



自然エネルギー財団

JAPAN RENEWABLE ENERGY FOUNDATION

Paradigm Shift in Energy

September 12, 2011

Masayoshi Son

Founder

Japan Renewable Energy Foundation

The First Case

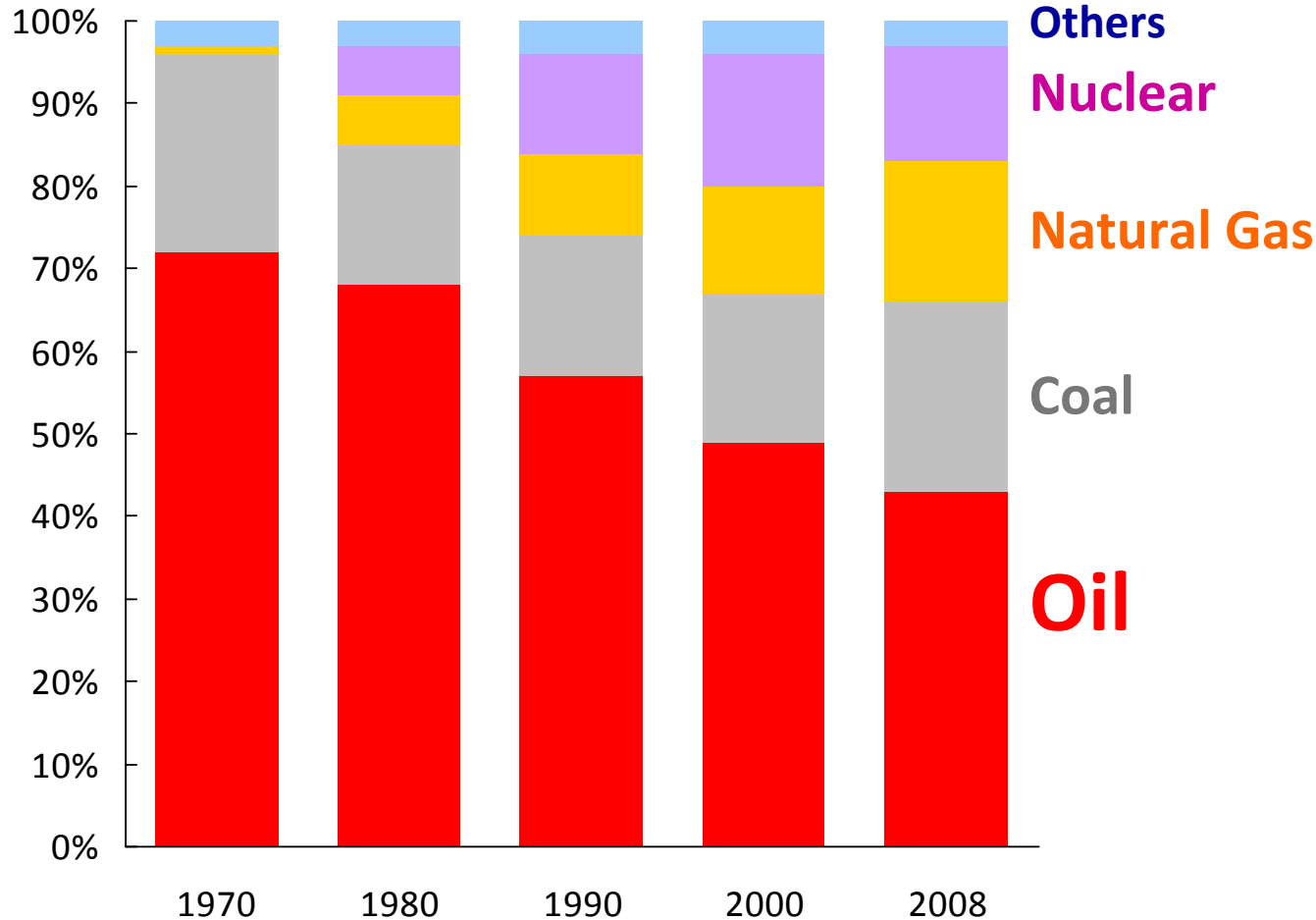
(approx. 40 years ago)

**in 1973
Oil Crisis**



**Moved away from
Oil Dependency**

Energy Source in Japan



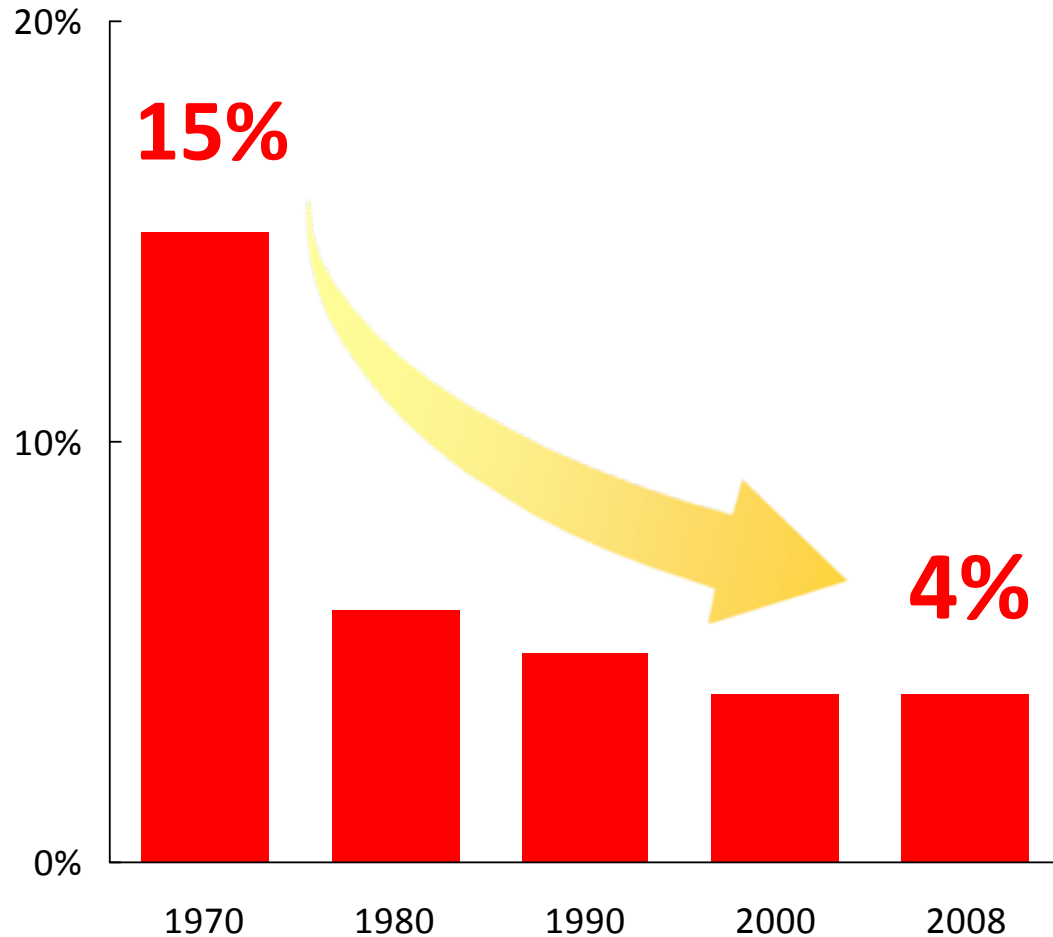
Oil Dependency

40% Down



**Led to
Paradigm Shift
in Energy**

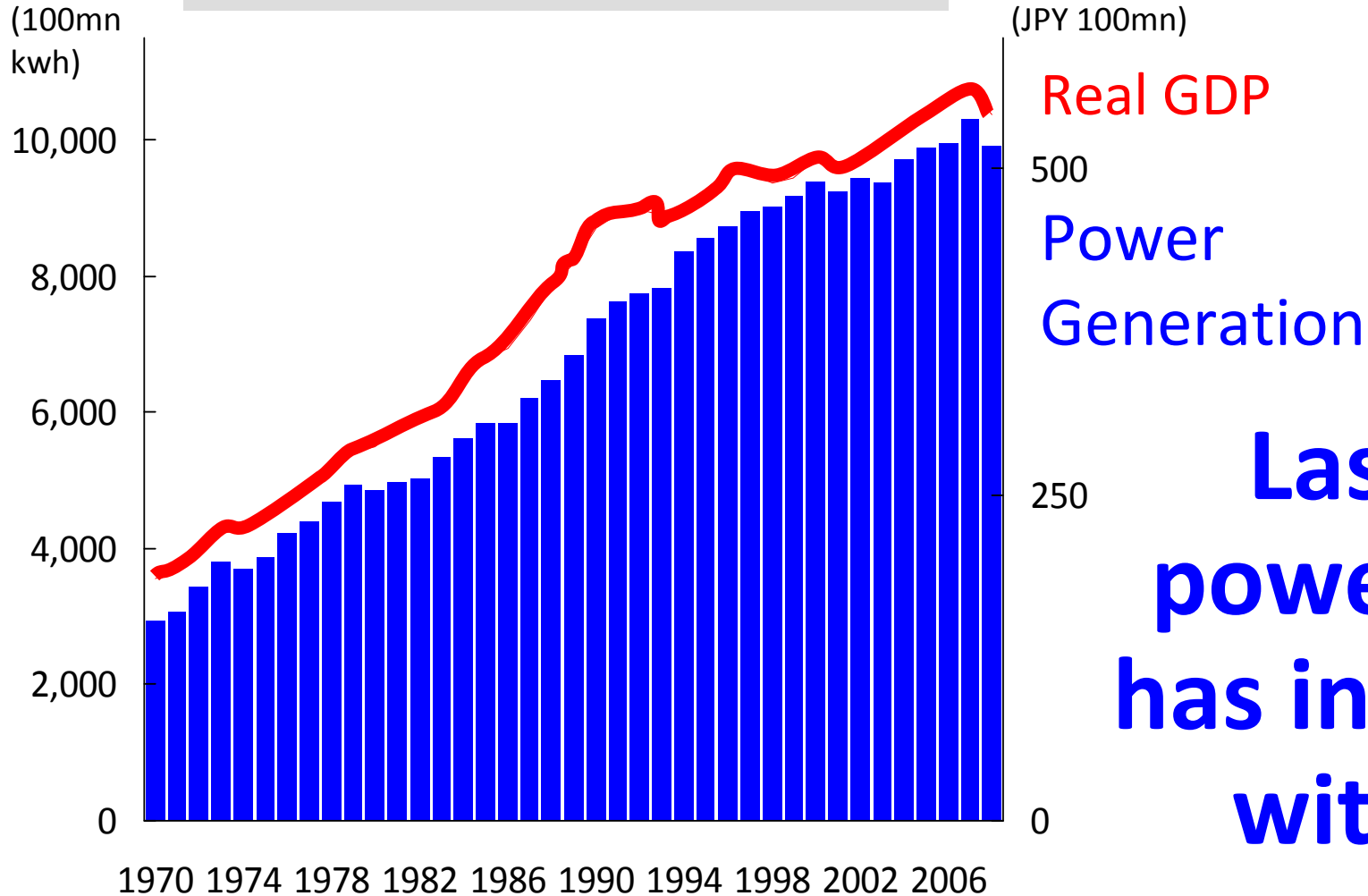
Energy Self Sufficiency %



Remaining Issue

**Stable Supply
of Energies**
(Improvement in Self
Sufficiency)

GDP & Power Generation



**Last 40 years,
power generation
has increased along
with economy**

Traditional Electricity Business

Full Cost Pricing
Regional Monopoly



**Contributed to
Development of
Electricity Infrastructure**



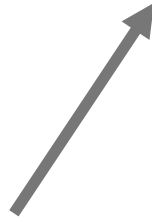
Disadvantage of Traditional Electricity Business

Full Cost Pricing



Expensive Electricity

Regional Monopoly



**Inflexible Electricity
Interconnection**



Need Overhaul

Japan's Energy Policy Development

1997 **Kyoto Protocol (COP3)**

2002

Basic Act on Energy Policy enacted



2003 **Strategic Energy Plan of Japan**

2007 **Strategic Energy Plan of Japan (1st Revision)**

2010 **Strategic Energy Plan of Japan (2nd Revision)**

(2030: **53% Nuclear Share** in Electricity Generation)

**2011
Great East Japan Disaster
& Nuclear Accident**



**Calling for
2nd Paradigm Shift**

Direction for 2030

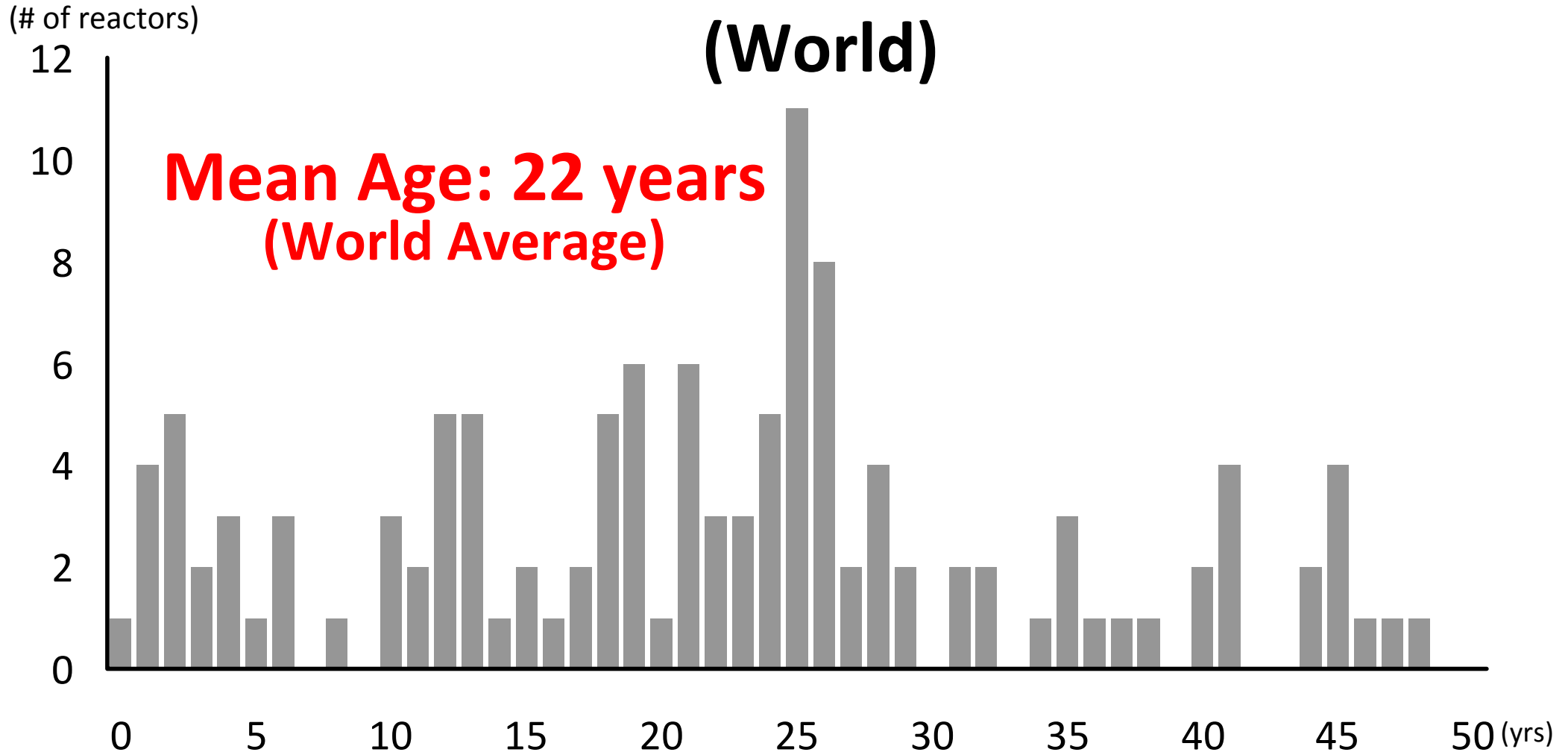
Prime Minister Yoshihiko Noda said

“Building new reactors will be next to impossible.”

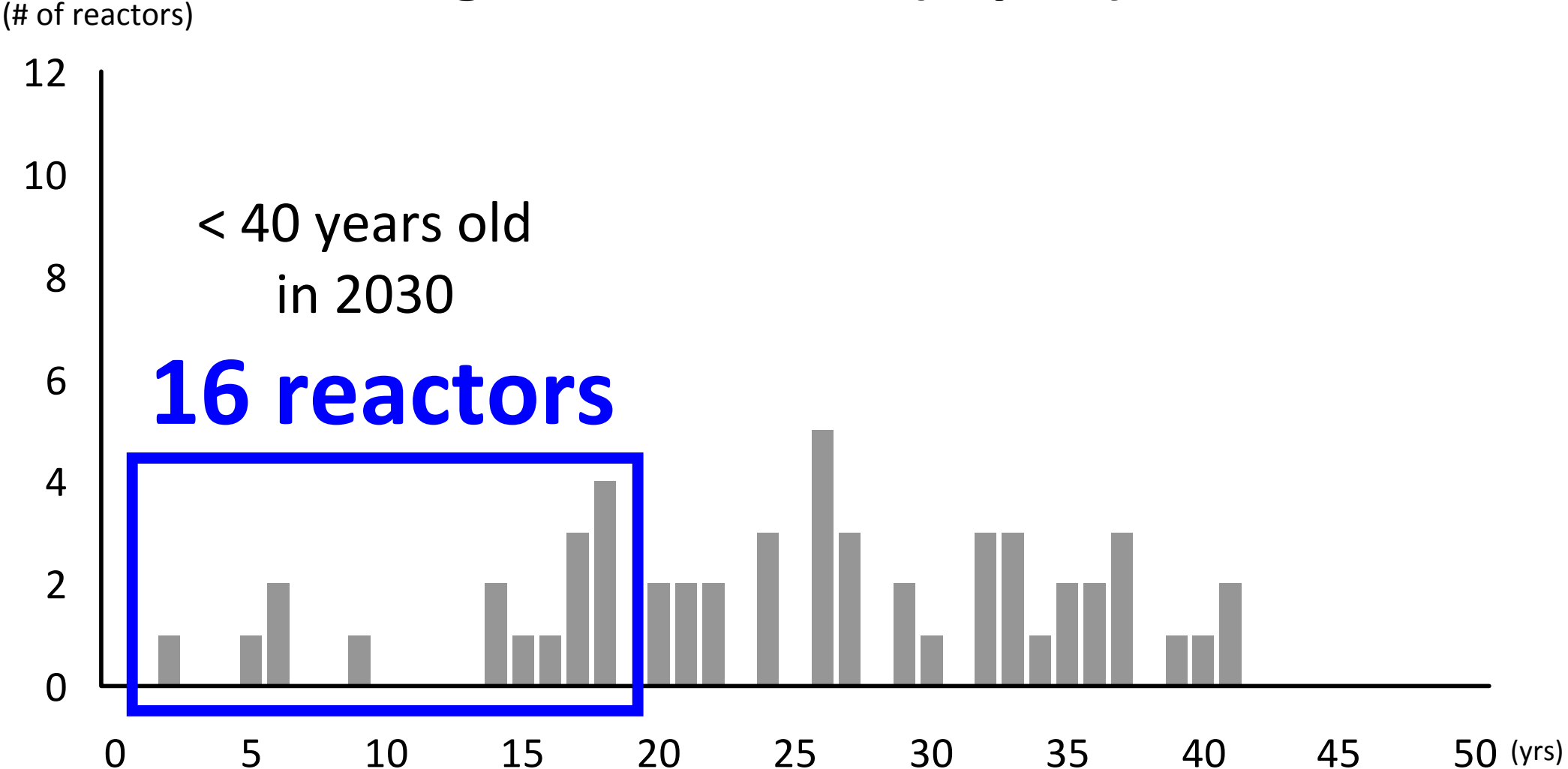
“Reactors will be decommissioned upon reaching the end of their lifetime.”



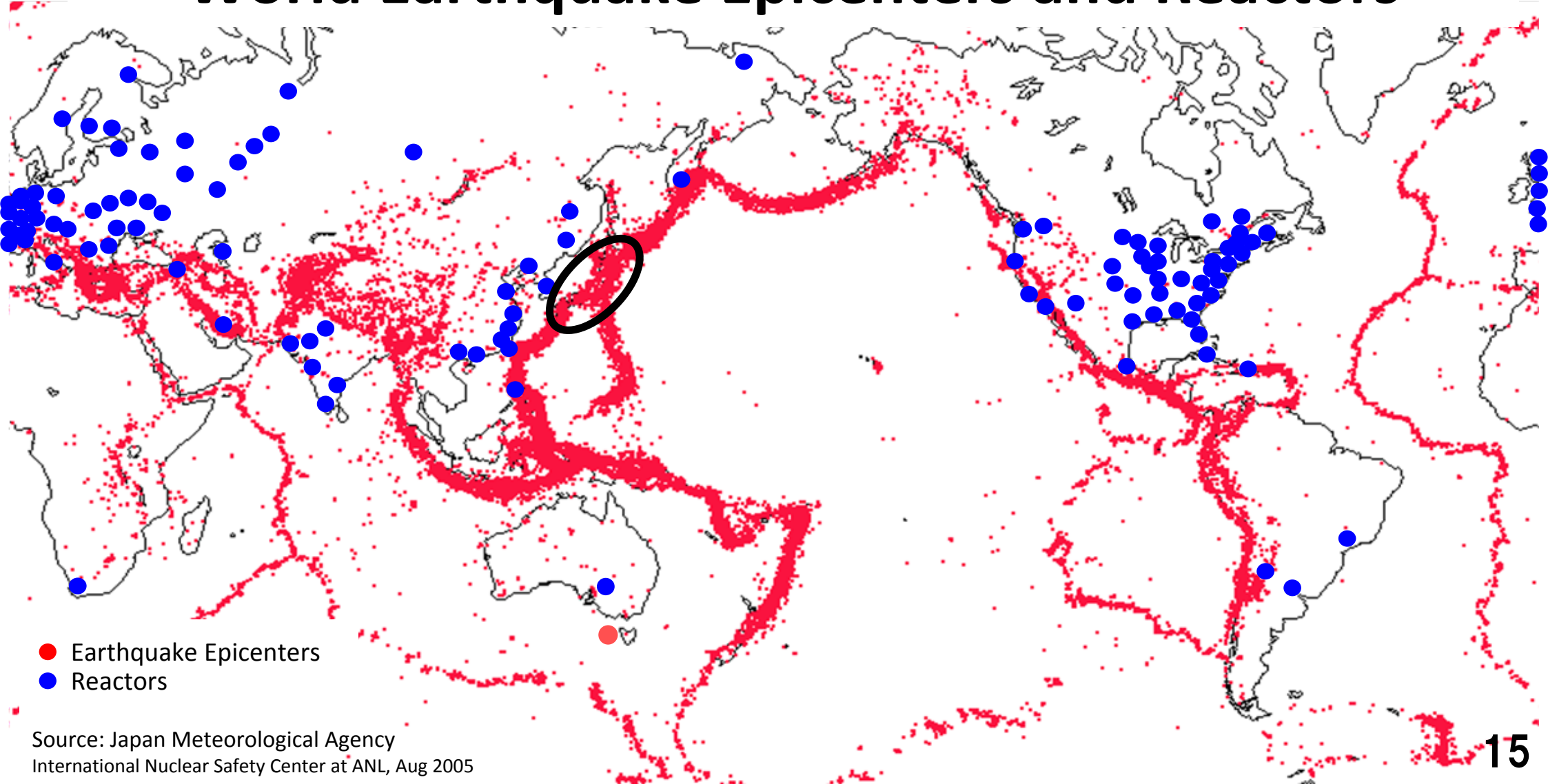
Age Distribution of Shutdown Reactors (World)



Age of Reactors (Japan)

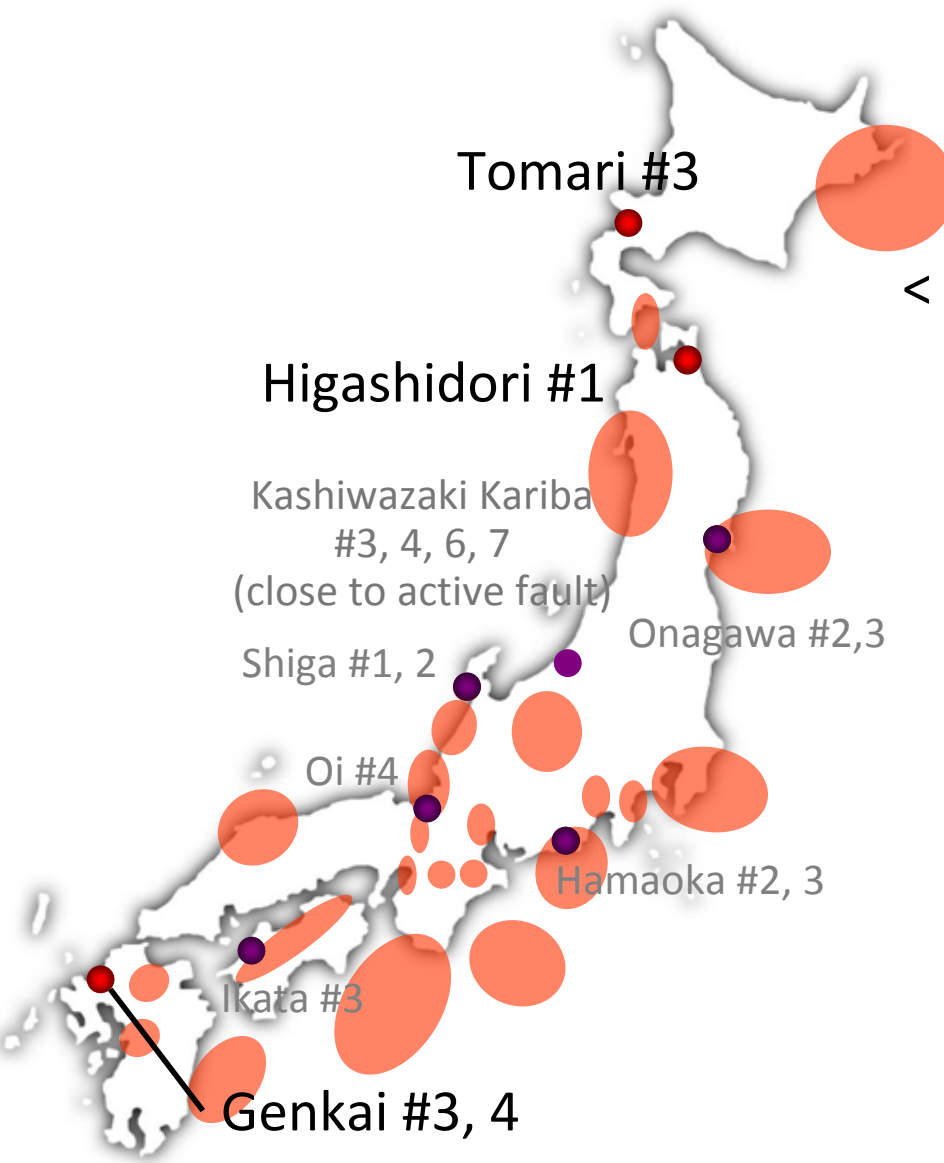


World Earthquake Epicenters and Reactors



- Earthquake Epicenters
- Reactors

Source: Japan Meteorological Agency
International Nuclear Safety Center at ANL, Aug 2005



< 40 years old
in 2030

Earthquake
Risk

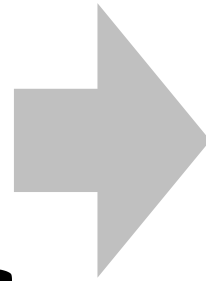
$$16 - 12? = 4?$$

- Reactors of <40 years old in 2030
- Earthquake High Risk Zone

Direction for 2030 (2)

Today

**Freeze
Development
of New Reactors**

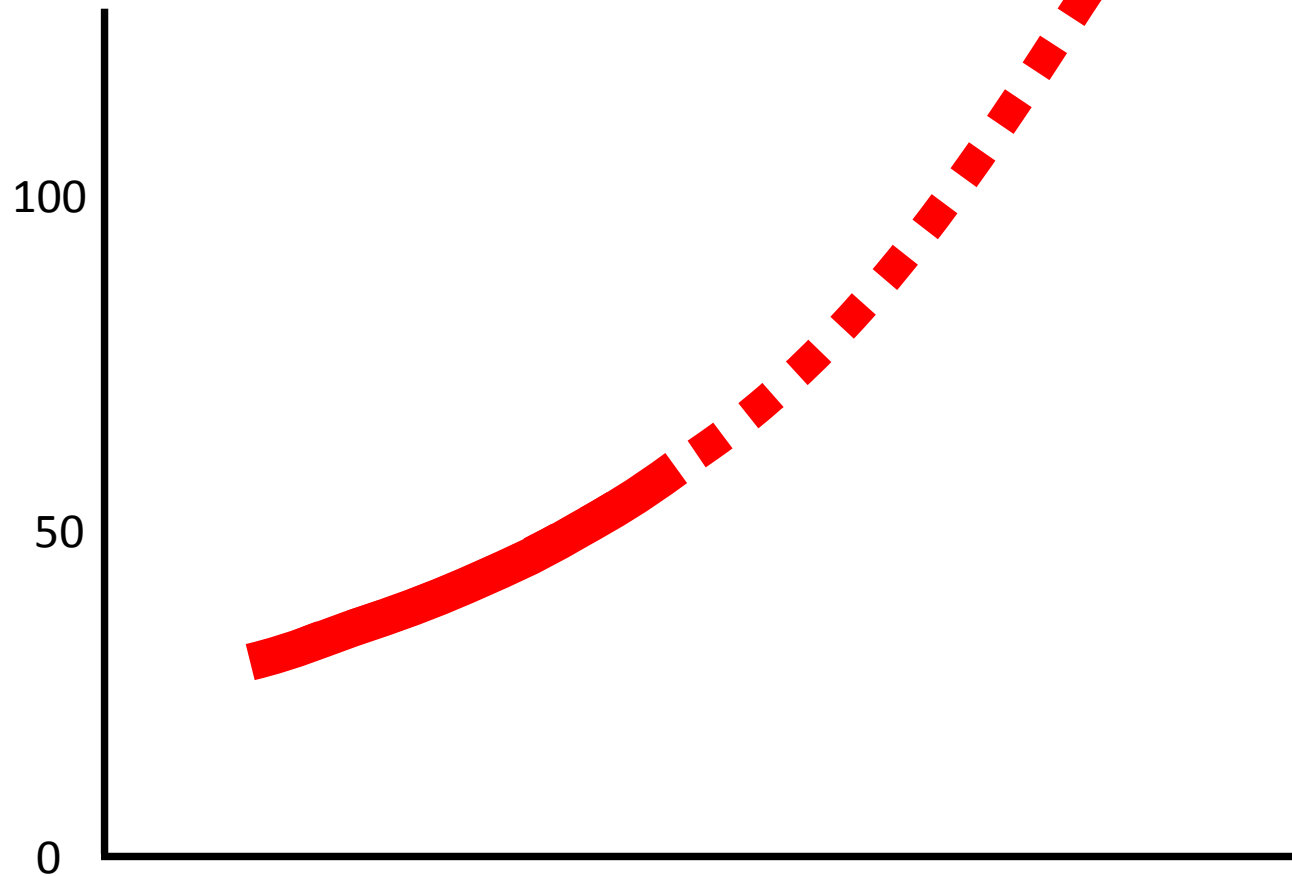


2030

**Minimize
Dependency
on Nuclear**

Crude Oil Price Trend & Outlook

\$/Barrel



Price Increase of fossil fuel



Source: "World Energy Outlook 2010"
Outlook after 2010 is based on IEA's forecast.

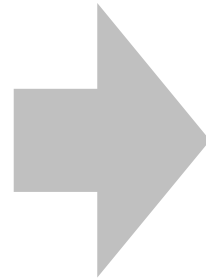
Direction for 2030 (2)

Today

2030

**Fossil Fuel
Price Surge**

Decrease CO2



**Lower
Dependency
on fossil fuel**

Countries with Feed in Tariff System



Germany



France



Italy



UK



Spain



Switzerland



Austria



Norway



Serbia



Turkey



South Africa



Canada



Australia



China



South Korea



Indonesia



Mongolia



Macedonia



Argentine



Portugal



Bulgaria



Czech



Greece



Hungary



Slovakia



Pakistan



Nicaragua



Cyprus



Ireland



Israel



Slovenia



Estonia



Lithuania



Sri Lanka



Albania



Uganda



Denmark



Netherland



Kenya



Algeria



Croatia



Ukraine



India



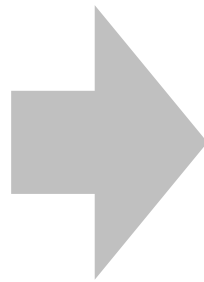
Japan

and others.

Direction for 2030 (3)

Today

**Enactment of
Renewable
Energy Bill**



2030

**Wide
Deployment of
Renewable Energies**

Direction for 2030

- (1) Minimum Dependency on Nuclear**
- (2) Lower Dependency on fossil fuel**
- (3) Wide Deployment of Renewable**

Entering into Renewable Energy Era

2030

New Energy Vision

Proposal for New Energy Policy 2030



Wide Deployment of Renewable Energy

Keys for Wide Deployment of Renewable



**Tariff &
Buying Period**



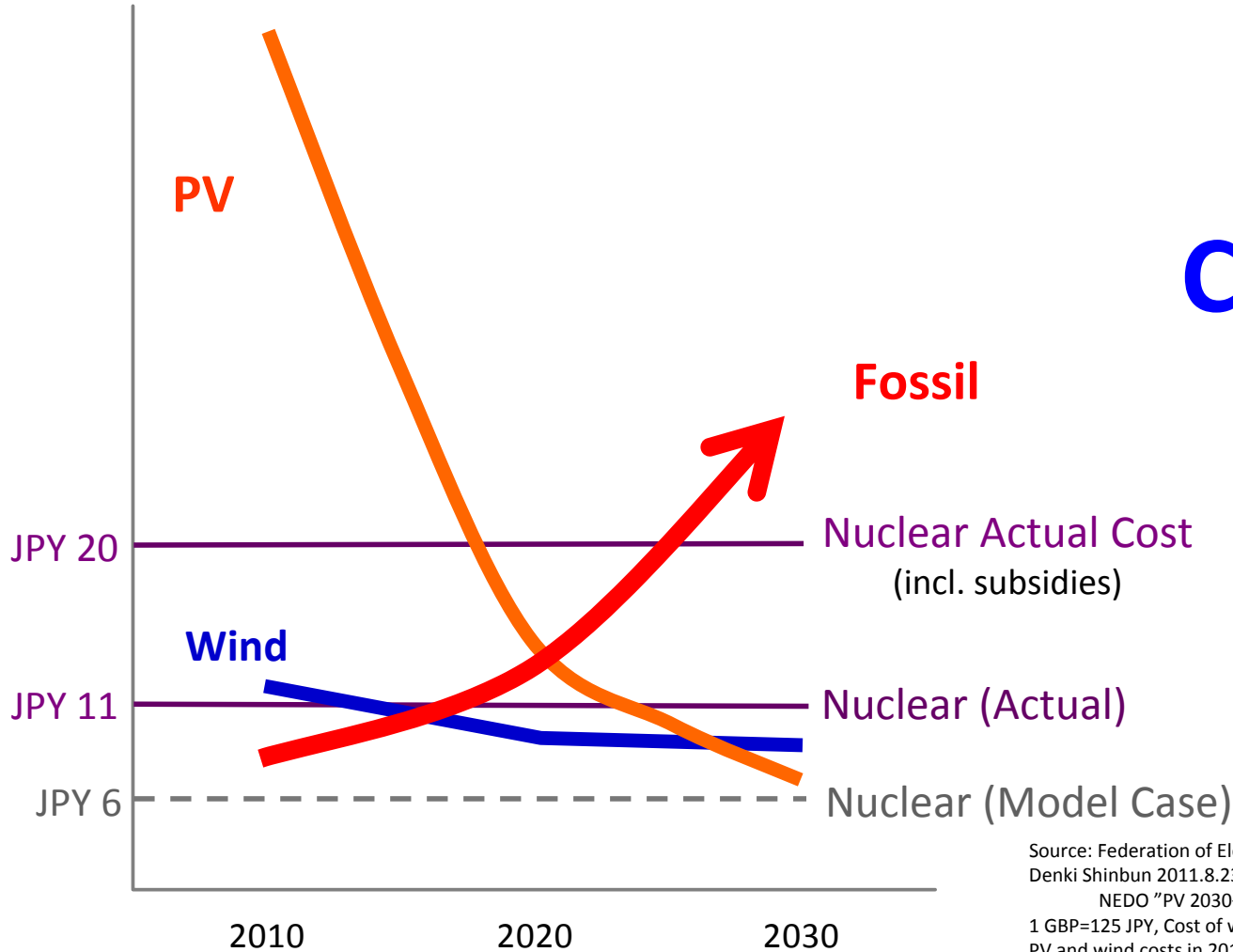
**Obligation
to Connect Grid**



**Deregulation
on Land Use**

Generation Cost (Image)

(yen/kWh)



Wide Deployment of Renewable Improve Price Competitiveness



Exporting Renewable

Source: Federation of Electric Power Companies, Kenichi Oshima-"Politico Economic Science of Renewable Energy",
Denki Shinbun 2011.8.23

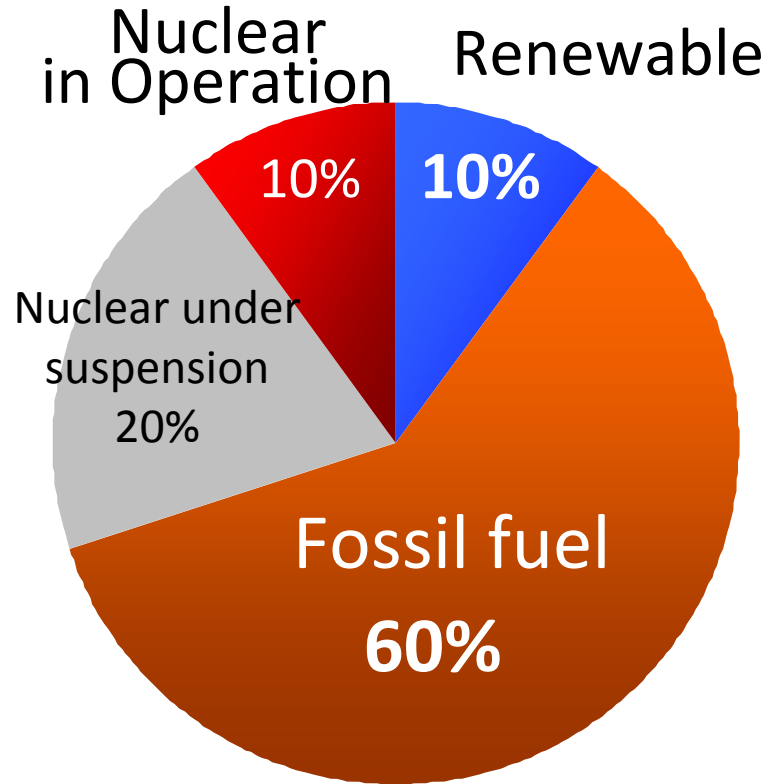
NEDO "PV 2030+", Committee of Climate Change "The Renewable Energy Review"

1 GBP=125 JPY, Cost of wind is based on the estimates of the cost of onshore wind.

PV and wind costs in 2010 are based on 2010 Annual Report on Energy ("Energy White Paper 2010")

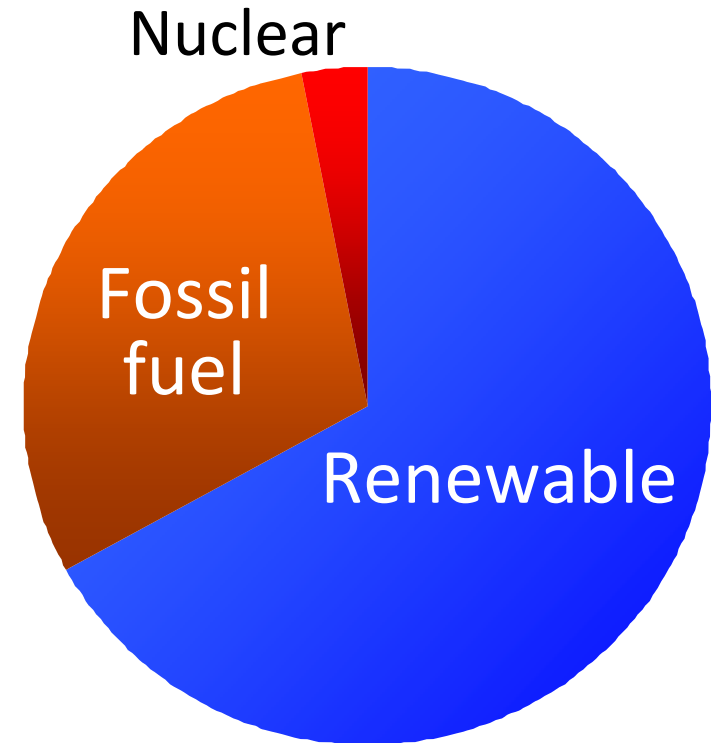
PV and wind costs after 2010 are based on "The Renewable Energy Review"

Today



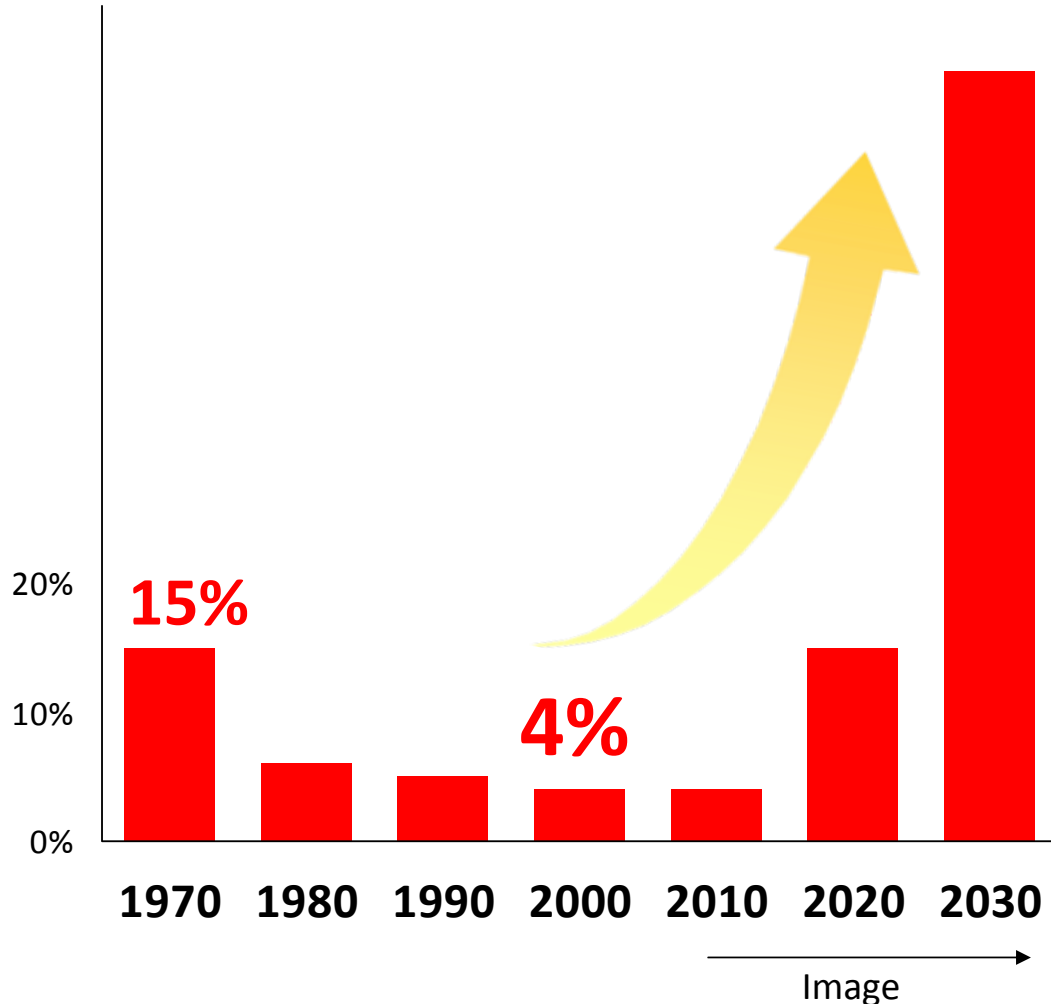
2030

(Image)



Need Goal Setting for Renewable

Energy Self Sufficiency %



**Wide Deployment of
Renewable**



**Increase Energy
Sufficiency**

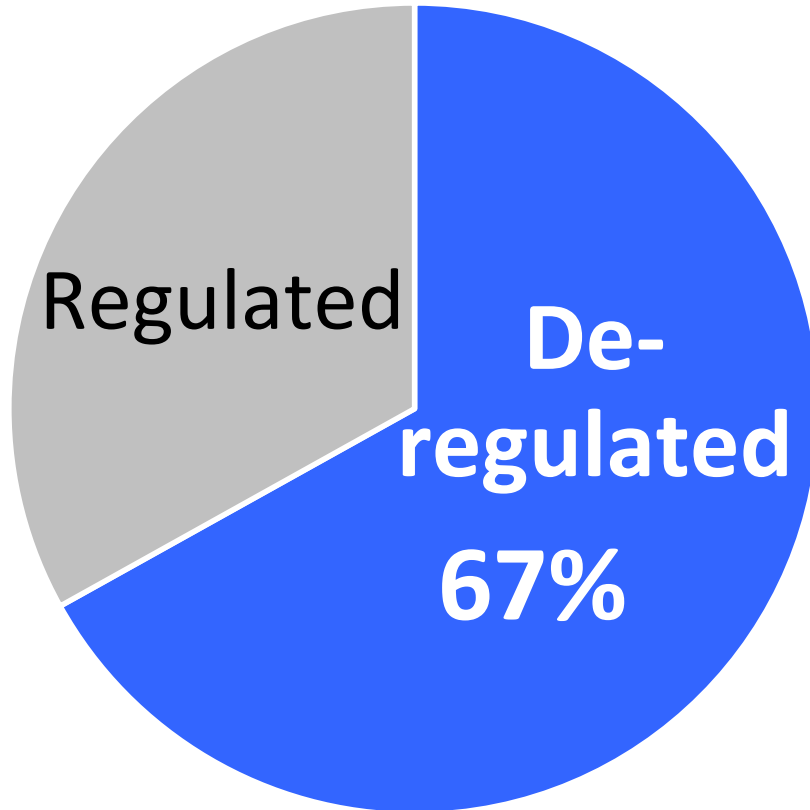
(National Security Strategy)

Proposal for New Energy Policy 2030

2

Vitalization of Electricity market

Total Electricity Demand 1t kWh

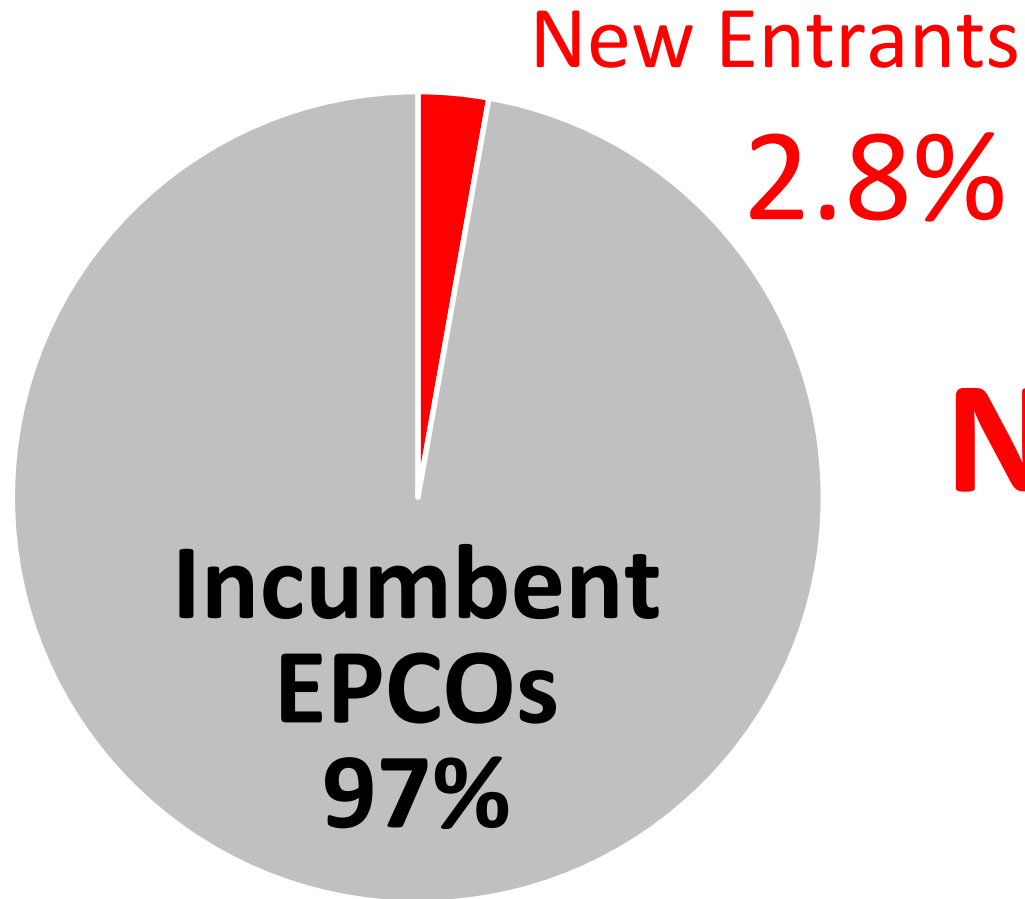


Deregulation in
2000 Ultra High Voltage
2004 Part of High Voltage
2005 All High Voltage



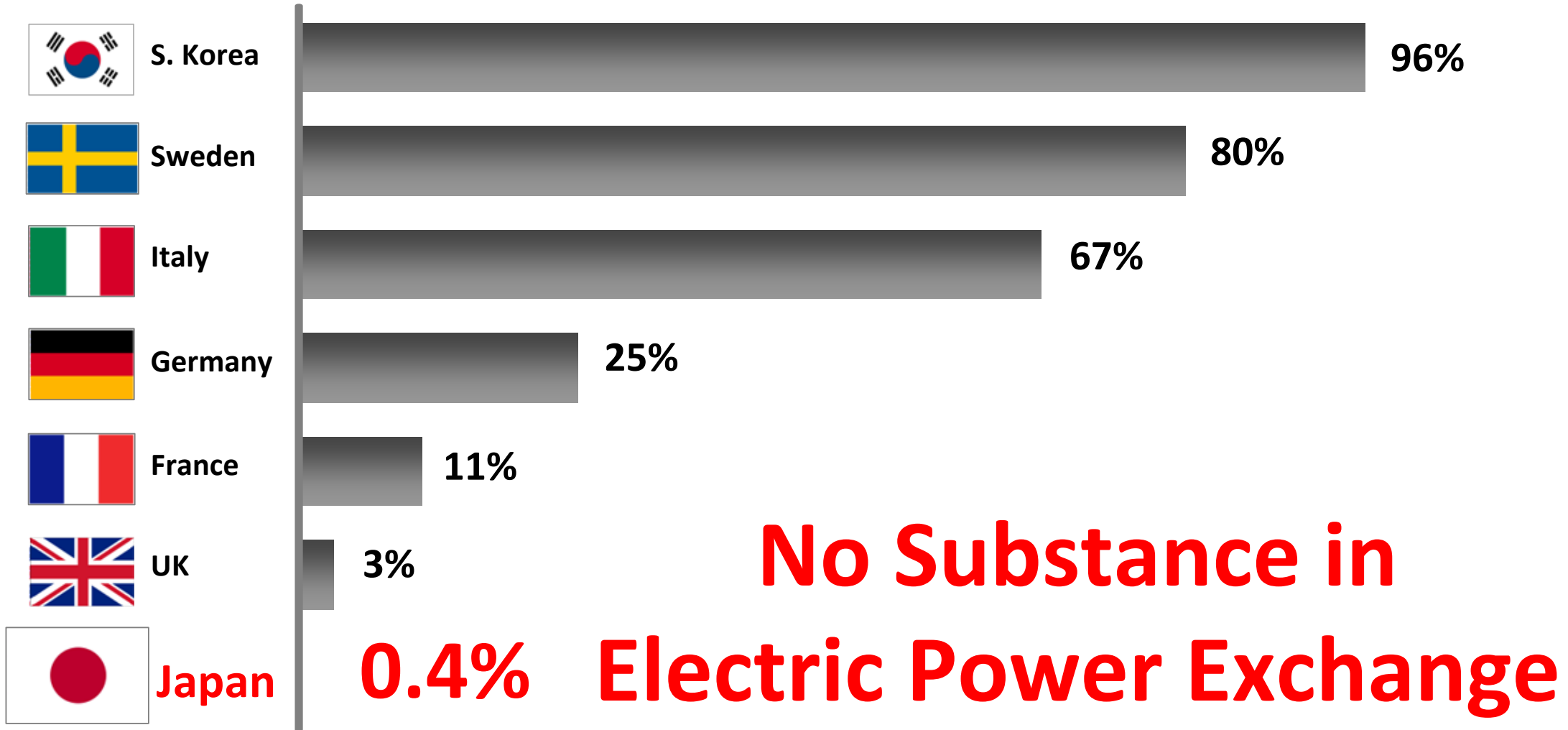
**2/3 has
deregulated
(to Competition Market)**

Power Company Share in Deregulated Market



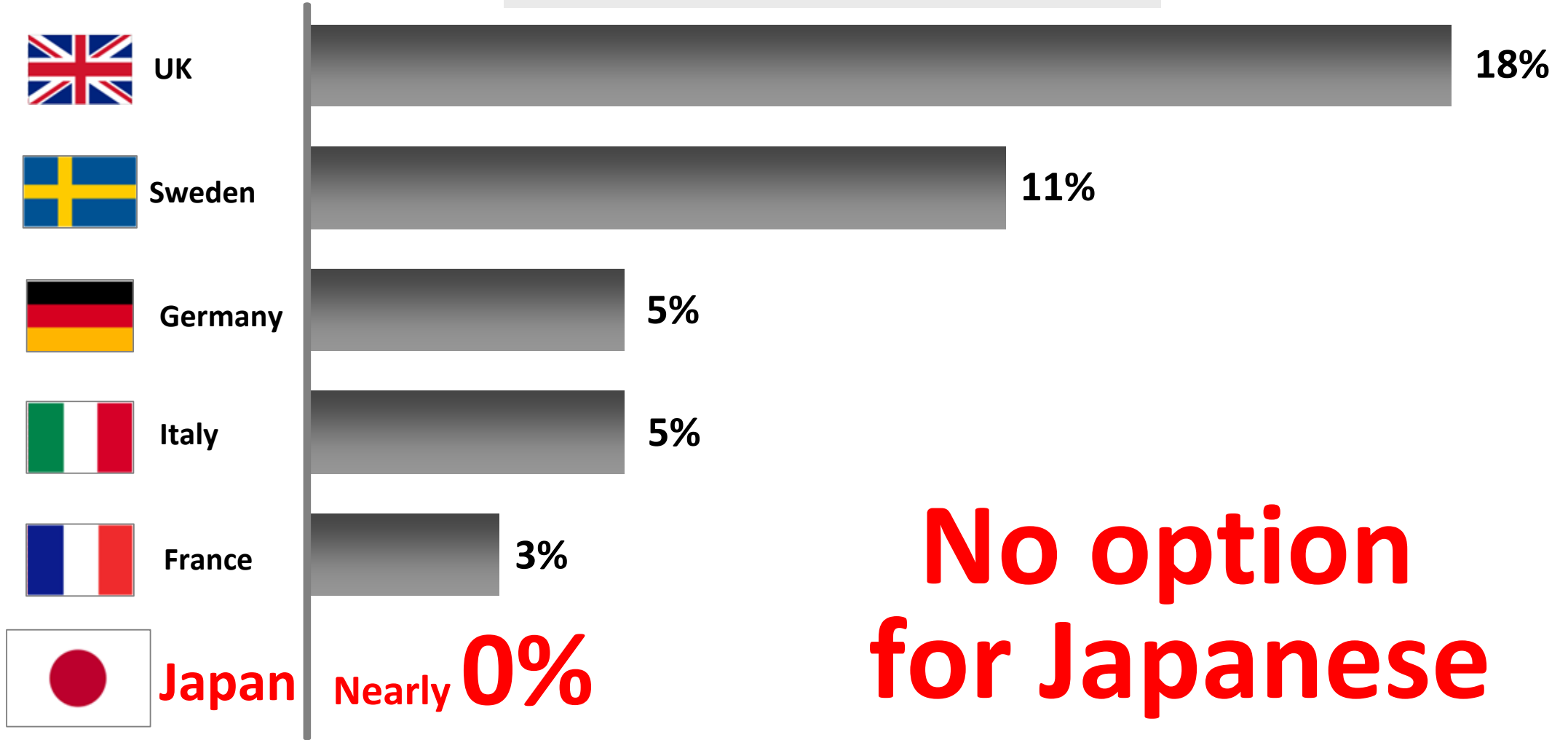
**No Competition
in Reality
(Oligopoly)**

% of Transaction Volume at Electric Power Exchange



*Source: EC, "2009-2010 Report on Progress in Creating the International Gas and Electricity Market, Technical Annex
Volume of spot transaction for those other than South Korea and Japan

Annual Switching Ratio (2009)



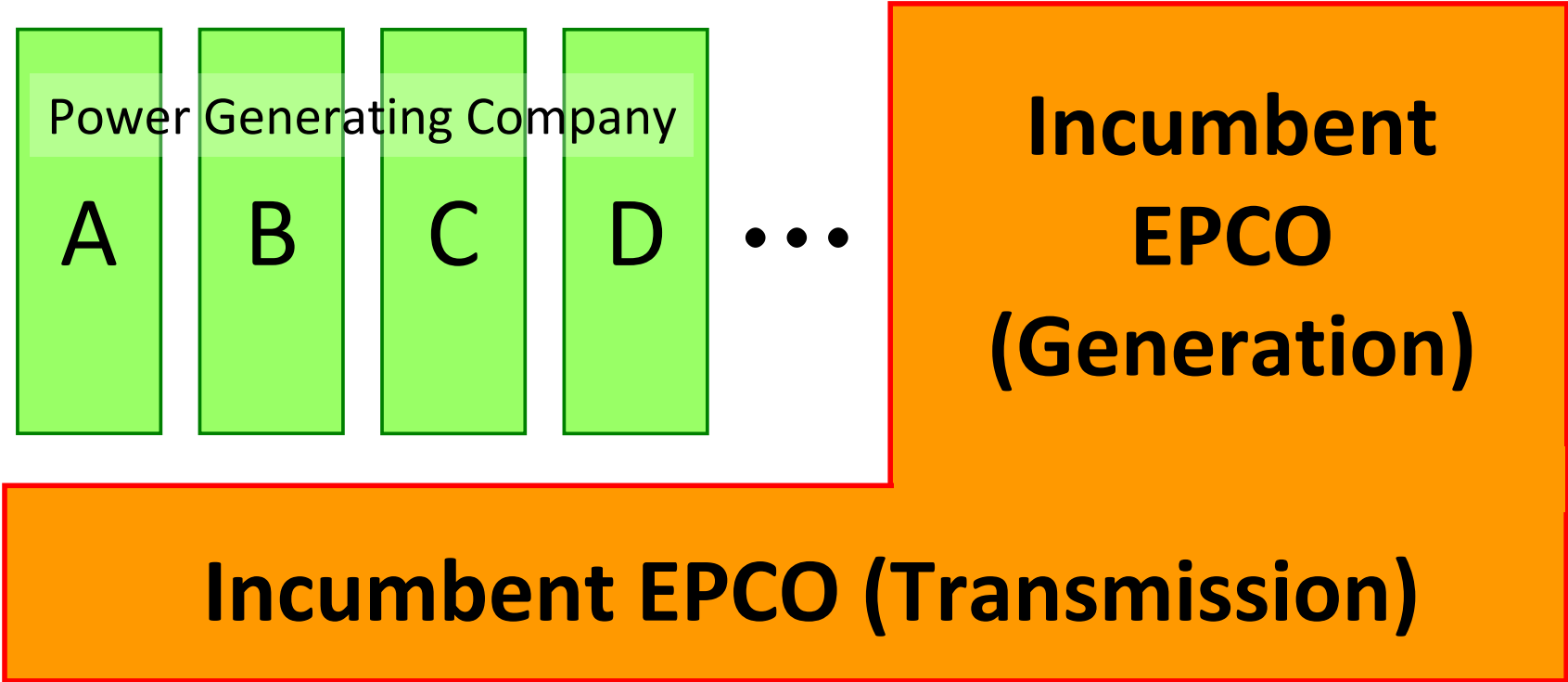
**No option
for Japanese**

*Source: EC, "2009-2010 Report on Progress in Creating the International Gas and Electricity Market, Technical Annex
Figures are the total market of each country, except for UK (figures of small size business and households.
PPS sales ratio among high voltage power demand is only 2.8% in Japan.

Reason for Little Activities in Electric Power Market

**Expensive
Transmission Tariff**

Reason for Expensive Transmission Tariff



Need for an Independent Grid

Solution

Separation of
Generation &
Transmission

or

Reasonable
Transmission
Tariff

(Transparent and Fair)

Need Discussion in Legislative Process

Countries with Separate System (generation & transmission)



Sweden



Germany



UK



Spain



Canada



US



China



India



Finland



Denmark



Italy



France



South Korea



Austria



Belgium



Greece



Ireland



Czech



Hungary



Poland



Portugal



Slovakia



Slovenia

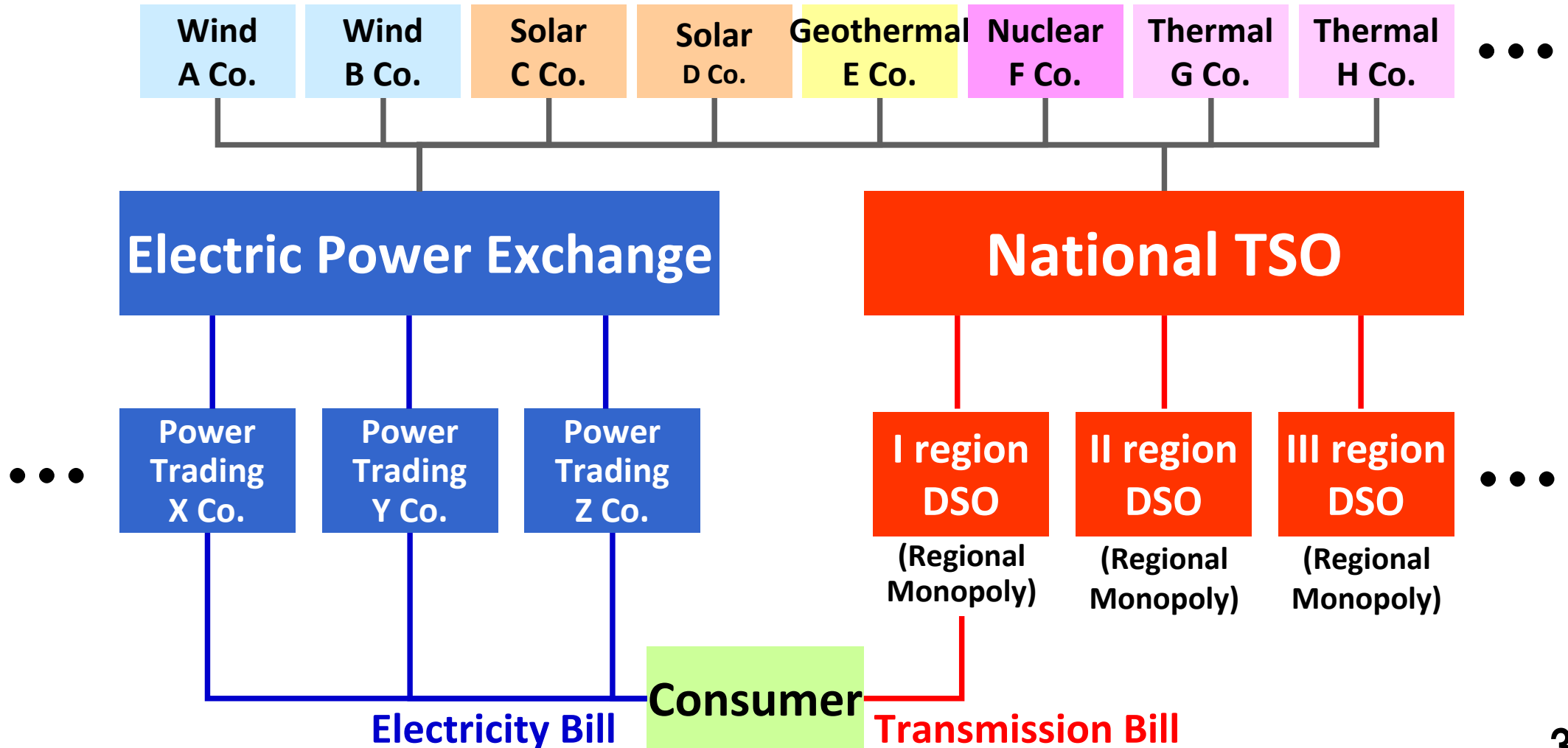


Netherland
and others

*Situation in Canada and US depends on the state.



Electricity Market in Sweden (Image)

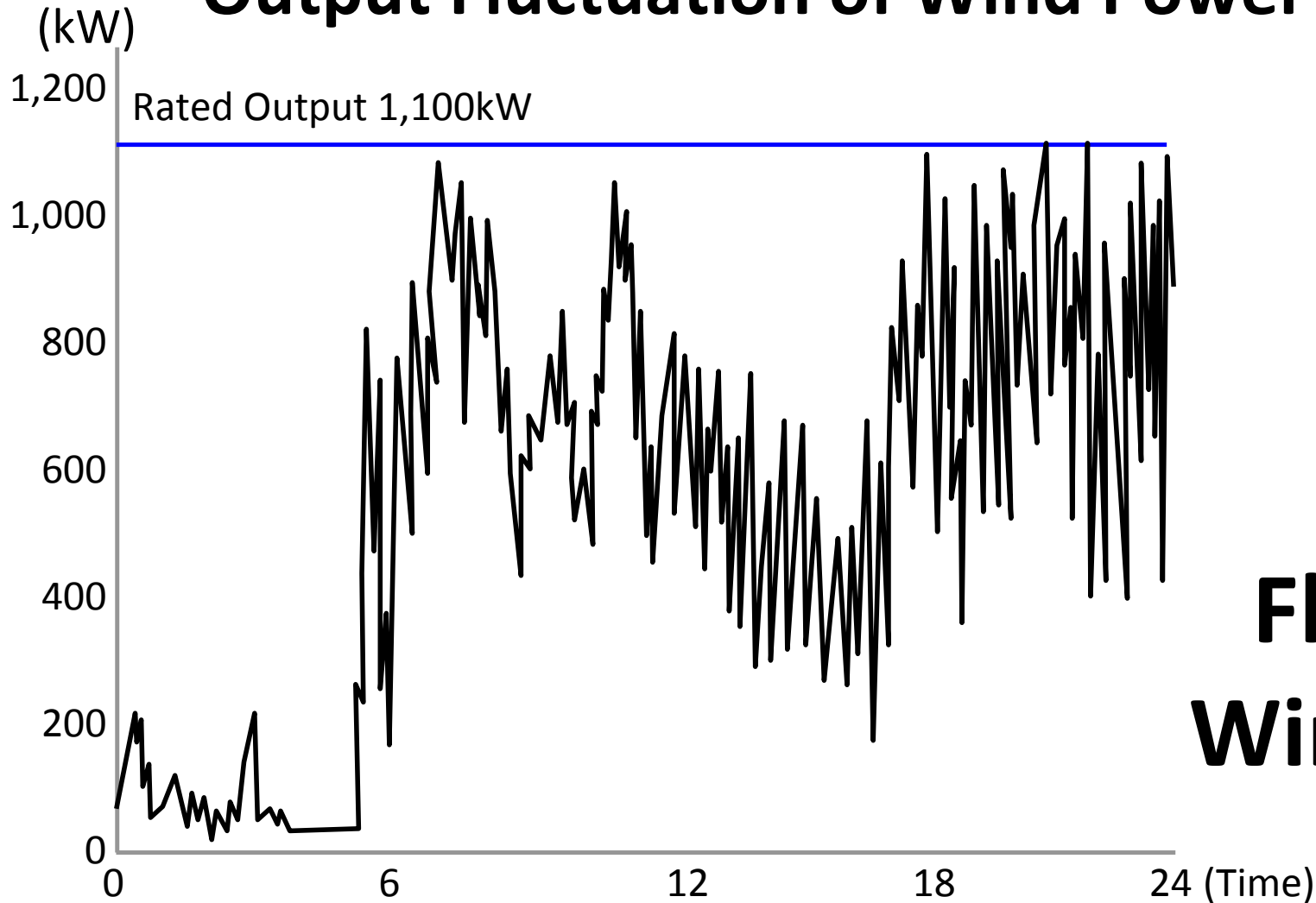


Proposal for New Energy Policy 2030

3

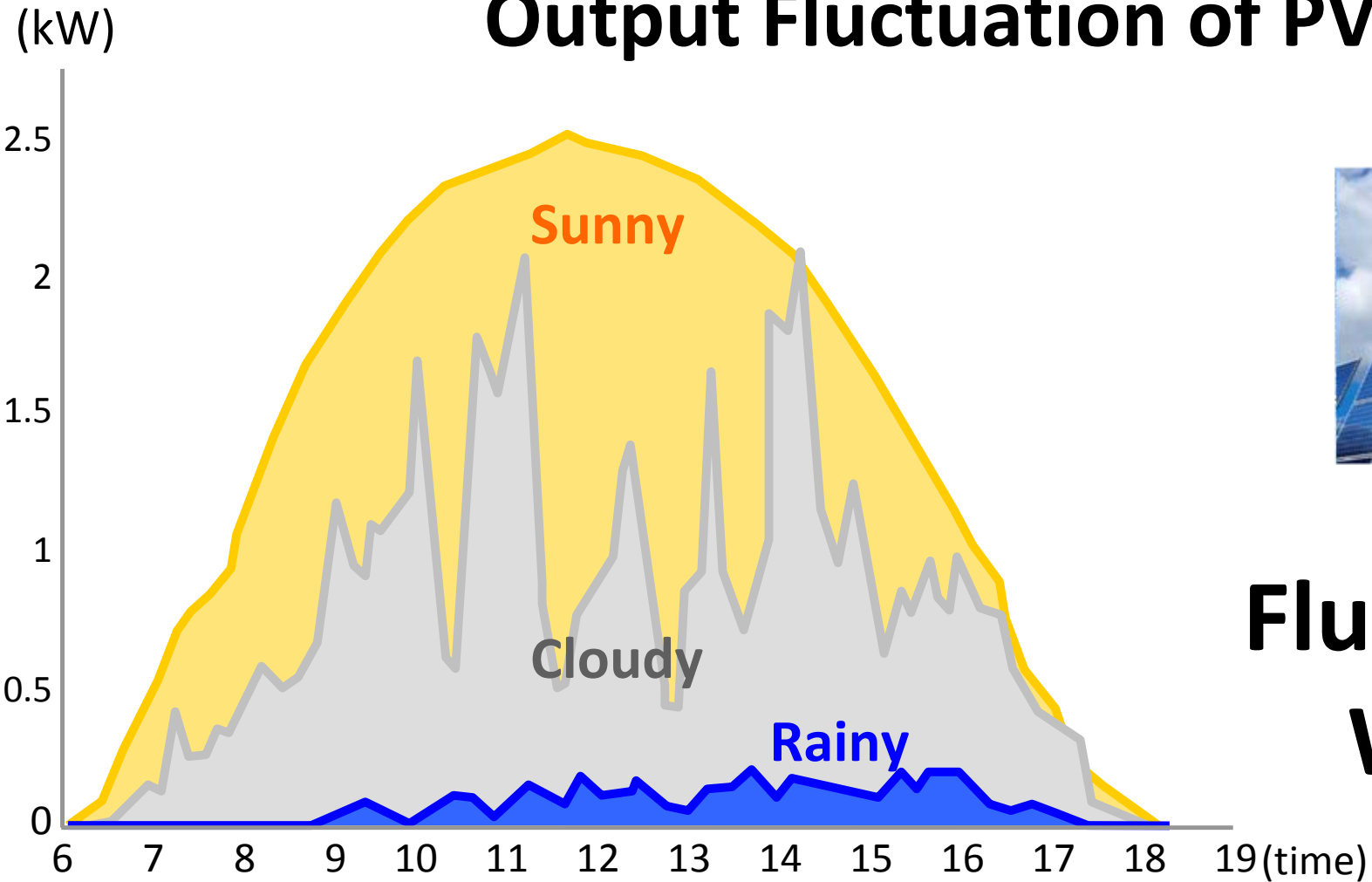
Enhancement of Transmission Infrastructure

Output Fluctuation of Wind Power Generation



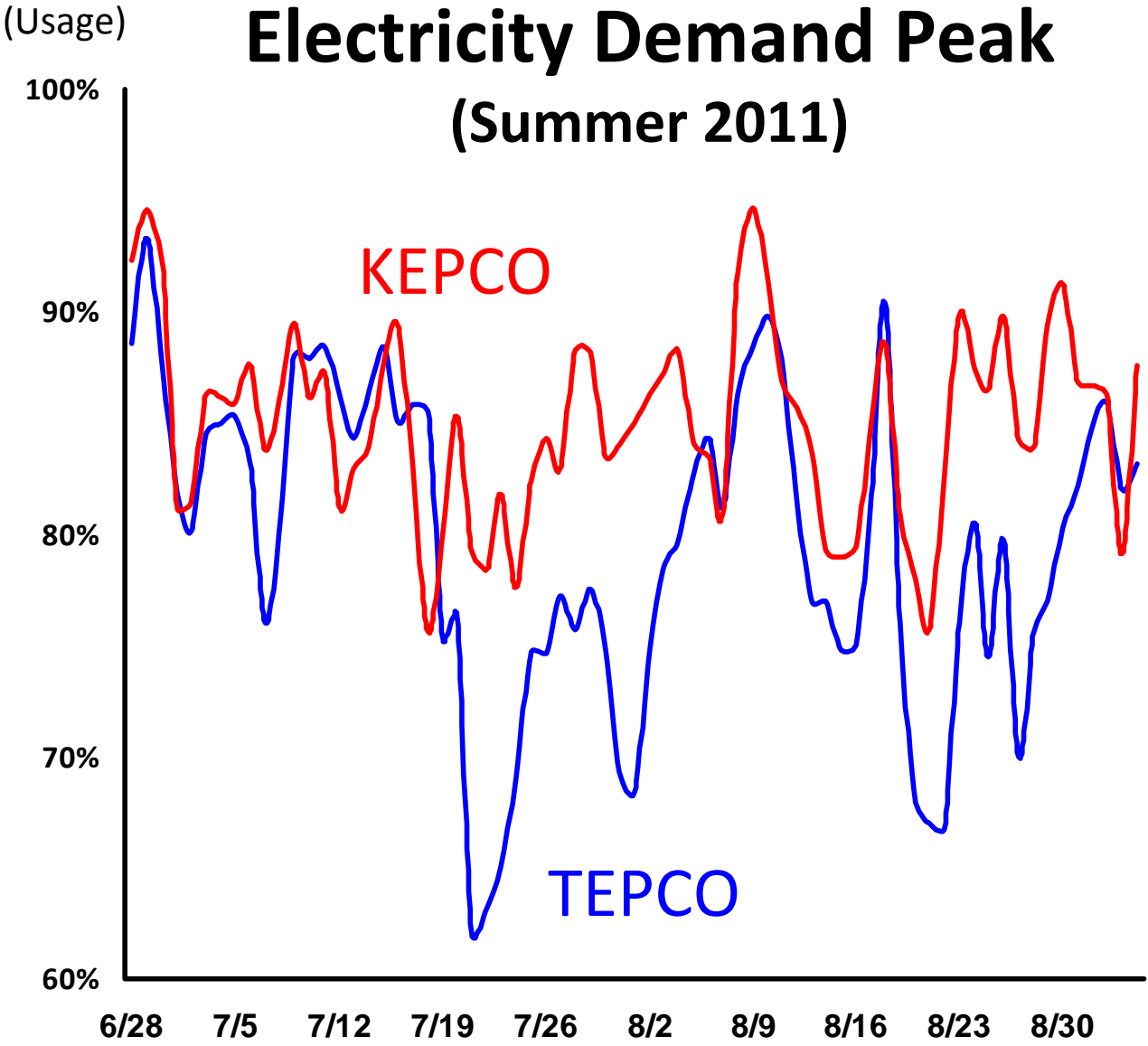
**Fluctuated by
Wind Conditions**

Output Fluctuation of PV



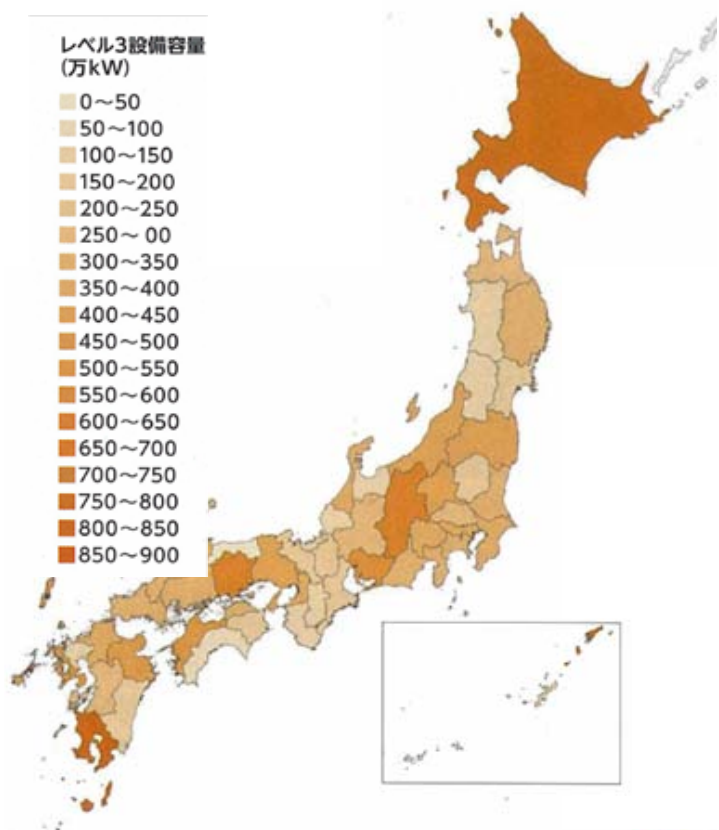
**Fluctuated by
Weather**

Electricity Demand Peak (Summer 2011)

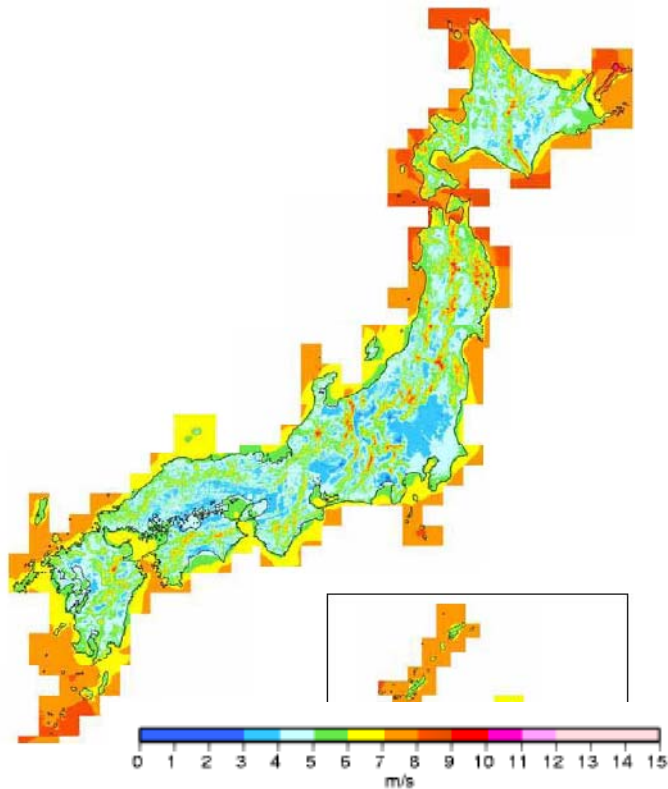


**Limitation of
Regional
Monopolies
(50Hz/60Hz)**

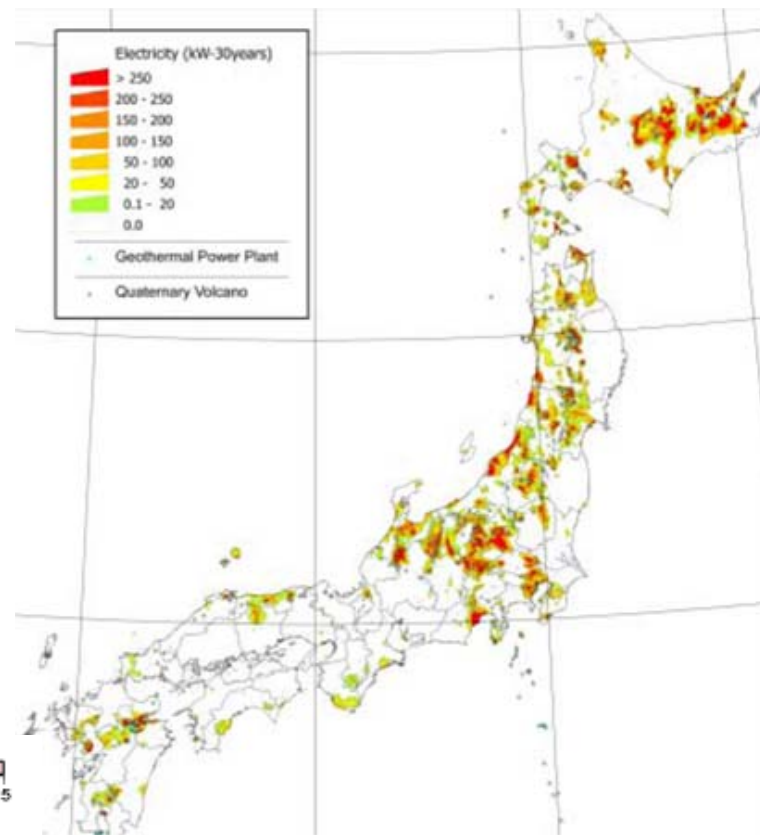
Renewable Energy Potential



PV



Wind



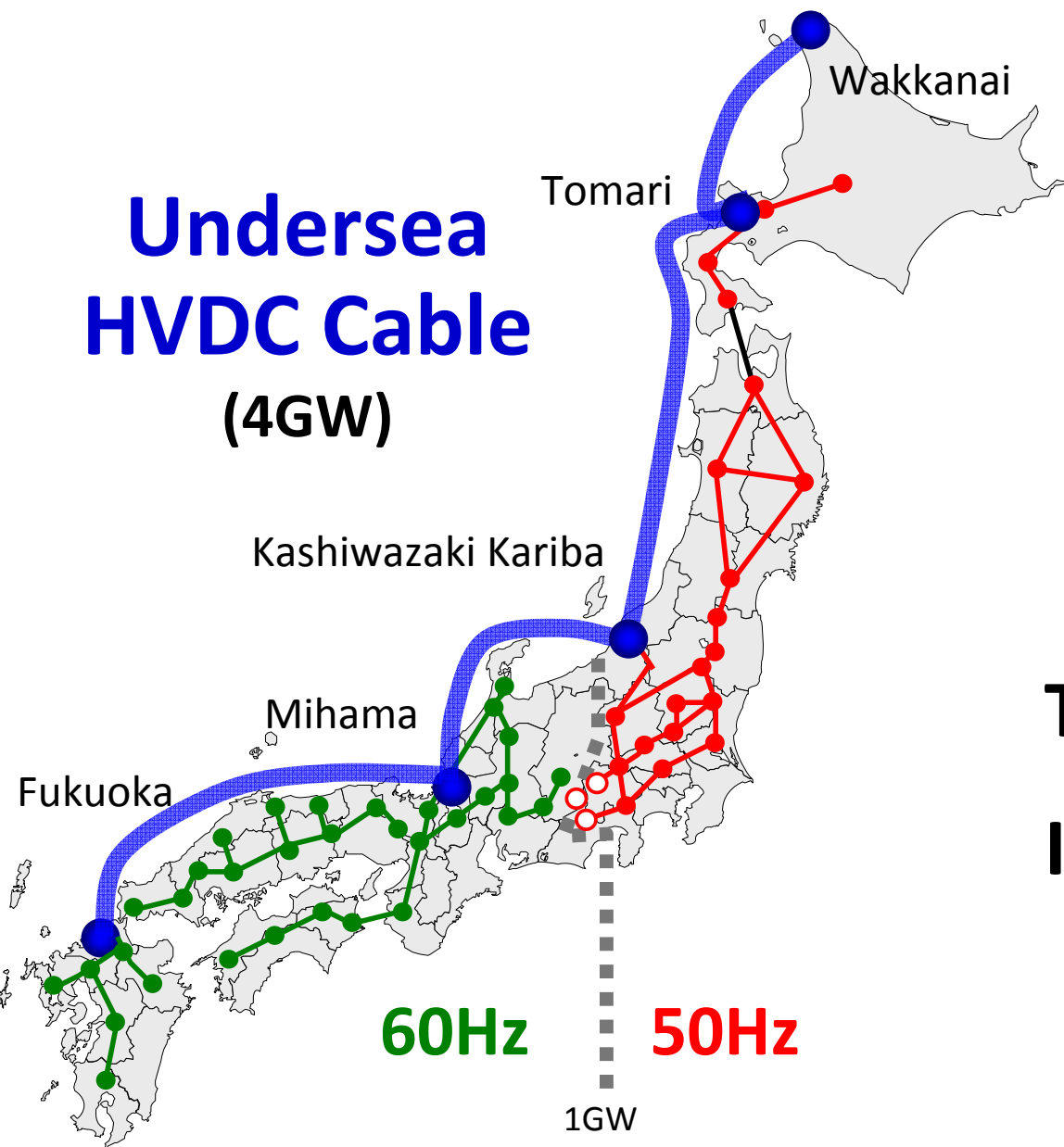
Geothermal

*Source: monthly magazine "Environment Business" issued on October 2011
Ministry of Environment "Report on Potential of Renewable Energy Heisei 21"

Solution

Super Grid
(HVDC)

Undersea HVDC Cable (4GW)

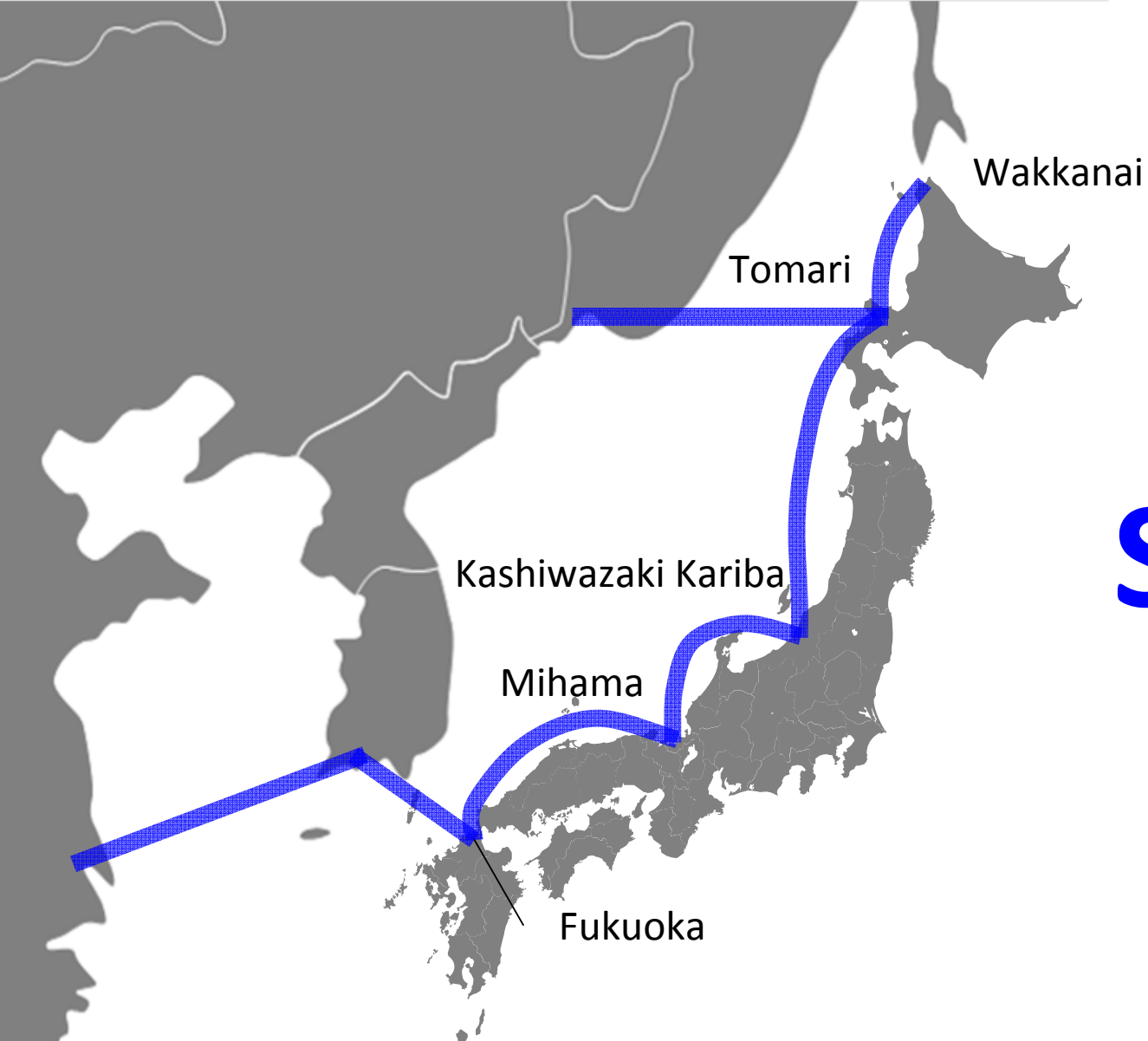


Japan Super Grid

Total 2,000km

Investment (ball park figure) **JPY 2t**

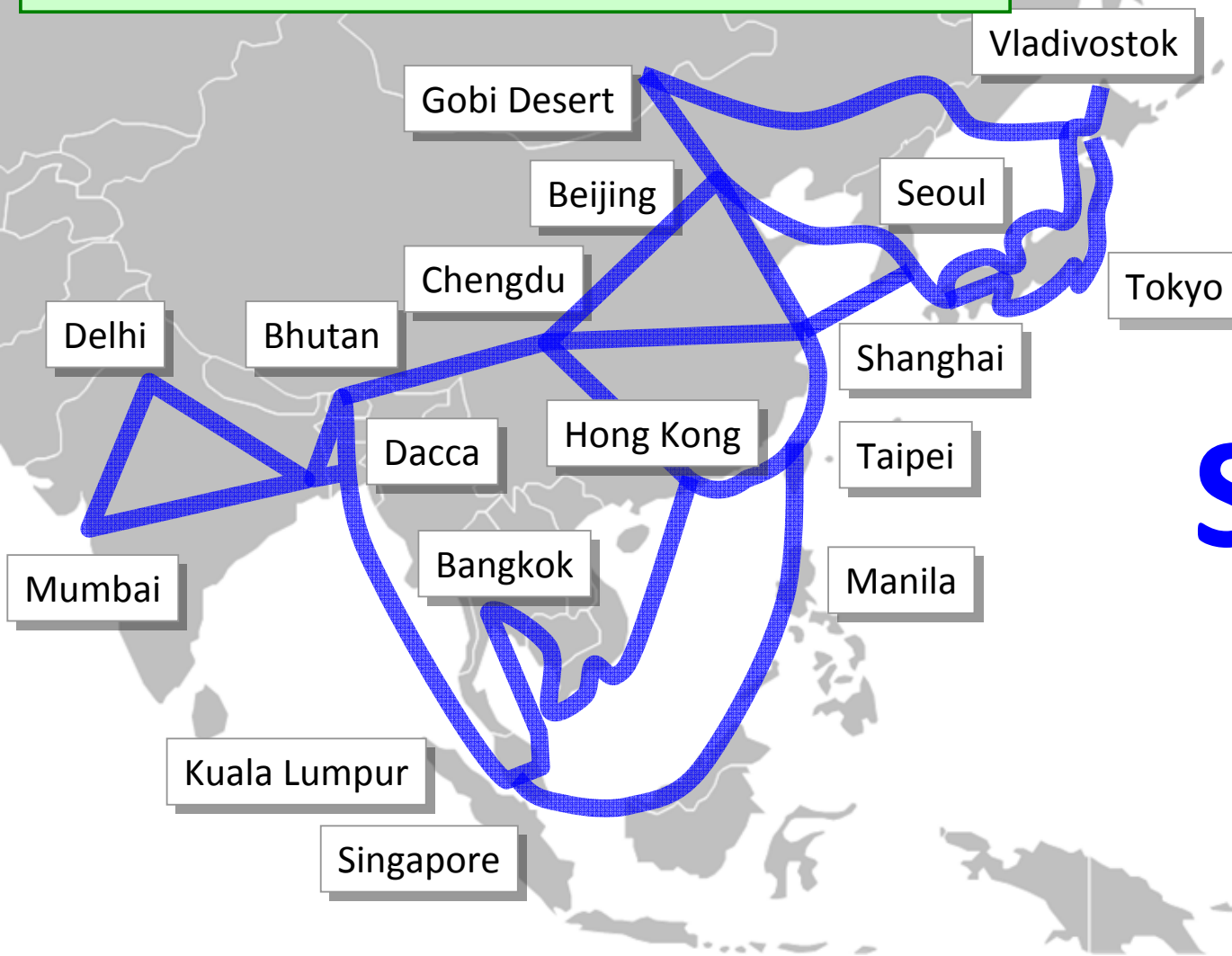
- Annual Cost JPY 50bn (40 yr depreciation)
- 0.3% of 10 EPCOs' Total Revenues



Phase2 East Asia Super Grid

Total 3,800km

Demand Leveling (Time Zone & Climate Difference)
Stable Supply (through regional interdependence)
Fair Electricity Price



Phase 3

Asia Super Grid

Total 36,000km

Electricity Price 1kWh in USD

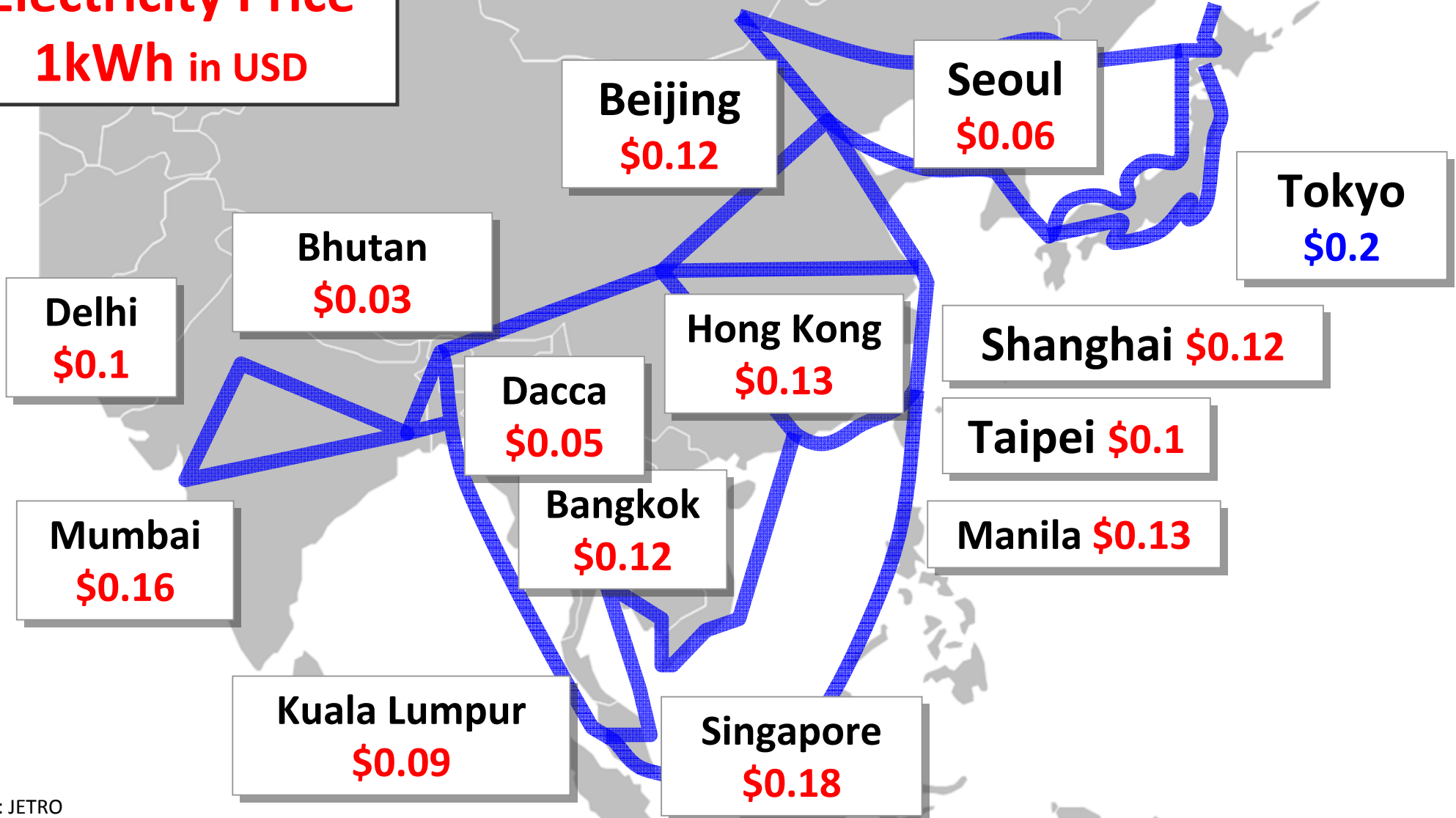
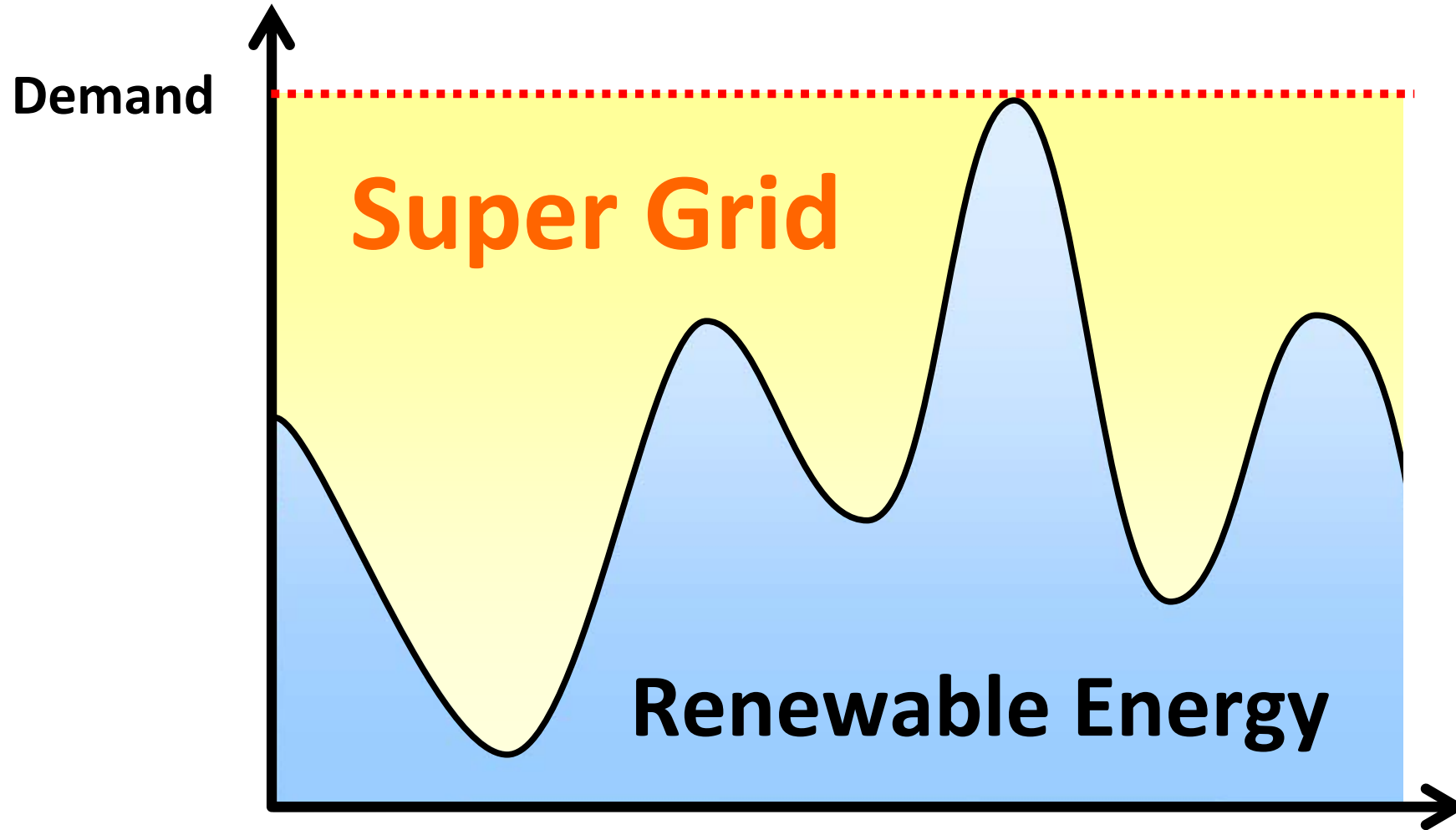


Image of Electricity Stabilization





China

UHV Grid Plan (2011-2015)

Total	40,000km
Investment	RMB 50bn+ (JPY 7t+)

DESERTEC



Source: DESERTEC FOUNDATION



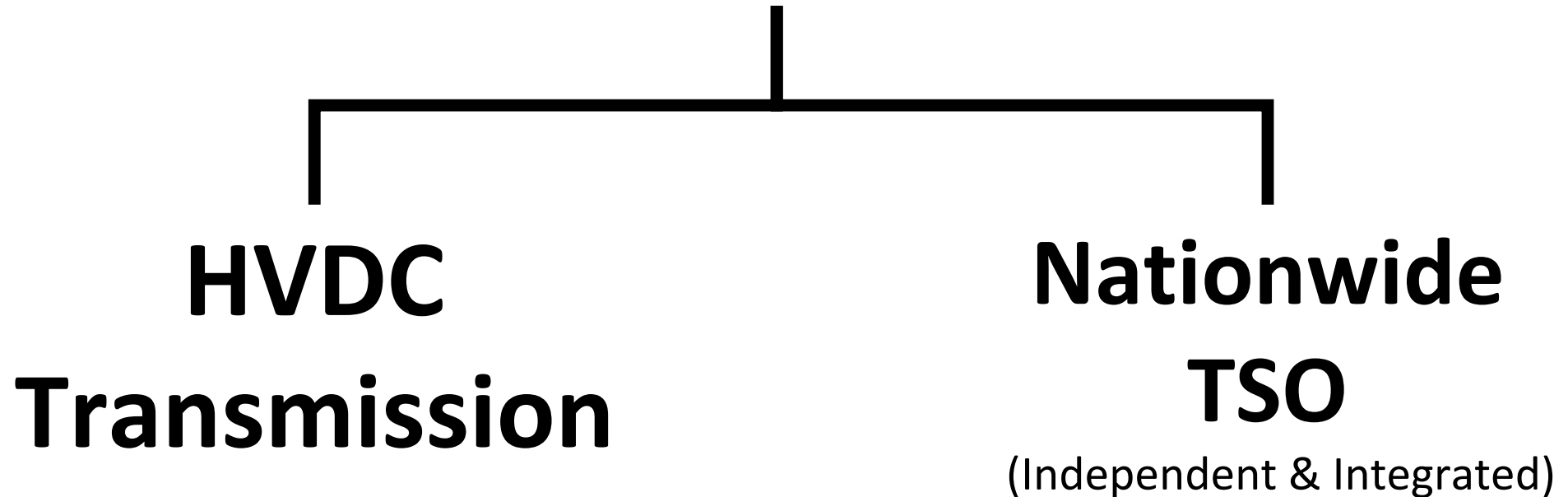
海底ケーブル敷設・
保守専用船
「ケイディディ」
パシフィックリンク



Submarine Communication Cable

Source: KDDI
Report on the progress of JIH Cable Project (January 1998)

Japan Super Grid



Core of Japan Energy Strategy

Proposal 1 Wide Deployment of Renewables

Proposal 2 Vitalization of Electricity market

Proposal 3 Enhancement of Transmission Infra



Paradigm Shift in Energy

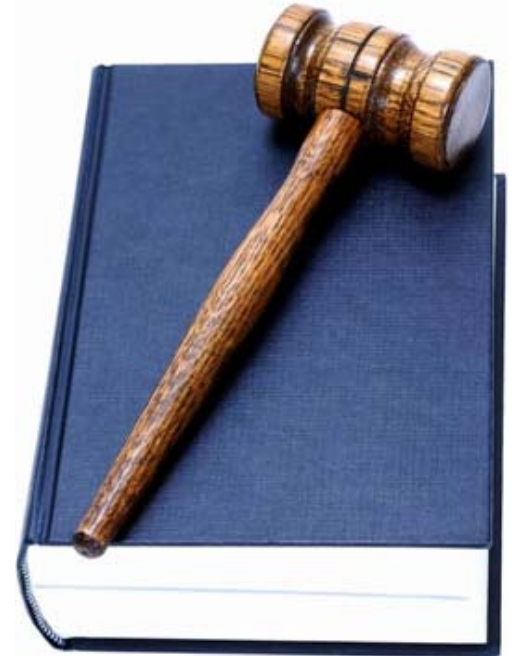
“Basic Act on Energy Policy”

(Effective in 2002)

Development of Important Energy Resource for Japan

Deregulation of Energy Market

Mutual cooperation among the state, local gov. and business operators



- 2001** **Strategic Energy Plan of Japan**
- 2007** **Strategic Energy Plan of Japan (1st Revision)**
- 2010** **Strategic Energy Plan of Japan (2nd Revision)**



“New Strategic Energy Plan of Japan”

(Ver. 2.0)

**Human beings
have fought over energy
more than 100 years**

Energy for Peace in Asia

Paradigm Shift in Energy



自然エネルギー財団

JAPAN RENEWABLE ENERGY FOUNDATION