

**APEC EGNRET 34, Kuala Lumpur**

# **Current New and Renewable Energy Utilization in Japan**

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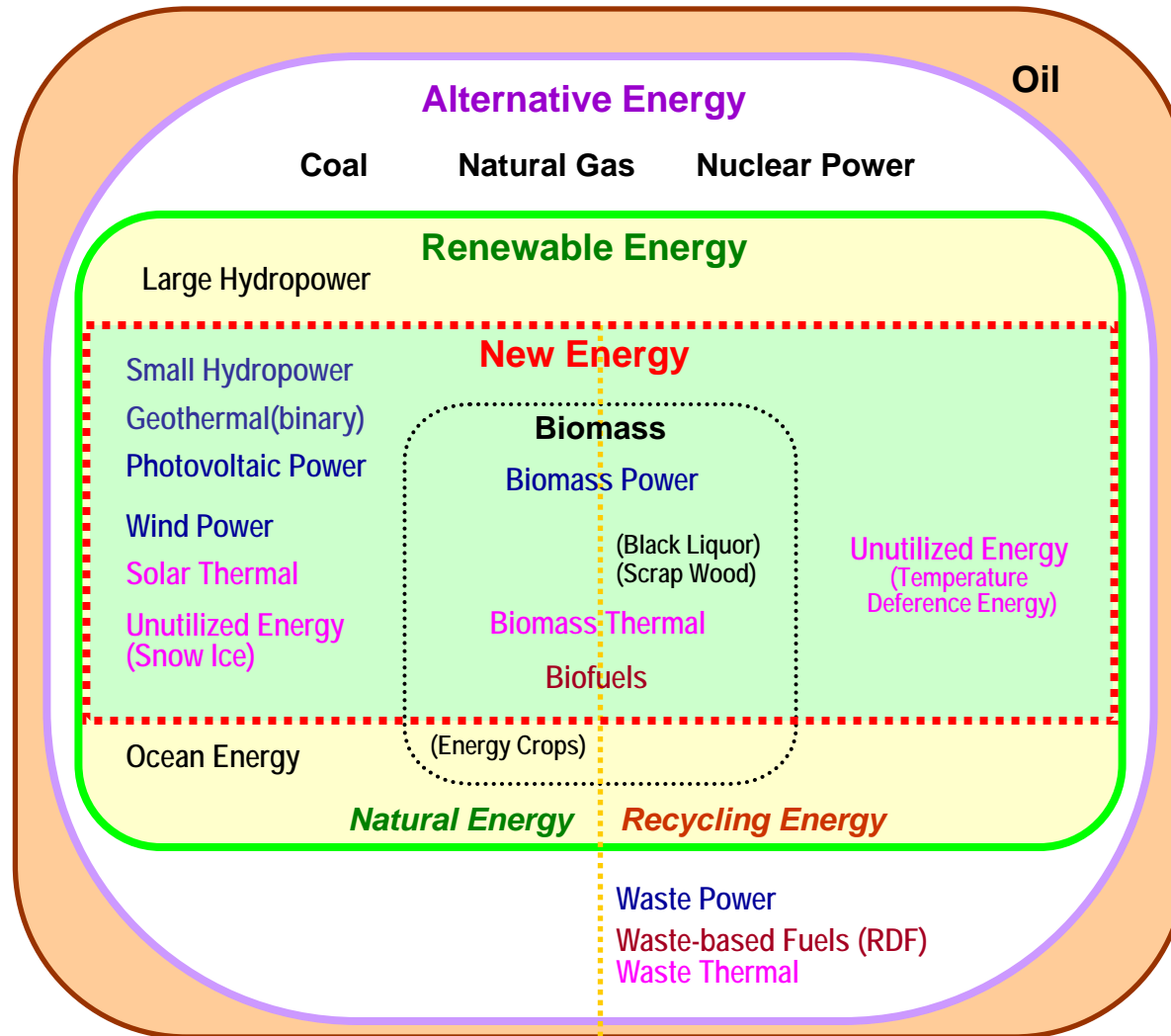
Ken Johnson  
New Energy and Industrial Technology  
Development Organization (NEDO)



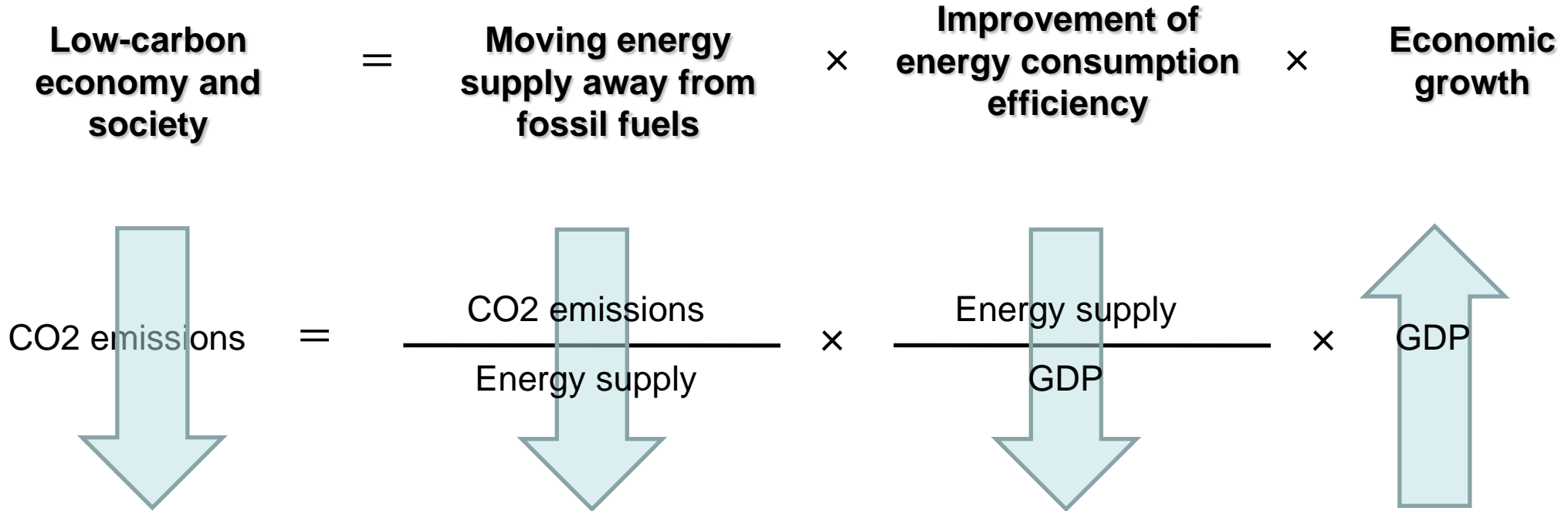
The Institute of Energy Economics, Japan



# New and Renewable Energy in Japan



# Low-carbon Economy and Society, Energy Efficiency and New Energy

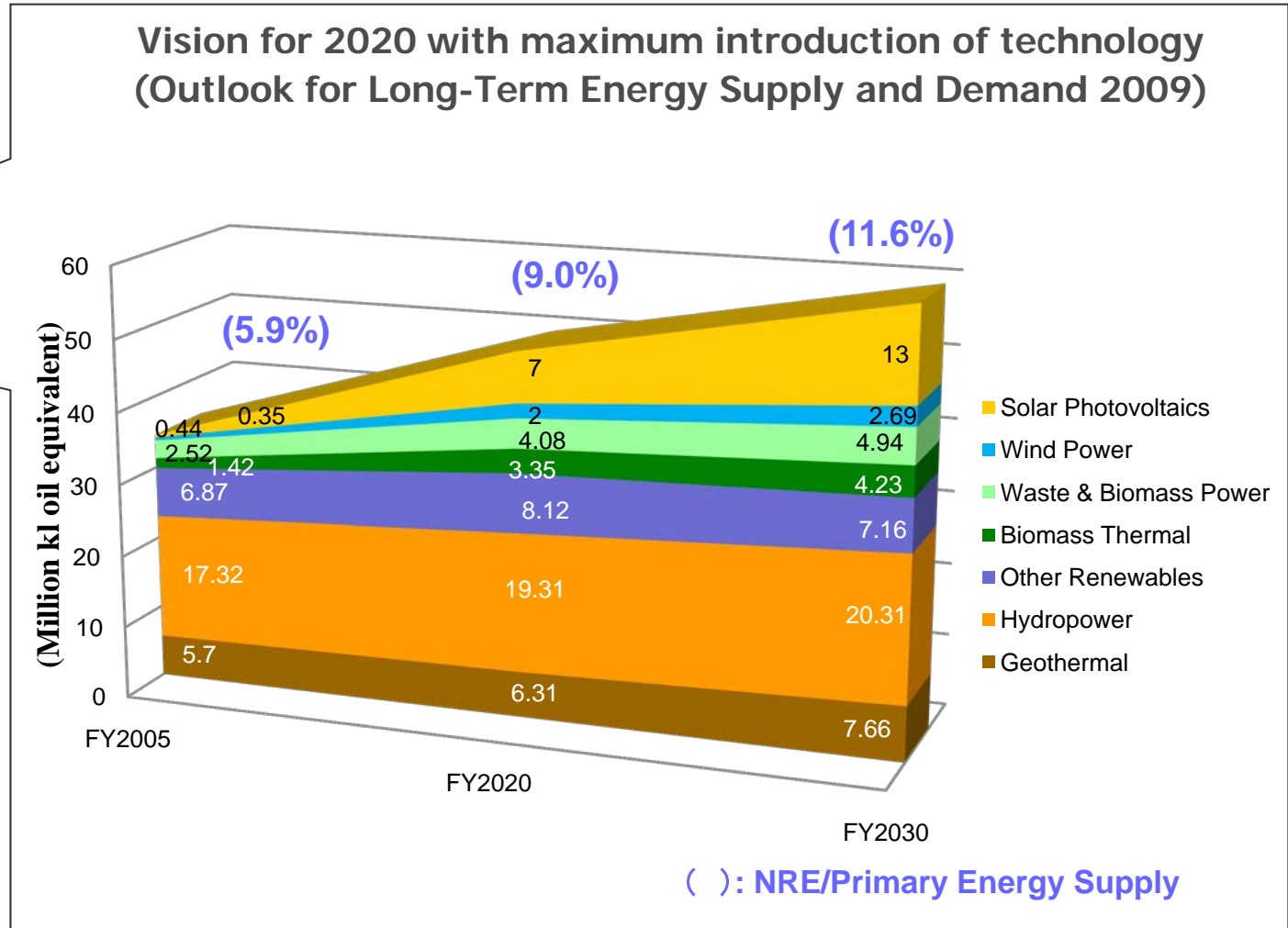
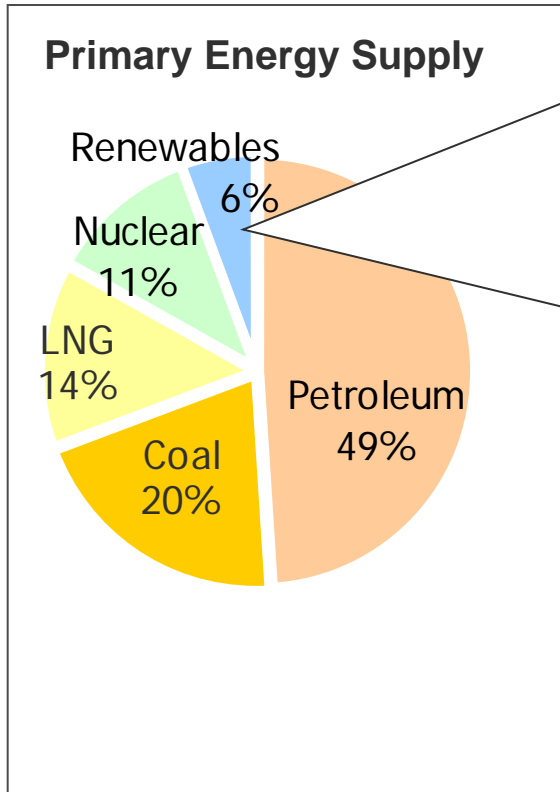


- ✓ Expanded introduction of new energy
- ✓ Promotion of nuclear energy
- ✓ Expanded utilization of biofuels
- ✓ Others

- ✓ Promotion of energy efficiency
- ✓ Improvement of energy utilization intensity
- ✓ Improvement of fuel efficiency performance
- ✓ Others

# Future Vision for Renewable Energy Deployment

- Increase Renewable Energy/Primary Energy Supply to 9.0% by 2020 and 11.6% by 2030 (cumulative installed capacity of photovoltaic systems will be 20 times current level by 2020)



# Challenges for Development and Deployment of Renewable Energy

Unit: 1000 kl oil equivalent

|  | 2005          | 2020 forecast | Deployment challenges   |
|--|---------------|---------------|---|
| <b>Solar PV</b>  | <b>350</b>    | <b>7,000</b>  | Cost gap, increasing installations on public buildings, effects on power grid, new technology development, etc.                     |
| <b>Wind</b>  | <b>440</b>    | <b>2,000</b>  | Cost, lack of suitable locations in Japan (birds, aesthetics, noise), regulatory barriers, new technologies (offshore, small scale) |
| <b>Waste/biomass power generation</b>                  | <b>2,520</b>  | <b>4,080</b>  | Collection and transport costs associated with using biomass, utilization of distributed and labor intensive energy resources       |
| <b>Thermal utilization of biomass (incl. biofuels)</b> | <b>1,420</b>  | <b>3,350</b>  | Increasing use of transport biofuels, R&D of second generation biofuels   |
| <b>Hydro</b>   | <b>17,320</b> | <b>19,310</b> | Time and cost barriers for large-scale projects, increasing use of small scale hydro  |
| <b>Geothermal</b>                                      | <b>730</b>    | <b>770</b>    | Time and cost barriers for large-scale projects (coordination with hot water rights, national park regulations)                     |

# Regulatory Schemes & Incentives

## ■ Alternative Energy Act → Nonfossil Energy Act

Revised in 2009: “alternative energy” expanded to “non fossil” (now includes nuclear)

## ■ New Energy Promotion Act

## ■ Act for Promotion of Non-fossil Energies by Energy Suppliers

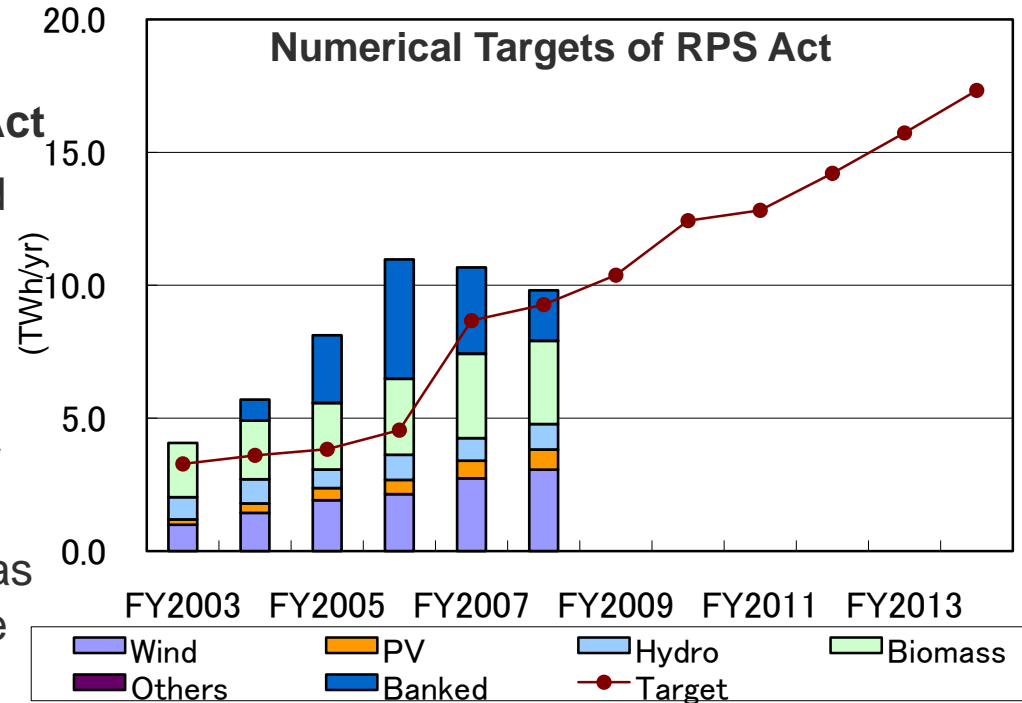
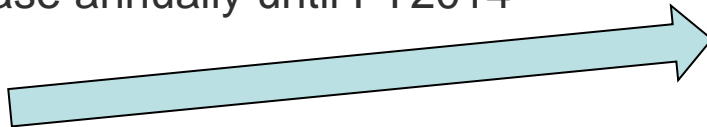
Energy suppliers (electric power companies, gas companies, oil companies) required to increase use of non-fossil energies and use fossil fuels more efficiently

## ■ Renewable Portfolio Standards (RPS) Act

- Electric utilities required to use electricity generated from renewable energies
- Targets increase annually until FY2014

## ■ Incentives

- Subsidies and tax incentives for residential and non-residential installations



## Subsidies and Tax Incentives

|                | Residential  | Non-residential   |
|----------------|--|---|
| Subsidies      | <b>Photovoltaics</b><br><b>70,000 yen per kW</b><br>(systems under 700,000 yen)                  | <b>All New Energies</b><br>Non-profit org., etc.<br><b>1/2 of installation cost</b><br>Companies<br><b>1/3 of installation cost</b> |
| Tax incentives | <b>Photovoltaics</b><br>Tax reduction for home loans and remodeling to improve energy efficiency | <b>All New Energies</b><br><b>7% Tax Reduction</b><br>(Small & Medium Enterp.)<br>or <b>Special Depreciation</b>                    |

# METI's New and Renewable Energy Budget Request

FY2010 Budget Request: 134 billion yen

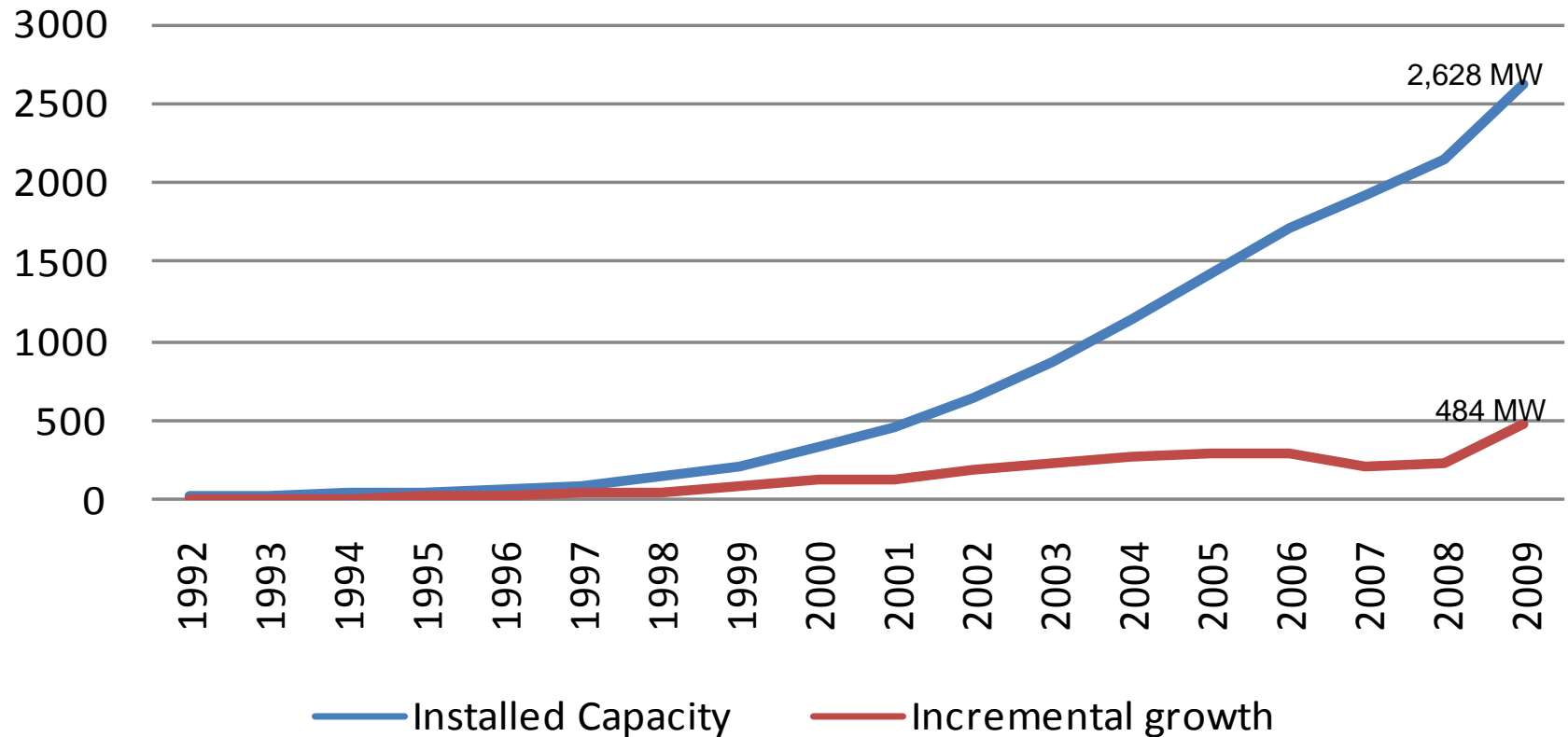
|  | FY2010 budget request<br>(billion yen) | FY2010 budget request<br>(million US\$*) |
|--|--|--|
| ■ <b>Deployment (Subsidies)</b>                            |  |  |
| Installation of Residential Photovoltaic Systems           | 40.1                                   | 445.6                                    |
| Purchase of Clean Energy Vehicles                          | 13.7                                   | 152.2                                    |
| Installation of Residential Fuel Cell Systems              | 6.8                                    | 75.6                                     |
| Installation of New Energy Systems (non-residential)       | 34.5                                   | 383.3                                    |
| ■ <b>Research and Development</b>                          |  |  |
| Photovoltaics  | 6.4                                    | 71.1                                     |
| Innovative Photovoltaic Cells                              | 1.9                                    | 21.1                                     |
| Wind Power   | 2.6                                    | 28.9                                     |
| Off Shore Wind Power Technologies                          | 2.3                                    | 25.6                                     |
| Bioenergy  | 6.2                                    | 68.9                                     |
| System to Produce Bioethanol from Cellulosic Biomass       | 1.9                                    | 21.1                                     |
| Storage Battery  | 10.6                                   | 117.8                                    |
| R&D for Scientific Innovation of Next-generation Batteries | 3.0                                    | 33.3                                     |
| R&D on Practical Combination of Energy Storage Systems     | 4.3                                    | 47.8                                     |
| Fuel Cells   | 10.7                                   | 118.9                                    |
| Support for New Energy Business Start-ups                  | 1.6                                    | 17.8                                     |

\*\$1=90 yen

# Solar Photovoltaics



## Domestic PV Installations

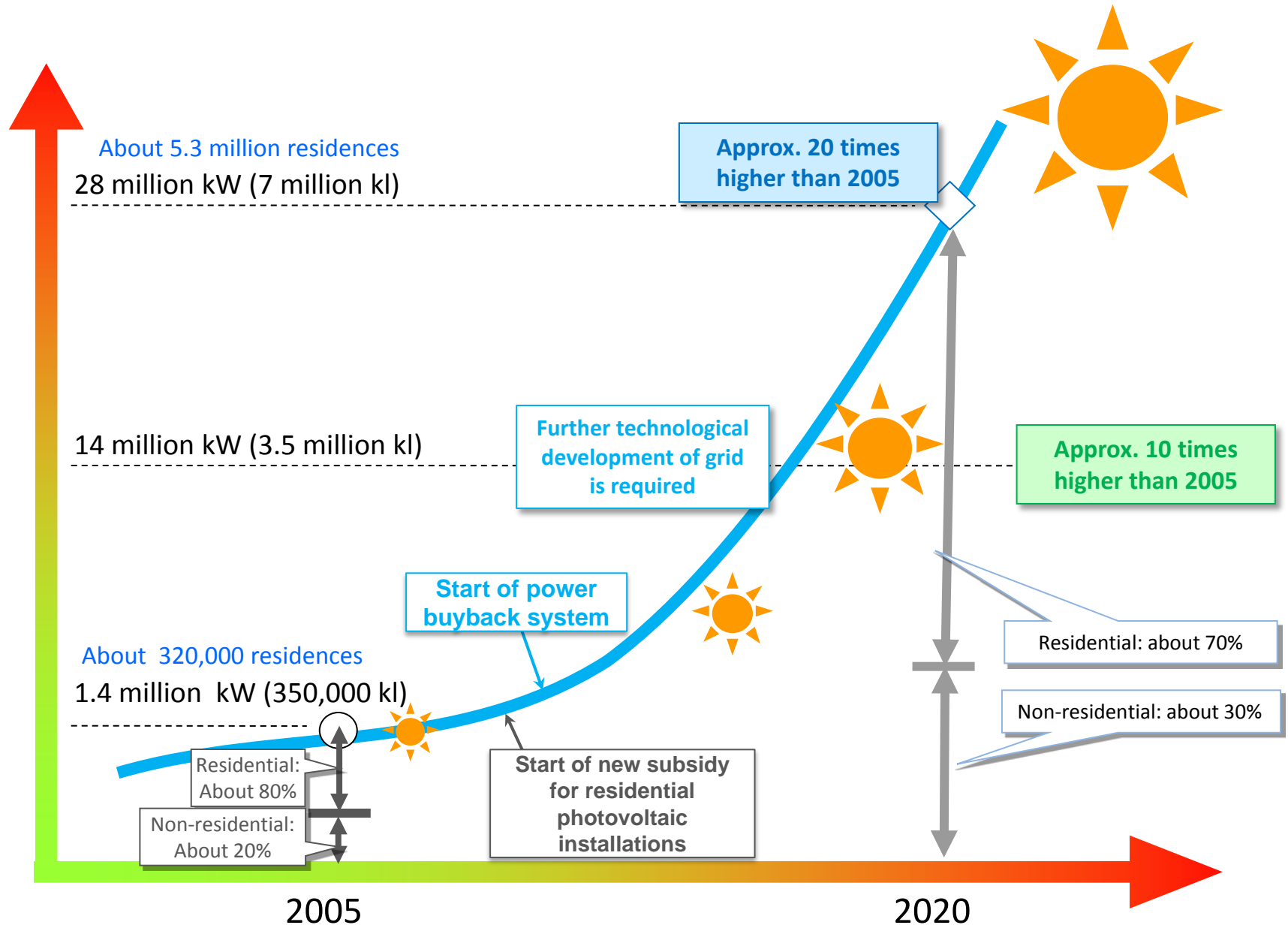


Note: 2009 data is preliminary

Sources: Trends in PV Applications; survey report of selected IEA countries between 1992 and 2008  
2009 data: European Photovoltaic Industry Association



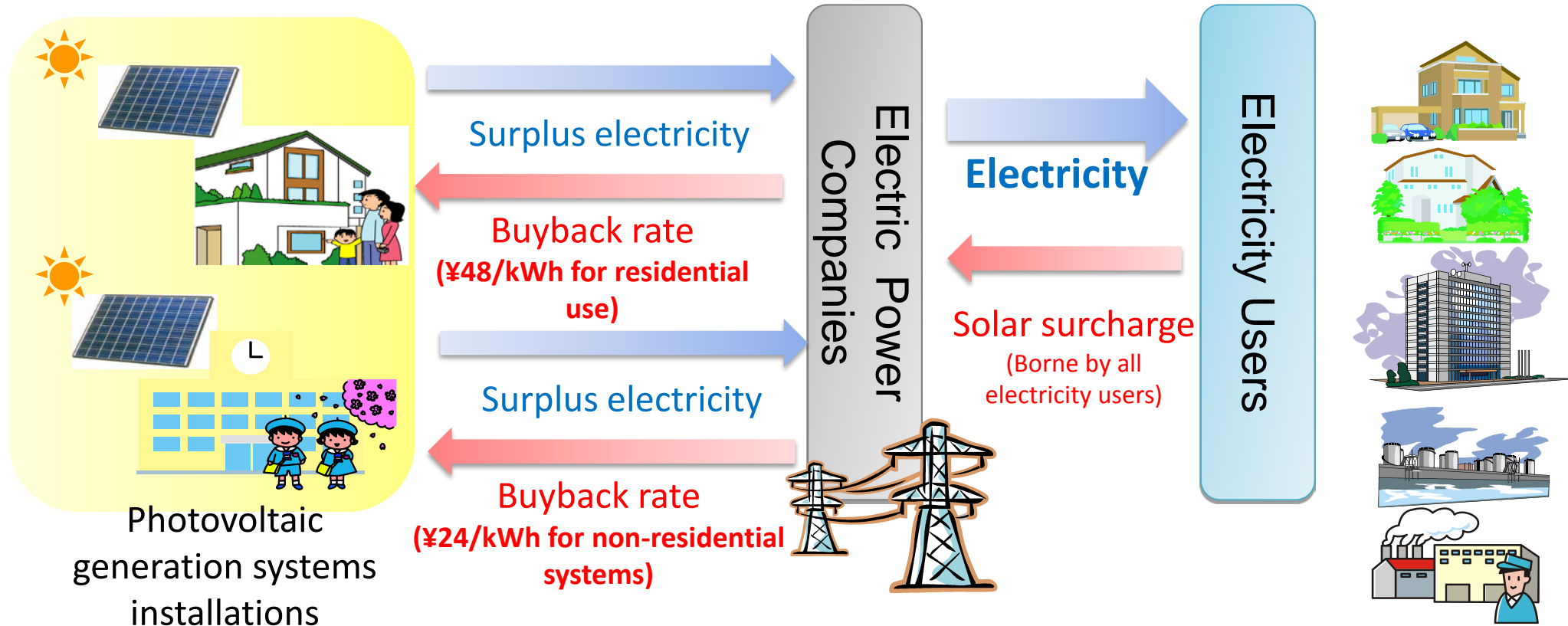
# Scenario for Introduction of Photovoltaic Systems



# New Buyback Program for Photovoltaic Power Generation

## Major points:

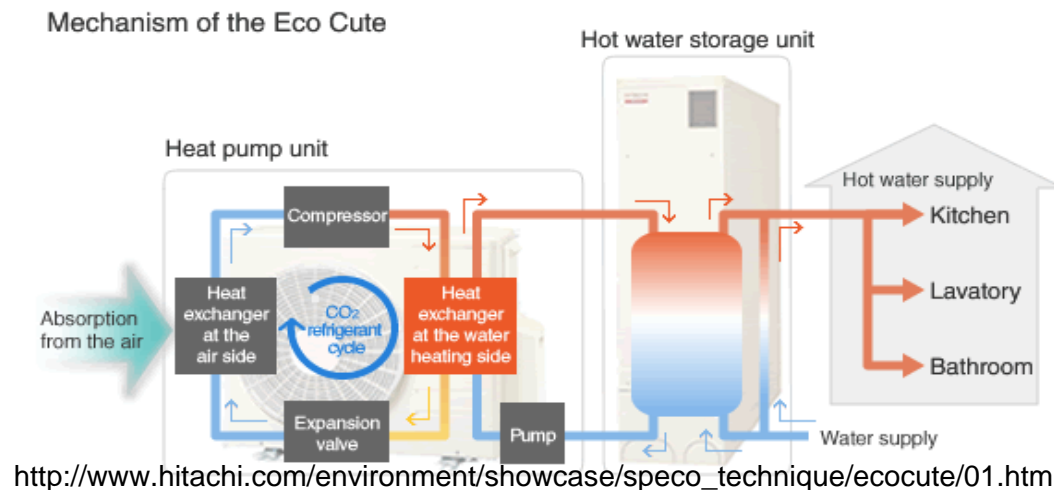
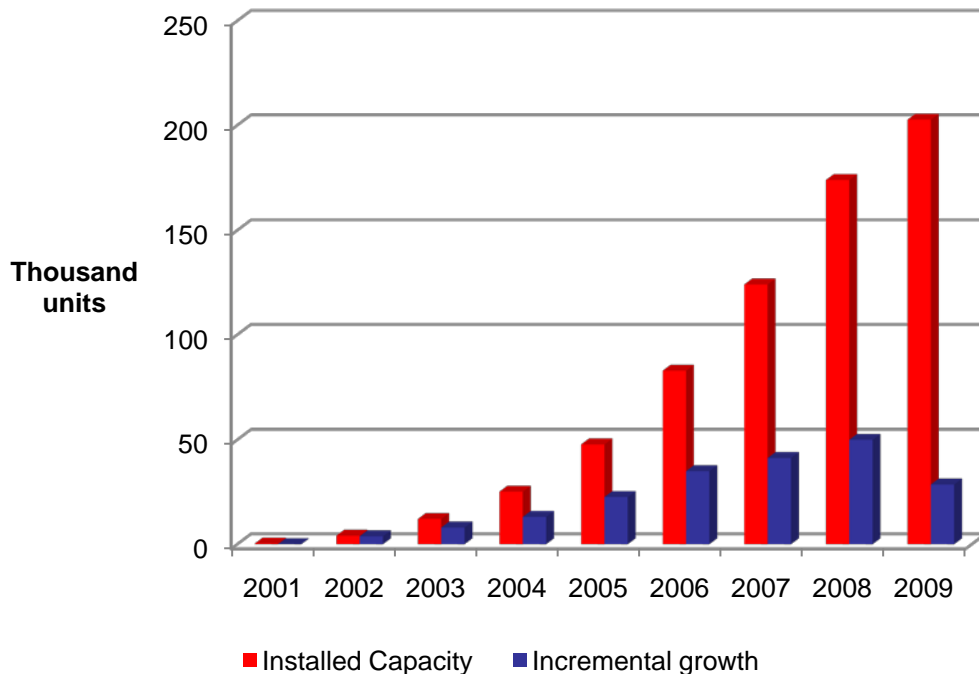
- Of the electricity generated by photovoltaic generation systems, only surplus electricity is purchased
- Expenses are borne by all electricity users (¥0.1/kWh surcharge: ~¥30-100 per month for households)
- Buyback period: 10 years from the start of the program. Buyback rate is fixed
  - ¥48/kWh for residential installations less than 10kW and ¥24/kWh for commercial installations



# Eco Cute

## CO<sub>2</sub> Heat Pump Technology

- Eco-Cute heat pump residential hot water heater
- Natural refrigerant (CO<sub>2</sub>)
- Price: ¥500k-700k
- 2 million units sold through October 2009
- APF 3.5 (COP: 4.9)
- 70% of energy comes from ambient air (remainder from electricity)
- Payback period: (4-8 years)



# Ene-Farm: 1kW PEFC Stationary System Miniature Power Plant

A 1 GW thermal power plant discharges 1.5 million kW of heat into the sea. If we have power plants in our houses, we can use the waste heat and thereby double the overall energy efficiency and cut CO2 emissions in half. This is the concept of home generation.

This compact system generates electricity at nearly the same efficiency as a large-scale thermal power station and in addition it supplies hot water to the household.

Only fuel cells, for which size and generation efficiency aren't correlated, can claim this.

## Specifications

Power output 1.0KW (range 0.3-1.0KW))

Heat output 1.4KW (range 0.3-1.4KW)

Fuel consumption 3.0kW (LNG)

Generation efficiency 33% (HHV) <37% (LHV)>

Heat output efficiency 47% (HHV) <52% (LHV)>

Total efficiency 80% (HHV) <84%(LHV)>

Hot water temperature 60 °C

Water storage capacity 200 L

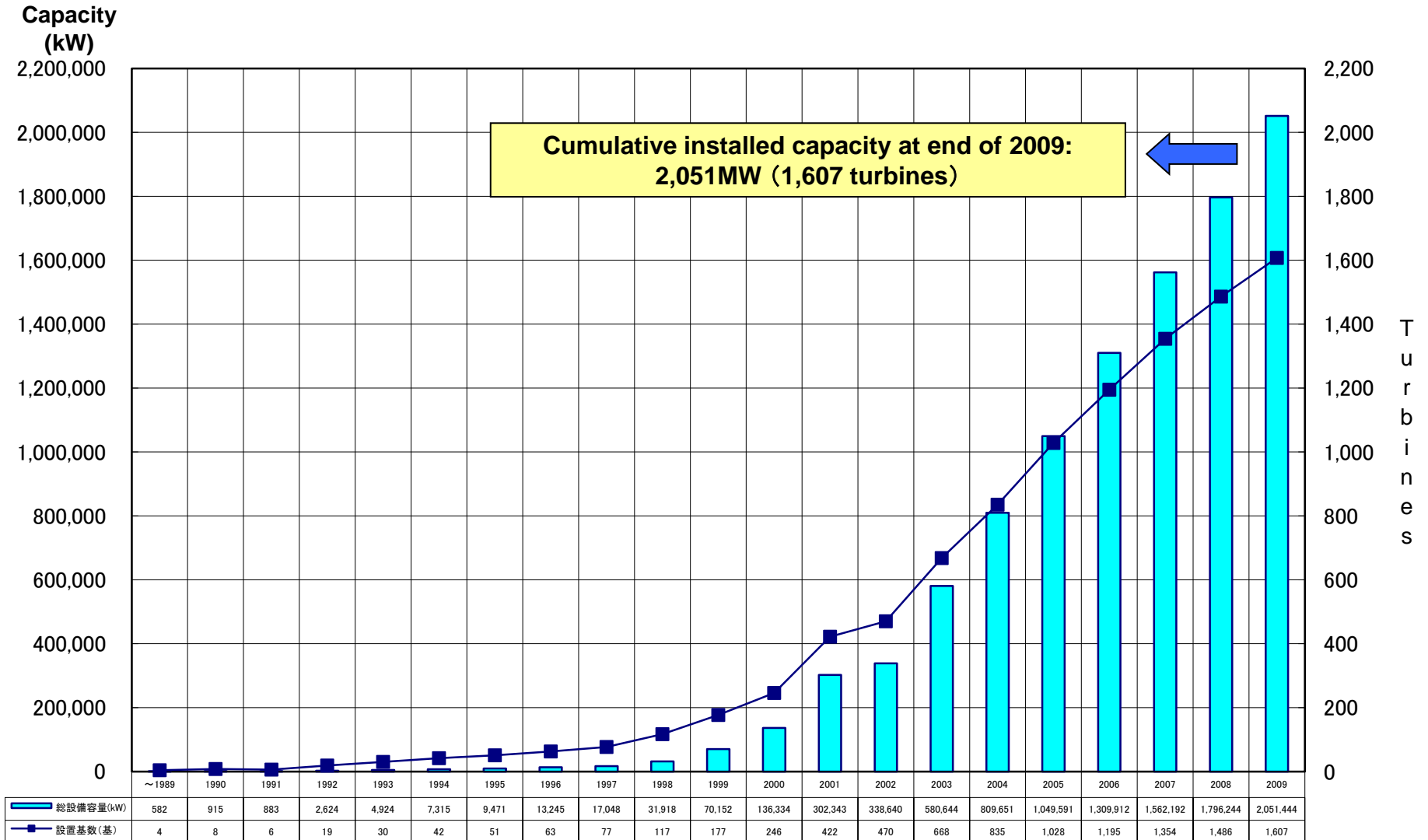
Noise 39db

Durability 40,000 operating hours  
4,000 times of start stops

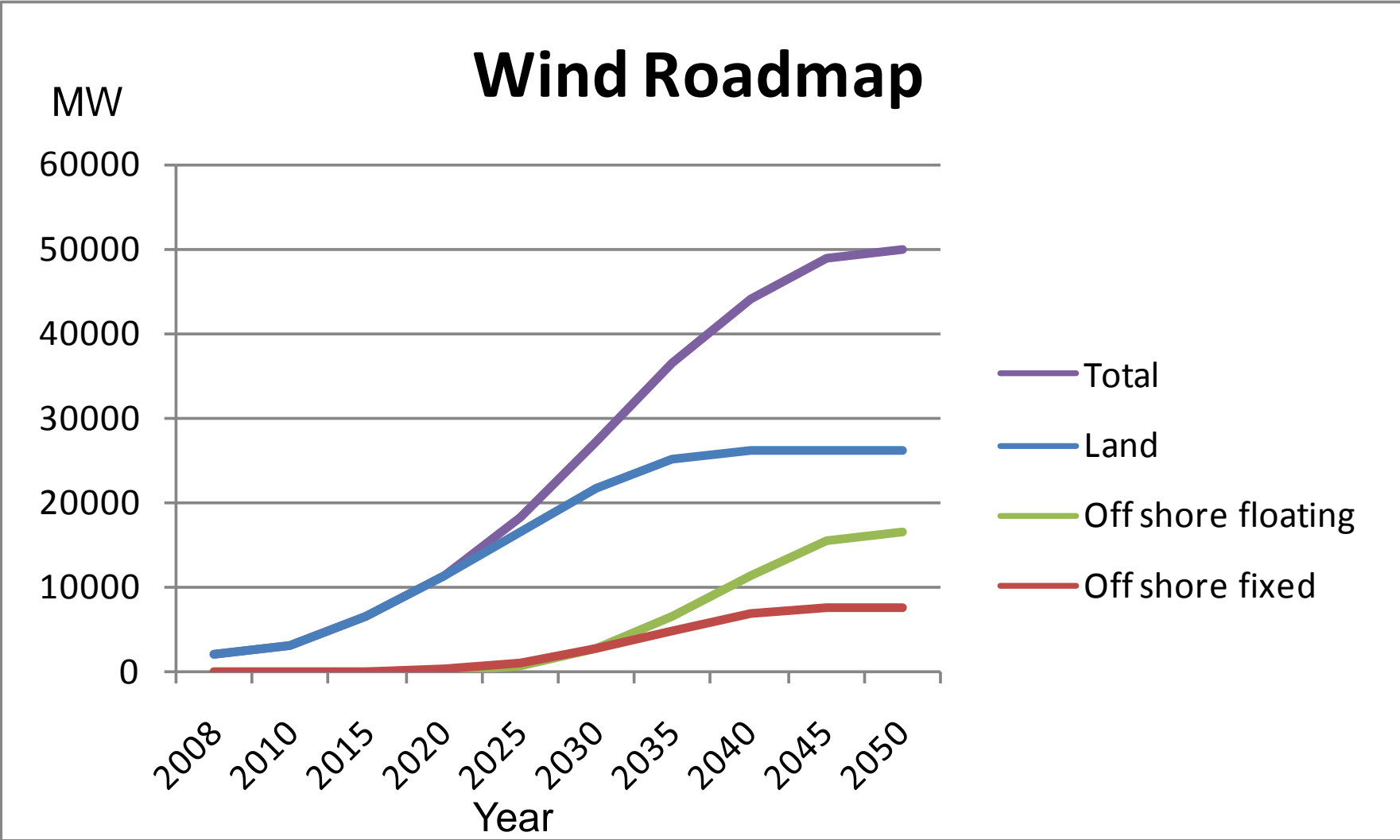


Current price is 3,250,000 yen, but R&D is being carried out to reduce that to 500,000 yen.

# Growth of Wind Power Generation in Japan



# 2050 Roadmap



# Geothermal

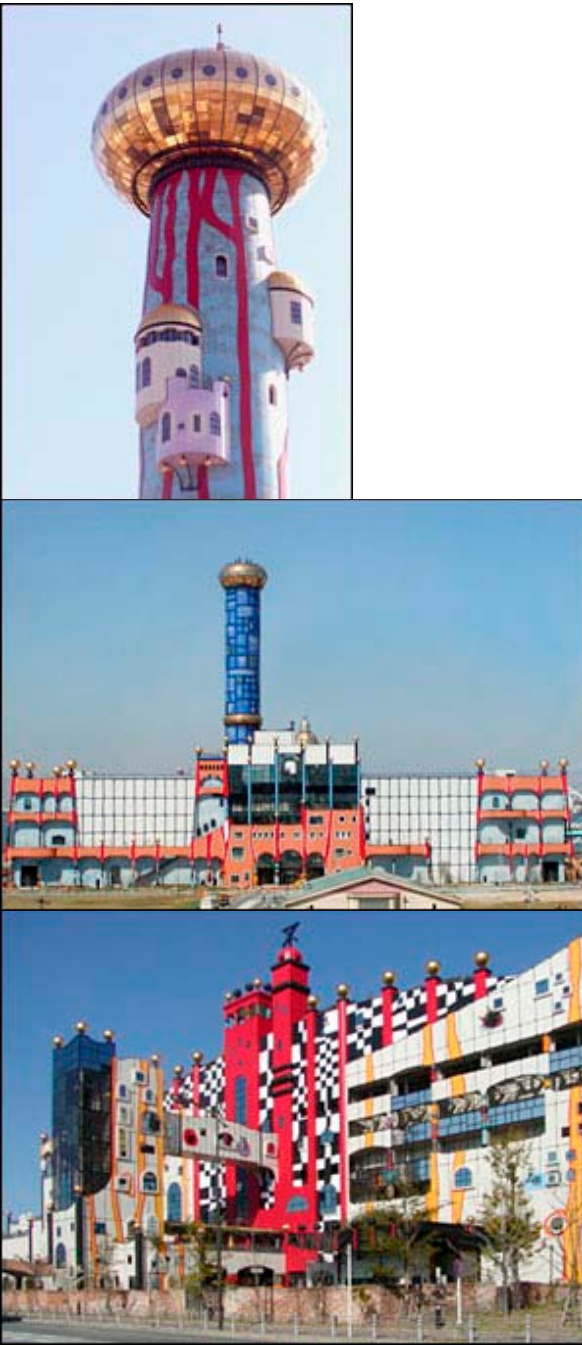
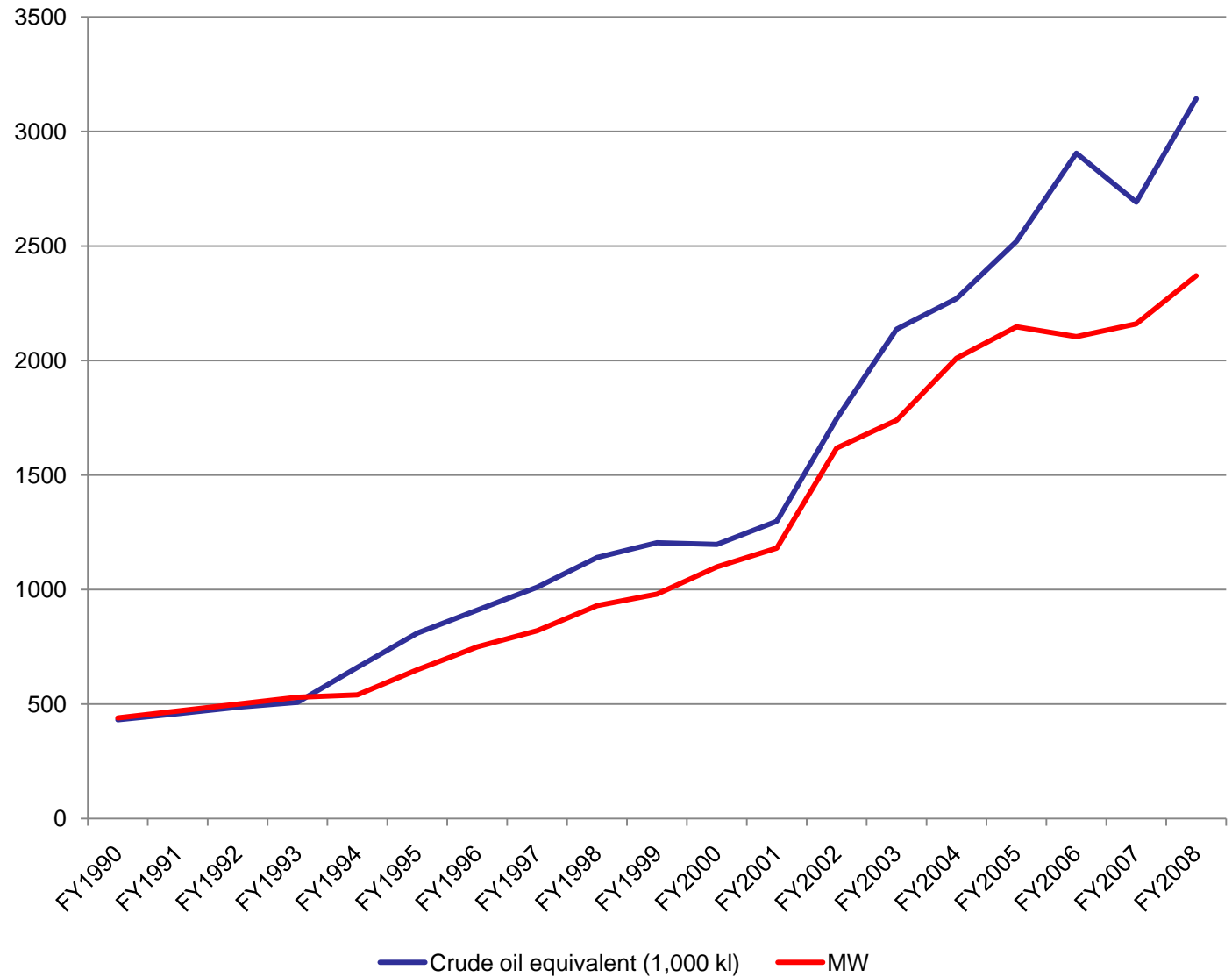
- 18 geothermal power stations
- Combined output of ~500,000kW
- .2% of electricity generated in Japan

| Name of power plant     | Power plant operator                            |   | Authorized output (MW) | Annual energy production (MWh) | Start of operation |
|-------------------------|---|---|------------------------|--------------------------------|--------------------|
|                         | Power generator                                 | Steam supplier                                  |                        |                                |                    |
| Mori                    | Hokkaido Electric Power Co., Inc.               | Hokkaido Electric Power Co., Inc.               | 50.00                  | 114,620                        | Nov. 1982          |
| Sumikawa                | Tohoku Electric Power Co., Inc.                 | Mitsubishi Materials Corporation                | 50.00                  | 337,871                        | Mar. 1995          |
| Onuma                   | Mitsubishi Materials Corporation                | Mitsubishi Materials Corporation                | 9.50                   | 59,932                         | Jun. 1974          |
| Matsukawa               | Tohoku Hydropower & Geothermal Energy Co., Inc. | Tohoku Hydropower & Geothermal Energy Co., Inc. | 23.50                  | 124,728                        | Oct. 1966          |
| Kakkonda 1              | Tohoku Electric Power Co., Inc.                 | Tohoku Hydropower & Geothermal Energy Co., Inc. | 50.00                  | 200,109                        | May 1978           |
| Kakkonda 2              |   |   | 30.00                  | 122,394                        | Mar. 1996          |
| Uenotai                 | Tohoku Electric Power Co., Inc.                 | Tohoku Hydropower & Geothermal Energy Co., Inc. | 28.80                  | 170,112                        | Mar. 1994          |
| Onikobe                 | Electric Power Development Co.                  | Electric Power Development Co.                  | 12.50                  | 104,034                        | Mar. 1975          |
| Yanaizu - Nishiyama     | Tohoku Electric Power Co., Inc.                 | Okuaizu Geothermal Ltd. Co.,                    | 65.00                  | 362,796                        | May 1995           |
| Hachijojima             | Tokyo Electric Power Company                    | Tokyo Electric Power Company                    | 3.30                   | 14,171                         | Mar. 1999          |
| Suginoi                 | Suginoi Hotel                                   | Suginoi Hotel                                   | 1.90                   | 11,655                         | Mar. 1981          |
| Kuju                    | Kuju Kanko Hotel                                | Kuju Kanko Hotel                                | 0.99                   | 8,380                          | Dec. 2000          |
| Takigami                | Kyushu Electric Power Co., Inc.                 | Idemitsu Oita Geothermal Co., Ltd.              | 25.00                  | 215,796                        | Nov. 1996          |
| Otake                   | Kyushu Electric Power Co., Inc.                 | Kyushu Electric Power Co., Inc.                 | 12.50                  | 82,726                         | Aug. 1967          |
| Hatchobaru 1            | Kyushu Electric Power Co., Inc.                 | Kyushu Electric Power Co., Inc.                 | 55.00                  | 351,007                        | June 1977          |
| Hatchobaru 2            |   |   | 55.00                  | 425,820                        | June 1990          |
| Hatchobaru Binary       |   |   | 2.00                   | 10,705                         | Apr. 2006          |
| Takenoyu                | Hirose Trading Co., Ltd.                        | Hirose Trading Co., Ltd.                        | 0.05                   | 0                              | Oct. 1991          |
| Ogiri                   | Kyushu Electric Power Co., Inc.                 | Nittetsu Kagoshima Geothermal Co., Ltd.         | 30.00                  | 224,296                        | Mar. 1996          |
| Kirishima Kokusai Hotel | Fuji Electric Systems Co., Ltd.                 | Daiwabo Kanko Co., Ltd.                         | 0.22                   | 694                            | Feb. 1984          |
| Yamakawa                | Kyushu Electric Power Co., Inc.                 | Kyushu Electric Power Co., Inc.                 | 30.00                  | 121,654                        | Mar. 1995          |
| <b>Total</b>            |   |   | <b>535.26</b>          | <b>3,063,500</b>               |                    |



# Waste-to-Energy

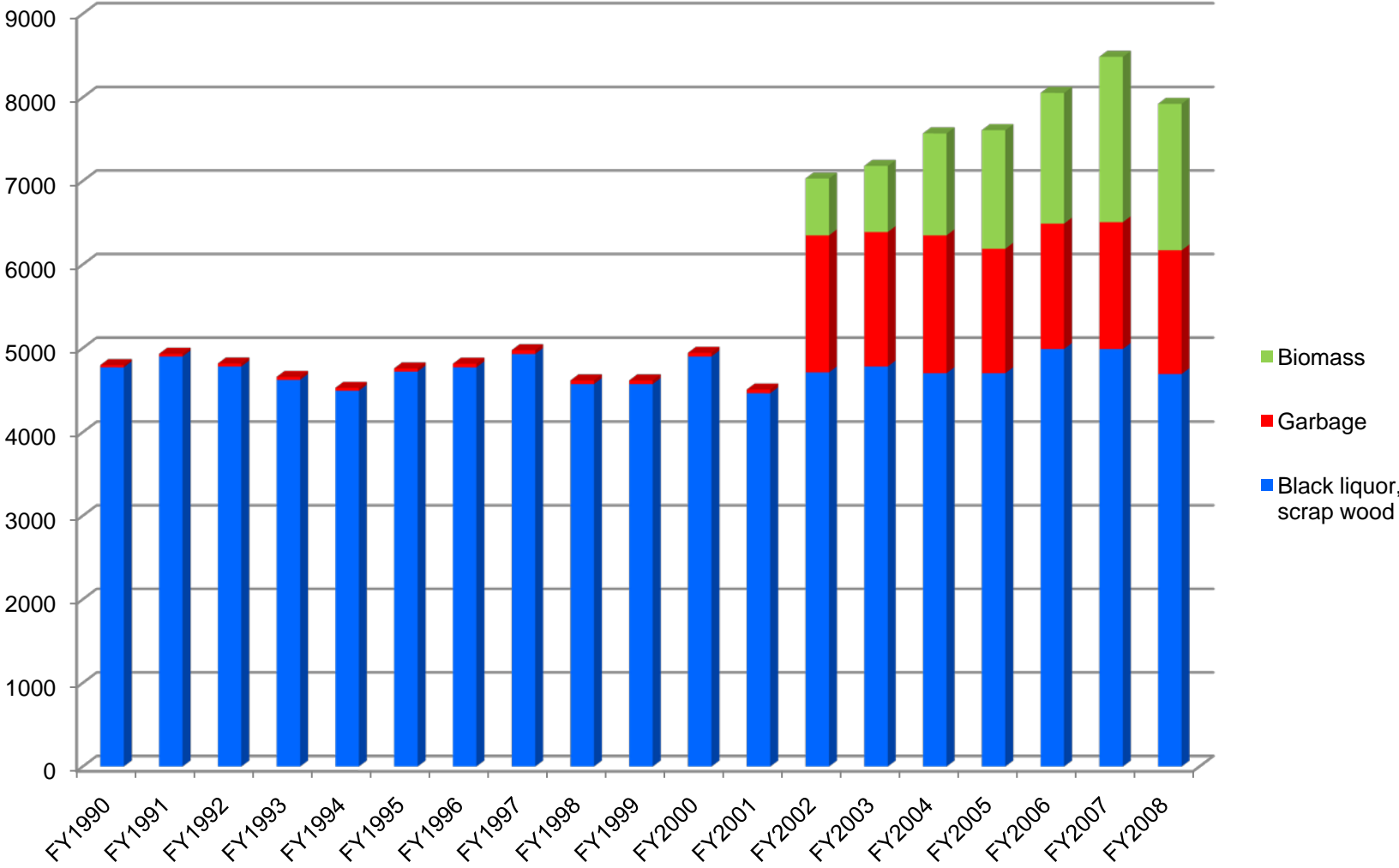
## Municipal waste and biomass to power





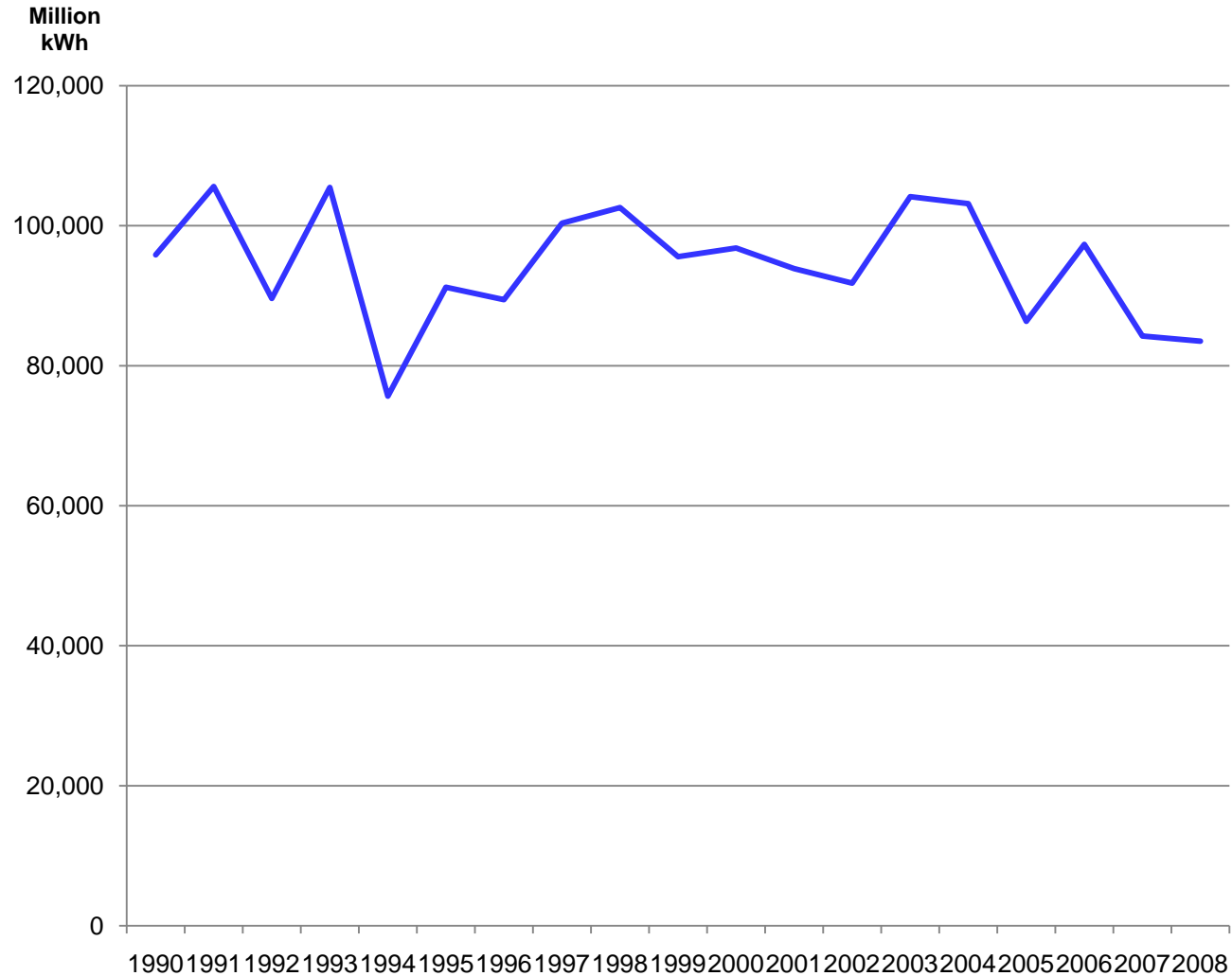
# Waste-to-Thermal

Crude oil equivalent  
(1,000 kl)



# Hydropower

For facilities 1MW or larger

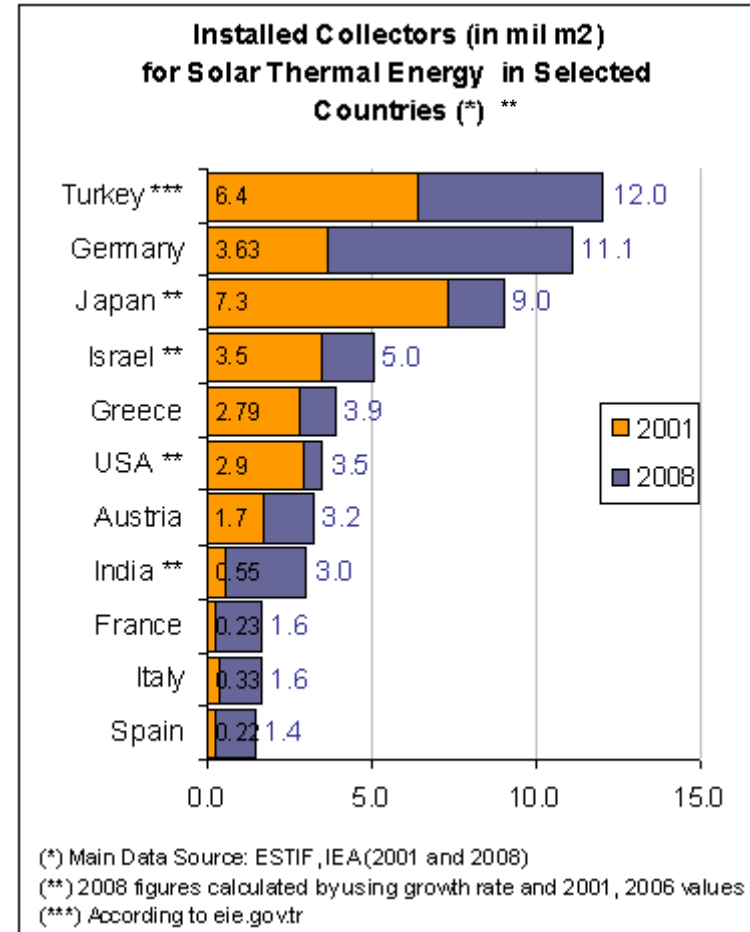
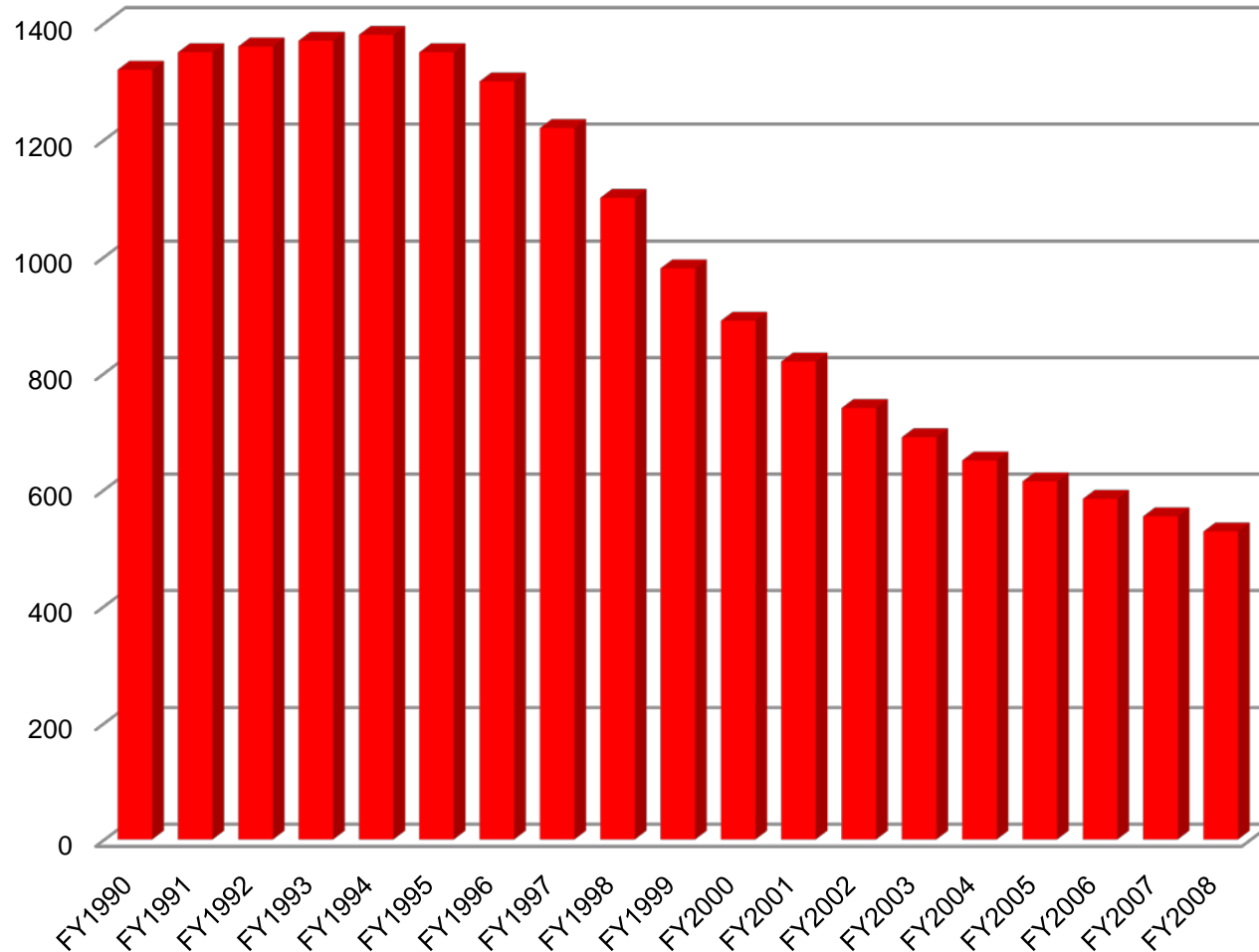


<http://www.ieahydro.org/03-Discharge-for-Sights-Ige.htm>

# Solar Thermal



Crude oil equivalent  
(1,000 kl)



# Thank you for your attention!

