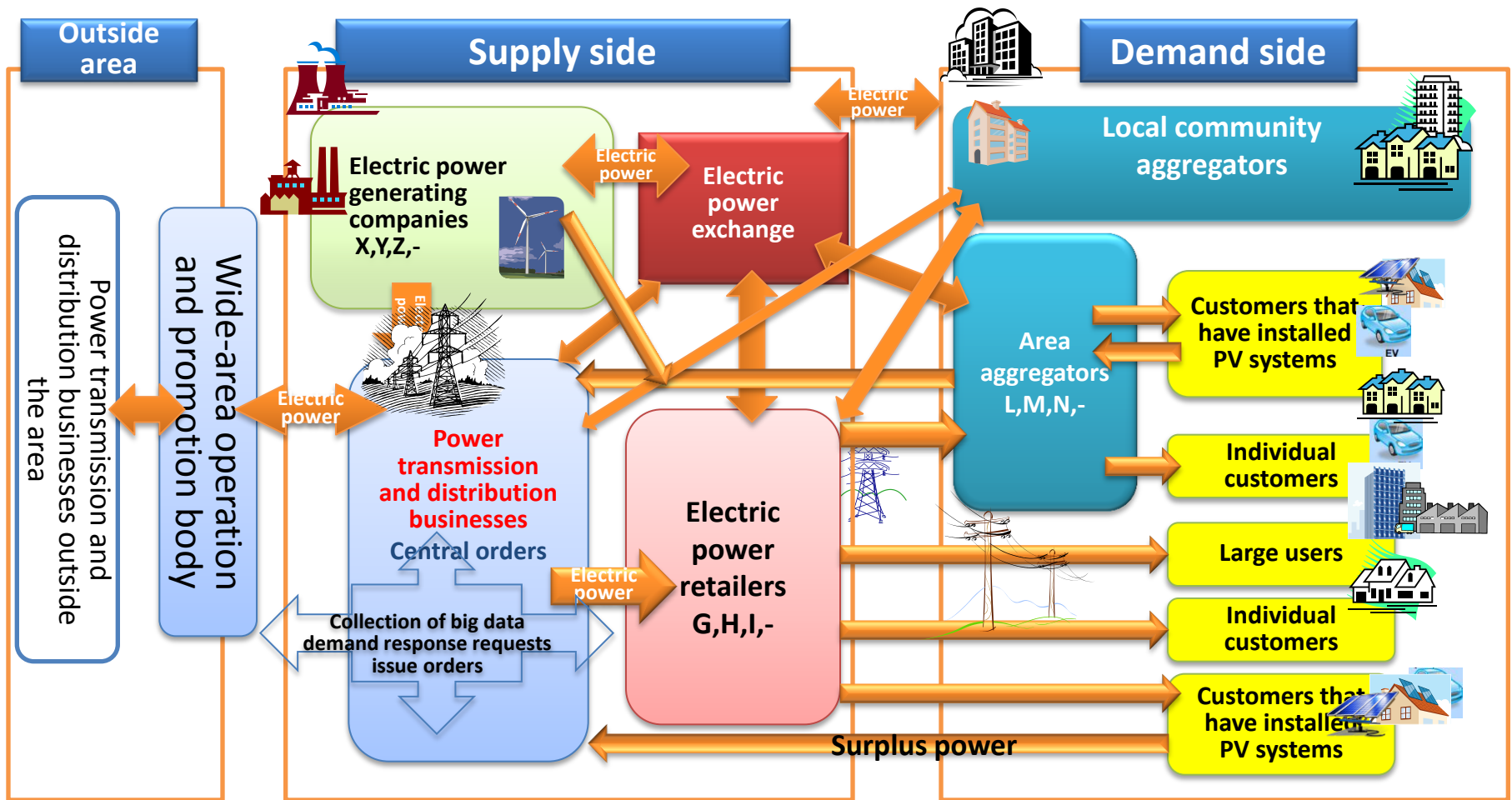
Current: JPY 225/month × 12 months = JPY 2,700/year



Total amount of existing certified renewable energy capacity:

JPY 935/month × 12 months = JPY 11,200/year

# Electric Power Operation System around 2030



From JPEA PV OUTLOOK (Revised in December 2013)

Thank you for your kind attention.



**Japan Photovoltaic Energy Association**  
<http://www.jpea.gr.jp/>