

Status and Future of Renewable Energies

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Tokyo, Japan

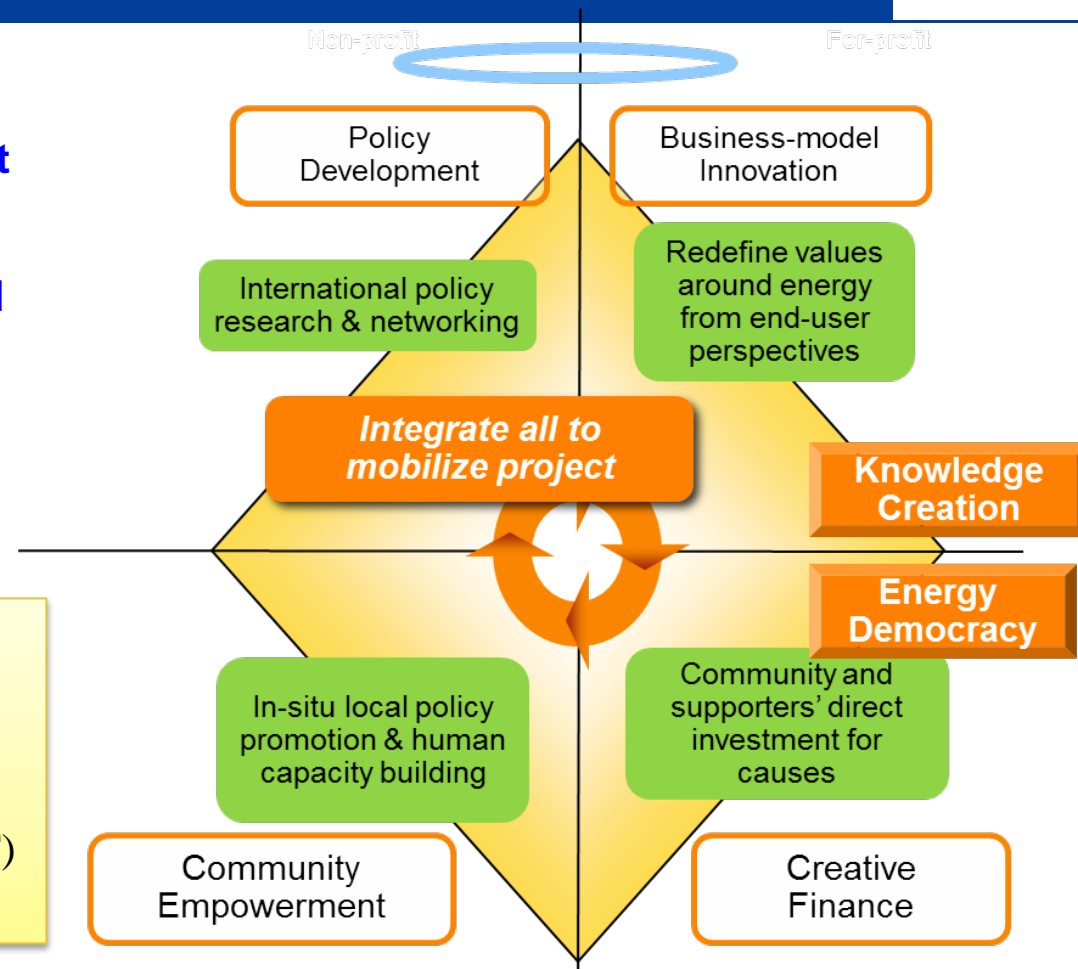
<http://www.isep.or.jp/en>

An independent nonprofit policy think-tank (Environmental NGO) aiming at the realization of sustainable energy policy mainly engaged in the rationalization of natural energy, energy saving, and energy market. Founded in 2000.

<http://www.isep.or.jp/en/>

- Green electricity, Green thermal Certificate system
- Community Fund Scheme
- Regional energy office
- Demand-pull strategy (such as FIT)
- Community Power Initiative

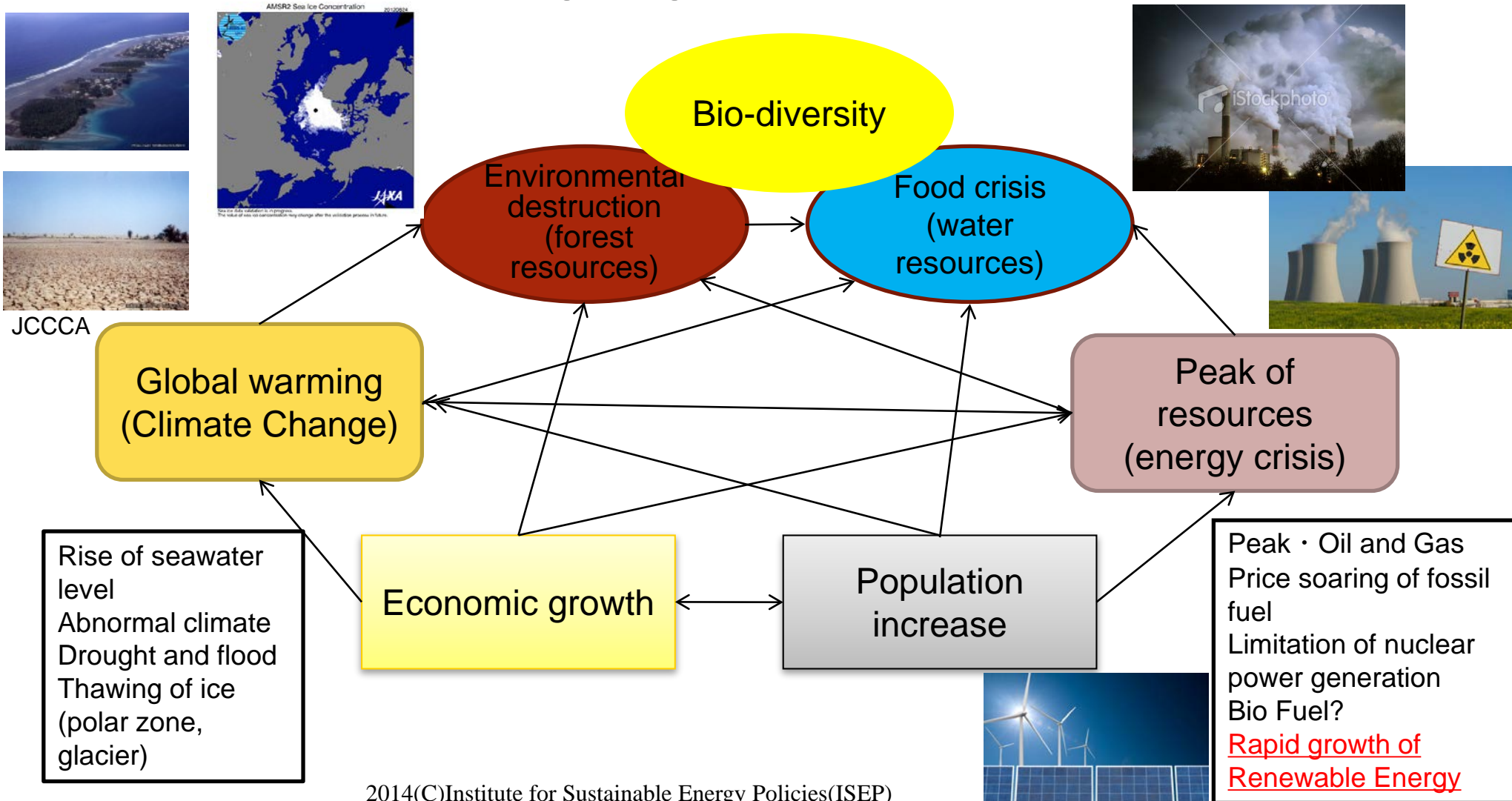
- Autonomy's policy advisory
- Autonomy's climate change policy research
- "Sustainable Zone" study group
- Regional economy effect study



- Renewable energy and building-up of social agreement
- Sustainable energy finance
- Japan Renewable Energy Platform (JREP)

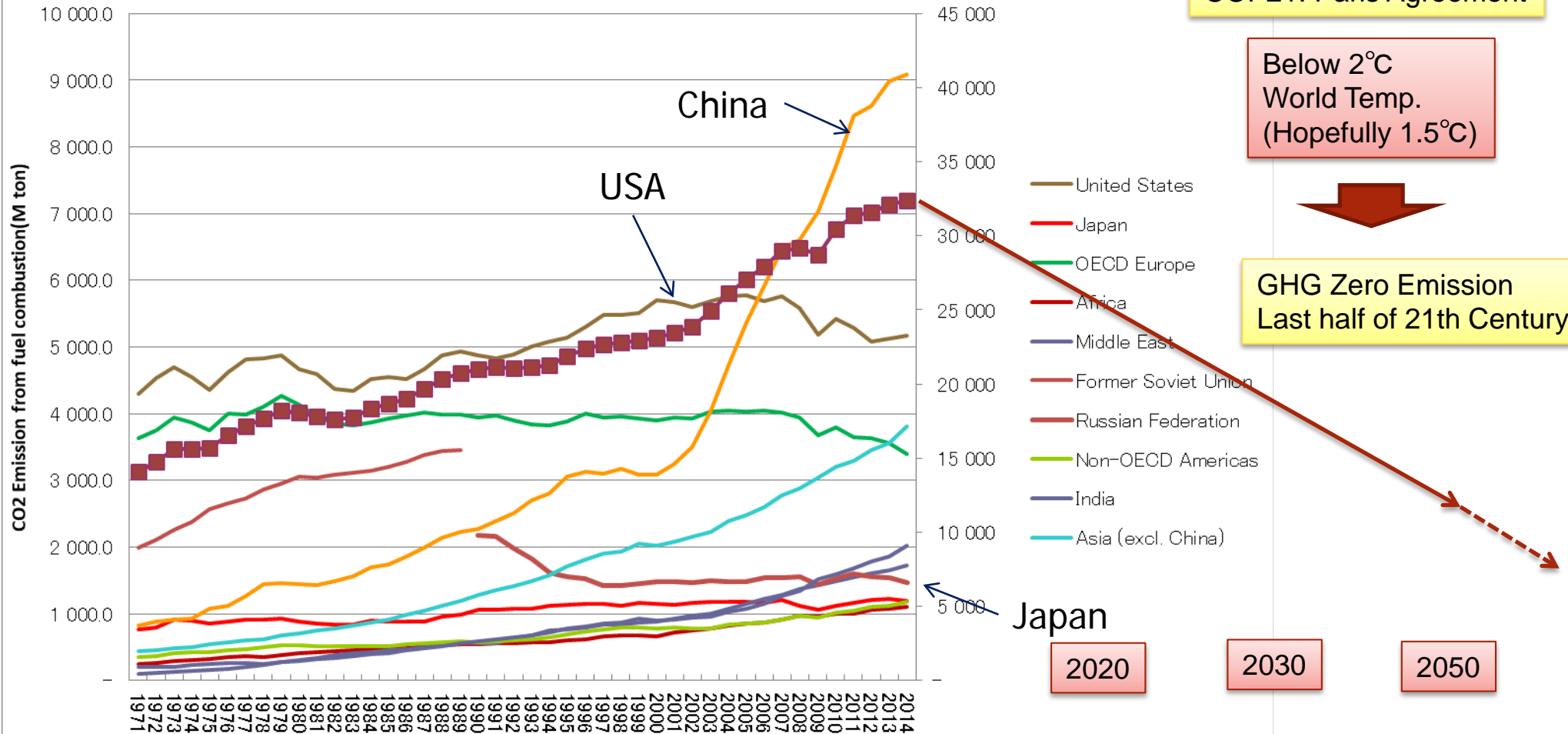
What is happening in the world now?

- Need for thinking of global scale complex relationship



CO2 Emission worldwide

CO2 Emission of China increased more than USA since 2006



IPCC 5th Assessment Report AR5

COP21: Paris Agreement

Below 2°C
World Temp.
(Hopefully 1.5°C)

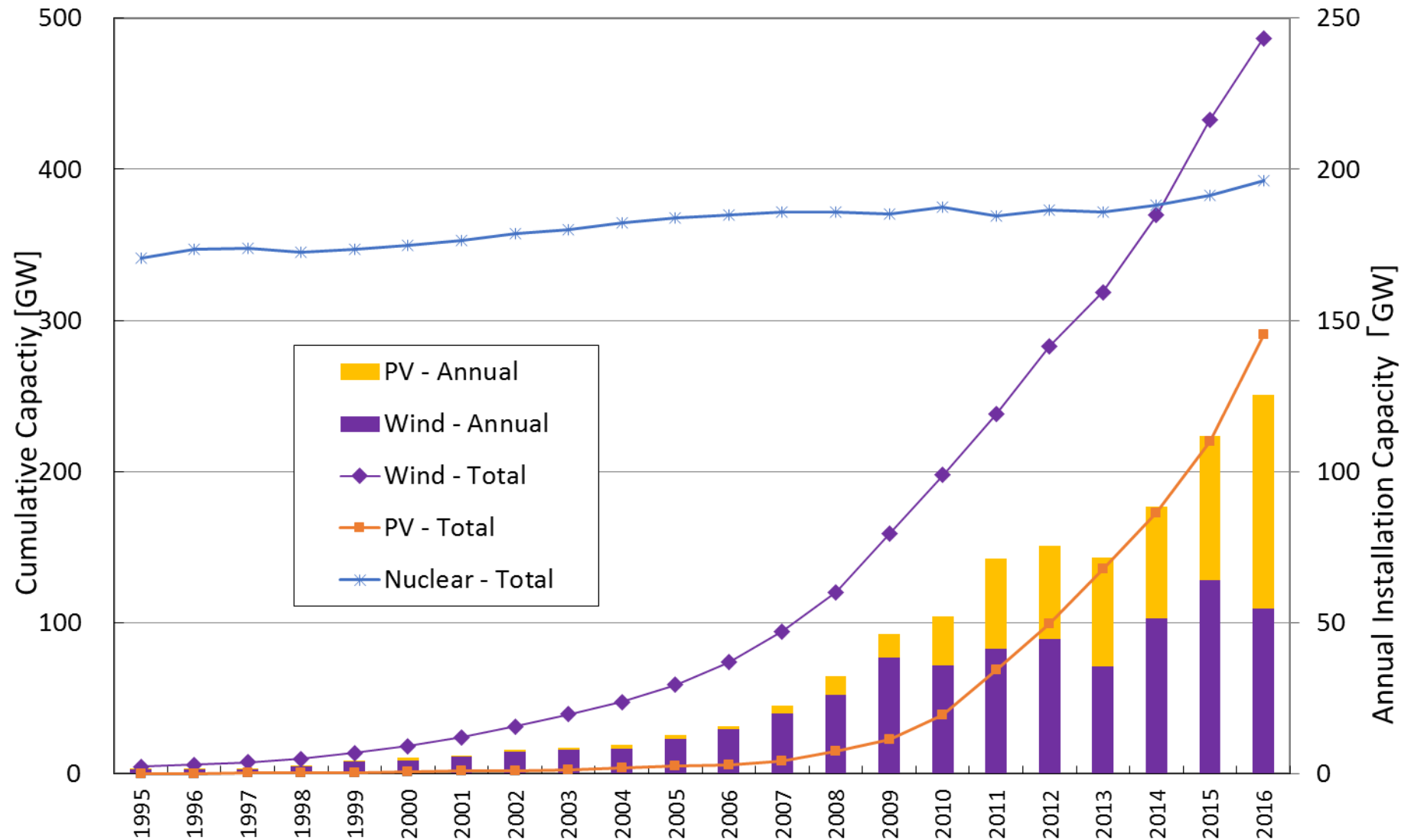
GHG Zero Emission
Last half of 21th Century

- United States
- Japan
- OECD Europe
- Africa
- Middle East
- Former Soviet Union
- Russian Federation
- Non-OECD Americas
- India
- Asia (excl. China)

2020 2030 2050

Source: Data from IEA:CO2 Emission from fuel combustion Highlights

Trend of Solar, Wind and Nuclear power capacity in the world

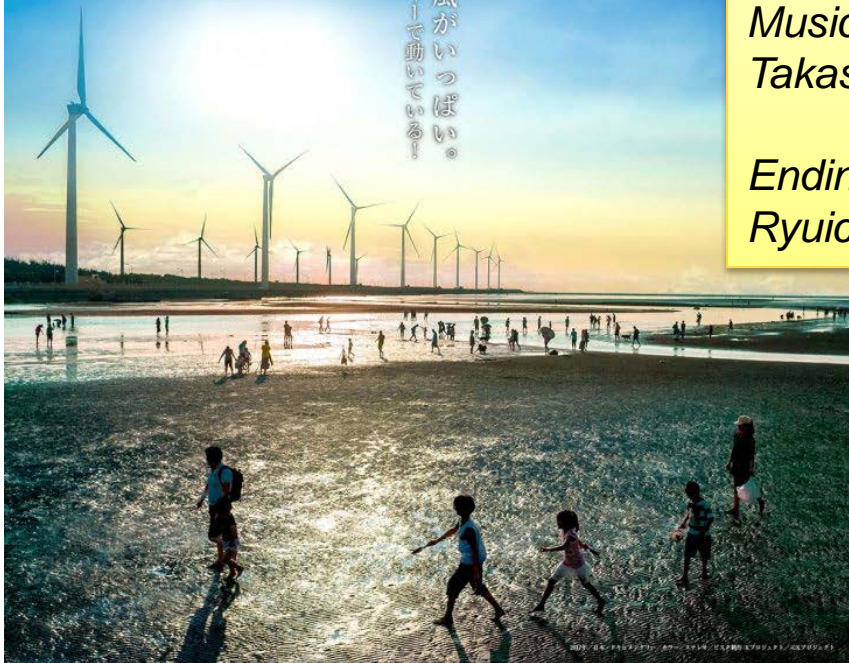


Movie "Renewable Japan" – The Search for New Energy Paradigm March 2017

「日本と原発」河合弘之監督の最新作
日本と再生
光と風のギガワット作戦

監督 河合弘之
(河合弘之)
企画・監修 飯田哲也
(飯田哲也)
音楽 新垣 隆
エンディング 坂本龍一

太陽がいつぱい。風がいつぱい。
世界はもう、自然エネルギーで動いている！

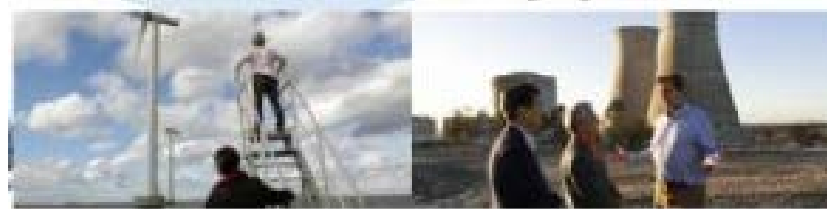
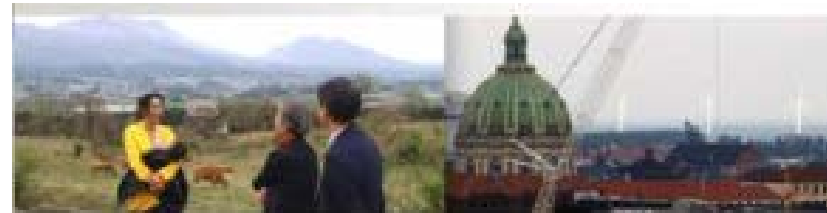
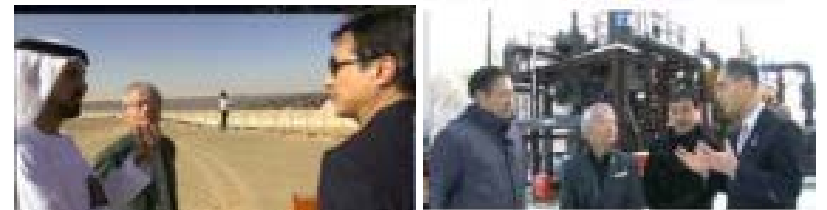


Movie Director:
Hiroyuki KAWAI

Supervisor:
Tetsunari IIDA

Music:
Takashi NIIGAKI

Ending Music:
Ryuichi SAKAMOTO



Source: <http://www.nihontogenpatsu.com/>

Renewable Japan – The Search for New Energy Paradigm Trailer of English version



Renewables 2017 Global Status Report

GSR2017 <http://www.ren21.net/gsr-2017/>



→ The report features:

- Global Overview
- Market & Industry Trends
- Distributed Renewable Energy for Energy Access
- Investment Flows
- Policy Landscape
- NEW: Enabling Technologies and Energy Systems Integration
- Energy Efficiency
- Feature: Deconstructing Baseload

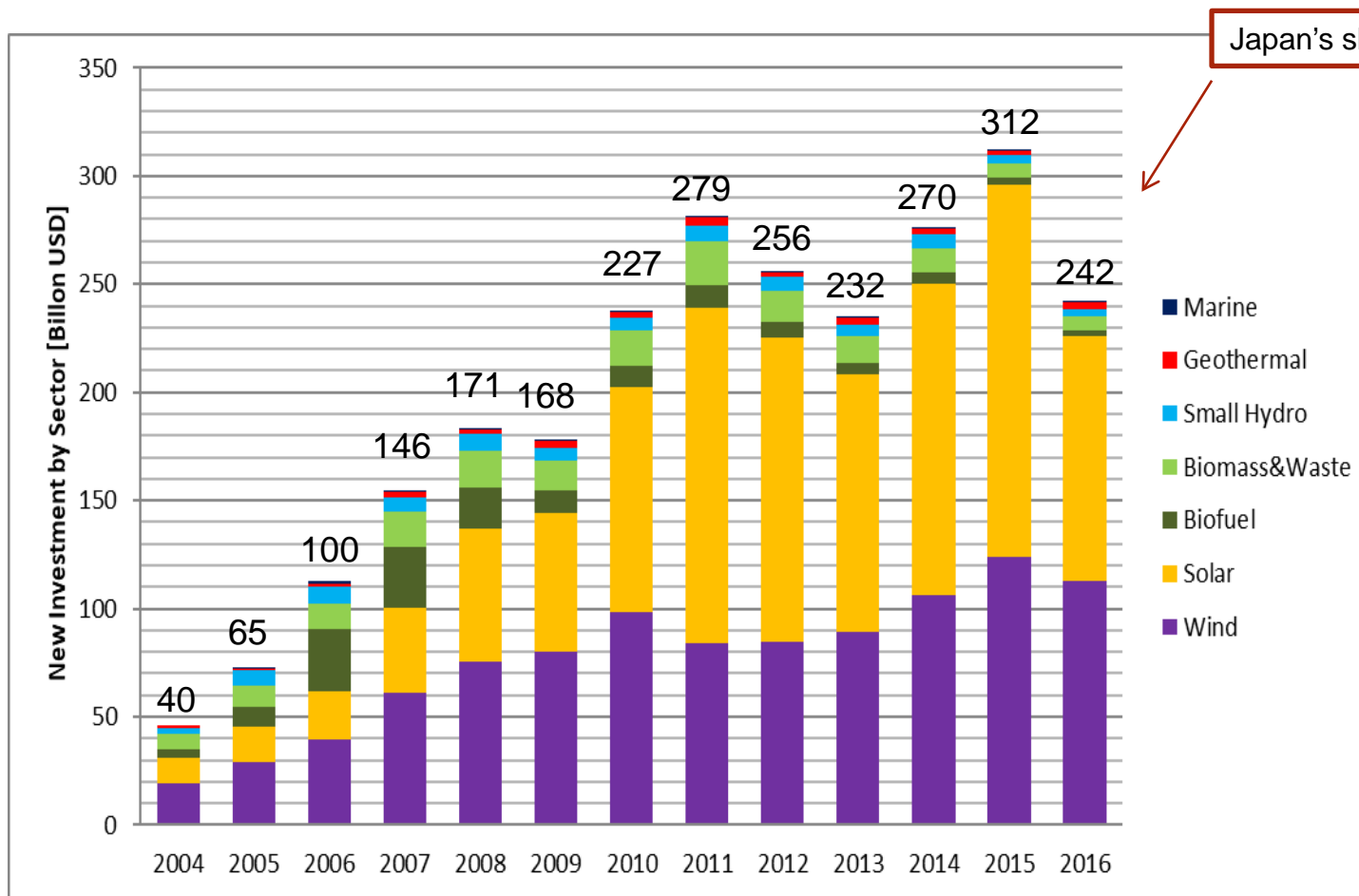


RENEWABLES 2017 GLOBAL STATUS REPORT



Renewable energy global market

- Global investment was 242 billion USD in 2016
- Decrease rate was 23% by comparison with 312 billion USD in 2015



Japan's share is about 13%.

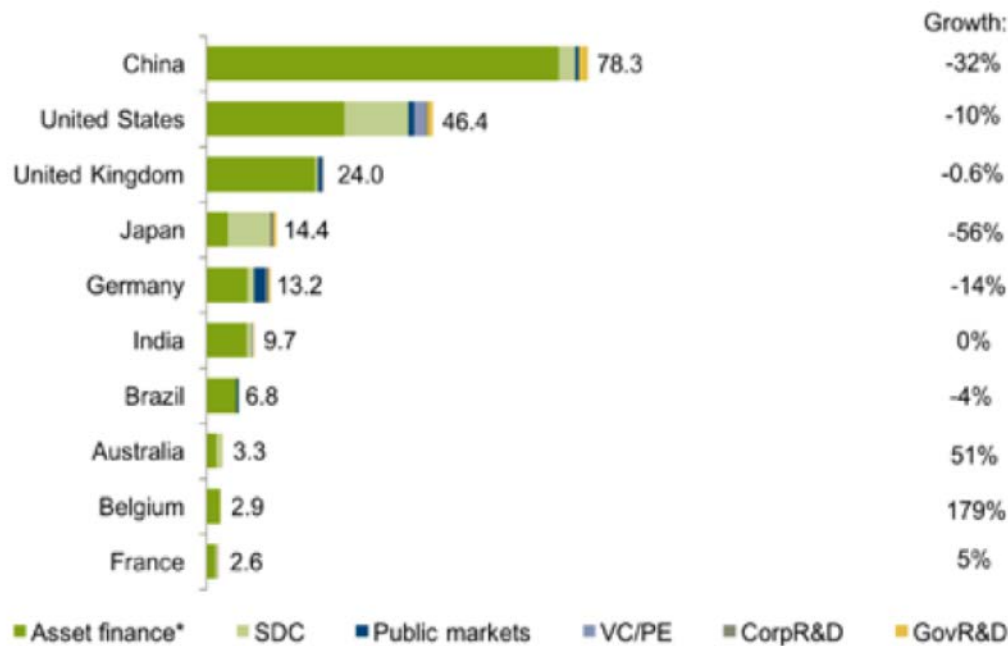


Data Source : UNEP , Global Trends in Renewable Energy Investment 2017

Investment on renewable energy

- Total investment of renewable energy reaches 242 Billion USD in 2016 world wide.
- Invested amount in Japanese market ranks 4th, occupying approx. 6% share (2016)
- Investment in Japanese market was mostly on Solar PV. (2016)

[Billion USD]



	Country	2016	Growth
1	China	783	-32%
2	USA	464	-10%
3	UK	240	-0.6%
4	Japan	144	-56%
5	Germany	132	-14%
6	India	97	0%
7	Brazil	68	-4%
8	Australia	33	51%
9	Belgium	29	179%
10	France	26	5%
	World	2,416	-23%

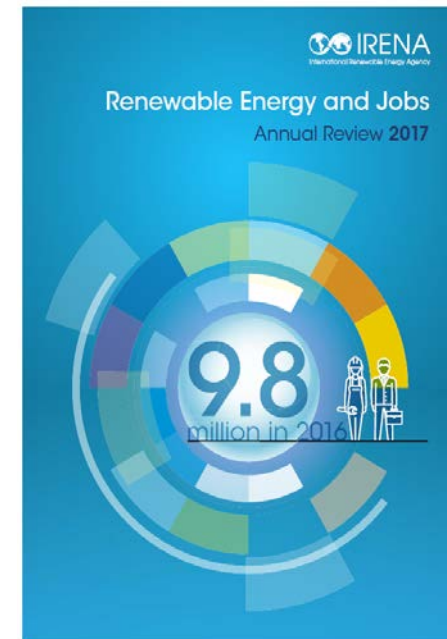
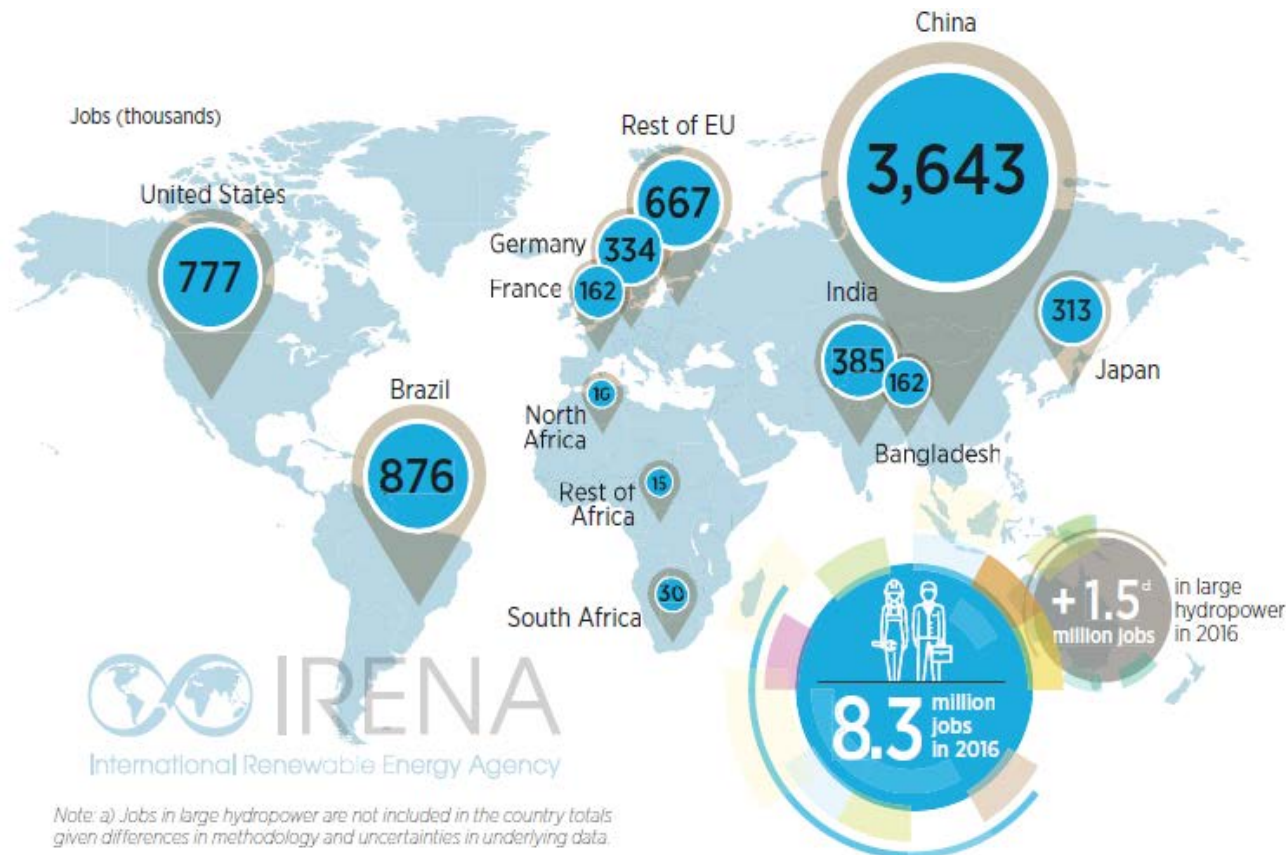
Top 10 countries. *Asset finance volume adjusts for re-invested equity. Includes corporate and government R&D

Source: UN Environment, Bloomberg New Energy Finance

Source : UNEP , Global Trends in Renewable Energy Investment 2015

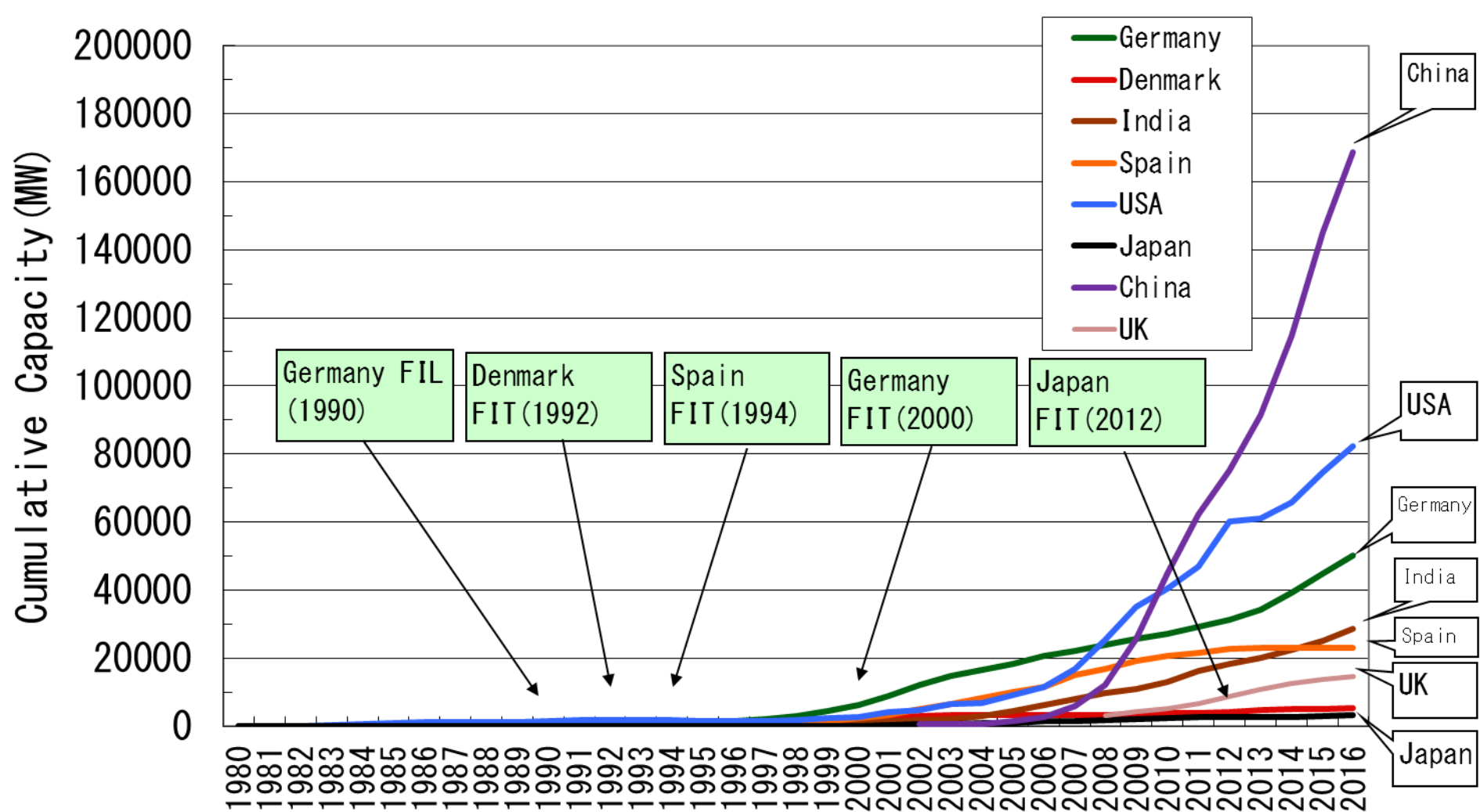
Jobs for renewable energy

- 9.8 million jobs for renewable energy in 2016 worldwide
- In Japan, 313 thousand jobs for renewable energy in 2016

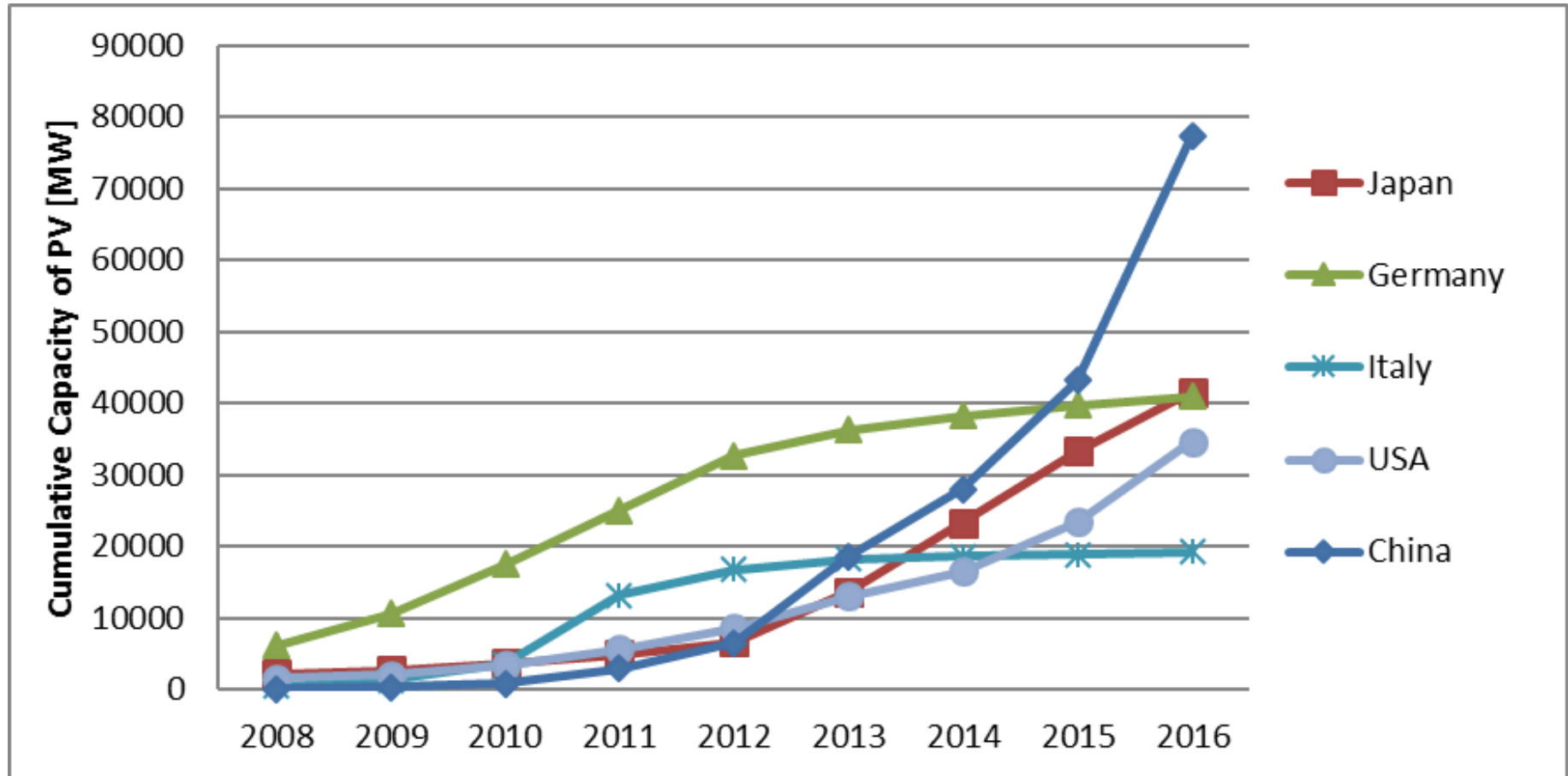


IRENA:
"Renewable Energy and Jobs
Annual Review 2017"
<http://www.irena.org/>

Trend of wind capacity in the world

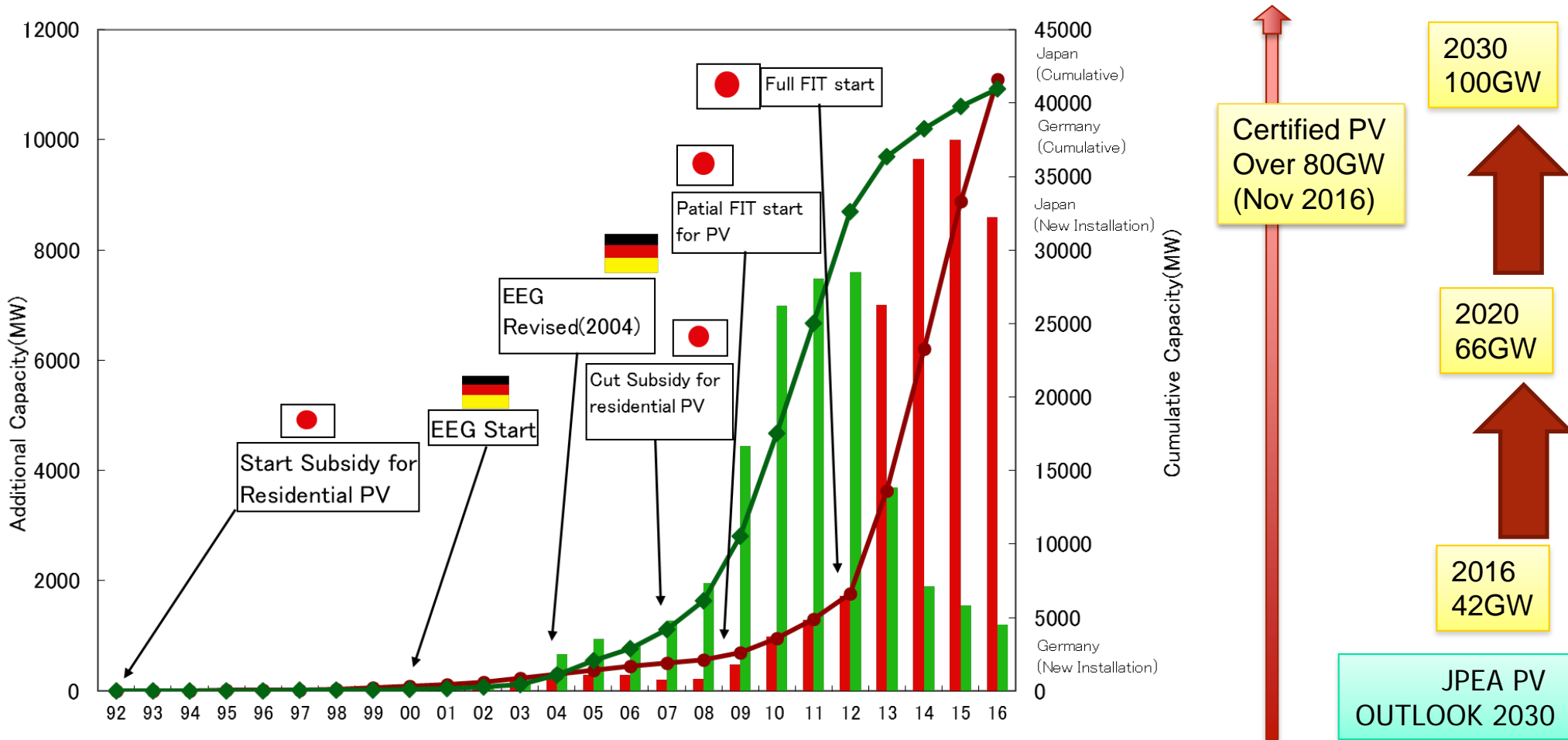


Trend of Solar capacity in TOP5 countries



Trends of Solar PV in Japan and Germany

- Expanded introduction of Solar PV in Japan and Germany
- Since 2013, trend of additional capacity is dramatically changed in Japan and Germany.



Source data: IRENA data

Graph: ISEP

Comparative Studies on Socially Equitable Energy Transition in Asia*

Status of Renewable Energy in Asian Countries

Country	RE Target (Electricity)	RE Share (Electricity)	PV [GW]	Wind [GW]	Biomass [GW]	Geo [GW]	Hydro[GW] (Pumped)	Total [GW]
Japan	22-24%(2030)	15%(2016)	42	3	4	0.5	49(27)	146
China	27%(2020)	24%(2015)	78	149	12	0.03	334(27)	1372
Korea	6%(2020) 10%(2024) 20%(2030)	5%(2016)	5	1	2	0	6(5)	16
Phillippines	40%(2020)	29%	0.8	0.4	0.5	2	4(1)	7
Thailand	20%(2036)	13%	2	0.5	3	0	4(1)	9
Indonesia	26%(2025)		0.1	0.01	2	2	5	31
Vietnam	5%(2020)		0.01	0.2	0.3	0	18	18
India	40%(2030)	16%(2016)	10	29	9	0	48(5)	210
Total(Asia)			138	183	33	5	468(66)	
World		25%(2015)	291	467	109	13	1245 (160)	2008

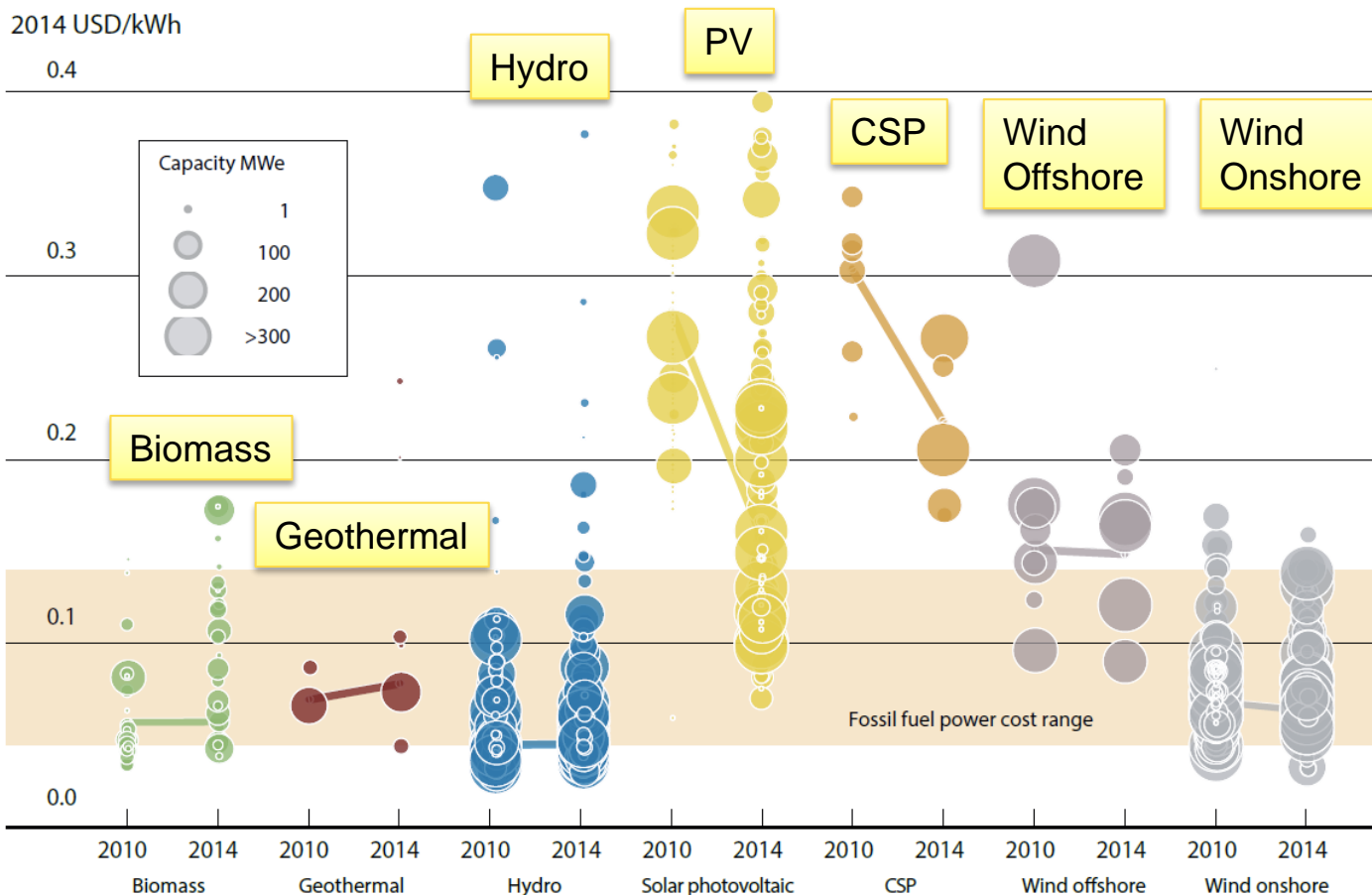
* This study is supported by Friedrich Ebert Foundation(2017)

Source: Miranda Schreurs and IRENA "Renewable Energy Statistics 2017"

Cost of Renewable Energy

“Biomass for power, hydropower, geothermal and onshore wind can all now provide electricity competitively compared to fossil fuel-fired power generation.

FIGURE ES 1: THE LEVELISED COST OF ELECTRICITY FROM UTILITY-SCALE RENEWABLE TECHNOLOGIES, 2010 AND 2014



IRENA “RENEWABLE POWER GENERATION COSTS IN 2014”

<http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=494>

Global Cost trends of Solar PV

※LCOE(Levelised Cost of Electricity)

Solar PV(Large scale)
Power generation Cost (2010):
Average 0.3USD/kWh

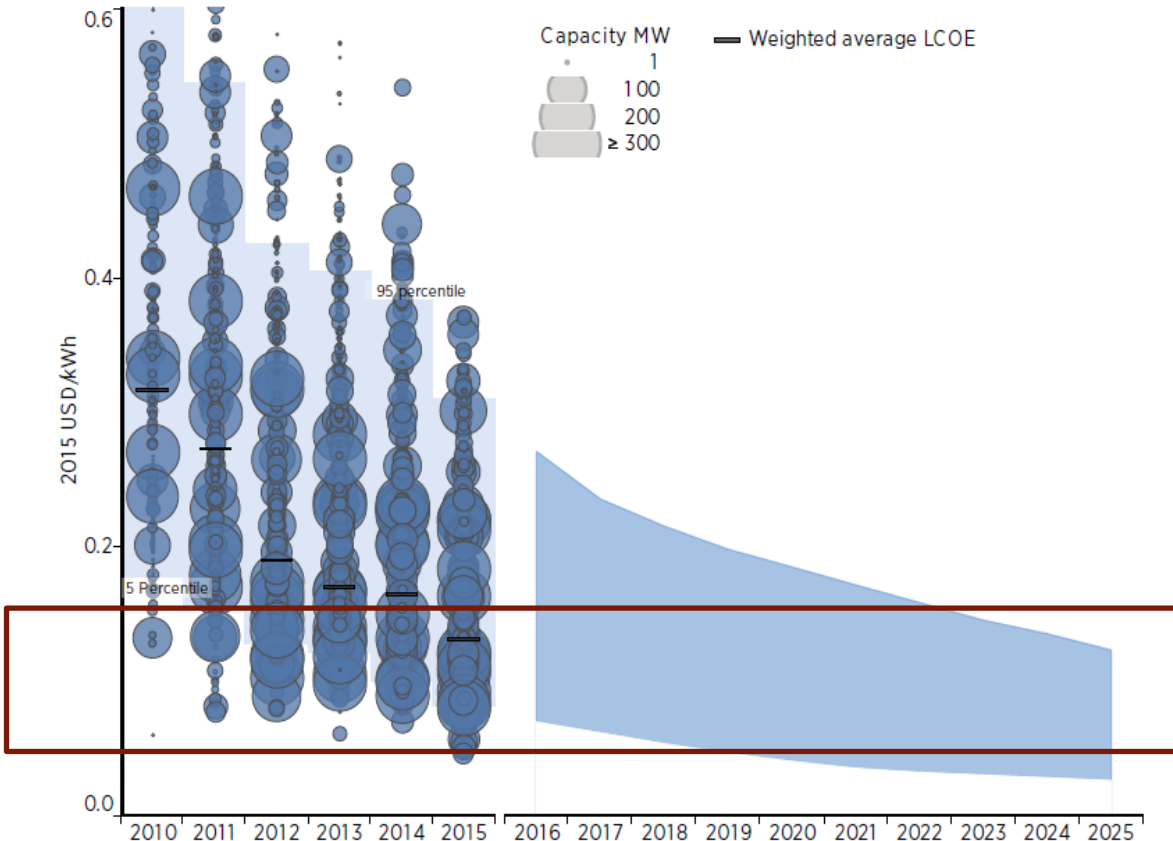


Solar PV(Large scale)
Power generation Cost (2015):
Average 0.12USD/kWh

Fossil Fuel
Power generation Cost
0.05~0.14 USD/kWh
※1USD=110円

Source: IRENA(2016)
“The Power to Change: Solar and Wind Cost Reduction Potential to 2025”

FIGURE ES 2: GLOBAL UTILITY-SCALE SOLAR PV LCOE RANGES BY PROJECT, 2010-2025

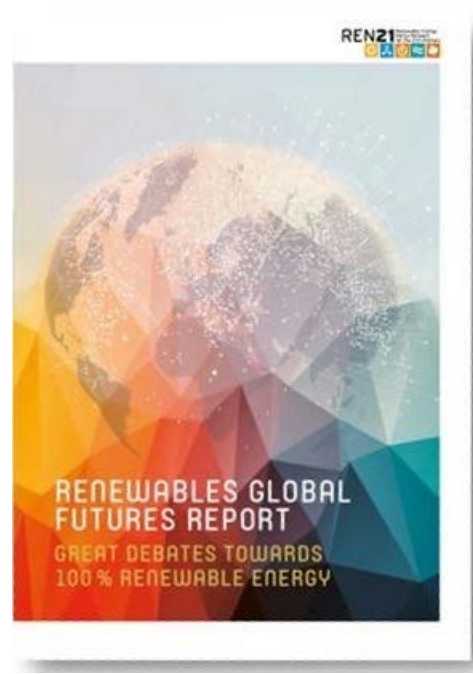


Note: Circles represent individual projects in the IRENA Renewable Cost Database, the centre of the circle the value for the Y axis and the diameter of the circle the size of the project.

REN21 "Renewables Global Futures Report"

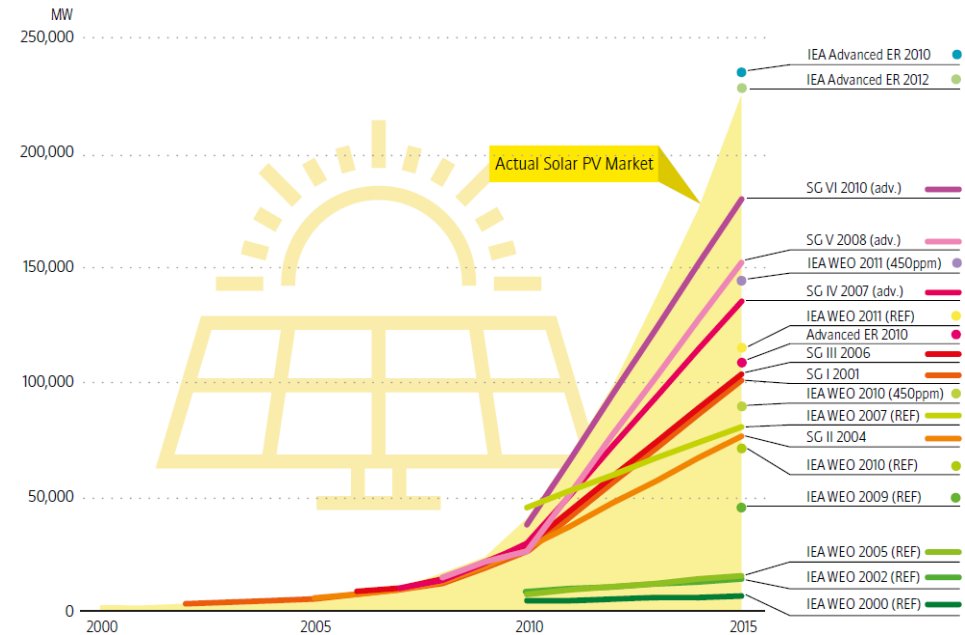


REN21/ISEP, 2013
Renewables Global
Futures Report
<http://www.isep.or.jp/gfr>



REN21, 2017, Renewables
Global Futures Report
<http://www.ren21.net/gfr>

Underestimate forecasting of Solar PV



Status report that summarizes trend and various data relating to renewable energy policies centering around Japan

Summary was Published in November, 2016

<http://www.isep.or.jp/en/info/3308>

Edit/Issue : Institute for Sustainable Energy Policies (ISEP)

Institute for Sustainable Energy Policies
isep 独立NPO法人
環境エネルギー政策研究所

Renewables 2016 Japan Status Report, Summary



Institute for Sustainable Energy Policies
<http://www.isep.or.jp/en/>

- Introduction“Toward the Age of Energy Democracy”
- Status and Trends of renewable energy in Japan
- Renewable Energy Policies in Japan
- The FIT Program: Current State and Issues
- Topic1: The trend to aim for 100% renewable regions
- Topic2: Renewable energy and getting social agreement
- Topic3: Coming to grips with community power
- Topic4: Production of food and renewable energy in agriculture

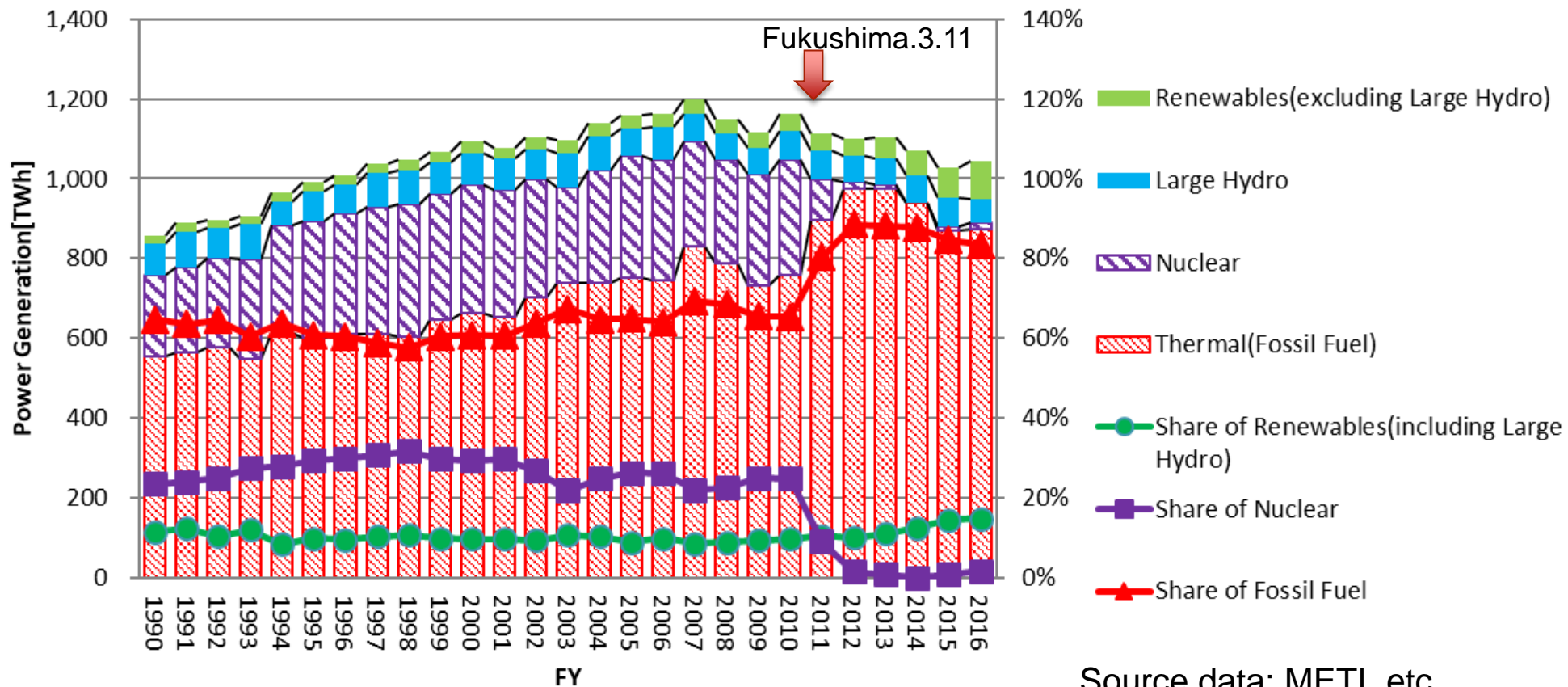
Full Version was Published in March 2017
(Japanese Only)

<http://www.isep.or.jp/jsr2016>

Trends of Power Generation in Japan

- Ratio of renewable energy is 10% which remained unchanged for the past two decades
- Ratio of renewable energy power generation increased to 14.8% in FY2016.

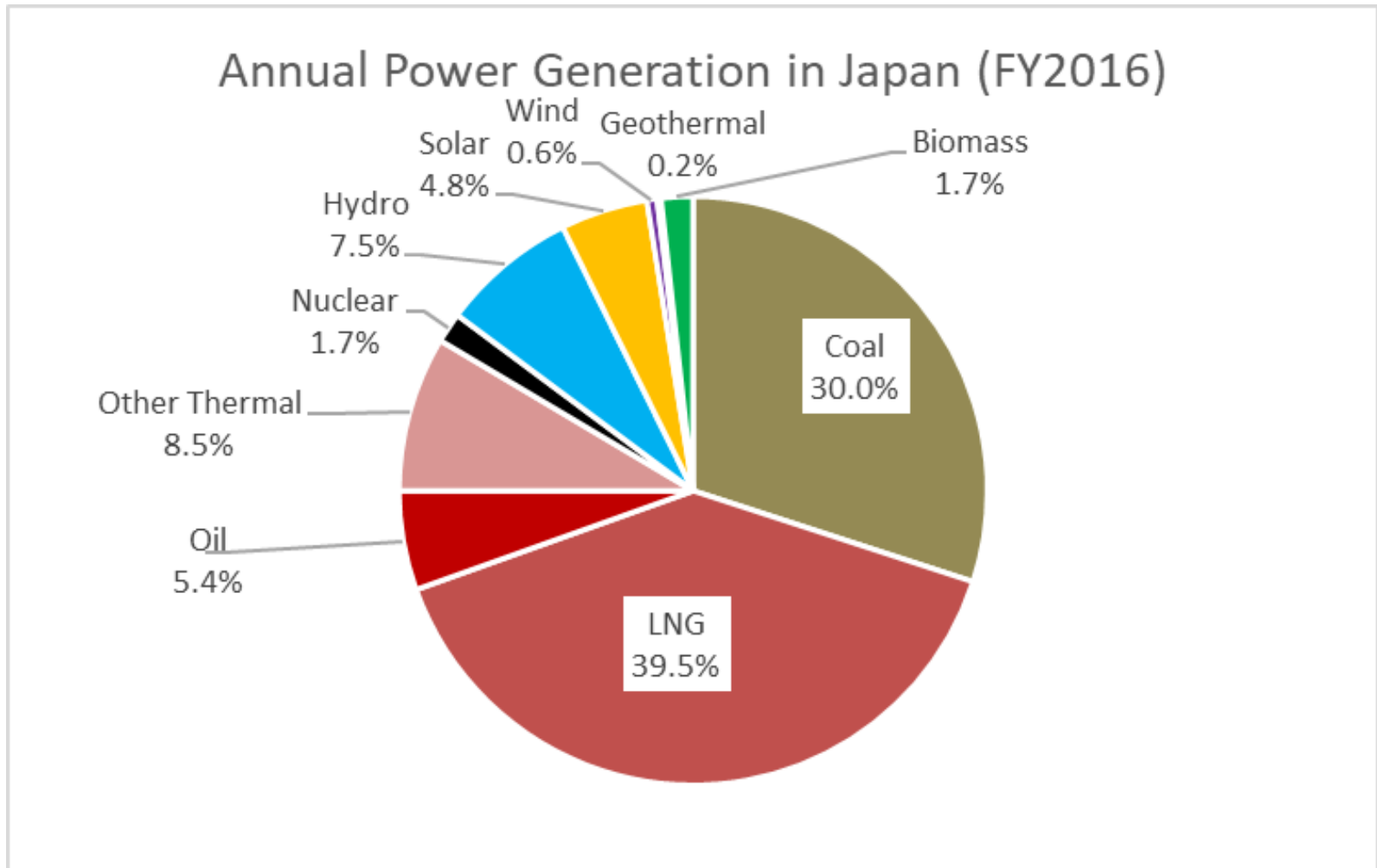
Power Generation in Japan(FY1990 - 2016)



Source data: METI, etc.
Graph: ISEP

Share of Power Generation in Japan (FY2016)

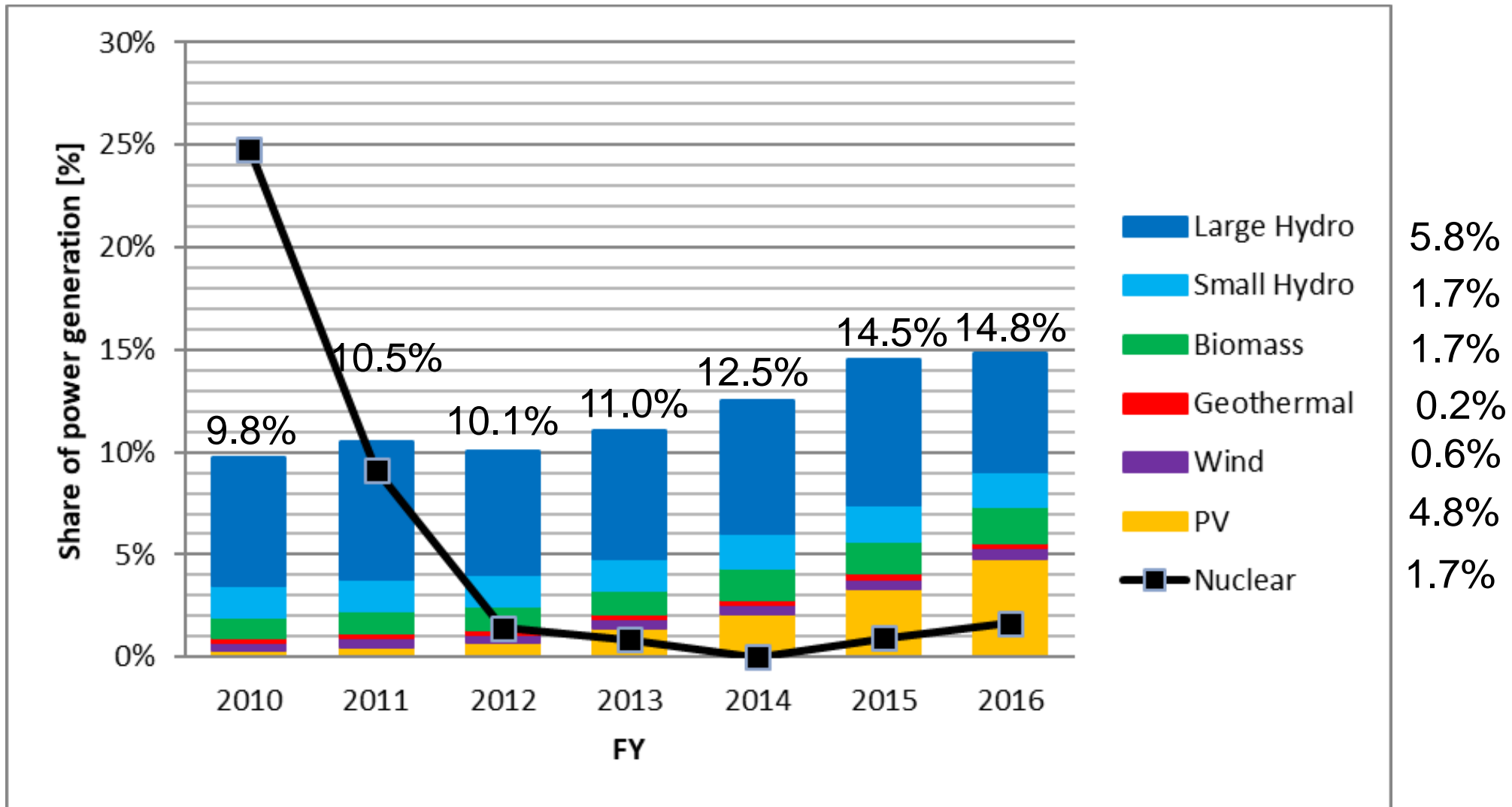
- Share of Renewable Energy reaches almost 15% of power generation in Japan
- VRE share is 5.4%(Solar PV 4.8%) of annual power generation in FY2016



Source: Estimated by ISEP using METI data

Trends of Renewable Power Generation in Japan

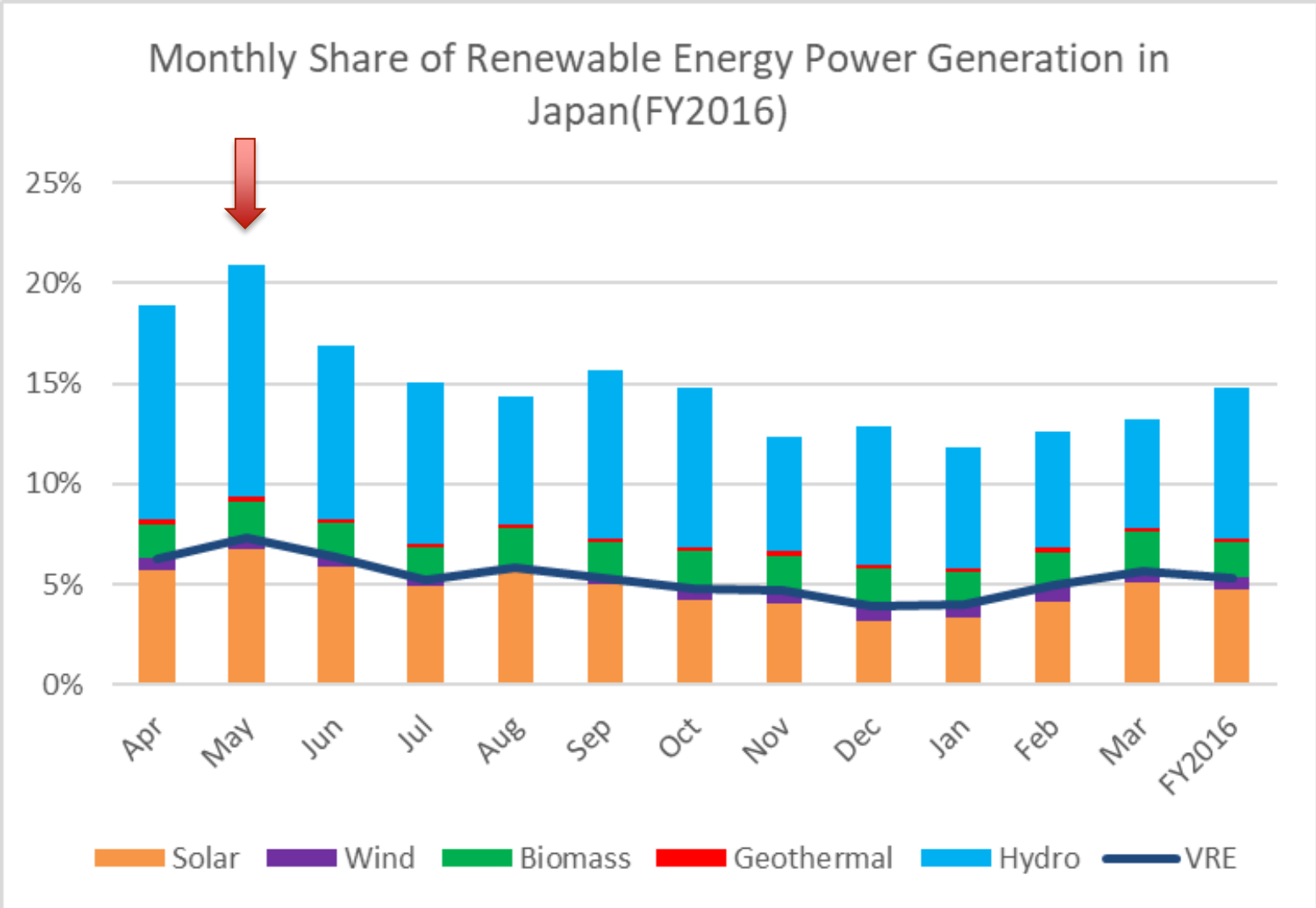
Share of renewable energy power generation increased to 14.8% in FY2016.



Source: METI, ISEP(Renewables Japan Status Report)

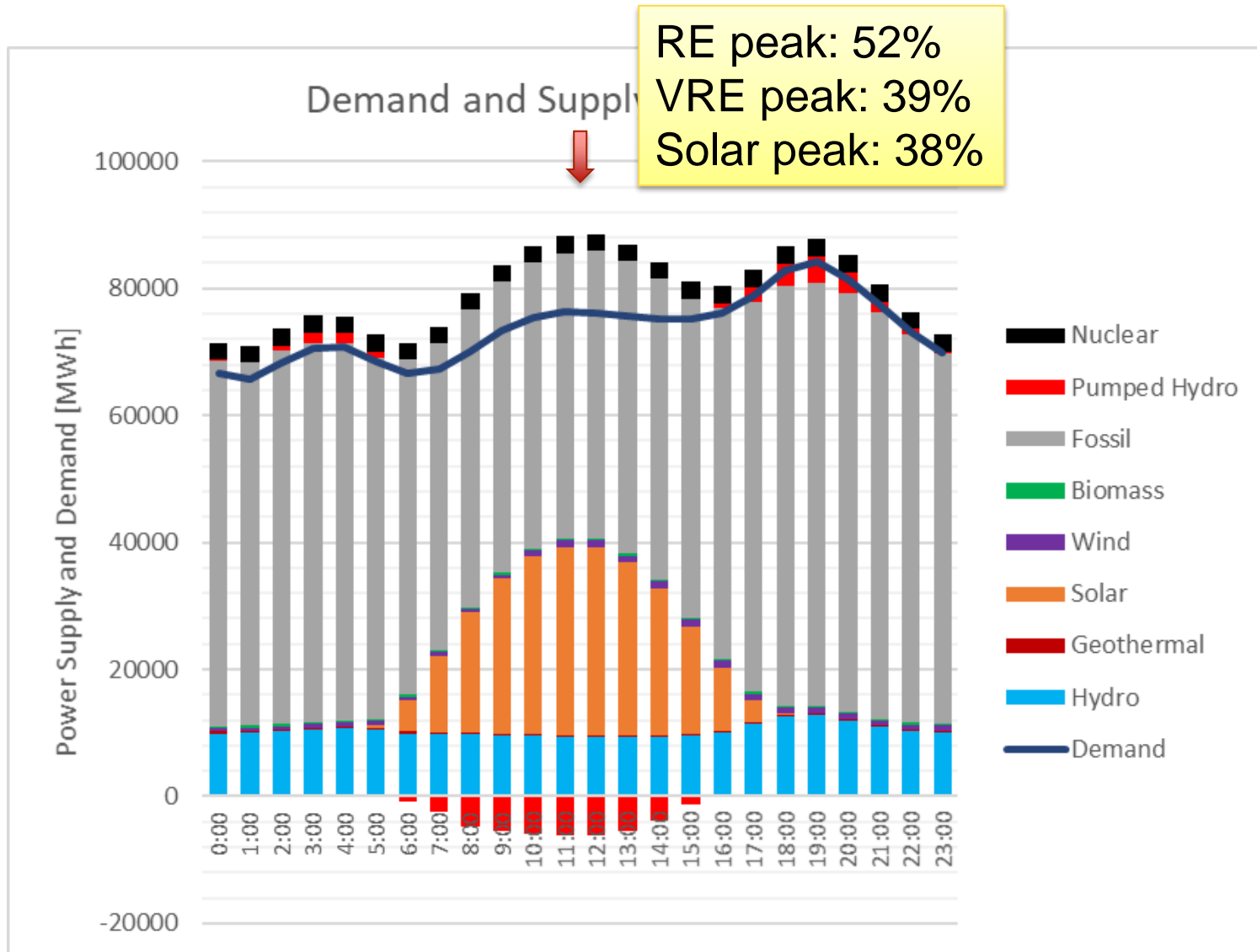
Monthly share of renewable energy power generation in Japan

- RE Share was over 20% and VRE share rised up to over 7% in May, 2016



Source: Estimated by ISEP using METI data

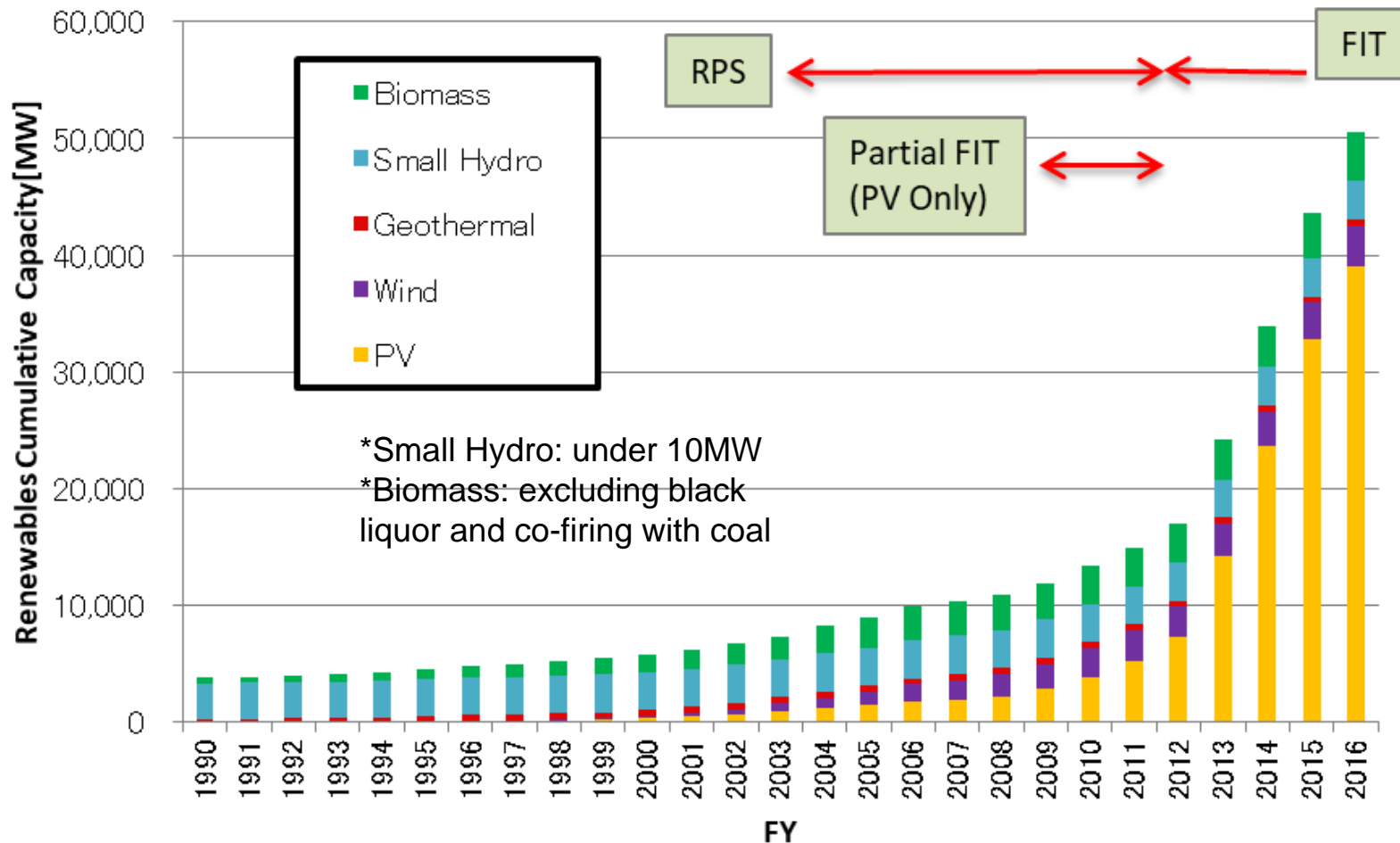
Demand and Supply during a day (30th April, 2017) in Japan



April 30th, 2017
Daily data:
RE: 28%

Trends of Renewable Energy Capacity in Japan

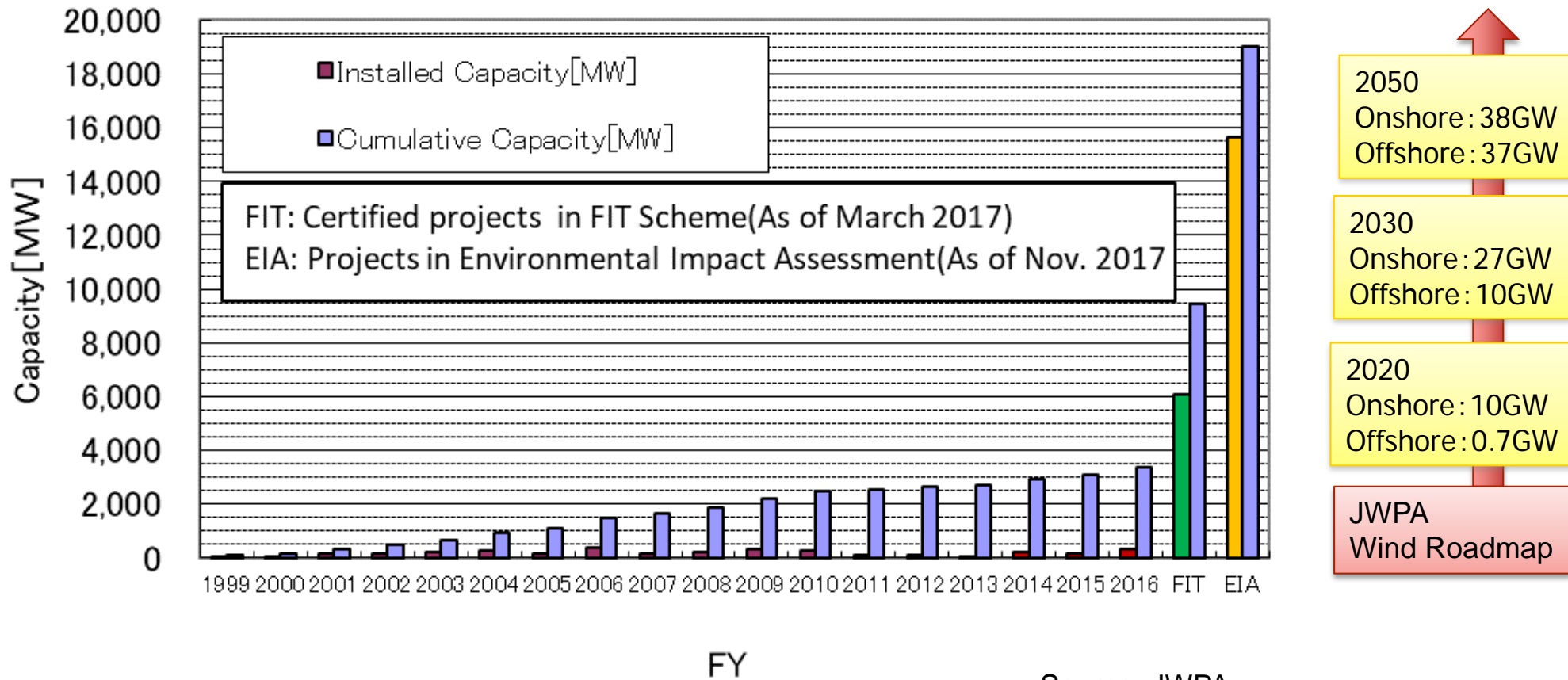
Trends of Renewable Energy Capacity in Japan(excluding large hydro): 50GW(FY2016)



Source: Renewables Japan Status Report (ISEP)

Trends of Wind power capacity in Japan

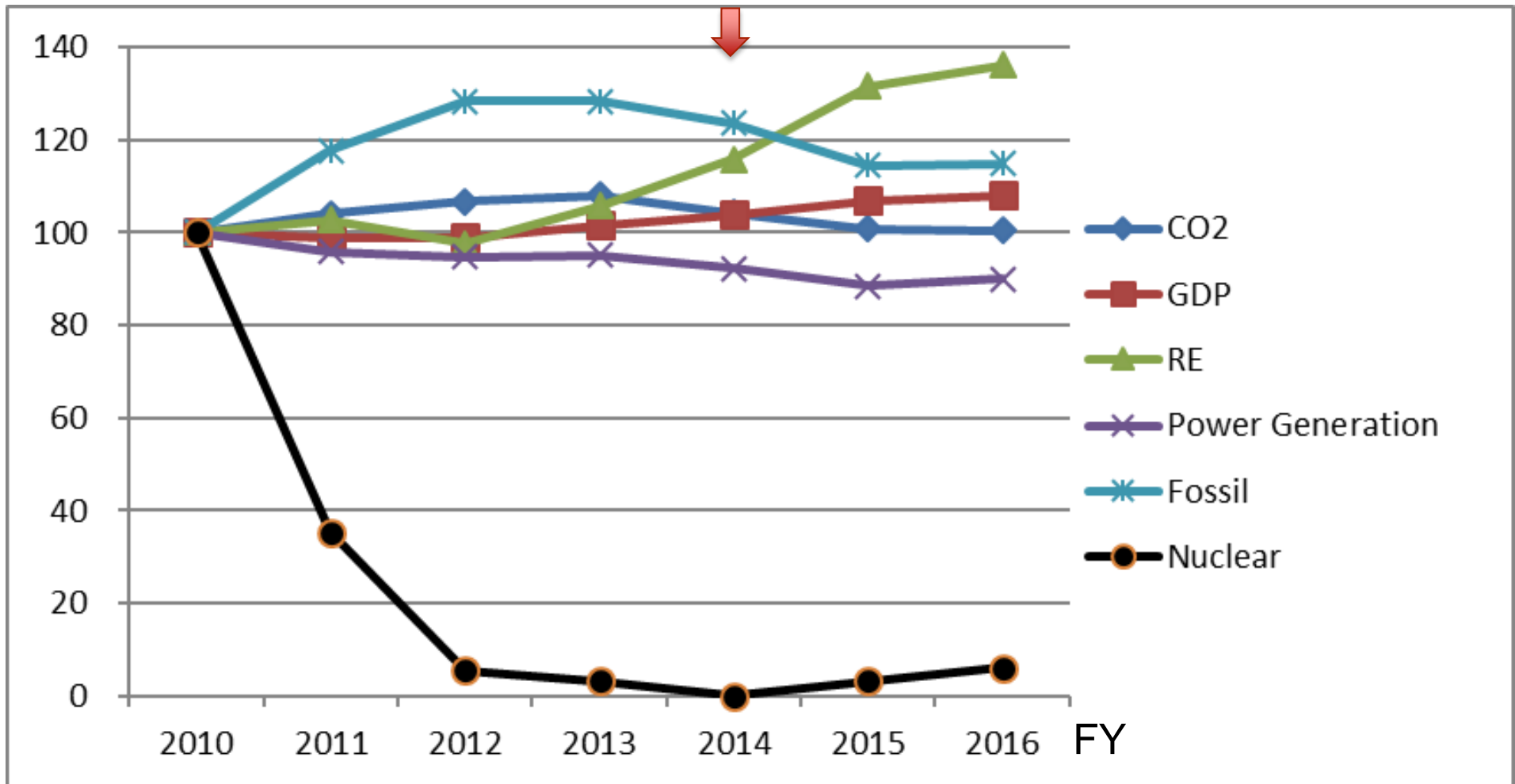
- After FY2011, annual installed capacity keeps very low level because of several regulation.
- Pipeline of environmental assessment is over 15GW including certified wind capacity is over 6GW



Source: JWPA

Energy Transition after Fukushima Nuclear Accident in Japan

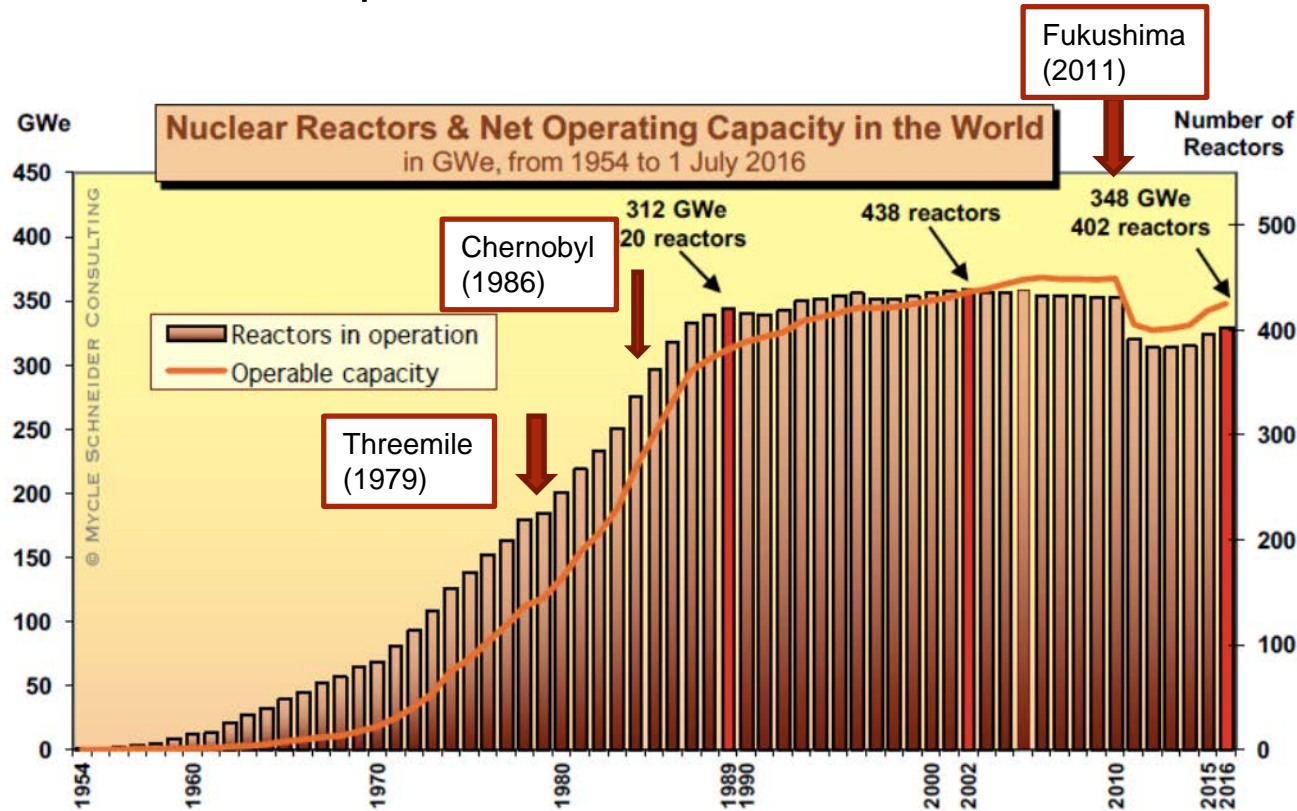
Decoupling started ?



Source: ISEP "Renewables 2016 Japan Status Report"

Limitation of Nuclear Power globally

- The nuclear industry is in decline: The 402 operating reactors are 36 fewer than the peak in 2002. The nuclear share of the world's power generation declined steadily from a historic peak of 17.6 % in 1996 to 10.7 % in 2015.



Sources: IAEA-PRIS, MSC, 2016



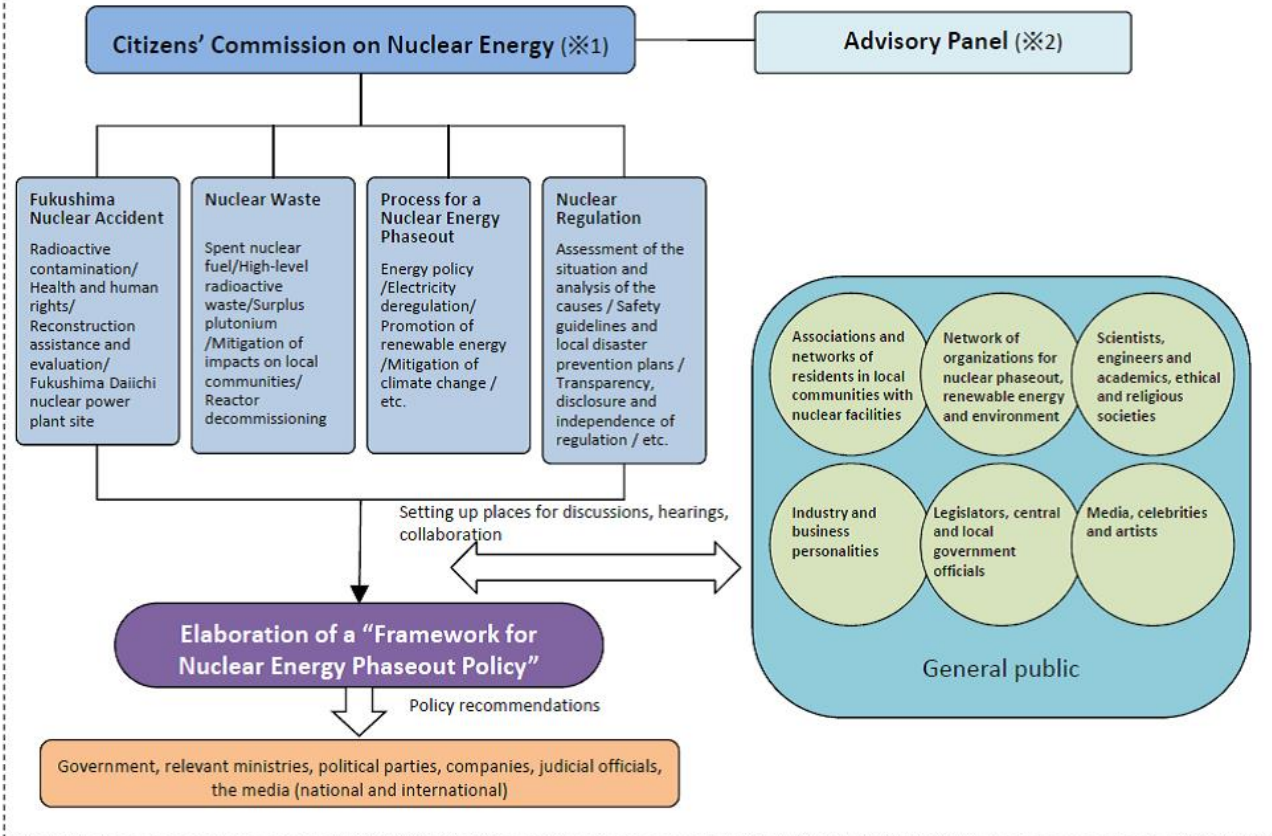
Figure 5. World Nuclear Reactor Fleet, 1954–2016

<http://www.worldnuclearreport.org/>

“Citizens’ Commission on Nuclear Energy (CCNE)”

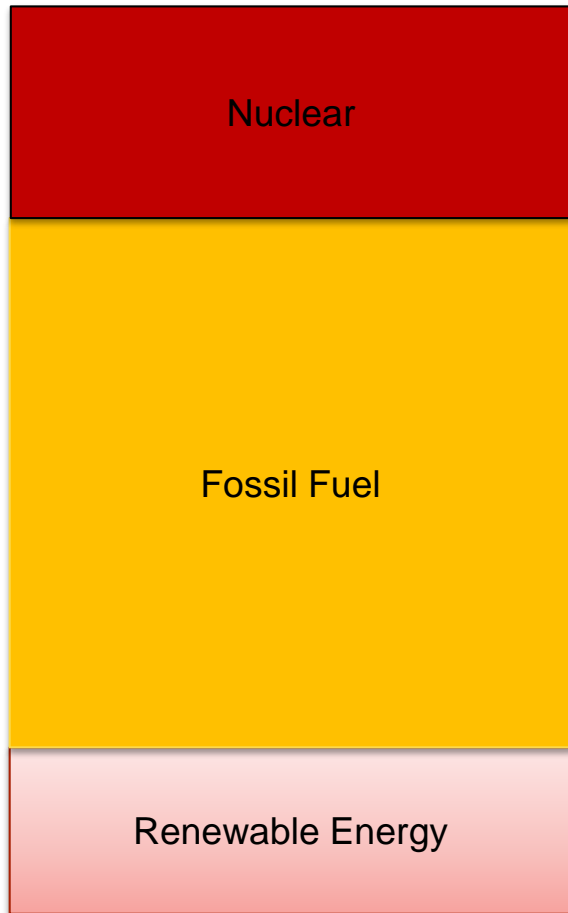
To organize a platform having think-tank function of collecting, analyzing and disseminating information, as well as making policy recommendations necessary to construct a society free of nuclear energy.

“Framework for Nuclear Energy Phaseout Policy”
 April 2014 released
http://www.ccnejapan.com/?page_id=3000

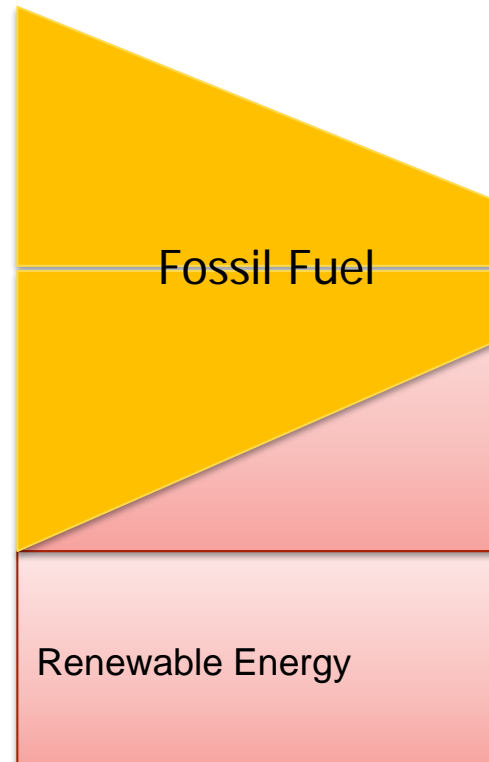


Energy Shift for Sustainable Society (CCNE)

Before Fukushima



After Fukushima
(Transition Phase) Energy Shift Phase



Long-term
Energy Shift to
100% Renewable
Energy

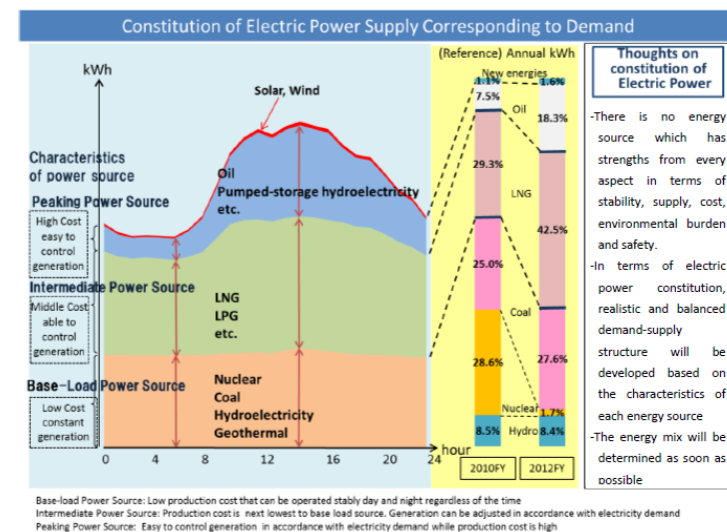
Japanese Government

“Strategic Energy Plan” (April 2014)

- Confirmation of the basic viewpoint of the energy policy (3E + S)
- Building a "multilayered and diversified flexible energy supply-demand structure" and policy direction
- Participation of diverse entities in the energy supply structure through structural reforms
- Creating an energy supply-demand structure led by the demand side through providing various options for end users
- Improving self-sufficiency by developing and introducing indigenous energies, etc. to minimize the impact of changes in overseas circumstances
- Contribution to global warming countermeasures for reducing global greenhouse gas emissions

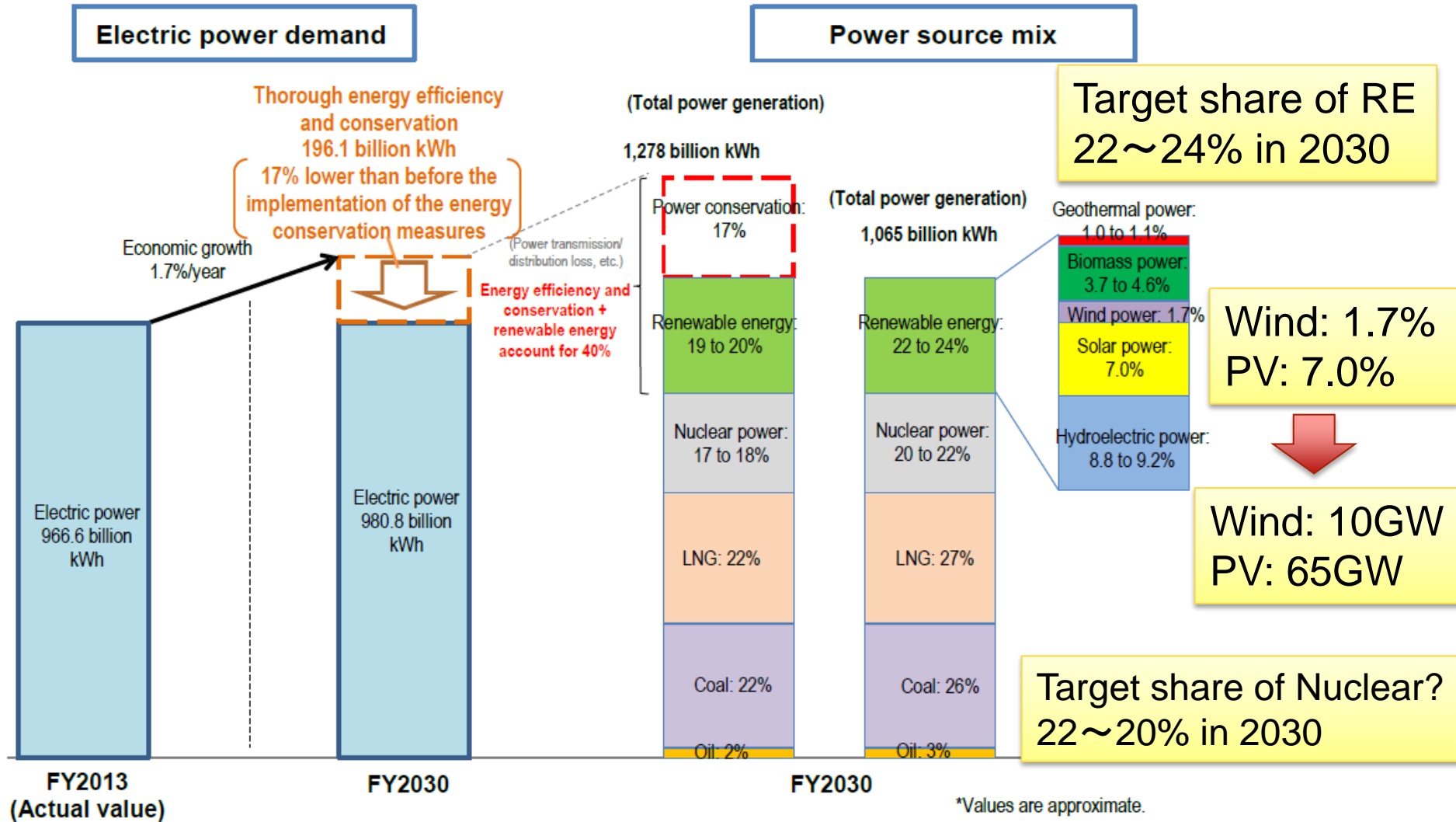


“Nuclear power is an important base-load power source as a low carbon and quasi-domestic energy source, contributing to stability of energy supply-demand structure,…”



Energy supply and demand in 2030 (METI) July, 2015

“Long-term Energy Supply and Demand Outlook”

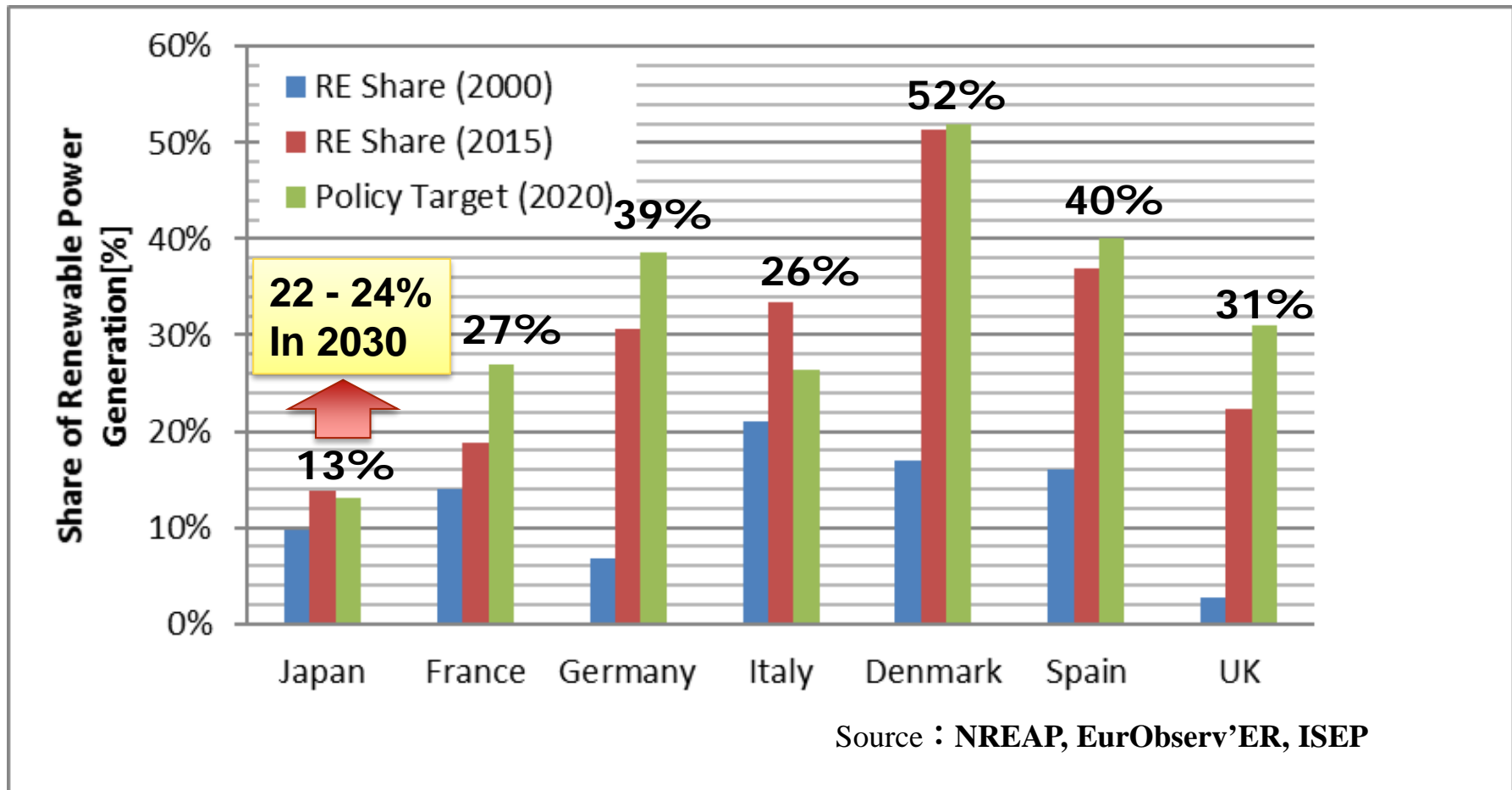


Based on “Strategic Energy Plan” in 2014

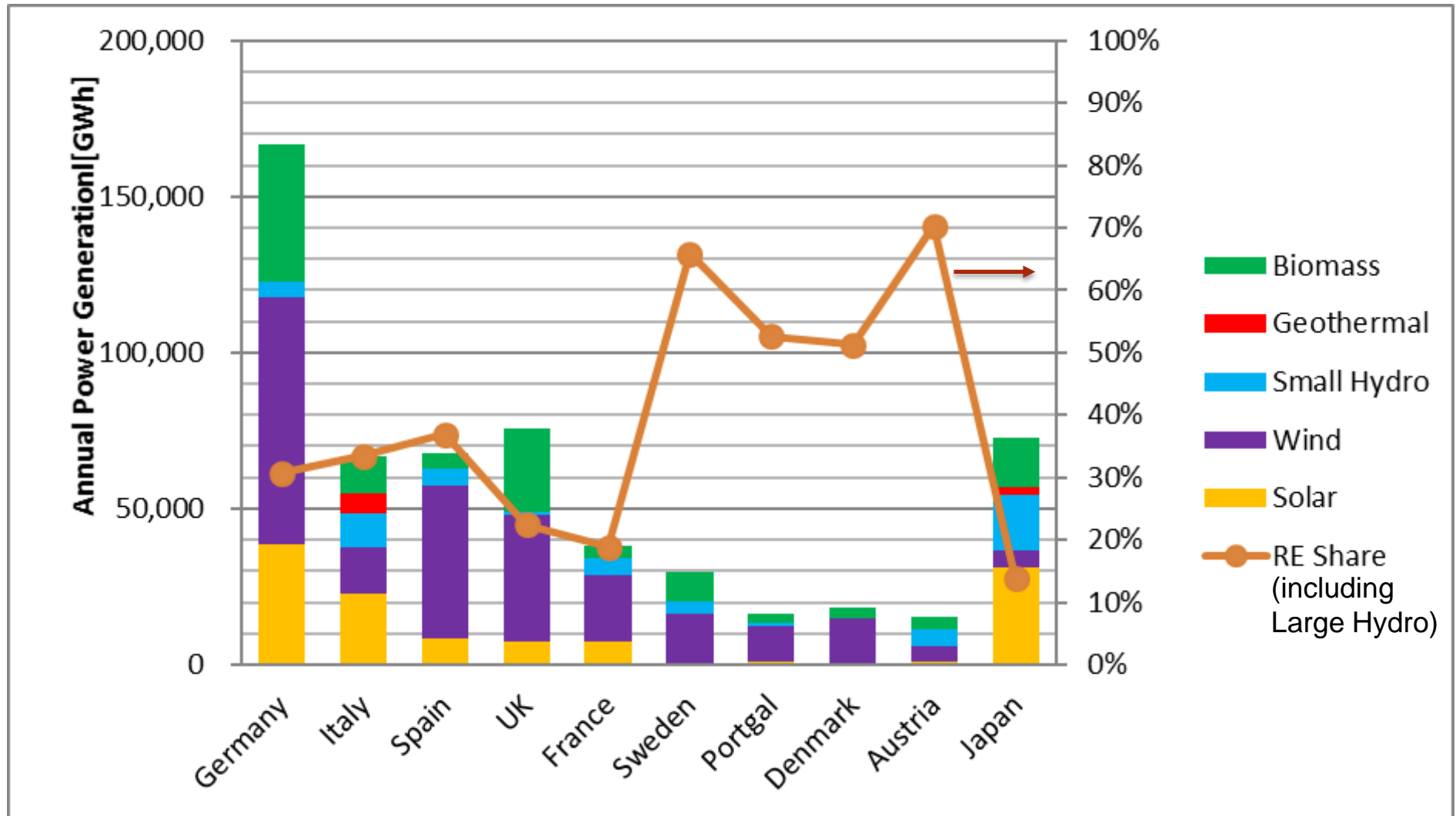
METI “Long-term Energy Supply and Demand Outlook”
http://www.meti.go.jp/english/press/2015/0716_01.html 31

Policy target of renewable energy

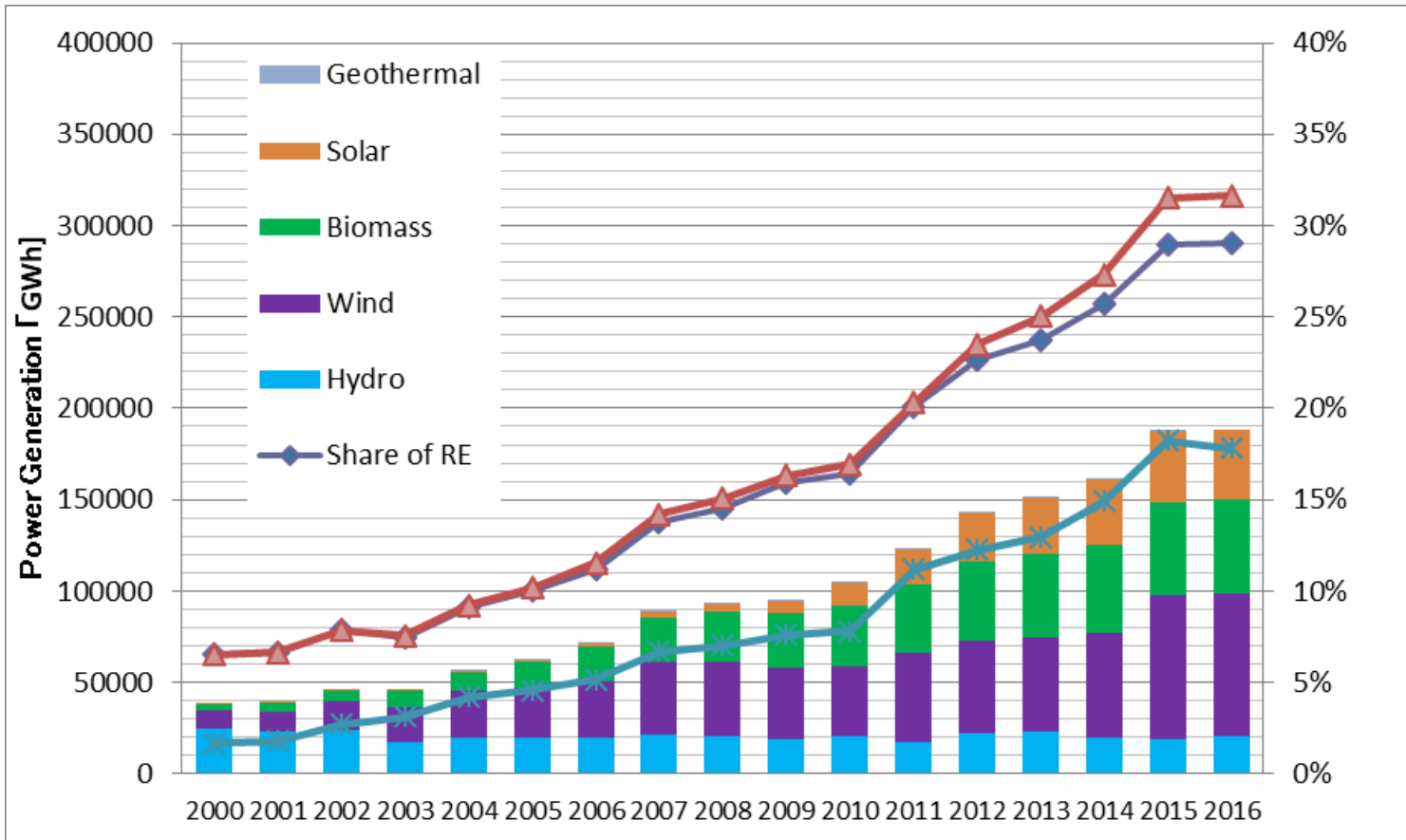
- EU directive causes renewable energy target of 2020 based on NREAP for each country in EU
- 2030 energy mix of renewable energy in Japan is 22 – 24%, which corresponds to 2020 target of EU countries.



Comparison of Power generation by Renewable Energy in European countries and Japan (2015)



Renewable Energy trends of Germany



2016
 Demand Share of RE
 31.6%
 Share of RE
 29.0%
 Share of VRE*
 17.8%

Target of RE
 2050 80%
 2035 55-60%
 2030 50%
 2025 40-45%
 2020 35%

*VRE: Variable Renewable Energy

Data Source: AGEB <http://www.ag-energiebilanzen.de/>

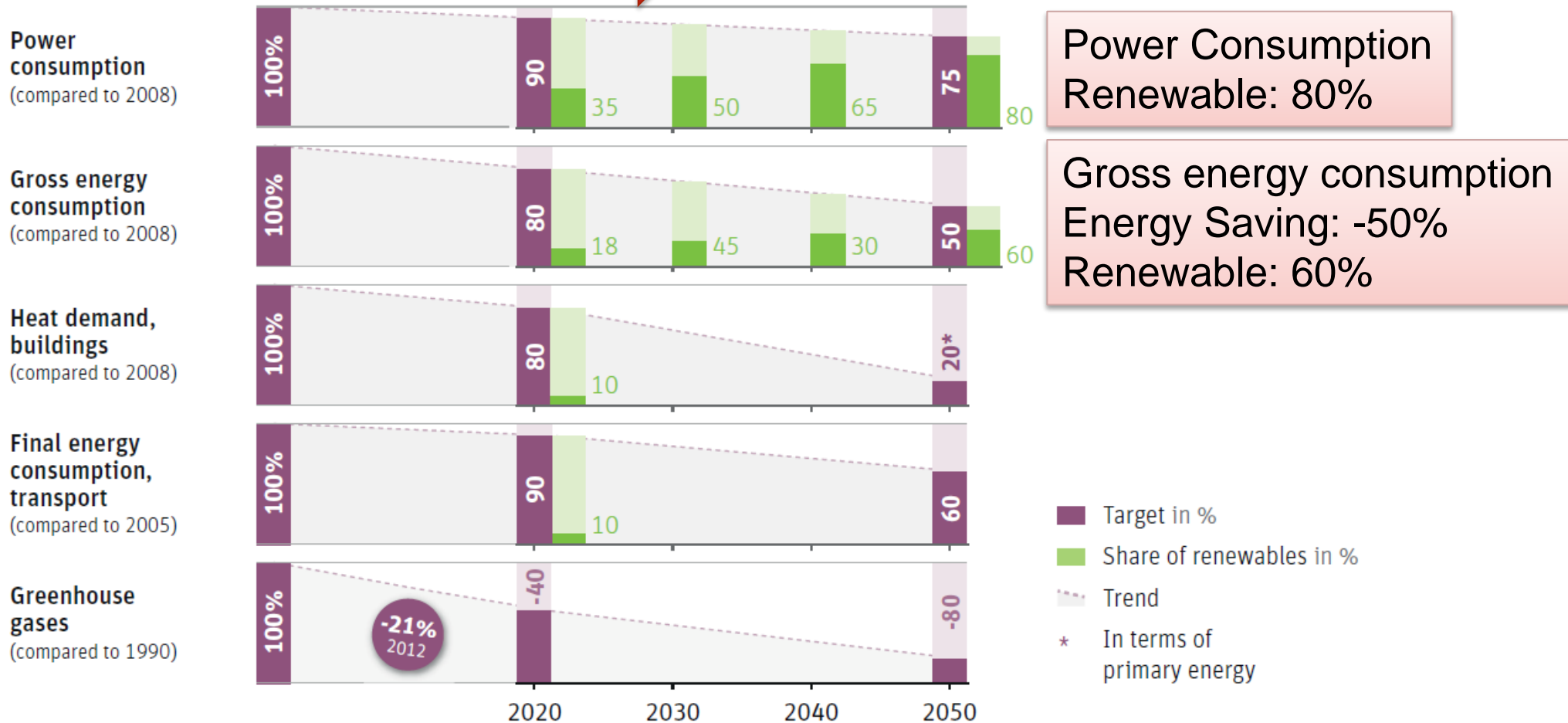
Germany Climate Action Plan ~Energiewende~

GHG emission reduction target: - 80% (2050)

Energy Concept(Sep. 2010)



Climate Action Plan 2050(Nov. 2016)



Economical effects of FIT scheme in Japan

Renewable Share : 9%(excluding large hydro)

Renewables
(PV,Wind,Geothermal,
Hydro,Biomass)

Tariffs for electricity

employment : 310,000
(IRENA)

2300B JPY

**Priority
Access**

**Power
Producers**

Electricity

**Electric
Utilities**

Electricity

**Investment,
Loan**

**Capacity
Investment**

57TWh

800TWh

Financial
Institution

Power Facility

Avoidable Cost:
500B JPY

2.25 JPY/kWh

**Electricity Price
(Surcharge)**

1800B JPY

Estimation
for FY2016

Home
(Regulated)

Company
(Office,
Industries,
Etc.)

Investment(2016) : 16Billion USD
(Total investment for clean energy
in Japan) estimated by UNEP

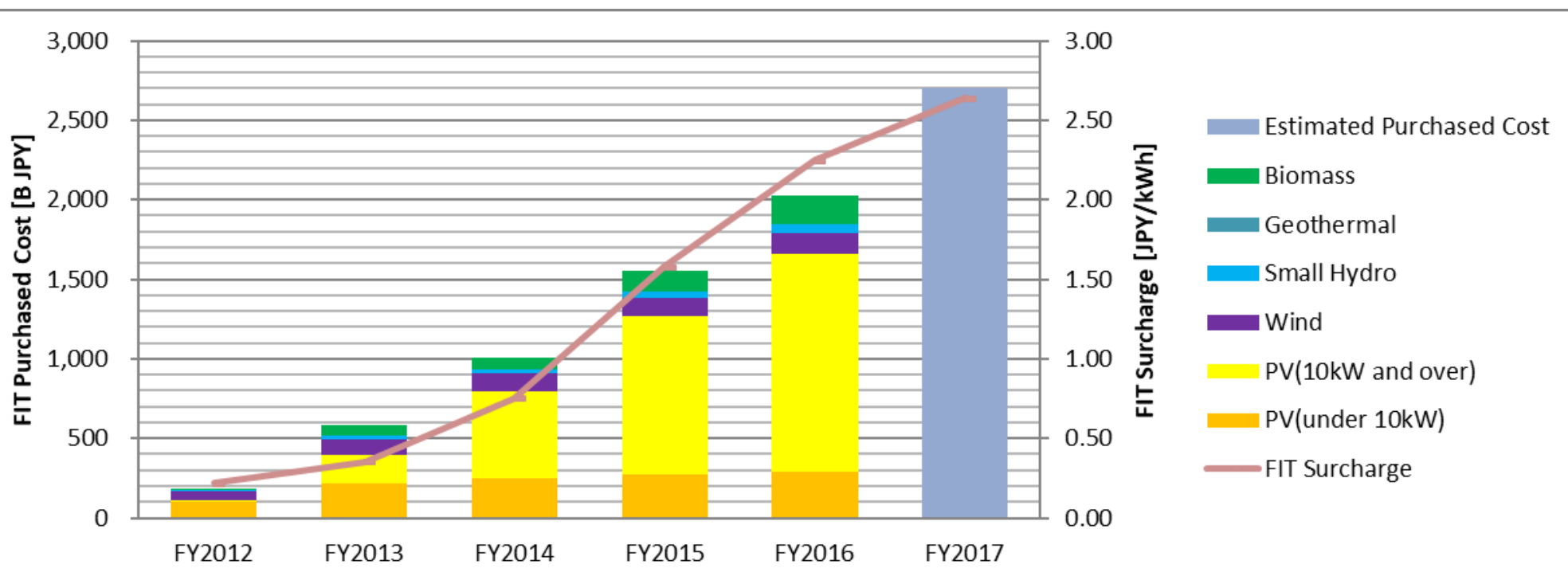
April,2016 – March,2017

Electric Consumer

Source Data: METI, Estimation by ISEP

Trends of Purchased Cost by FIT scheme in Japan

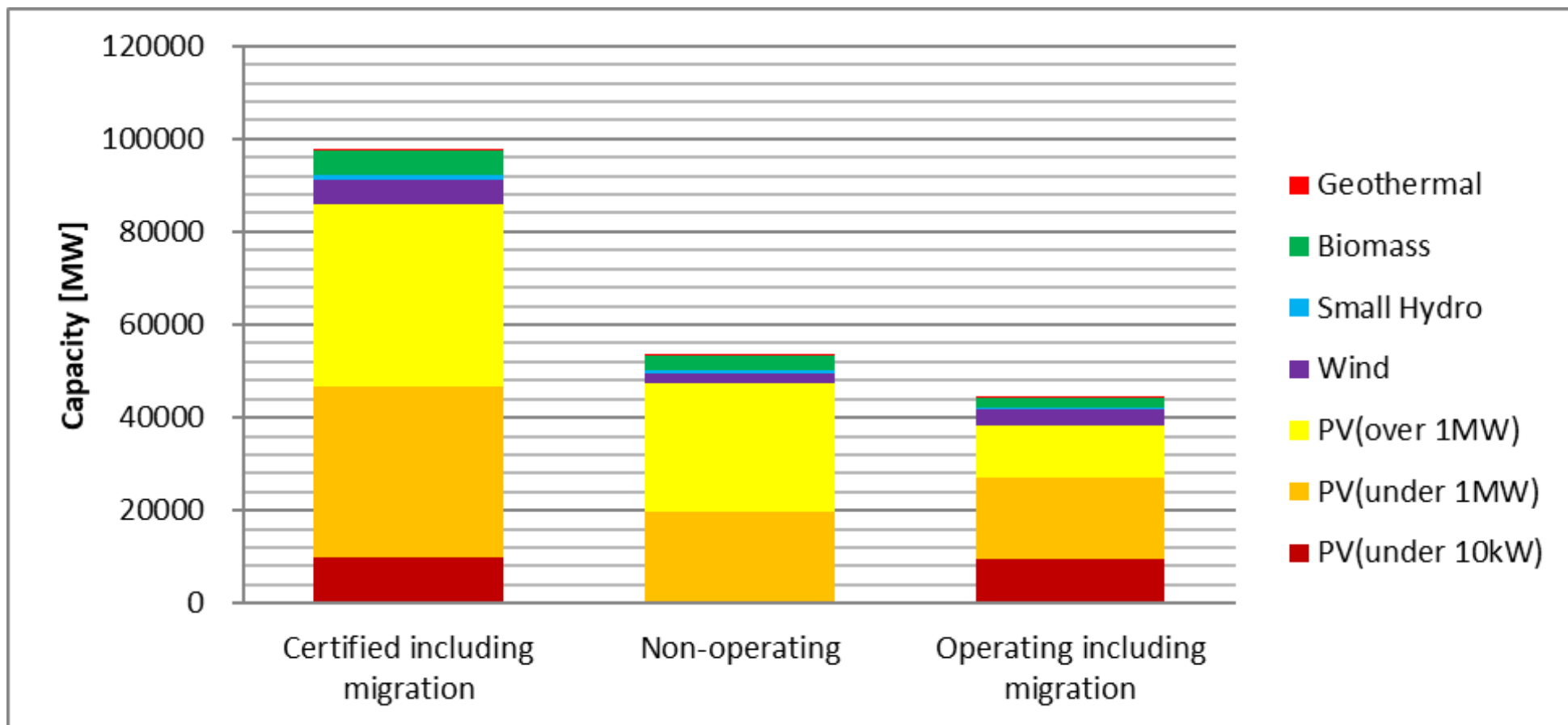
- Purchased cost for FIT scheme is increasing to over 2000 Billion JPY in FY2016
- Purchased cost is estimated to over 2500 Billion JPY in FY2017
- Surcharge for FIT scheme is set to 2.64 JPY/kWh in FY2017



Source data: METI
Graph: ISEP

Status of FIT in Japan (as of March 2017)

- Cumulative capacity of certified facilities is nearly 98GW until March, 2017 including migration from RPS.
- PV capacity is 88%(86GW) of certified facilities. And certified large PV over 1MW is 39GW(40%)
- Operating facilities are 32%(35GW) of certified facilities including migration by March 2017.
- 52% of Certified facilities(about 53GW) were non-operating by March 2017.



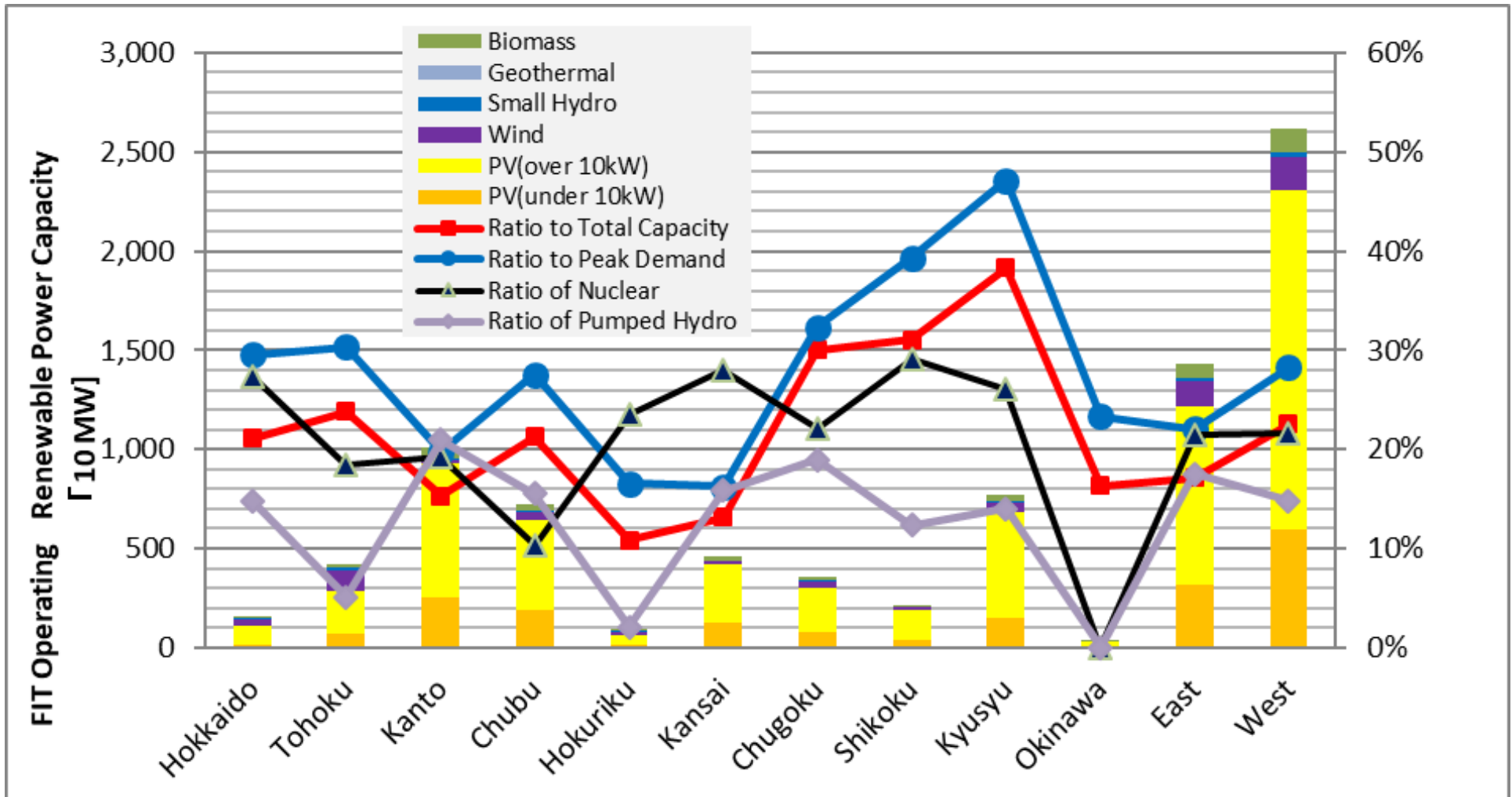
Source data: METI

Graph: ISEP

Results of FIT scheme (As of March 2017)

Operating Renewable power capacity in each utility

In kyusyu, operating renewable power capacity reaches 47 % of peak demand.



Source data: METI
Graph: ISEP

As of March 2017

Electrical System Reform in Japan:

Inter-regional grid connection between region of large utilities in Japan

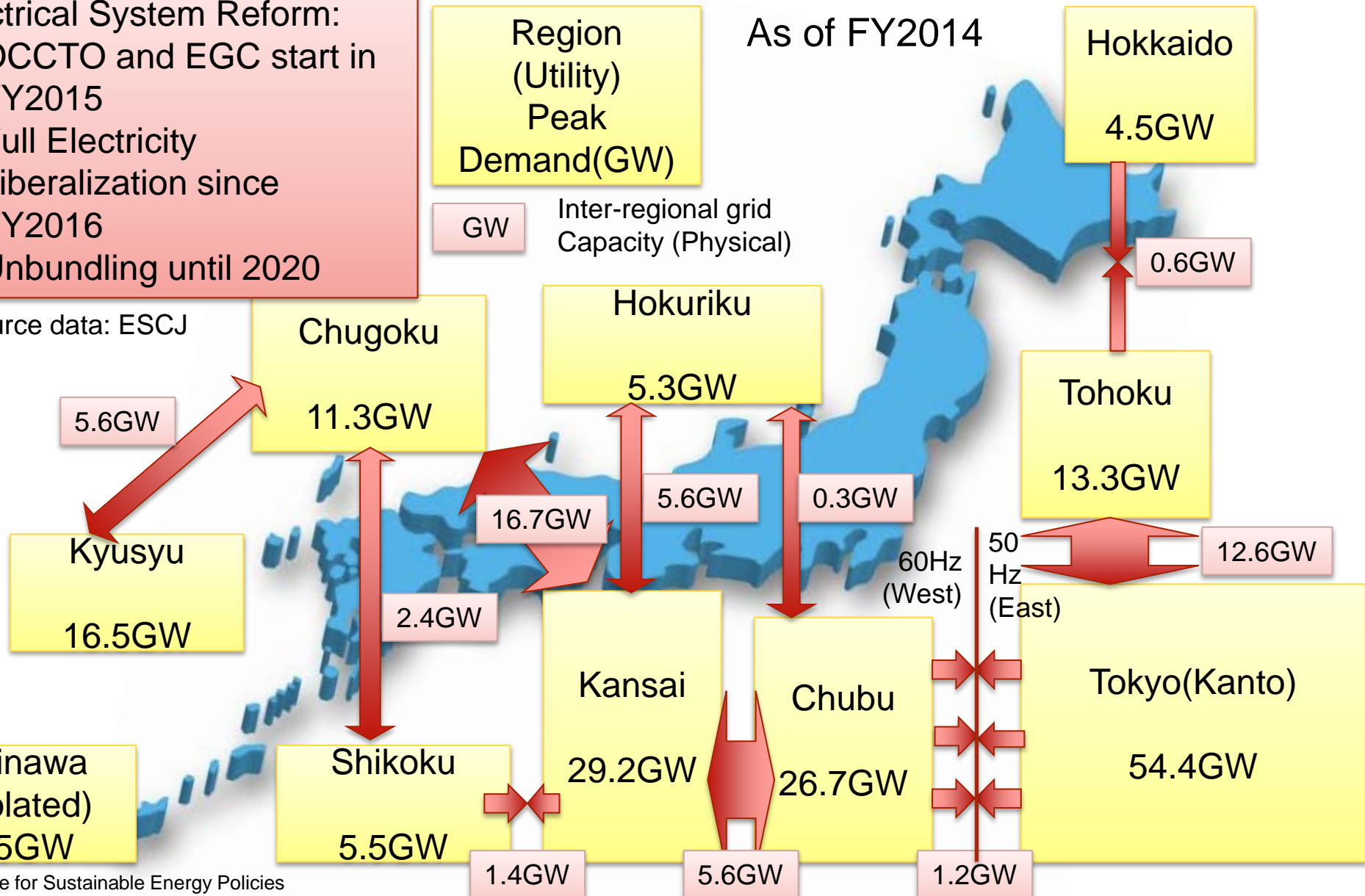
- Electrical System Reform:
- OCCTO and EGC start in FY2015
 - Full Electricity Liberalization since FY2016
 - Unbundling until 2020

Source data: ESCJ

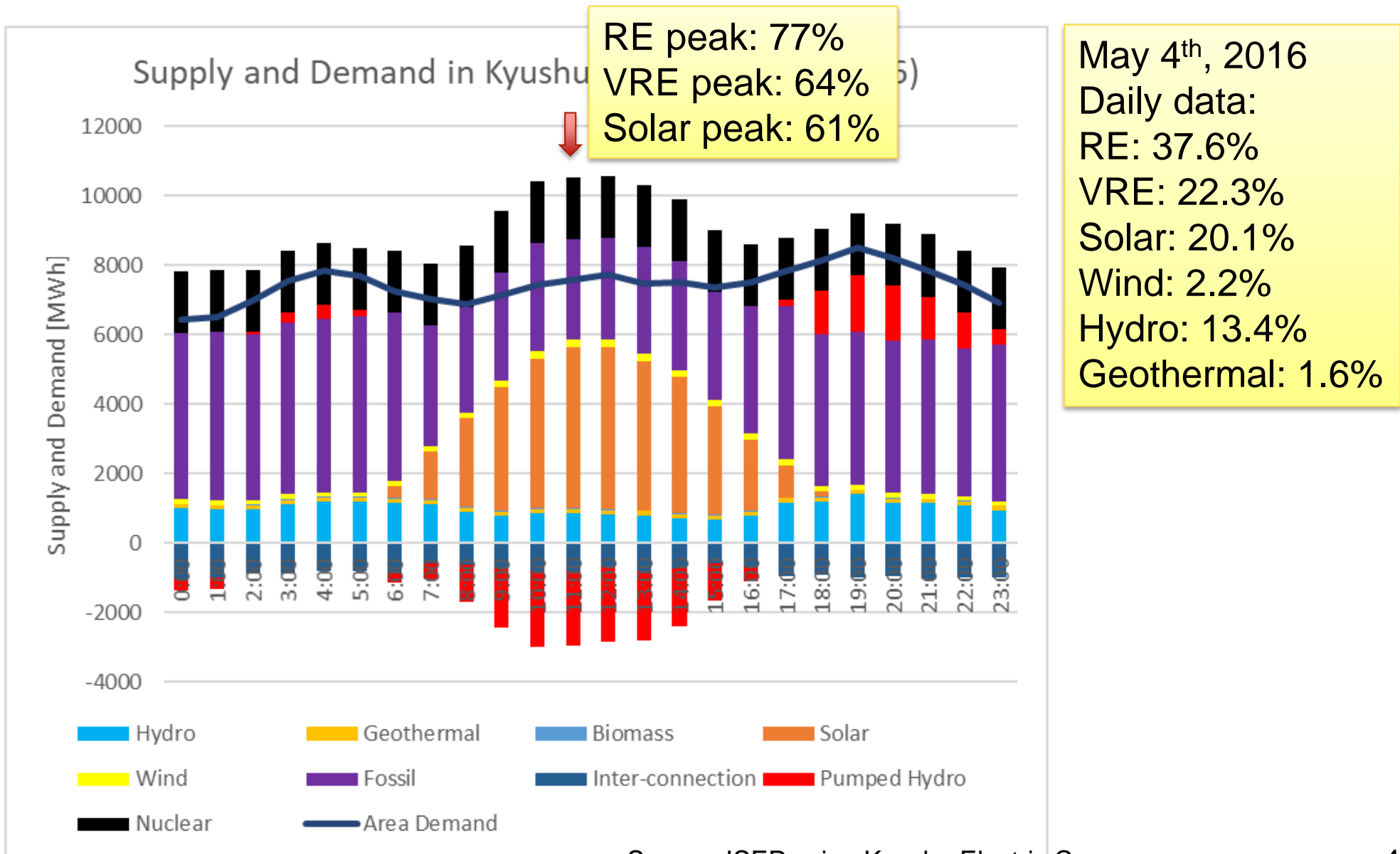
Region (Utility) Peak Demand(GW)

As of FY2014

GW Inter-regional grid Capacity (Physical)

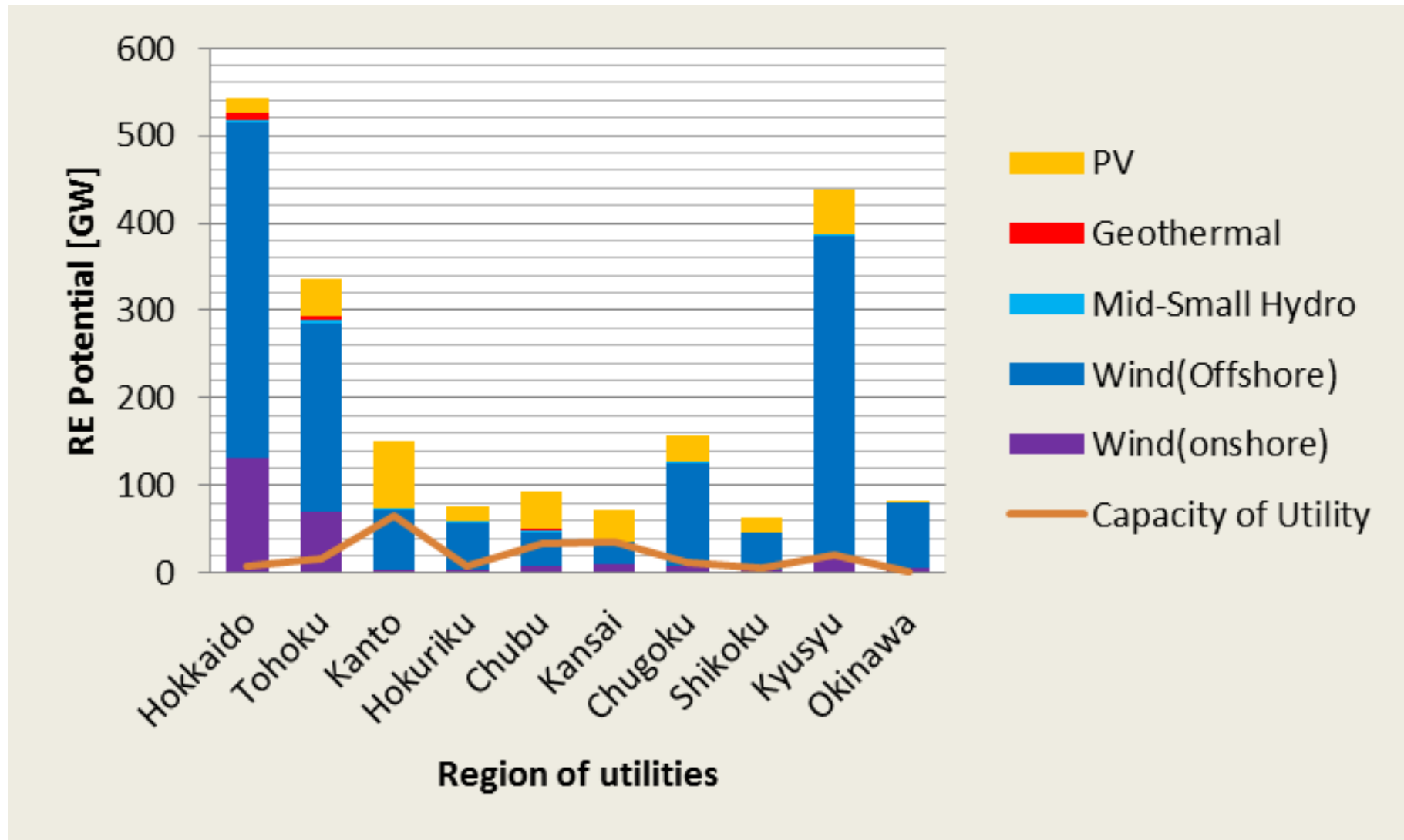


Single-day Supply and Demand in Kyushu area (May 4th, 2016)



Large Potential of Renewable Energy in Japan

Estimated by MoE, Japan

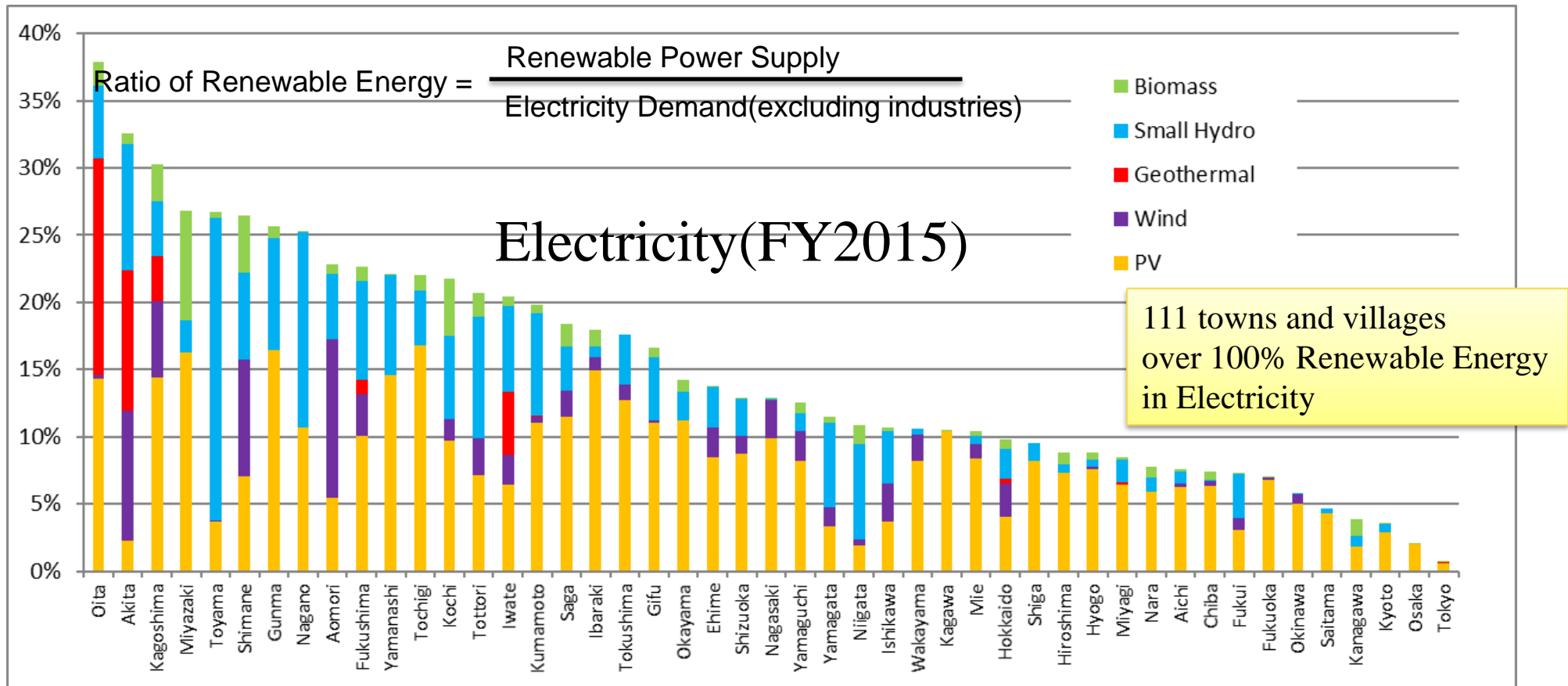


Ref: "Study of Potential for the Introduction of Renewable Energy (FY2012)" MoE, Japan

Sustainable Zone: Indicator for Sustainability of region in Japan

Energy Sustainable Zone (SZ) is an indicator to identify areas where local production of renewable energy exceeds local consumption of energy by residential and service sector.

Estimated by ISEP and Kurasaka Lab. Chiba Univ.

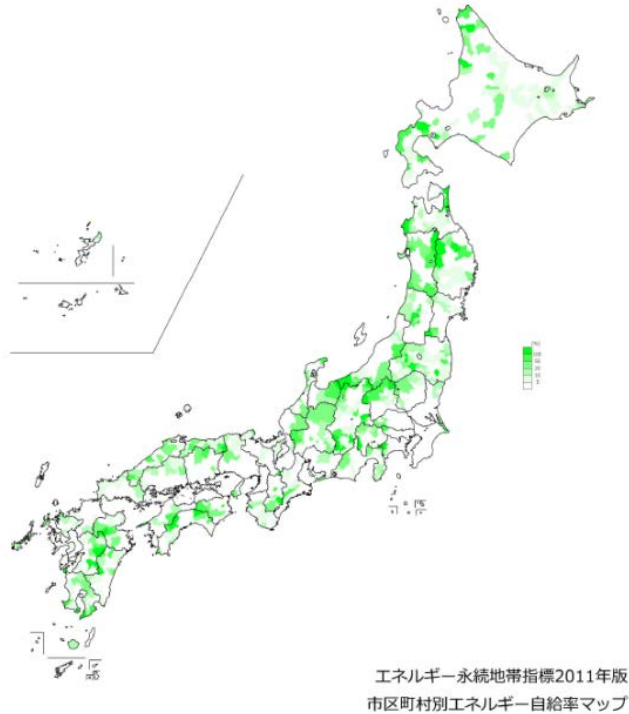


Prefectures

Source: Sustainable Zone Study Group
<http://www.sustainable-zone.org>

Sustainable Zone: 100% Renewable Region in Japan

Japan “Sustainable Zone”

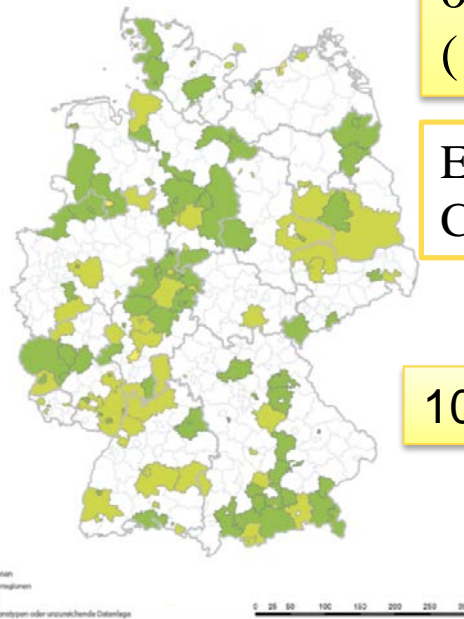


Source: Sustainable Zone Study Group

Germany “100% Renewable Region”

151 Regions (June 2016)
30% of area and population

Source: deENet, Germany



Energy Sustainable Zone (SZ) is an indicator to identify areas where local production of renewable energy exceeds local consumption of energy by residential and service sector.

71 towns and villages
over 100% Sustainable Zone
(100% renewables region) FY2015

Estimated by ISEP and Kurasaka Lab.
Chiba Univ.



100% Renewable Region in Germany

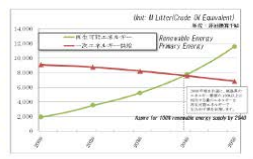
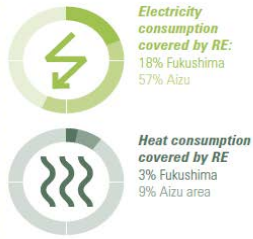


Global 100% RE Platform

100% RENEWABLES **100% RES COMMUNITIES**

Continent: Asia
 Country: Japan
 Municipality: Fukushima Prefecture, Aizu area
 Inhabitants: Fukushima Pref.: 1.98 million / Aizu area: 283,430 (2014)
 Surface area: Fukushima Pref.: 13,783 km² / Aizu area: 5,350 km²
 Awards: Yausmon Sato (Aizu Electric Power), "Stromrebell des Jahres" by EWS Elektrizitätswerke Schönau and City of Schönau (2013)
 Links: www.pref.fukushima.lg.jp/sec/11025c/energy56.html
 www.isep.or.jp/en/cp2014/
 http://s.100-ee.de/policyhandbook
 http://aipower.co.jp/

STARTING THE ENERGY REVOLUTION IN JAPAN FROM AIZU / FUKUSHIMA



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FACTS ON THE 100% RES TARGET:

MOTIVATION

- "No more Fukushima - Never" – to become independent from nuclear power
- To become energy self-sufficient by using and circulating our abundant natural resources for our community
- To reconstruct Fukushima and rebuild our community and local economy with renewable energy
- To pass on a healthy and safe country to our children and grandchildren

ELEMENTS

- Fukushima Renewable Energy Vision:
Vision: 100% renewable energy comparing to primary energy supply by 2040
Policy goal: 40% renewable energy by 2020, 64% renewable energy by 2030 comparing to primary energy

ACTORS

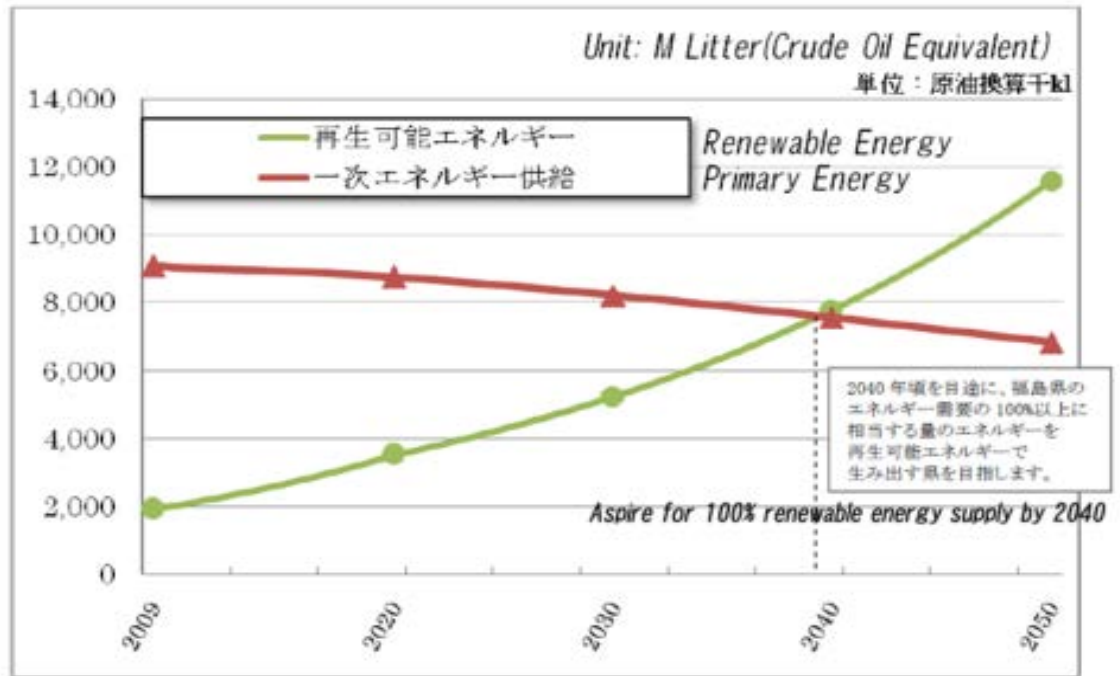
- Local governments of Fukushima prefecture, each city and town
- Support organization for development of renewable energy projects in each community, such as Fukushima Project Network.
- Community based companies for renewable energy development, such as Aizu power in Aizu area.
- Domestic and international network motivated by community power international conference 2014 in Fukushima

MEASURES

- National Energy Policies: FIT, Liberalization of electricity market and unbundling, etc.
- Fukushima renewable energy vision (March 2012): Infrastructure for implementation such as ownership, capacity building, support program, relaxation of regulations and technology development. Infrastructure for industries of Renewable energy such as PV industries, offshore wind farm projects, R&D facilities based in Fukushima

FACTOR OF SUCCESS

- Networking for support of capacity building, sharing know-how and financing for project development
- Community Power in each area such Aizu and support by so many citizens
- Support of local government and reform of energy system such as liberalization of electricity market, unbundling of power system.



- Fukushima Prefecture:**
- Vision and Scenario of 100% Renewable Energy.
 - Primary Energy Share:
 - Current Status: 20% (2009)
 - Policy Target1: 40% (2020)
 - Policy Target2: 64% (2030)
 - Vision: 100% (2040)

Community Power

“The deployment of distributed renewable energy lead to communities’ benefit if local people take the ownership of the projects. And local people’s participation and cooperation enable renewable energy projects to become rooted in the local communities and that produce various social benefits. Such renewable energy development is called as “Community Power”, and the idea has created new global trend in rapidly growing renewable energy sector.”

Source: <http://www.isep.or.jp/en/cp2014/>

A project can be defined as Community Power if at least two of the following three criteria are fulfilled (WWEA community power WG):

1. Local stakeholders own the majority or all of a project
A local individual or a group of local stakeholders, whether they are farmers, cooperatives, independent power producers, financial institutions, municipalities, schools, etc., own, immediately or eventually, the majority or all of a project.
2. Voting control rests with the community-based organization:
The community-based organization made up of local stakeholders has the majority of the voting rights concerning the decisions taken on the project.
3. The majority of social and economic benefits are distributed locally:
The major part or all of the social and economic benefits are returned to the local community.

Regions and Enterprises towards 100% Renewable Energy



**Climate Summit
for
Local Leaders**
DECEMBER 4TH 2015 - PARIS

Paris City Hall Declaration
A decisive contribution to
COP21 (2016年12月4日)

RE

100

Over 110 Companies already have
commitment of RE 100%

<http://there100.org/companies>



BROUGHT TO YOU BY

THE CLIMATE GROUP

IN PARTNERSHIP WITH



AS PART OF

WE MEAN BUSINESS

”Global 100% Renewable Energy Platform“



<http://www.go100re.net/>



Established on May 17th, 2017



EREF
European Renewable Energies Federation



全国ご当地エネルギー協会
～地域でつくる、地域のエネルギー～

Members(Nov. 2017)

ICLEI “100% Renewable Energy Cities & Regions Network”

100% Renewable Energy Cities & Regions Network since 2015

<http://www.iclei.org/lowcarboncity/100RE>



Cities(March 2017)



- Aspen, USA
- Australian Capital Territory, Australia
- Växjö, Sweden
- Vancouver, Canada
- Tshwane, South Africa
- Saanich, Canada
- Byron Shire, Australia
- Jeju, Republic of Korea
- Malmö, Sweden
- Inje County, Republic of Korea
- Pingtung County, Chinese Taipei

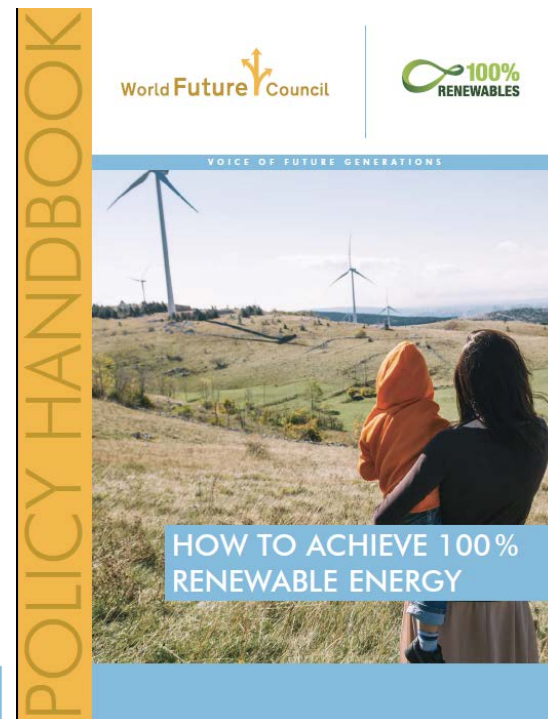
How to achieve 100% renewable energy

- #1 Achieving 100% RE can generate significant cost savings
- #2 100% RE strategies are not just for the wealthiest countries
- #3 Transitioning to 100% RE can mitigate risks and make countries more resilient
- #4 Transitioning to 100% RE can generate new economic activities, create jobs, and improve quality of life
- #5 Achieving a fully 100% RE system will require significantly expanding RE in the heating/cooling and transport sectors

Key findings of
100% RE Case
studies Analysis

Key Findings of 100% RE Case Study Analysis

- ✓ Inform and educate citizens and business leaders about the concrete possibility of a 100% renewable energy future
- ✓ Analyse the cost savings, environmental benefits, and improved economic security of a 100% renewable energy strategy
- ✓ Clearly communicate the economic advantages of renewable energy
- ✓ Build alliances across political parties and across sectors
- ✓ Engage citizens and investors



<http://www.go100re.net/e-library/studies-and-reports/>

Policy
Recommendations for
achieving 100 % RE

Criteria for a Sustainable Transformation towards '100% Renewable Energy'

Criterion 1 - Implementation status and outcomes

Criterion 2 - 100% RE target

Criterion 3 - Planning & orientation

Criterion 4 - Institutionalisation

Criterion 5 - Local stakeholders' engagement

Criterion 6 - Renewable energy technologies in use

Criterion 7 - Buildings

Criterion 8 - Mobility and Transport

Criterion 9 - Energy efficiency in utility-scale generation

Criterion 10 - Knowledge generation

Criterion 11 - Public engagement

Criterion 12 - Participation in Networks



<http://go100re.net/>

“100% RE Building Blocks”



1. Activate local resource potential
2. Develop the 100% RE Blueprint
3. Formalize aims and functions
4. Promote energy conservation and efficiency
5. Increase and integrate RE across sectors
6. Identify financial resources
7. Support decentralization and inclusion
8. Nurture vertical and horizontal cooperation and integration
9. Promote knowledge generation and capacity building
10. Engage in networks

Source: <http://go100re.net/>

Group Workshop:

How to achieve 100% renewable energy in your region?

Where? Country? Municipality? Community? Company?

When? Target of RE? Roadmap?

Who? Policymaker? Citizen? NGO? Corporation?

What? Power, Heat and Transport?

Which? Solar, Wind, Biomass, Hydro, Geothermal, etc.

How? Policy? Finance? Actor? Network?

Thank you !

*“Future is not predictable
but selectable.”*

Jorgen Norgard,
Denmark



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