# Japan's Feed-in Tariff Scheme and Its Grid Connection Issues, in Comparison with Germany's

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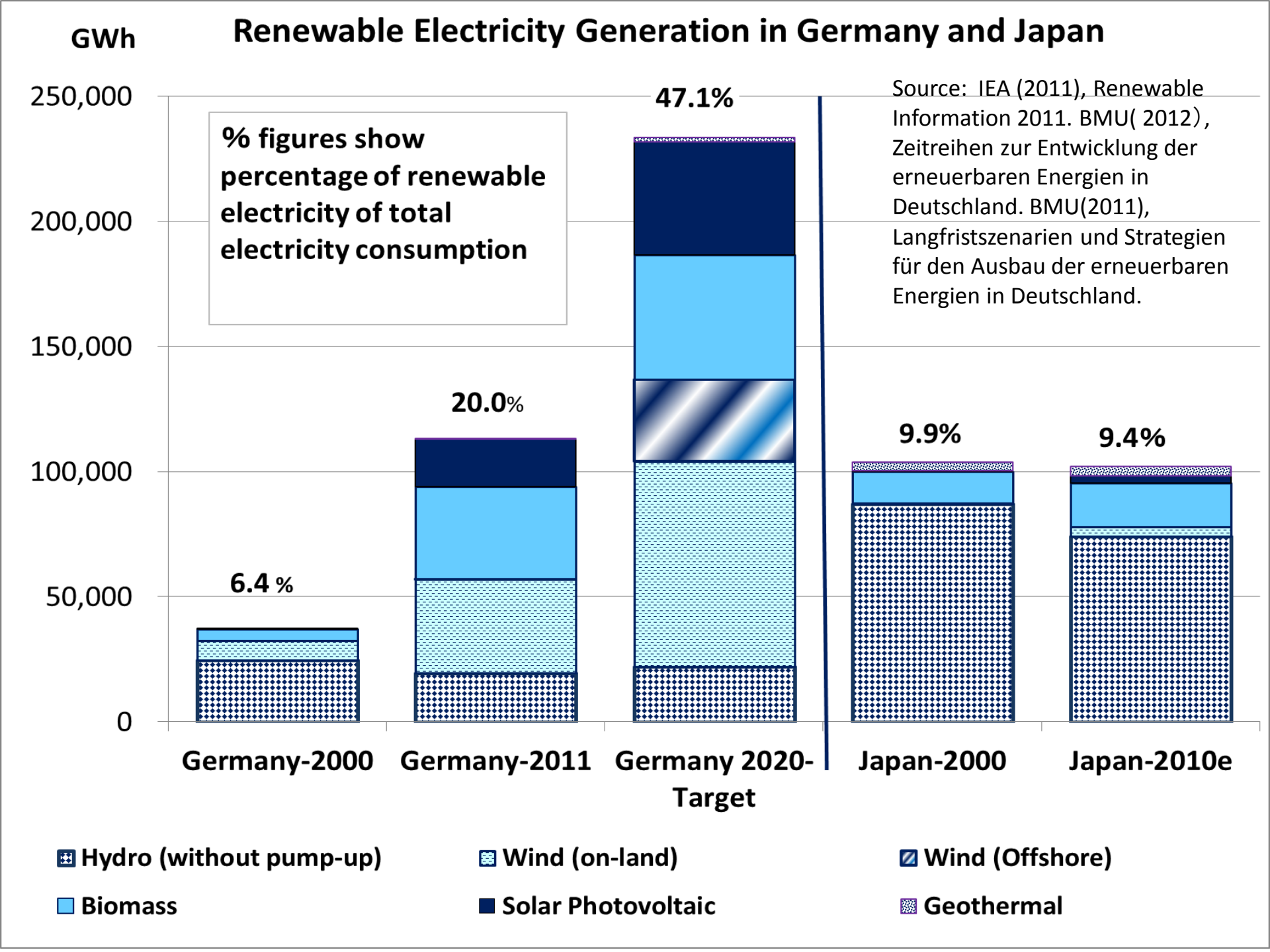
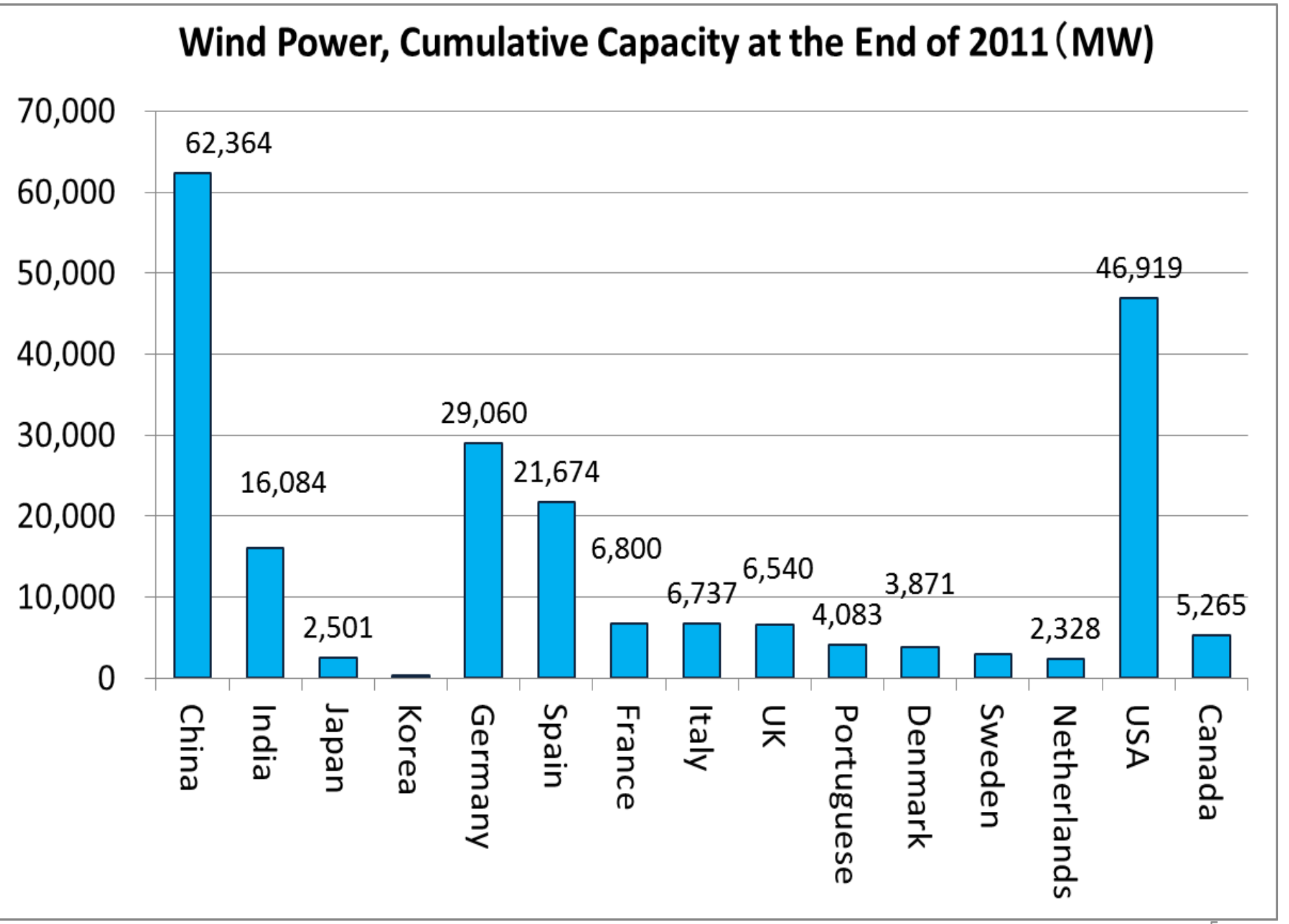
# Trends in Renewable Electricity in Japan

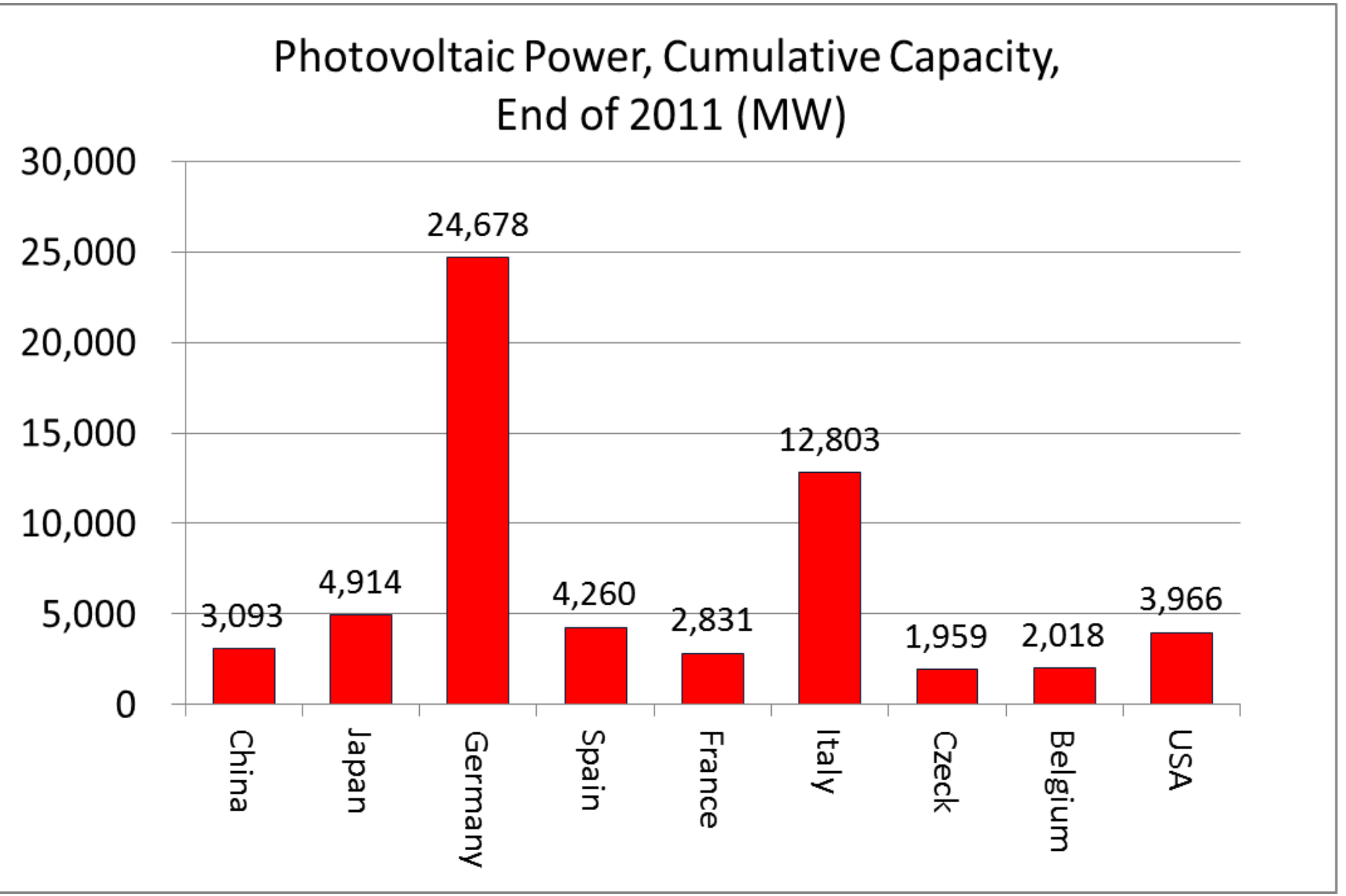
- Mainly large-scale hydropower and small amount of biomass (urban biomass waste)
- **Japan's renewable electricity has not increased in the past 10 years.**
- This is due to heavy reliance on nuclear power generation.
- **Japan's wind power installation has been stagnant in the past years,**

  **because of the low purchase price and the limited capacity for grid integration set by major power companies.**


Renewable Electricity Generation in Germany and Japan
GWh
250,000
200,000
150,000
100,000
50,000
0
% figures show percentage of renewable electricity of total electricity consumption
6.4 %
20.0%
47.1%
9.9%
9.4%
Germany-2000
Germany-2011
Germany 2020-Target
Japan-2000
Japan-2010e
Hydro (without pump-up)
Wind (on-land)
Wind (Offshore)
Biomass
Solar Photovoltaic
Geothermal
Source: IEA (2011), Renewable Information 2011. BMU( 2012), Zeitreihen zur Entwicklung der erneuerbaren Energien in Deutschland. BMU(2011), Langfristszenarien und Strategien für den Ausbau der erneuerbaren Energien in Deutschland.




Source: GWEC (2012), Global Wind Report 2011.




Source: EPIA(2012), Global Market Outlook for Photovoltaics until 2012 ; IEA-PVPS (2012), Task1, Trend Preview.

# Japan's Electricity Generation and Grid System

- **10 major power companies** own **more than 90 % of generation capacity**.
- They own their control zones and **almost all of the grid systems** (transmission and distribution grid).
- They **dominate** generation, distribution and the retail market.
- They are **vertically integrated local monopolies**.
- Transmission capacity between control zones is limited and not flexible.
- 10 major power companies completely control the retail market for households and consumers under 50 kW contract .
- Japanese consumers under 50kW contract cannot choose their power supplier.

# Power Supply (Maximum Output) of Power Companies

電気事業者の供給力

Takehama, Aug.2012-Salzburg

| FY 2010 (MW) | Maximum Output 供給力(最大出力) | % | of which, Nuclear Energy |
|---|---|---|---|
| Hokkaido 北海道 | 7,419 | | 2,070 |
| Tohoku 東北電力 | 17,206 | | 3,274 |
| Tokyo (TEPCO) 東京電力 | 64,988 | | 17,308 |
| Chubu 中部電力 | 32,828 | | 3,617 |
| Hokuriku 北陸電力 | 8,056 | | 1,746 |
| Kansai 関西電力 | 34,877 | | 9,768 |
| Chugoku 中国電力 | 11,986 | | 1,280 |
| Shikoku 四国電力 | 6,962 | | 2,022 |
| Kyushu 九州電力 | 20,330 | | 5,258 |
| Okinawa 沖縄電力 | 1,919 | | 0 |
| **10 Major Power Companies (A)** | **206,575** | **90.4%** | **46,343** |
| Tokutei-Kibo (B) 特定規模 | 2,011 | 0.9% | 0 |
| Wholesale Power Producer 卸事業者 | 19,609 | 8.6% | 2,617 |
| Other | 283 | 0.1% | 0 |
| **Total of All Power Companies (C) 電気事業総供給力** | **228,478** | **100%** | **48,960** |

| Nuclear % |
|---|
| 21% |

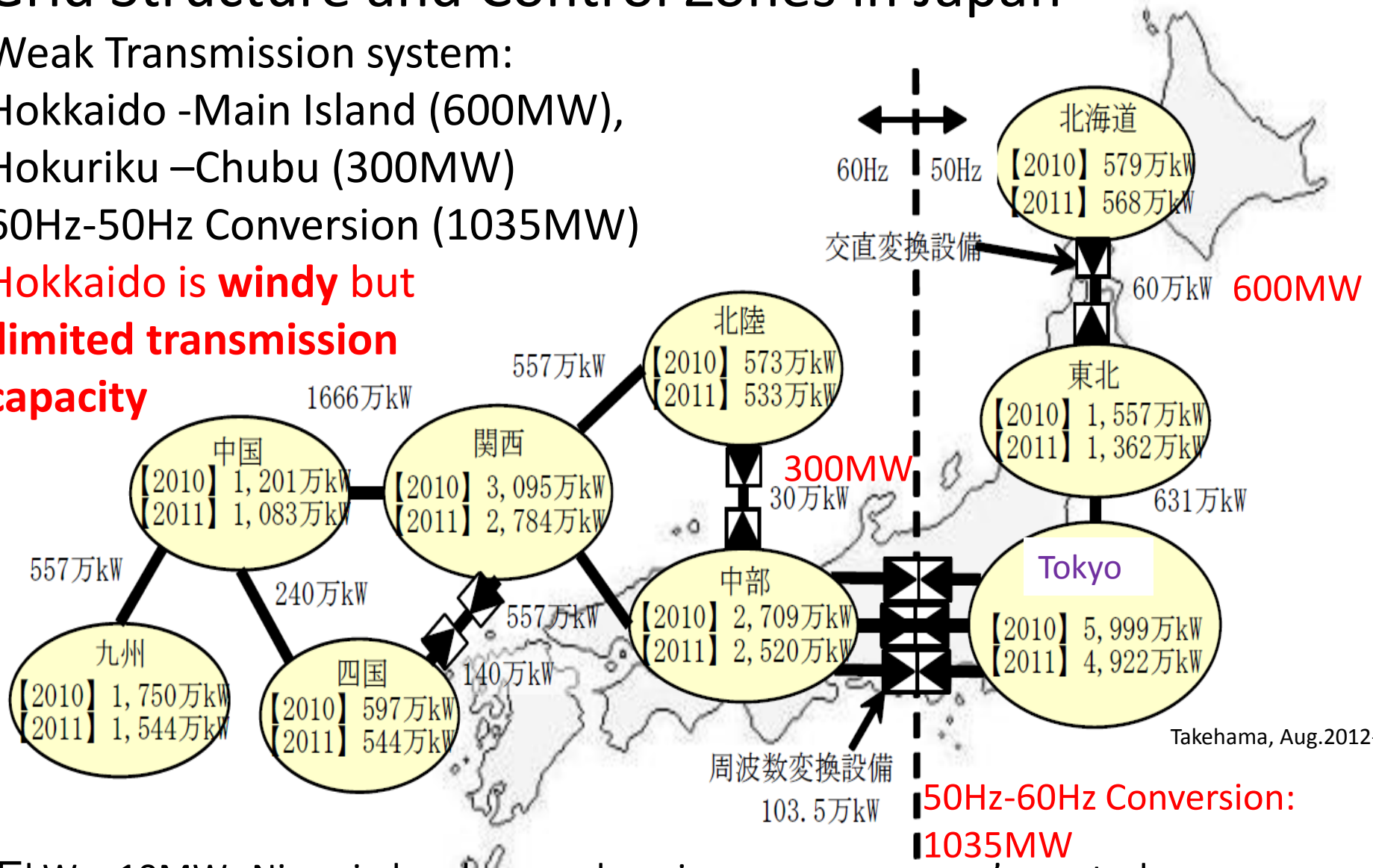


Source: Takehama (2012). Calculated from data provided by the Federation of Electric Power Companies of Japan

# Grid Structure and Control Zones in Japan

Weak Transmission system:
Hokkaido -Main Island (600MW),
Hokuriku –Chubu (300MW)
60Hz-50Hz Conversion (1035MW)

Hokkaido is **windy** but **limited transmission capacity**




Takehama, Aug.2012-Sal

万kW＝10MW. Nine circles show each major power company's control zone.
Figures in each circle show maximum electricity demand in each control zone.
Figures between circles show capacity of main transmission lines between control zones



Source:「地域間連系線等の強化に関するマスタープラン研究会中間報告書」、電力システム改革専門委員会, p.5.

# Photovoltaic Feed-in Tariffs (2009-2012) and New Feed-in Tariffs for Renewable Energy (July 2012-)

# Photovoltaic Feed-in Tariffs in Japan (1)

■ Photovoltaic feed-in tariff for surplus electricity

- PV FIT started in November 2009 and continued till June 2012 .
- Tariffs for only surplus electricity. Firstly, PV electricity must be self-consumed.
- Only under 500kW systems are compensated.
- Compensation for 10 years
- Under 10kW, 42ct/kWh (1 Euro=100 JPY)

# PV Feed-in Tariff in Japan (2)

- IRR in PV surplus FIT is around 4% /a for 10 KW systems. Not very attractive.
- Larger than 10kW systems were not profitable because of the low tariff.
- Only residential roof-top systems have increased.
- Major power companies did not want a large increase in photovoltaic electricity.
- The Japan's PV market is slowly developing since PV FIT.

# The **Feed-in Tariff Scheme** for **Renewable Energy**

- Since the Fukushima disaster, energy-related conditions have changed.
- Japan's feed-in tariff finally took effect in July 2012.
- Obligatory grid connection and grid feed-in
- Compensation for 20 years, except for PV residential 10 years, Geothermal 15 years
- Tariff levels are revised every year.
- IRR from tariffs is from 1% to 13%.
- IRR of PV tariffs for larger than 10kW is at 6%.
- Actual IRR in PV tariff could be much higher.
- Large-scale PV installations are rapidly increasing in number and capacity.

# The New Scheme of Feed-in Tariffs for Renewable Energy Electricity since July 2012

Tariffs for Renewable Energy Electricity in Japan (from 1st July 2012)

| | Photovoltaic | | Wind | | Geothermal | | Hydro (Small and Medium) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 10 kW and more | <10 kW, Surplus Electricity | 20 kW and more | < 20kW | 15 MW and more | <15MW | 1,000 – 30,000 kW | 200 – 1,000 kW | <200 kW |
| IRR (Before Tax) | 6% | 3.2% | 8% | 1.8% | 13% | | 7% | 7% | |
| Tariffs before Tax JPY/kWh 1JPY = 1ct | 42 | 42 | 23.1 | 57.75 | 27.3 | 42 | 25.2 | 30.45 | 35.7 |
| Compensation Years | 20 years | 10 years | 20 years | | 15 years | | 20 years | | |

# The New Scheme of Feed-in Tariffs for Renewable Energy Electricity since July 2012

| | Biomass Energy | | | | |
|---|---|---|---|---|---|
| | Methane Gas Processing | Wood Biomass, Not Waste Wood | Wood Biomass, Palm Shell | Biomass Waste, without Wood Biomass | Recycled Wood |
| IRR (Before Tax) | 1% | 8% | 4% | 4% | 4% |
| Tariffs, before Tax, JPY/kWh | 40.95 | 33.6 | 25.2 | 17.85 | 13.65 |
| Compensation Years | 20 years | | | | |

Source: Tariff Committee (2012)

# Weaknesses of Japan's FIT

- No obligation of priority access
- Grid operators (power companies) have no obligation to give priority access to renewable energies.
- No obligation of grid expansion
- Grid operators have no obligation to expand the grid in order to avoid grid overload or grid bottleneck.
- No unbundling of generation and transmission for now

  (In two years, the government would introduce unbundling.)
- For now, major power companies control transmission, distribution and retail business.

# The Surcharge of Feed-in Tariff Scheme for Renewable Energy

■ Surcharge rates for FY2012

- Surcharge for households is 87 JPY/month on average (1 JPY = 1 ct )
- **0.29 JPY/kWh** (PV surcharge included).
- Standard households (Electricity consumption is 300 kWh/month), paying 7,000 JPY/month

# Costs for Renewable Energy vs. Costs for Nuclear Energy in Electricity Price

- The costs for nuclear energy account for **11 - 12% of TEPCO's electricity charge**.
- **Nuclear energy** costs **2.96** JPY /kWh in 2012 at TEPCO.
- The **surcharge for renewable energy** costs **0.28** JPY/kWh, **1.1 %** of electricity charge in 2012 at TEPCO.
- **Germany:** Households pay **14%** of electricity charge for **EEG Feed-in Tariffs (2012, estimated).**
- **Japan**: TEPCO consumers pay **12%** of electricity charge for **Nuclear Energy.** (2012)

# A Comparison of Costs for Nuclear and Renewables in Electricity Price at Tokyo Electric Power Company

| 2012 September | JPY ／kWh | % |
|---|---|---|
| Electricity Price at TEPCO (From September 2012) 料金単価 | **25.31** | 100% |
| **Costs for Nuclear Power** 原子力料金原価 | **2.96** | 11.7% |
| **Surcharge of FIT for Renewable Energy Electricity** in 2012 (PV FIT Included) | **0.28** | 1.1% |
| （ Surcharge for PV FIT, 2012 ） | **0.06** | 0.2% |
| （ Surcharge for Renewables FIT, 2012） | **0.22** | 0.9% |

Source: Calculated by Takehama based on the following data: The costs for nuclear energy is estimated as 11.7% of the electricity price. calculation is based on documents for Electricity Price Examination Committee (2012), 電気料金審査専門委員会配布資料; Tokyo Electric Power Company, (2012),「別冊1、供給約款変更認可申請補正書」; METI (2012),「東京電力の規制部門の電気料金改定について」, Press release 25th July; TEPCO (2012),「再生可能エネルギー発電促進賦課金および太陽光発電付加金のお知らせ」; METI (2012),「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI (2012)、「東京電力の認可申請にかかる査定方針について」

# The Costs for Nuclear Power in the Electricity Price (Tokyo Electric Power Company : TEPCO)

| (from Sep. 2012) | (100 Million JPY ) | of Which, Costs of Nuclear Energy (100 Million JPY, 1JPY = 1ct ) 原子力関係費用 |
|---|---|---|
| Labor Costs | 3,387 | 252 |
| Fuel Costs | 24,585 | 110 |
| Cost of Repairs | 4,095 | 709 |
| Depreciation 減価償却費 | 6,171 | 900 |
| Business Profits (= Divident, Interest Payment) 事業報酬 | 2,685 | 405 |
| Electricity Purchase from Other Power Suppliers 購入電力料 | 7,876 | 1,002 |
| Tax Payment | 3,013 | 864 |
| Other Costs ( Including Back End Costs for Used Nuclear Fuel ) その他経費（原子力バックエンド費用含） | 7,098 | 2,396 |
| Income except for Electricity Charge 控除収益 | -2,128 | |
| Total Costs | 56,783 | 6,639 |

I expect that other power companies have the similar situations as TEPCO.

* Business Assets *2.9%

Costs for Nuclear Energy/Total Costs (%)
総原価に占める原子力比率

11.7%

Source: Calculated by Takehama. This is estimated from the following documents: METI (2012),「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI(2012),「東京電力の認可申請にかかる査定方針について」; TEPCO(2012),「別冊1、供給約款変更認可申請補正書」. These figures are annual figures.

# Why TEPCO's Electricity Charge ?

- Before the Fukushima disaster, **power companies did not disclose breakdown** list of electricity price for the past price raising.
- Because of huge criticism by citizens about TEPCO's price rise, TEPCO was enforced to disclose the detail data on electricity charge under the special committee on examination of electricity charge (under METI).
- **This is the first time for us that we can get the breakdown lists of electricity charge**.
- Japanese energy policy paid much emphasis on nuclear energy for decades.
- **I assume that other power companies have similar situations on costs for nuclear energy in the electricity charge .**

# Breakdown Lists of Costs for Nuclear Power in the Electricity Charge of TEPCO,

( Sep. 2012 - Aug. 2014, Annual,  Unit= Billion JPY)

# Breakdown Lists of Costs for Nuclear Power in the Electricity Charge of TEPCO, ( Sep. 2012 - Aug. 2014, Annual, Unit= Billion JPY)

| New Electricity Charge, from September 2012, (Billion JPY/Year), Approved by METI. | | (1) |
|---|---|---|
| Breakdown Lists of the Charge | of which, Costs for Nuclear Energy うち原子力発電原価分 | |
| Labor Costs 339 Billion JPY 人件費 | 25.2 Billion JPY ( Personnel for Nuclear Department and Fukushima Disaster Compensation Management: 4668 persons * 97% * 5.56 Million JPY for 3 years) | 25.2 |
| Fuel Costs 2,459 Billion JPY 燃料費 | | |
| of which, Nuclear Fuel Costs うち核燃料分 | 11 Billion JPY (Nuclear Fuel Costs for Kashiwazaki Nuclear Power Plant: Fukushima Daiichi 0 Billion JPY, Fukushima Daini 0 Billion JPY, Kashiwazaki No.13,4,5,6,7 reactors 11 Billion JPY) | 11.0 |

Source: Calculated by Takehama. This is estimated from the following documents: METI (2012), 「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI(2012),「東京電力の認可申請にかかる査定方針について」; TEPCO(2012),「別冊1、供給約款変更認可申請補正書」. **These figures are annual figures.**

| | | |
|---|---|---|
| Costs for Repair 410 Billion JPY 修繕費 | 70.9 Billion JPY (Costs for repair, cooling and stabilization of Fukushima Daiichi Nuclear Power Plant No.1-No.4 reactors are decommissioned. They need 65. 2 Billion JPY. Billion JPY. Fukushima Daiichi No.5, No,6 (out of operation), Daini No.1-No.4 (out of operation) need 20.3 Billion for repair. Nuclear power plants need huge costs even if being decommissioned or outage. ) | (2)<br>70.9 |
| Costs for Electricity Procurement 788 Billion JPY 購入電力料 | Electricity purchase of nuclear electricity from whole sale power producers | 100.2 |

Source: Calculated by Takehama. This is estimated from the following documents: METI (2012),「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI(2012),「東京電力の認可申請にかかる査定方針について」; TEPCO(2012),「別冊1、供給約款変更認可申請補正書」. **These figures are annual figures.**

| | | |
|---|---|---|
| Capital Costs 886 Billion JPY 資本費 | Unit= Billion JPY) (3) | |
| of which, Depreciation Costs, 617 Billion JPY うち減価償却費 | 90 Billion JPY : For Fukushima Daiichi No.5, No.6 reactors, 27.1 Billion JPY. For Fukushima Daini No.1–No.4 (no meltdown) 14.3 Billion JPY. Including other costs, totaling depreciation for nucler power 90 Billion JPY (Mainly for construction of Tsunami protection wall and earthquake-proof storage shelf for used nuclear fuel | 90.0 |
| of which, Business Profit ( = Interest and Dividends Paid ) 269 Billion JPY うち事業報酬 | Costs for dividends and interest payment for nuclear fuel assets 21 Billion JPY | 21.0 |
| | Divident Costs for Nucler Power Facilities 12.9 Bilion JPY | 12.9 |
| | Divident costs for uclear special investment not by TEPCO 6.6 Billion JPY (for Japan Nuclear Fuel 5.1 Billion JPY, Recycled nuclear fuel storage 0.1 Billion JPY, New Project for Uranium Mine Project 1.3 Billion JPY. Nuclear Disaster Compensation Support Scheme 0.1 Billion JPY | 6.6 |

Source: Calculated by Takehama. This is estimated from the following documents: METI (2012),「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI(2012),「東京電力の認可申請にかかる査定方針について」; TEPCO(2012),「別冊1、供給約款変更認可申請補正書」. **These figures are annual figures.**

| Taxes 301 Billion JPY<br>公租公課 | Unit= Billion JPY) |
|---|---|
| | The costs for nuclear energy in the Special Tax for Development of Power Sources: 69.8 Billion JPY. This tax is the surcharge for development of power generation sources, especially for nuclear energy. I estimated 64% of the tax is for nuclear costs. |
| | Special Tax for Nuclear Fuel and Used Nuclear Fuel , Funds reserved for processing of used nuclear fuel 2.8 Billion JPY |
| | Estate Tax for nuclear energy 12.8 Billion JPY (Fukushima Daiichi 5.6 Billion JPY, Fukushima Daini 2.7Billion JPY, Kashiwazaki-Kariha 6.7 Billion JPY , and METI's reduction ) |
| | Water use charge for hydropower plants 1 Billion JPY |

Source: Calculated by Takehama. This is estimated from the following documents: METI (2012),「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI(2012),「東京電力の認可申請にかかる査定方針について」; TEPCO(2012),「別冊１、供給約款変更認可申請補正書」. **These figures are annual figures.**

| | | |
|---|---|---|
| Backend Costs for Nuclear Energy　66.7 Billion JPY　原子力バックエンド費用 | Unit= Billion JPY)<br>Backend costs for used nuclear fuel ( Fund reserve, Transport costs for used fuel to Aomori-Rokkasho Village) 51.5 Billion JPY , | (5)<br>51.5 |
| | Processing costs for radioactive wastes 10 Billion JPY | 10.0 |
| | Deassemble costs for nuclear power facilities 5.2 Billion JPY for Kashiwazaki Kariha Plant 1-No.3 -No.7 reactor. (Fukushima Daiichi: 0 Billion JPY, Fukushima Daini: 0 Billion JPY) | 5.2 |

Source: Calculated by Takehama. This is estimated from the following documents: METI (2012),「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI(2012),「東京電力の認可申請にかかる査定方針について」; TEPCO(2012),「別冊１、供給約款変更認可申請補正書」. **These figures are annual figures.**

| | Unit= Billion JPY) | (6) |
|---|---|---|
| Other Costs 643 Billion JPY<br>その他経費<br><br>of which, Removal Costs of Estate Assets 94.2 Billion JPY うち固定資産除去費 | Insurance costs for nuclear accsidents 1.4 Billion JPY 損害保険料のうち原子力災害関係 | 1.4 |
| | Removal costs of estate assets from nuclear power plants 6.7 Billion JPY<br>固定資産除去費のうち、原発分 | 6.7 |
| | Promotion and advertising costs for 'All-Electrification' 0 Billion JPY オール電化関連の普及費用 | 0.0 |
| | Contribution Payment for the Support Scheme of Nuclear Accident Compensation 56.7 Billion JPY 原子力損害賠償支援機構一般負担金 | 56.7 |
| | Costs for waste processing for radioactive waste from nuclear energy plants 7.6 Billion JPY 廃棄物処理費用のうち原子力関係 | 7.6 |
| | Consumables including protecting clothes against radioactive 5.8 Billion JPY 消耗品(保護衣防護具等) | 5.8 |

Source: Calculated by Takehama. This is estimated from the following documents: METI (2012),「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI(2012),「東京電力の認可申請にかかる査定方針について」; TEPCO(2012),「別冊1、供給約款変更認可申請補正書」. **These figures are annual figures.**

| | Unit= Billion JPY) |
|---|---|
| Maintenance coste for the PR Building of Kashiwazaki-Kariha Nuclear Power Plant, the costs for Public Relationlon for local citizens 0.5 Billion JPY | 0.5 |
| Outsourcing costs for nuclear energy 84.5 Billion JPY （ Including Outsourcing for accepting bills, payment and telephone call center 29.9 Billion JPY, Stabilizing costs 21.5 Billion JPY (outsourceing of radiation dose monitoring, water processing for stagnant and contaminated radioactive water) , costs for temporary storage of radioactive used fuel 9.3 Billion JPY | 84.6 |
| Costs for 'Reports on Fukushima Daiichi Nuclear Power Site for Local citizenz', 1.3 Billion JPY | 1.3 |

Source: Calculated by Takehama. This is estimated from the following documents: METI (2012),「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI(2012),「東京電力の認可申請にかかる査定方針について」; TEPCO(2012),「別冊1、供給約款変更認可申請補正書」. **These figures are annual figures.**

| | |
|---|---|
| Compensation for Fukushima Daiichi Nuclear accident, without outsourcing (Rents, renting, communication costs, others) 5 Billion JPY | 5.0 |
| The costs for the Commission on Reprocessing of Used Nuclear Fuel in Overseas, the costs for Japan Nuclear Technology Association : 0.5 Billion JPY | 0.5 |
| Research costs for nuclear energy at Central Research Institute fo Electric Power Industry 2.9 Billion JPY | 2.9 |

Source: Calculated by Takehama. This is estimated from the following documents: METI (2012),「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI(2012),「東京電力の認可申請にかかる査定方針について」; TEPCO(2012),「別冊１、供給約款変更認可申請補正書」. **These figures are annual figures.**

# Breakdown Lists of Costs for Nuclear Power in the Electricity Charge of TEPCO, (Sep.2012 - Aug. 2014) (9)

Unit= Billion JPY)

| | | |
|---|---|---|
| Total costs for electricity charge 5,678 Billion JPY (56.8 Billion EURO) 総原価 | of which, Costs for nuclear energy in electricity charge, 663.9 Billion JPY ( 6.6 Billion EURO) | 663.9 |
| | Share of nuclear energy in the electricity charge | 11.7% |
| % of Interest and Divident Paid 2.9% | 査定により、事業報酬率は、2. 9%に引き下げ | |

Source: Calculated by Takehama. This is estimated from the following documents: METI (2012), 「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI(2012),「東京電力の認可申請にかかる査定方針について」; TEPCO(2012),「別冊1、供給約款変更認可申請補正書」. **These figures are annual figures.**

# Breakdown List of Electricity Price at TEPCO by Sector of Utility Business

| | Electricity Price from Sep. 2012 (100 million Yen) | (%) |
|---|---|---|
| Hydropower | 3,547 | 2.4% |
| Fossil Fuel Power | 85,849 | 58.4% |
| Nuclear Energy | 16,089 | 10.9% |
| Renewable Energy | 100 | 0.1% |
| Transmission Costs | 12,021 | 8.2% |
| Transformer Costs 変電費 | 5,685 | 3.9% |
| Distribution Costs 配電費 | 18,323 | 12.5% |
| Retail Costs 販売費 | 5,327 | 3.6% |
| Total Takehama, Aug.2012-Salzburg | 146,943 | 100% |

Note: Conditions for calculation are different from slide p. 20. Therefore, the amount of total costs is different from p.20. Source: Date is based on TEPCO (2012), Application for approval on amendment of electricity supply agreements, revised (供給約款変更認可申請補正書).

**Total amount of electricity costs is shown in the sum of 3 years costs.**

- I estimate that **the costs for nuclear energy is**
- **12.1%** of electricity charge, Sep. 2008 -31 Aug. 2012. (*1)
  - Consumers in **TEPCO zone** **paid** **2,616 Billion JPY** for nuclear energy.
- **11.7%** of electricity charge, Sep. 2012 -Aug. 2014 (*2)
  - Consumers in **TEPCO zone** **will** **pay** **2,018 Billion JPY** for nuclear energy.

- TEPCO's consumer paid / will pay **totaling** **4,634** Billion JPY (= 46 Billion EUR, 1ct =1EUR) for nuclear energy for 7 years.
- The **total amount of surcharge for PV feed-in tariff** from 2009 to 2011 was **67.9 Billion JPY (= 0.679 Billion EURO) in the entire Japan.**

Source: Calculated by Takehama, based on the following documents:

1) **Electricity Price Examination Committee (2012)** **（電気料金審査専門委員会配布資料）**; 2) The documents for Electricity Price Examination Committee (2012) （電気料金審査専門委員会配布資料）; Tokyo Electric Power Company, (2012),「別冊1、供給約款変更認可申請補正書」; METI (2012),「東京電力の規制部門の電気料金改定について」, Press release 25th July; TEPCO (2012),「再生可能エネルギー発電促進賦課金および太陽光発電付加金のお知らせ」; METI (2012),「東京電力株式会社の供給約款変更認可申請に係る査定方針」; METI (2012)、「東京電力の認可申請にかかる査定方針について」http://www.meti.go.jp/press/2012/07/20120725005/20120725005.html.

# **Germany:** Households Pay **14%** of Electricity Charge for **EEG Feed-in Tariffs.**



| | EEG Surcharge (ct/kWh) | Electricity Charge for Household in Germany, Surcharge Included (ct/kWh) ドイツ家庭料金 | Percentage in the Electricity Charge 賦課金比率 |
|---|---|---|---|
| Y2000 | 0.2 | 13.94 | 1.4% |
| Y2002 | 0.35 | 16.11 | 2.2% |
| Y2004 | 0.51 | 17.96 | 2.8% |
| Y2006 | 0.88 | 19.46 | 4.5% |
| Y2008 | 1.16 | 21.65 | 5.4% |
| Y2009 | 1.31 | 23.21 | 5.6% |
| Y2010 | 2.05 | 23.69 | 8.7% |
| Y2011 | 3.53 | 24.95 | 14.1% |
| **Y2012** | **3.59** | 24.95 | **14.4%** |

Source: BDEW (2011), Energie-Info. Erneuerbare Energien und das EEG: Zahlen, Fakten, Grafiken; EEG/ KWK-G (2012), EEG-Umlage 2012. The electricity charge in 2012 is estimated.

# Grid Connection Issues and Feed-in Management

# Comparison of FIT schemes

| Germany | Japan |
| --- | --- |
| Erneuerbare-Energien-Gesetz- EEG | The Act on Feed-in Tariff Scheme for Electricity from Renewable Energy Sources |
| Priority Access: Grid system operators shall as a priority connect renewable energy plants. | Major power companies are not obliged to give priority access to renewable energy.<br><br>They can refuse grid connection to renewable energy when renewable energy may unreasonably harm the profit of major power companies. (Section 4, 5) |
| Obligation of Grid Expansion:<br>Grid operators shall immediately strengthen and expand their grid systems in order to guarantee the purchase of renewable energy electricity. | Not specified by the law |

# Comparison of FIT schemes

| Germany | Japan |
| --- | --- |
| Unbundling of Transmission and Generation is mandatory. | No unbundling. Major power companies are vertically integrated local monopolies. They own large-scale power plants and almost all transmission and distribution grid systems. |

# Grid Connection Issues and Feed-in Management

| Germany | Japan |
| --- | --- |
| Feed-in Management (Output Reduction): When there is a risk of grid bottleneck or grid overload, grid operators are entitled to take output reduction of renewable energy. | When output of major power companies exceeds the demand in each contol zone, they are allowed to set output reduction on renewable electricity up to 30 days a year without compensation to renewable power suppliers. For output reduction, major power companies must reduce their output from fossil fuel energy and pump-up hydropower. They, however, do not need to reduce their output from nuclear energy. (The Ministerial Ordinance of the Law No. 46, Enforcement Regulations of the Law, Section 6) |
| Compensation for Feed-in Management (Output Reduction) : When output reduction was set to avoid grid overload and grid bottleneck, grid operators must compensate renewable power plants for 95% of lost income. If the lost income is more than 1% of annual sales income of renewable energy plants, grid operators must compensate 100% of the lost income (EEG Section 12). | Up to 30 days a year, major power companies can set output reduction of renewable energy electricity without compensation. |

# Japan's Feed in Management (Output Reduction)

- When output of major power companies exceeds the demand in each control zone, they are allowed to set output reduction on renewable electricity up to 30 days a year without compensation to renewable power suppliers.
- For output reduction, major power companies must reduce their output from fossil fuel energy and pump-up hydropower.
- They, however, do not need to reduce their output from nuclear energy.
- Up to 30 days a year, major power companies can set output reduction of renewable energy electricity without compensation.

(The Ministerial Ordinance of the Law No. 46, Enforcement Regulations of the Law, Section 6)

# Germany's Feed-in Management

- When there is a risk of grid bottleneck or grid overload, grid operators are entitled to take output reduction of renewable energy.
- Compensation for Feed-in Management
- When output reduction was set to avoid grid overload and grid bottleneck, grid operators must compensate renewable power plants for 95% of lost income. If the lost income is more than 1% of annual sales income of renewable energy plants, grid operators must compensate 100% of the lost income (EEG Section 12).

# Grid Connection Issues and Feed-in Management

| Germany | Japan |
| --- | --- |
| Grid Data Disclosure and Verification: Concerning output reduction on renewable power plants, grid operators must disclose grid data that they fed-in renewable electricity as much as possible. Numerical grid data is required. | Evidence for the necessity of feed-in reduction must be shown by 'documents'. Not specified by the law |
| Grid Data Disclosure: Grid operators shall disclose grid data on wind feed-in (both forecast and actual) on an hourly basis. Grid operators voluntarily disclose wind feed-in (both forecast and actual), solar feed-in (both forecast and actual) at 15 minute-intervals on thier website. | 規定なし Not specified by the law |

# Why Detail Grid Data is Necessary?

## Transparency of grid feed-in is important

- Every 15 minute grid data is important that RES power producers can check whether the maximum amount of RES electricity is fed-in.

  Wind Feed-in

  Solar Feed-in

  Power Load

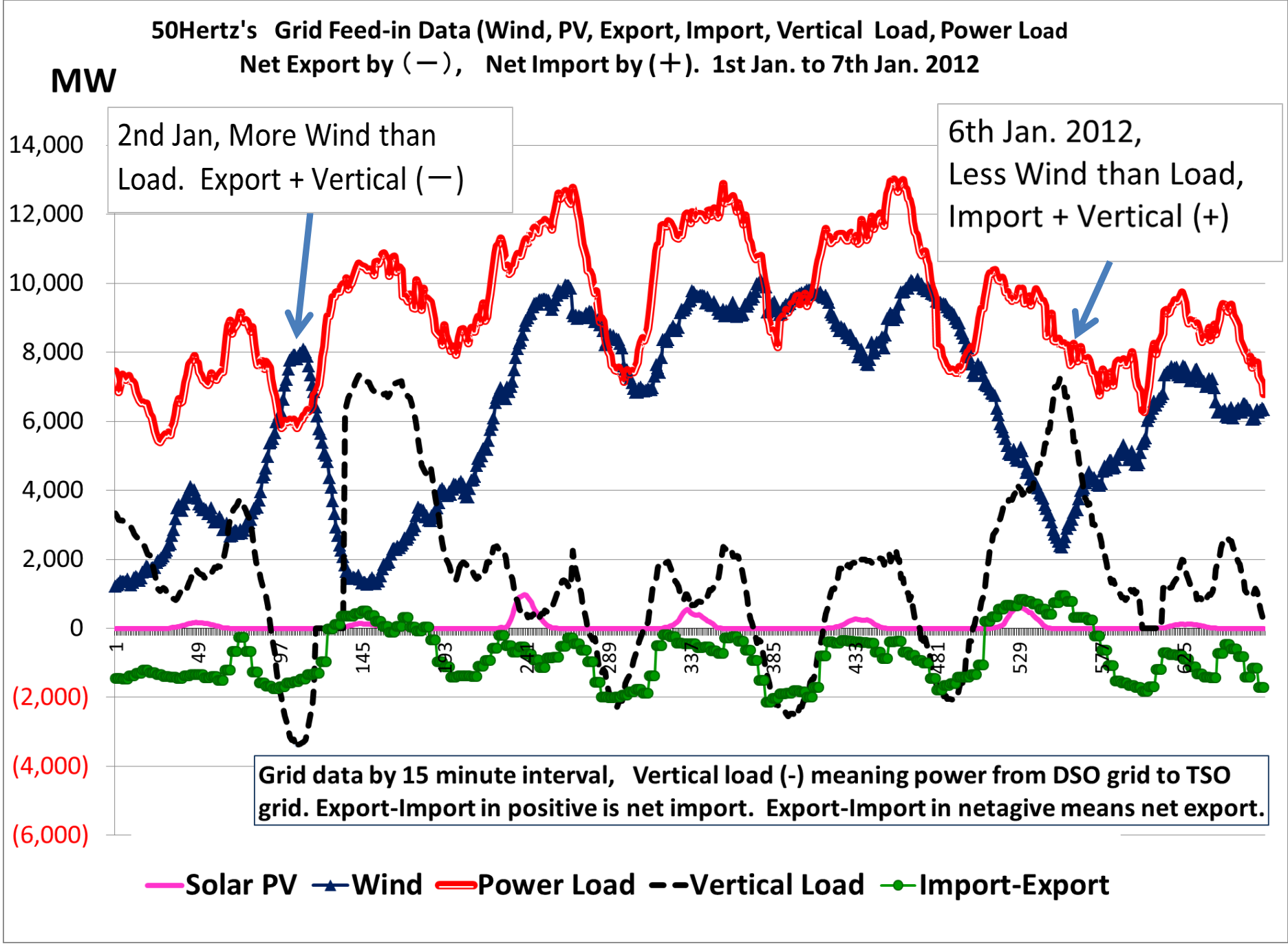
  Vertical Load

# Germany

- Grid operators must verify that they feed-in the maximum amount of RES electricity by numerical grid data. (EEG, EnWG)
- 4 German TSOs have to verify that they accept the maximum amount of solar and wind energy to the grid.
- By numerical grid data, they have to verify that their feed-in management is reasonable and appropriate.
- 50 Hertz (very windy, less population) shows huge efforts to maintain the transmission grid with more wind energy than the demand in its zone.

  max load in 50 Hertz zone : around 13GW,

  max wind feed-in: around 11GW in 2011)




Source: Takehama (2012)

# Japan

- Wind energy 0.4% , Photovoltaic electricity 0.3% in the total electricity consumption
- Japan's FIT scheme has set the feed-in management (output reduction) on RES-E, **without disclosure of detail grid data**.
- Renewable energy power producers cannot check whether feed-in management is appropriate and reasonable.
- Major power companies do not like to accept large amount of wind energy, especially in Hokkaido (north island ).
- **Hokkaido Power Company set a lottery for grid connection of wind farms.**

# Sub conclusion

- Japan's FIT scheme for renewables has a number of weaknesses:

- No priority access
- No obligation of grid expansion
- No unbundling
- Feed-in management without compensation up to 30 days
- Limited grid-data disclosure on wind feed-in and solar feed-in

# Conclusions

- **Germany:** Households pay **14%** of electricity charge for **EEG Feed-in Tariffs (2012, estimated).**
- **Japan**: TEPCO consumers pay **12%** of electricity charge for **Nuclear Energy.**
- **Japan's FIT cost is much smaller than the cost of nuclear energy in the electricity price.**
- Japan's FIT scheme for renewables has a number of structural weaknesses.
- The current FIT scheme is highly determined by the existing grid structure.
- **Lack of unbundling** has an especially serious negative impact on the **effectiveness of the FIT scheme**.
- The Japanese government's favoring of nuclear power is hurting the development of renewable energy.

- Thank you

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Schloss Leopoldskron, Salzburg

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