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RENEWABLE ENERGY INSTITUTE

Connecting Asia with Renewables

Global renewable energy revolution
and opportunities for Japan

2 NOV 2016

Economic Research Institute for North East Asia
The Ninth Japan–Russia Energy and Environment Dialogue in Niigata

Mika Ohbayashi
Director, Renewable Energy Institute

Renewable Energy Institute



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In the aftermath of March 11, 2011
the Great East Japan Earthquake
Nuclear Accidents at Fukushima Daiichi Nuclear Power Station



Masayoshi Son
Founder and Chairperson, REI
Chairman & CEO, SoftBank Group



Tomas Káberger
Executive Board Chair
Renewable Energy Institute

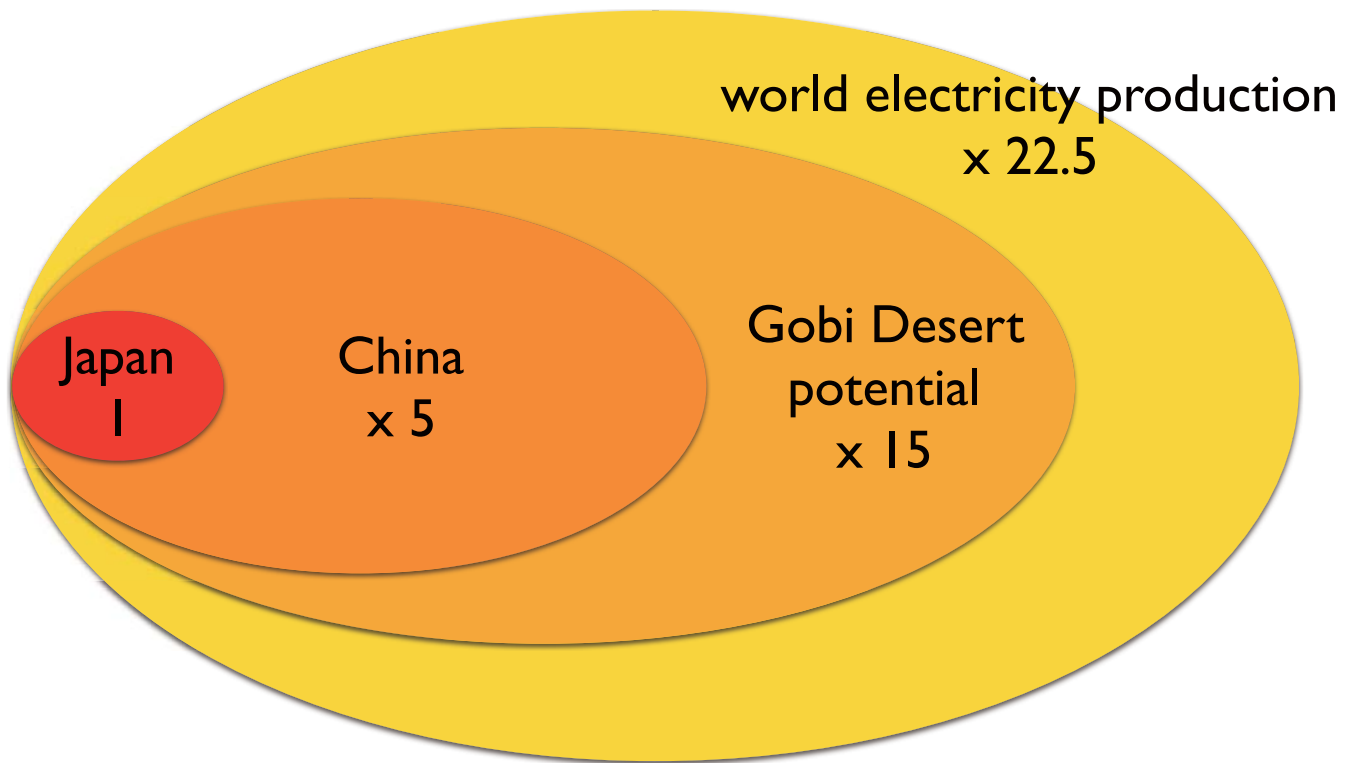


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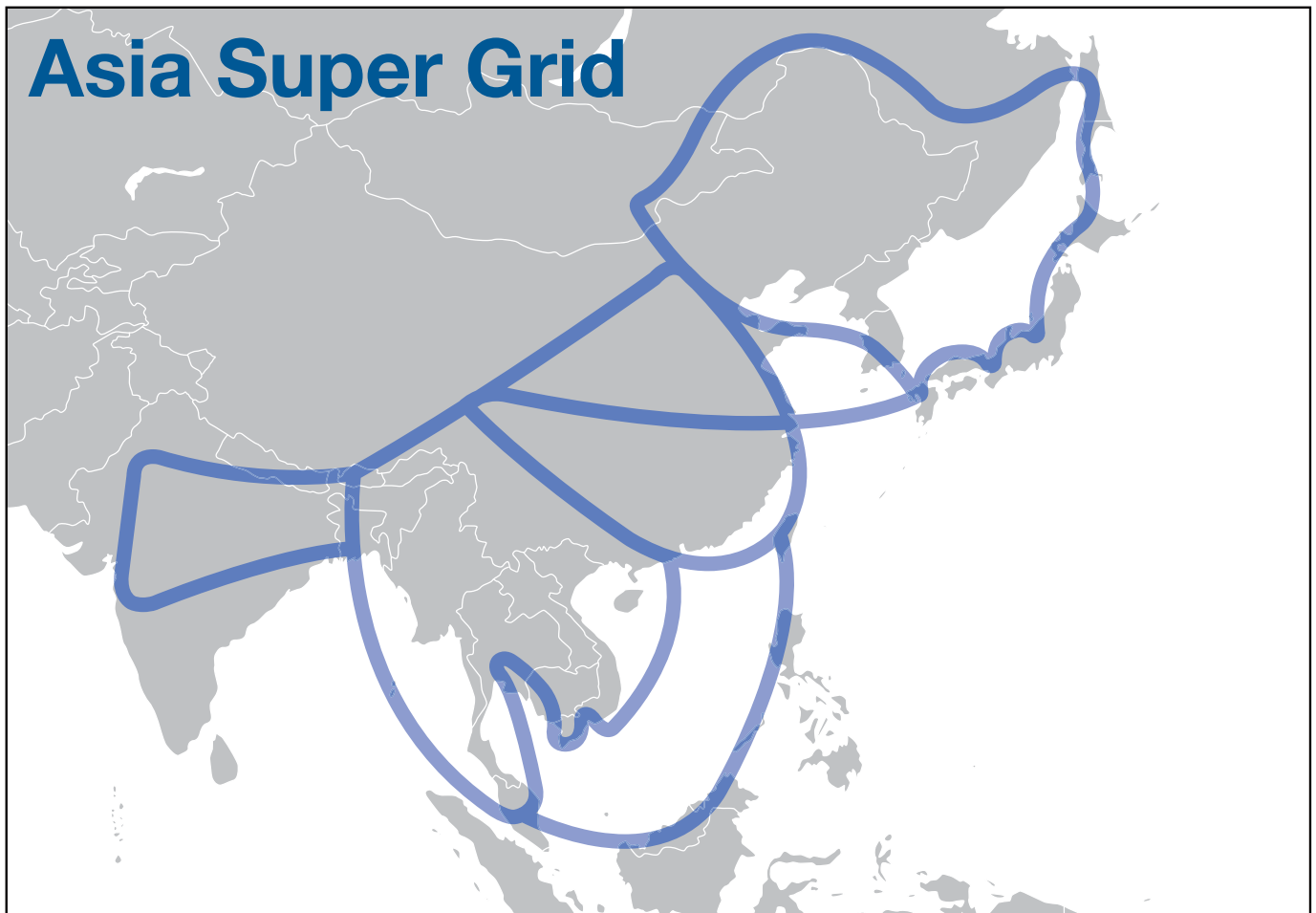
REI was established in August 2011;
to deliver safe, secure, sustainable and affordable energies to the society
to deliver energy shift to Japan's society

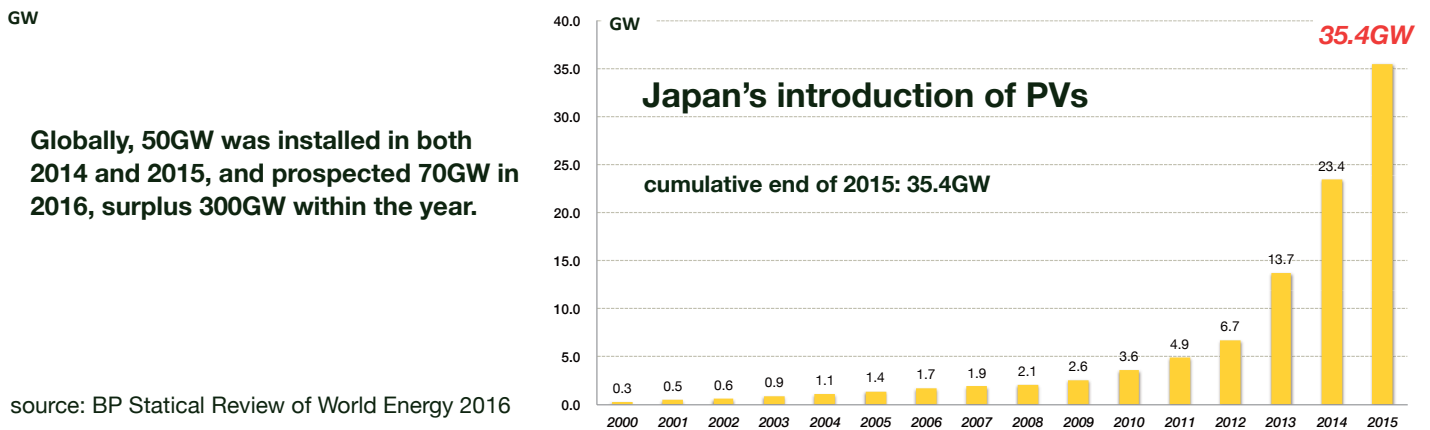
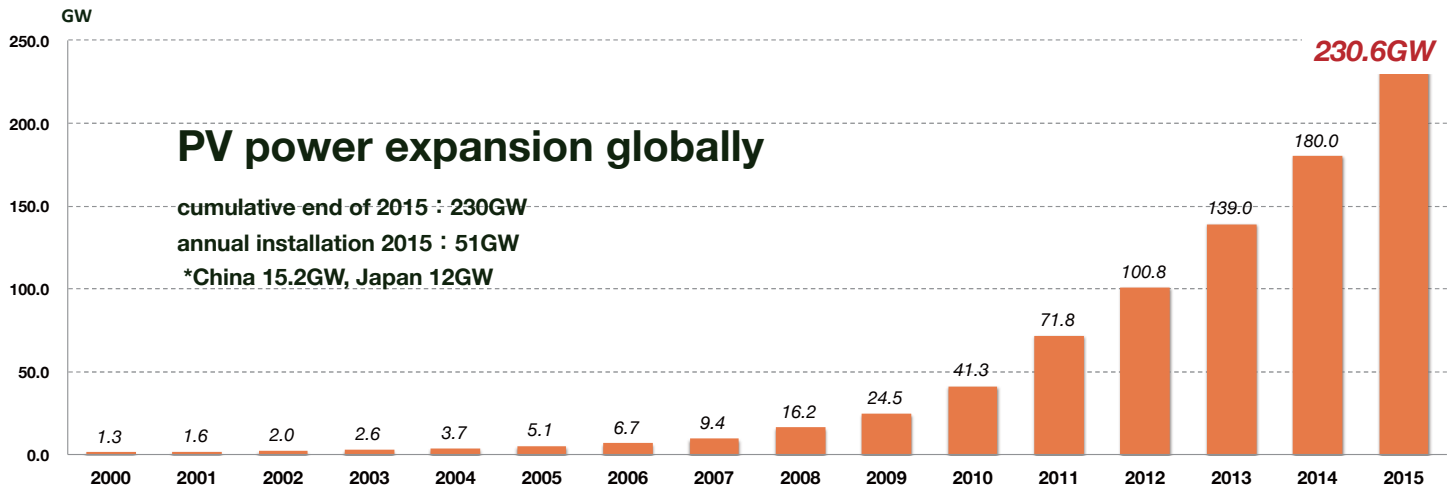
why not? using RE source from Asia

concept: using the abundance renewable energy resources in Asia

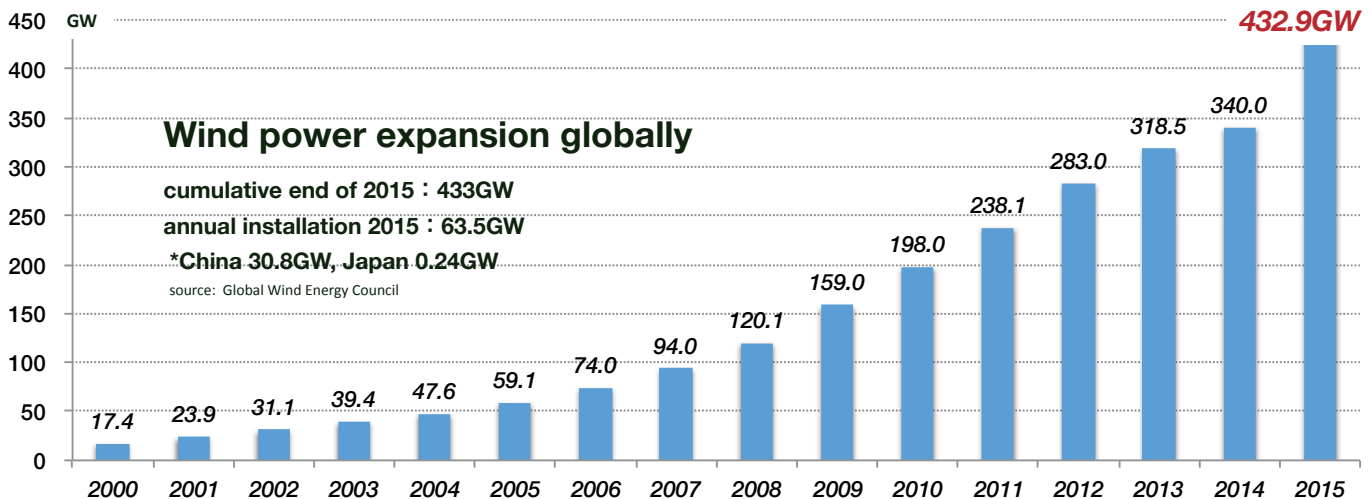


Asia Super Grid - connecting Asia with RE



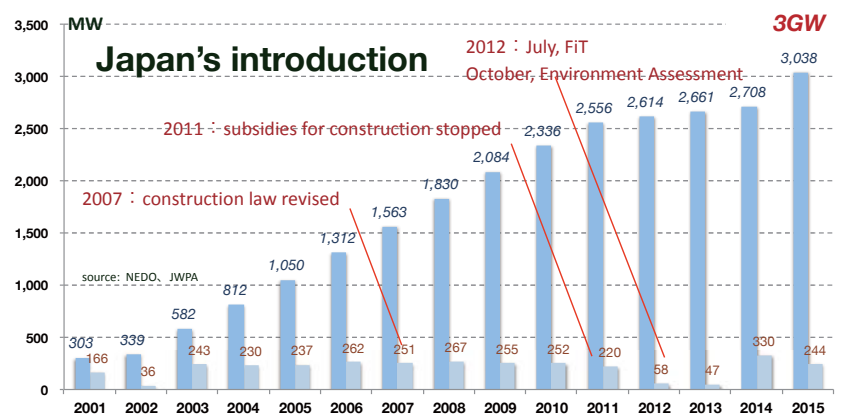


Global expansion of RE -wind



Globally, 52GW and 63GW were installed in 2014 and 2015 respectively, and prospected 64GW in 2016, will nearly reach 500GW the year.

Japan is still minor to install wind power, but slowly closer to energy trend change.



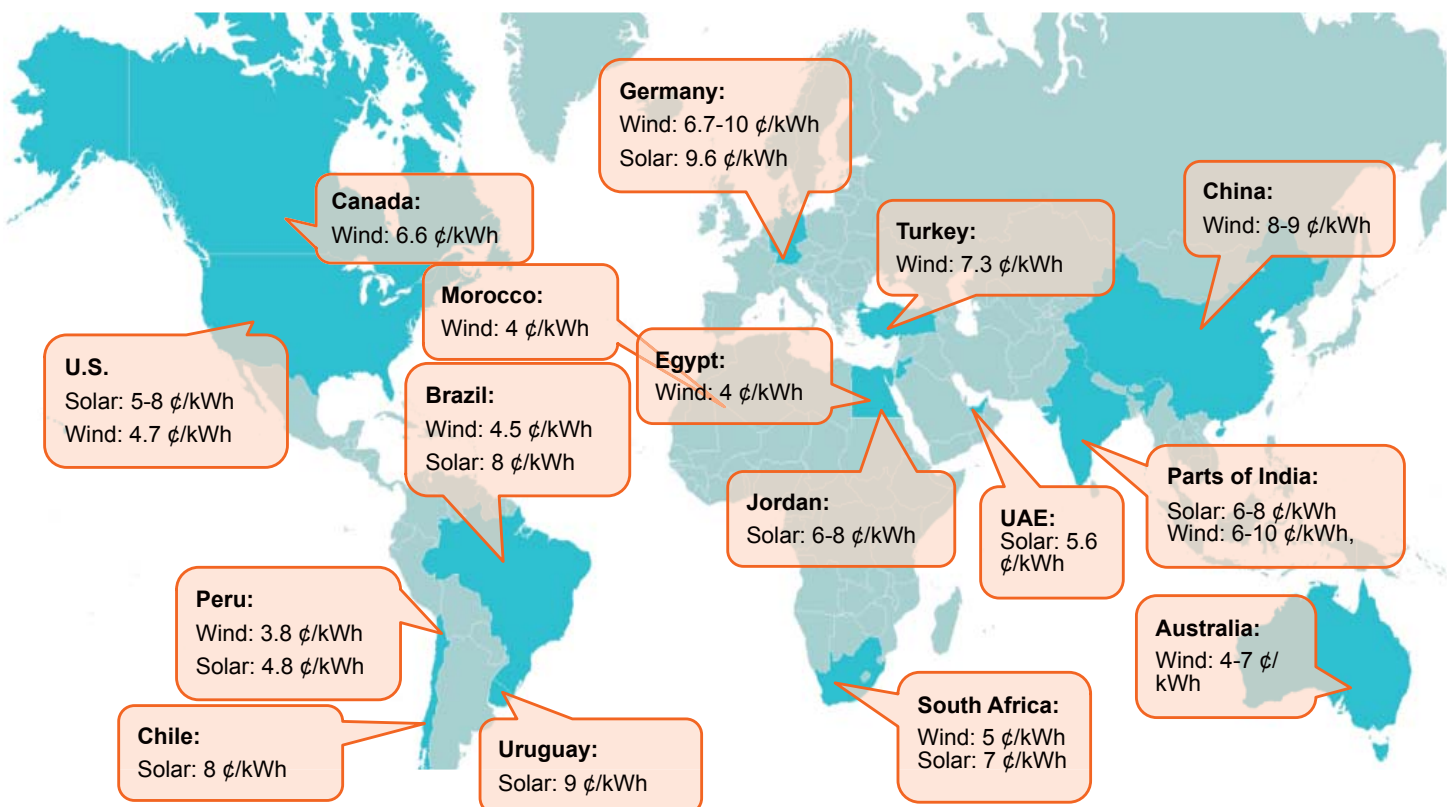
*numbers of abolished turbines are reduced from total

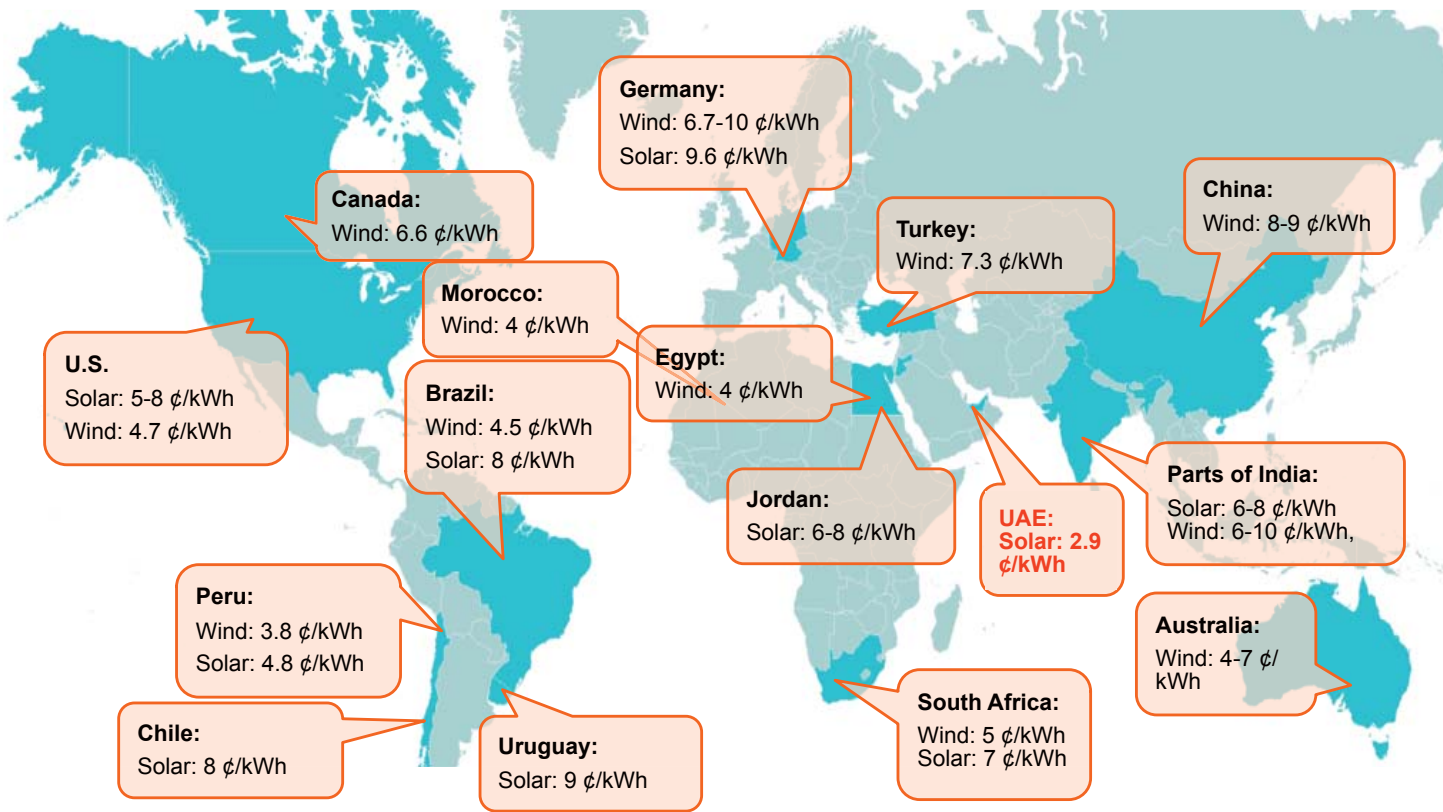
Countries have ambitious RE targets



countries and regions	RE elec. targets by 2030 and beyond
EU	2030: 45%
UK	2030: 40-65%
FRANCE	2030: 40%
SPAIN	2020: 40%
GERMANY	2035: 55–60% 2050: 80%
THE US	CA: 50% in 2030 NY: 50% in 2030 Hawaii: 40% by 2030, 100% by 2045
CHINA	it is possible to provide 86% RE by 2050 - by the government think tank studies

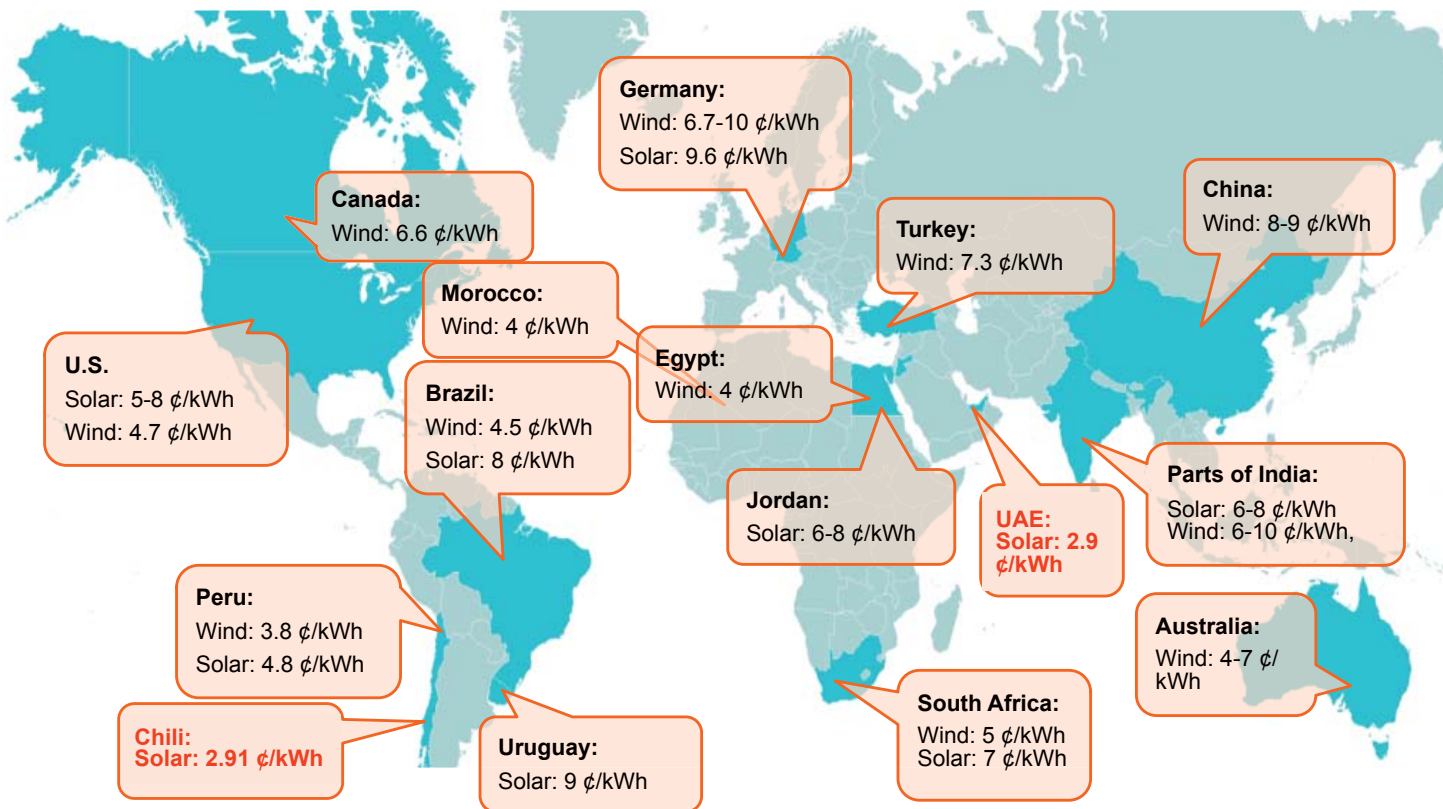
renewables' costs are going down and down



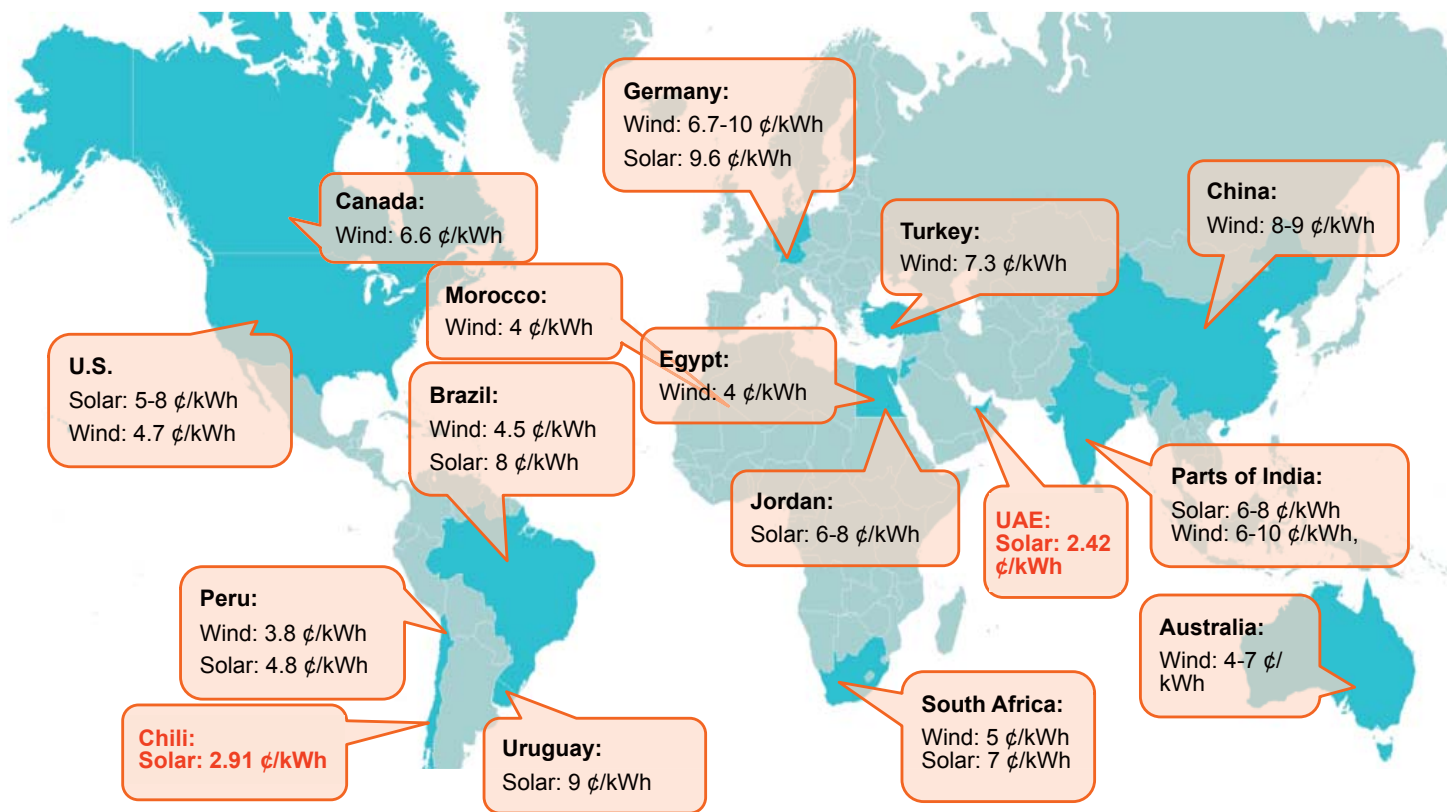


Source: presentation from WB at REI's REvision2016 Conference in March 2016 + media reports

renewables' costs are going down and down



Source: presentation from WB at REI's REvision2016 Conference in March 2016 + media reports



Source: presentation from WB at REI's REvision2016 Conference in March 2016 + media reports

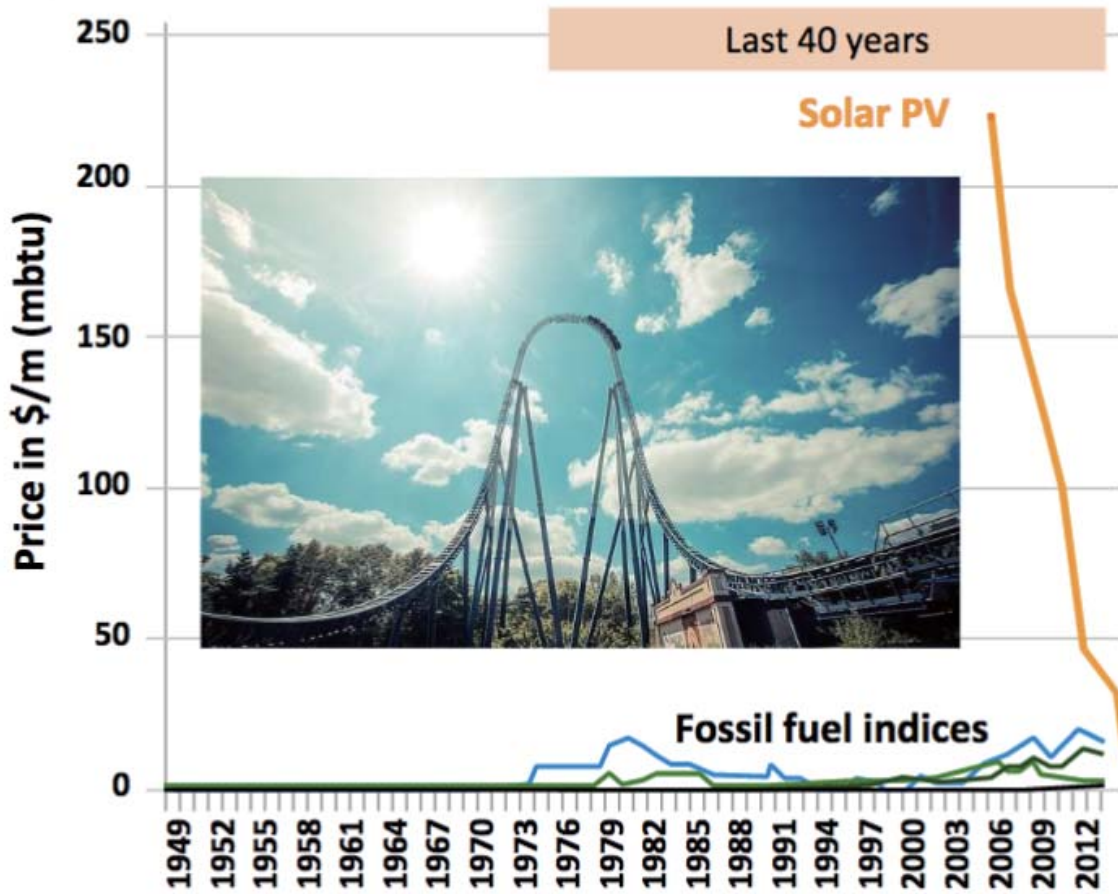
PV cost is going down and down



Managing Member	Consortium Member		IRR (%)	LEC (in fils/kWh)	Weighted LEC (in fils/kWh)	Ranking based on Weighted LEC
Marubeni	Jinko Solar		7.00%	10.796 (USD 2.940c)	8.888 (USD 2.420c)	1
Masdar	EDF	PAL	7.00%	11.311 (USD 3.080c)	9.404 (USD 2.533c)	2
Tenaga	Phelan Energy		7.15%	11.512 (USD 3.135c)	9.543 (USD 2.598c)	3
RWE	Belectric		7.00%	13.038 (USD 3.550c)	10.720 (USD 2.919c)	4
JGC	First Solar	Sojitz	8.46%	13.840 (USD 3.769c)	11.339 (USD 3.088c)	5
Kepeco	Q Cells	GSE	7.00%	15.980 (USD 4.351c)	13.349 (USD 3.635c)	6

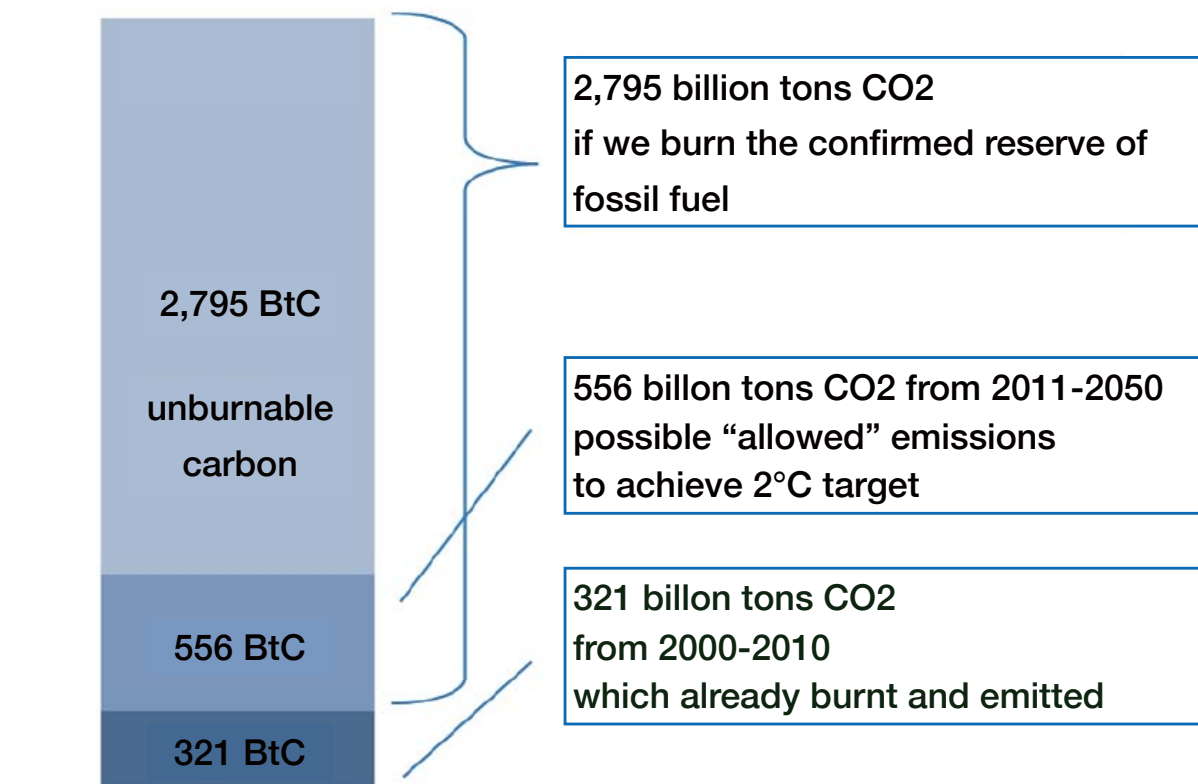
Source: Middle East Solar Industry Association (MESIA)

PV cost is going down and down



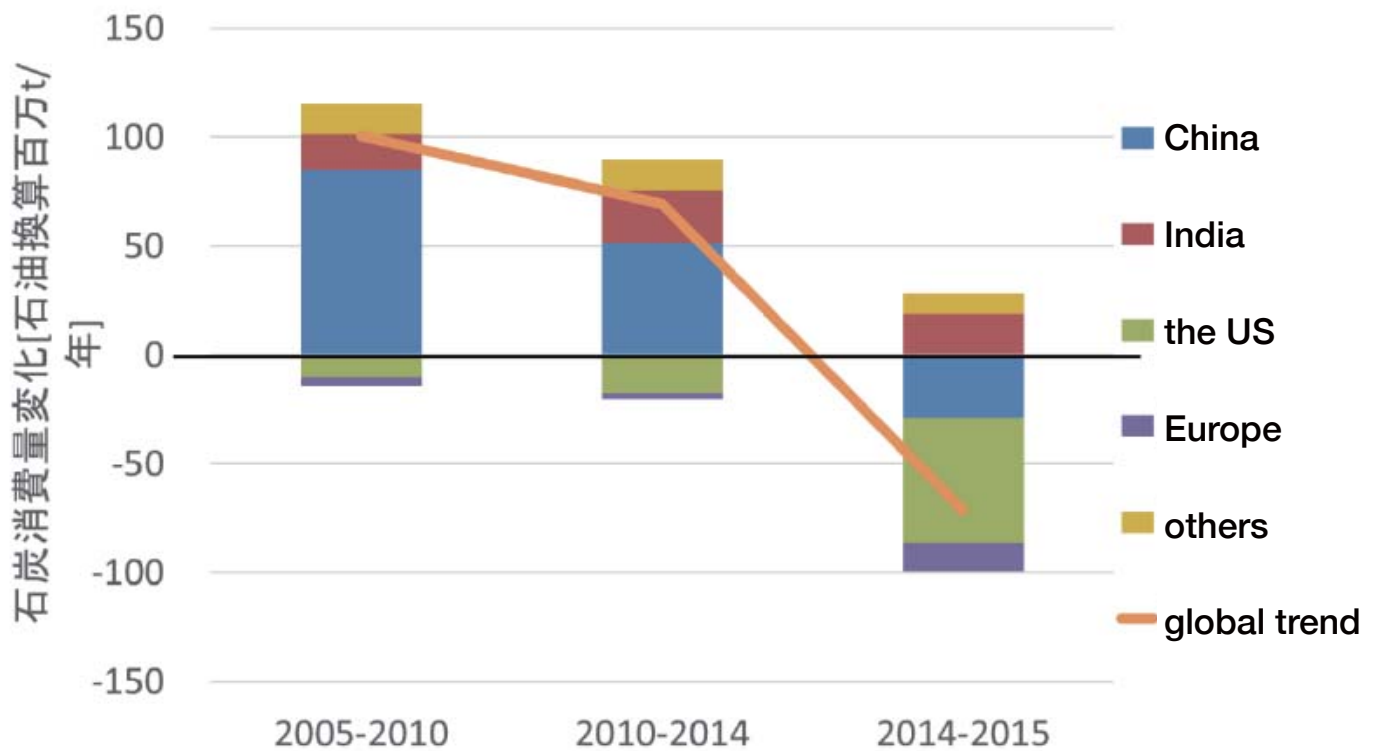
source: Jeremy Legget, 8 SEP 2016 REI's 5th anniversary event

non-burnable fossils pushes for CHANGE



source: REI from Carbon Tracker Initiative (2011) Unburnable Carbon – Are the world's financial markets carrying a carbon bubble?

trend of coal consumption Mtoe/year
 major countries and regions, global

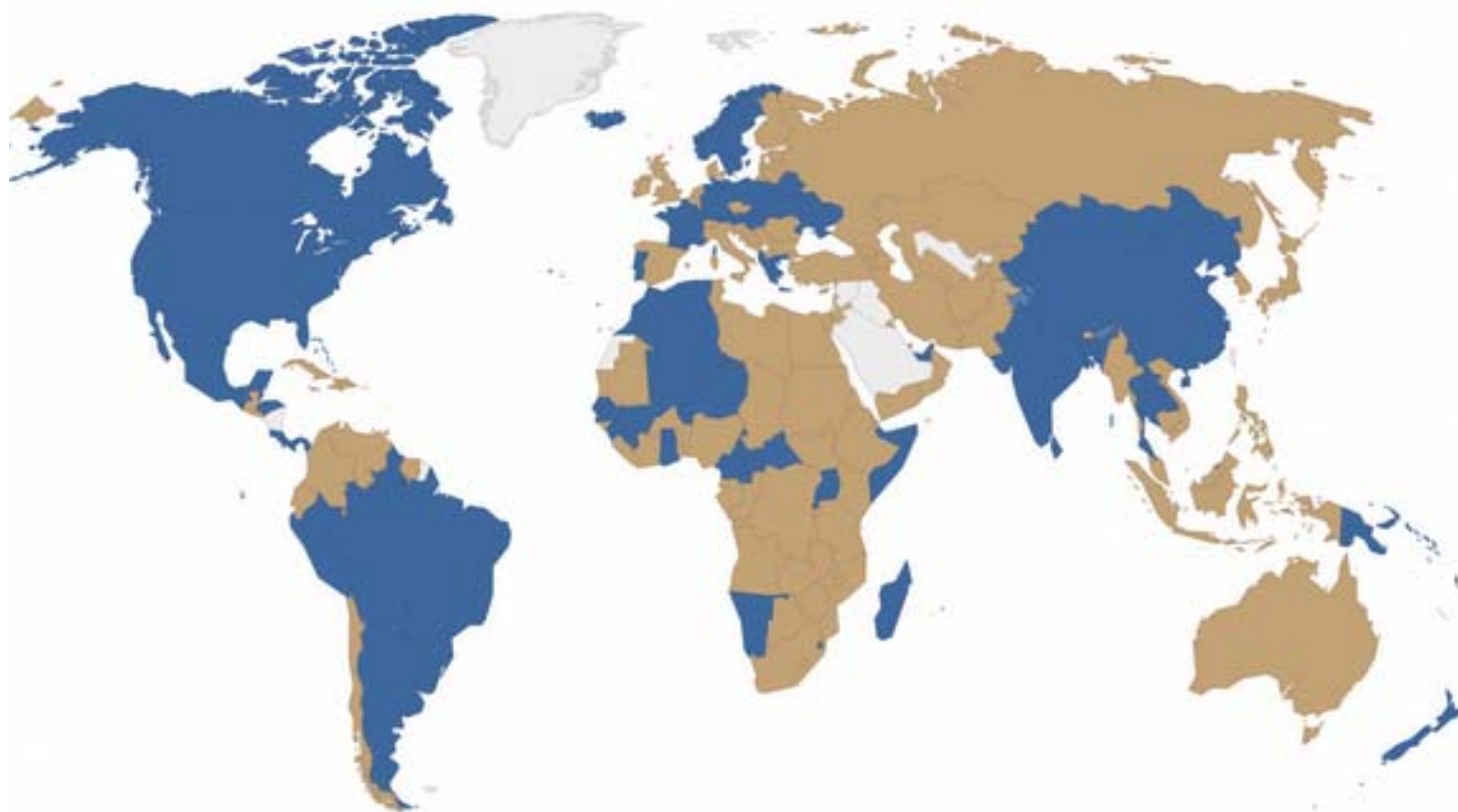


source: Coal Business and Policy Trends, REI + BP Statical Review of World Energy 2016

Paris agreement pushes for CHANGE



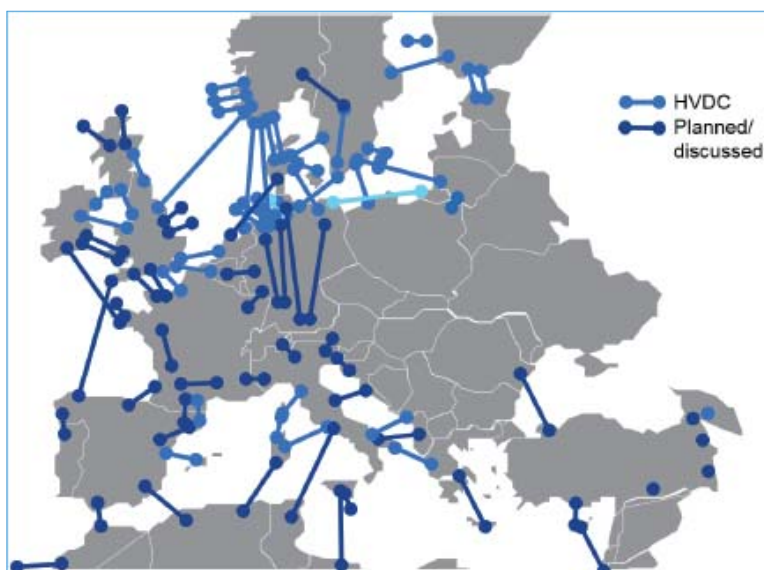
Paris Agreement achieved for the threshold for entry into force in less than one year.



opportunities : interconnection -ASG

HVDC - plays a big role in the evolution of interconnection and integration of RE

The efficacy of individual connections between regions is enhanced when connected in a grid structure



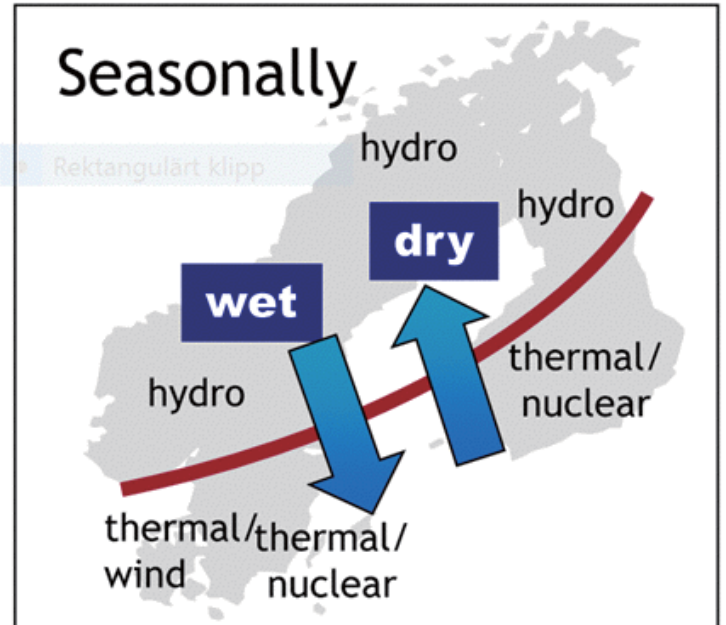
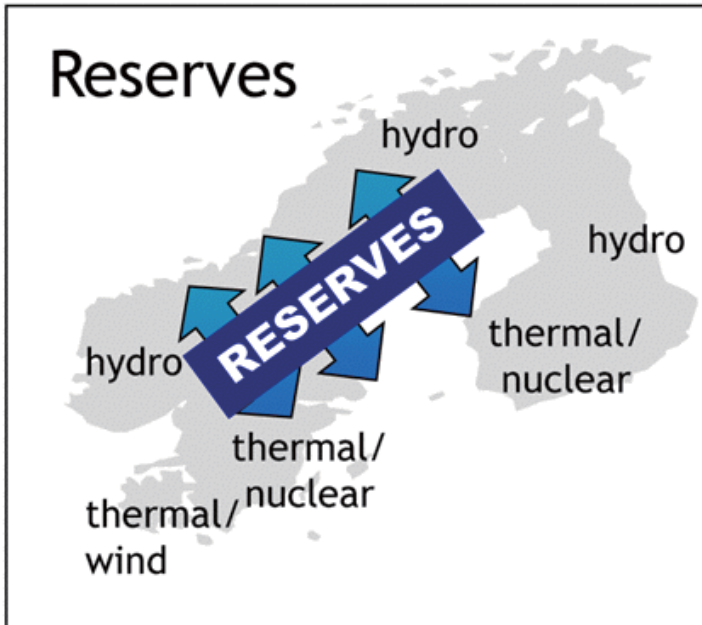
HVDC enabled interconnections – a solution for

- Energy trading
- Security of supply
- Integration of renewables
- Balancing of intermittent power
- Replacing conventional with RE
- Optimizing total grid efficiency

opportunities : interconnection -ASG



Cross regional management among different countries and regions with various electric mix and demand-supply patterns through interconnection, efficient use of power stations and stable electricity supply are assured

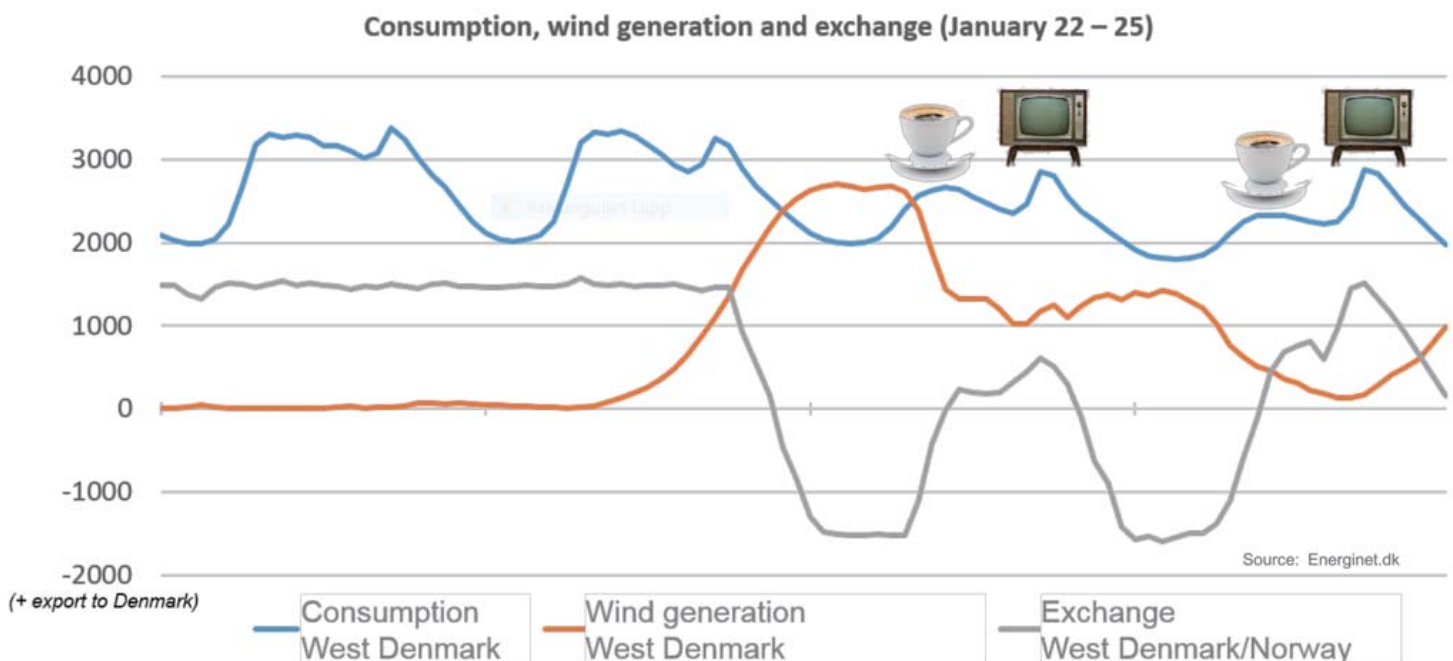


Source: Bo Normark at REI's International Workshop on Interconnection SEP 2016

opportunities : interconnection -ASG



Cross regional management through interconnection enables more flexibilities of grid management with high integration of renewables which contributes stable supply of energy, energy security and deployment of renewables



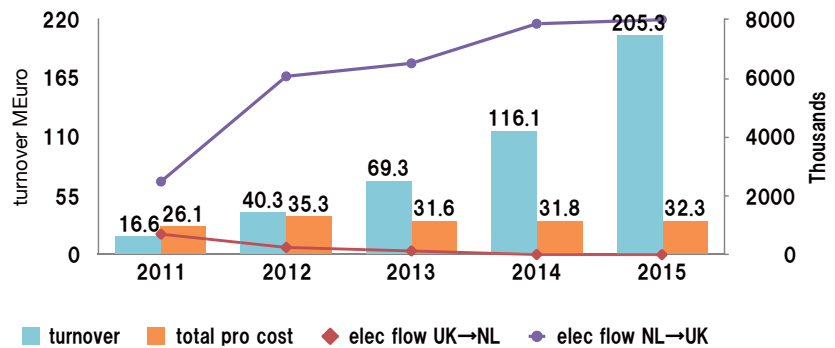
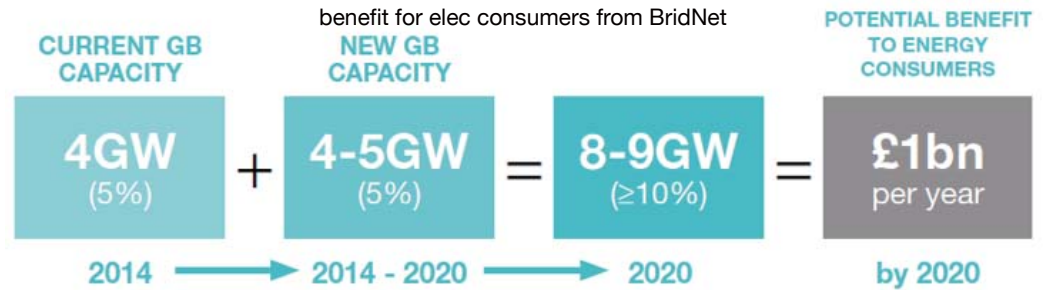
Source: Bo Normark at REI's International Workshop on Interconnection SEP 2016

opportunities : interconnection -ASG



UK electricity prices are usually higher than other countries in Europe, and new additional 1GW capacity of interconnection contributes to reduce 1-2% reduction of UK whole sale market price.

BridNed, which is the 50:50 joint business venture of Nationalgrid and TenneT, annual turnover in 2015 was €205M compare to total project cost of €600M.

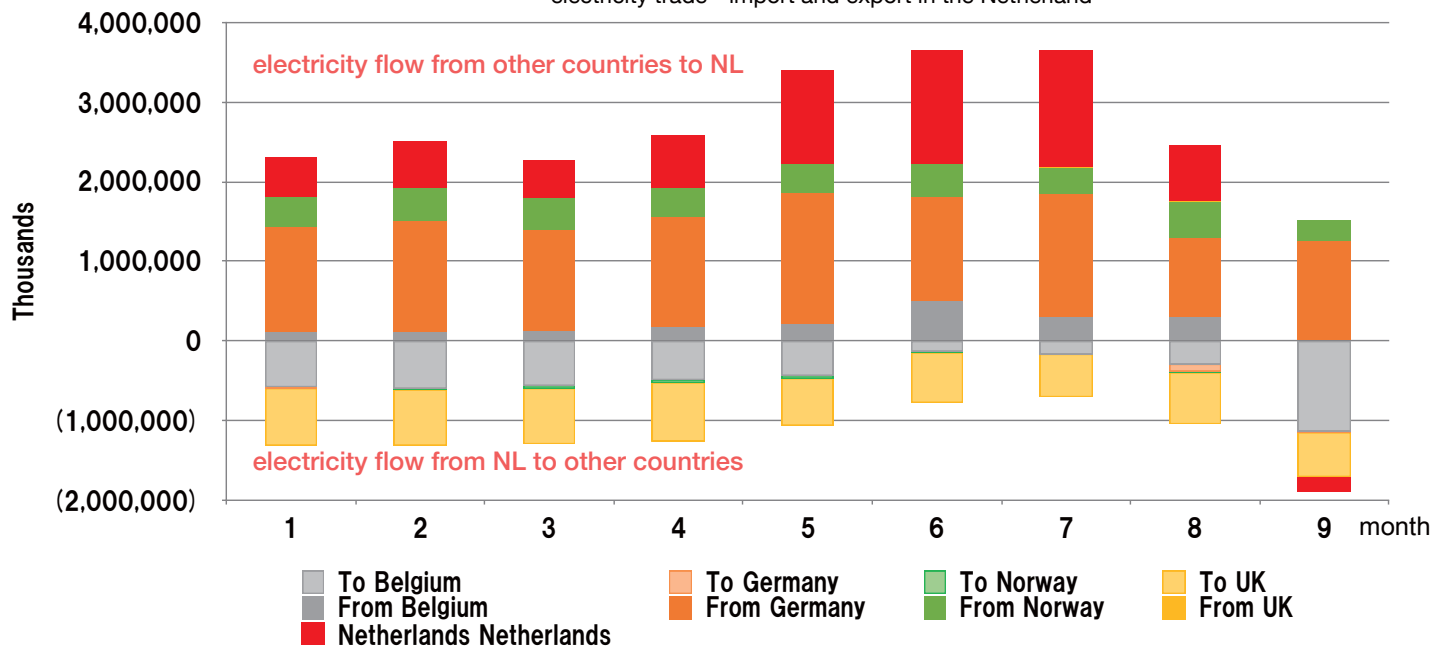


opportunities : interconnection -ASG



Not just HVDC cables, the Netherlands has many interconnections, and becomes the important transmission connection points. Through other countries' electricity market trade, cheap electricity from Norway and Germany is brought to UK and Belgium where electricity is more expensive.

electricity trade - import and export in the Netherland



オランダにおける各月の電力融通状況 (時間別の国際融通量を月ごとに集計)
ENTSOe Transparency platform のCross-border physical flowデータより財団作成



Energy security

- Wider regional management of demand/supply
- Sharing common reserves
- Energy security - development of economical interdependence

Economical efficiency

- Merit order management in wider region:
 - abstraction of different electricity prices
- Open market effects: cheaper prices through competition/pressure

Environment effect

- Interconnection is the extreme cross regional management
- Supplement of electricity mix

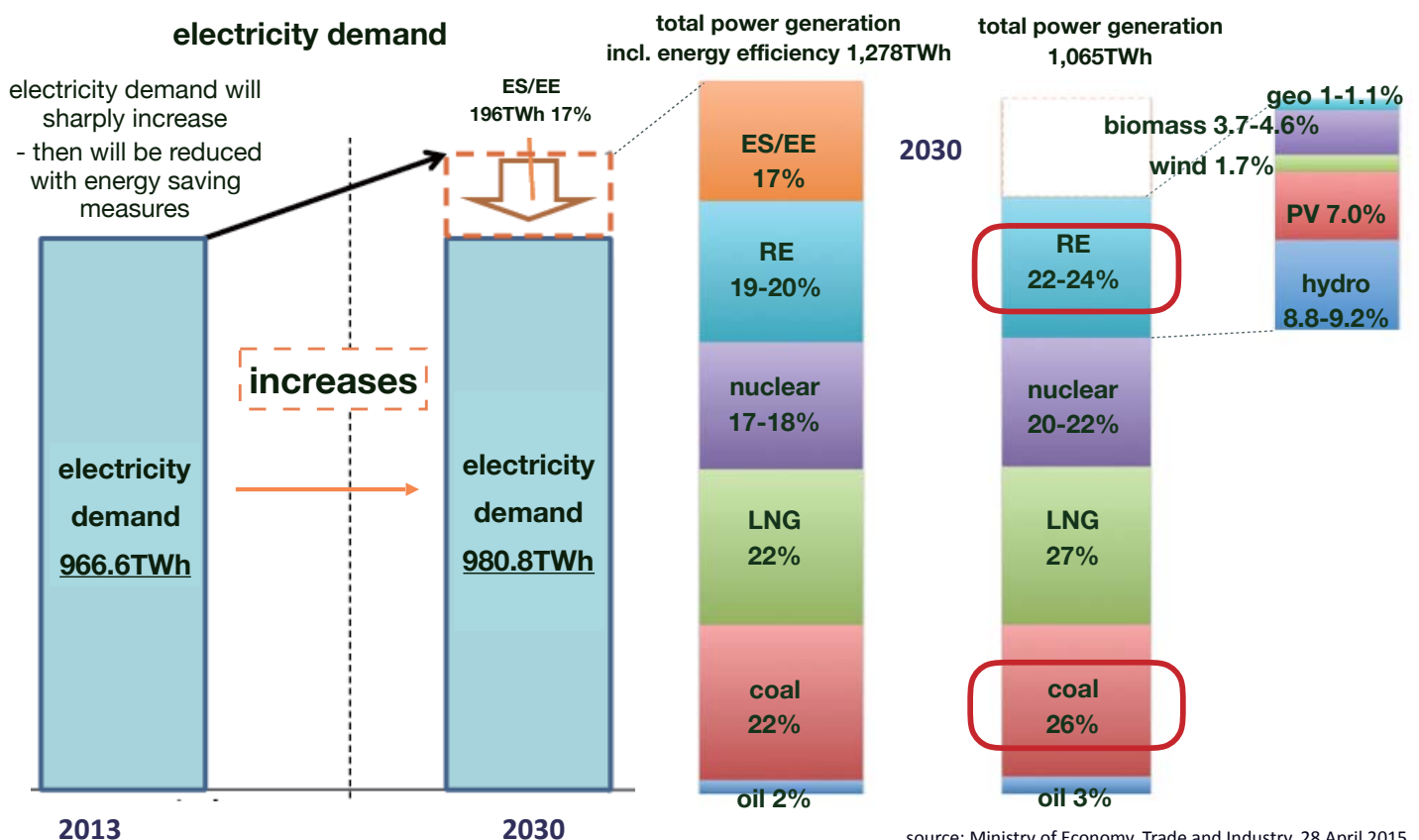
Interconnection Brings;

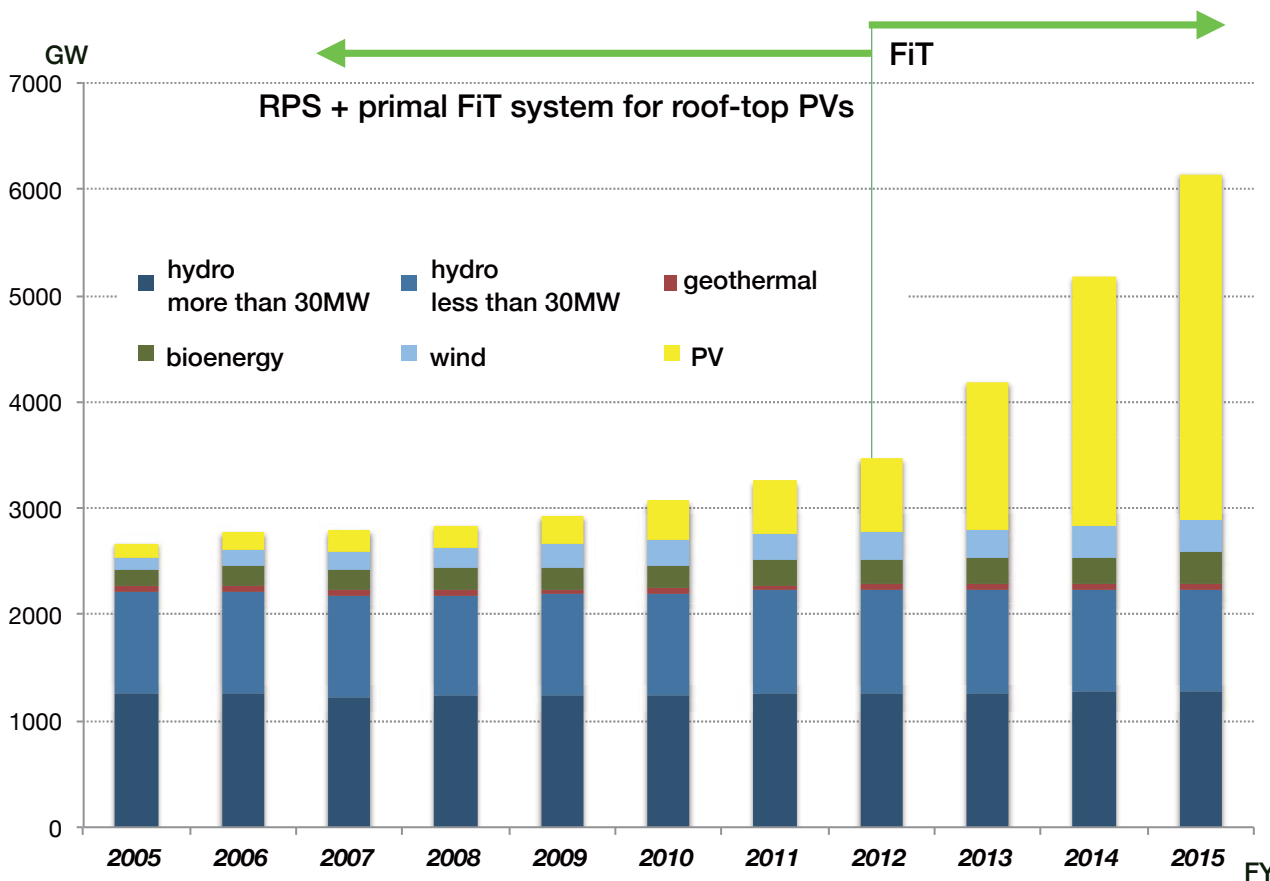
flexibility in the grid, fluidity and efficiency in the market,
 information disclosure, RE deployment, interdependence,
 and collaboration

Japan's electricity mix - RE 22-24% in 2030



Japan's electricity mix in 2030: gas 27%, coal 26%, oil 3%, nuclear 20-22%, **renewables 22-24%**
 GHGs emission reduction : 26% by 2030 from 2013 level = 18% reduction from 1990 level

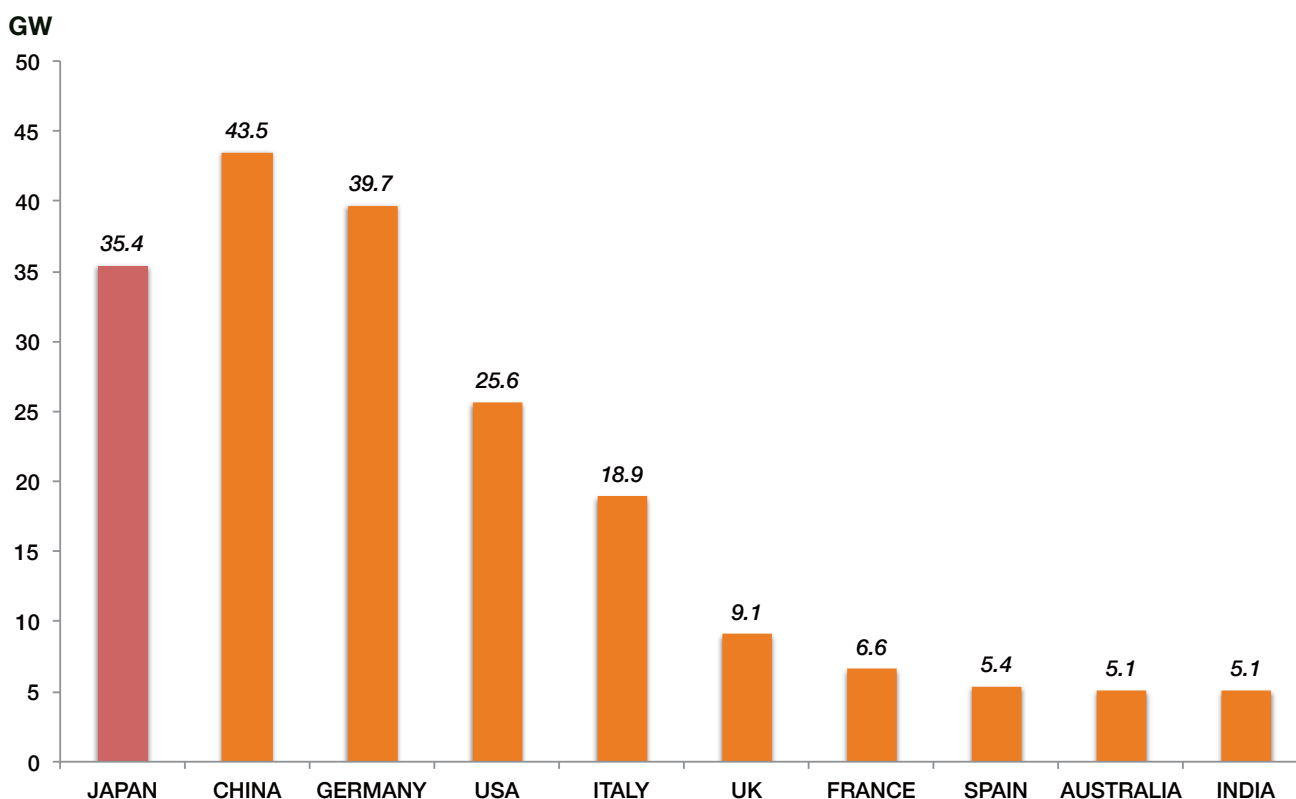




source: 自然エネルギー財団・Renewable Energy Institute <http://rei-ei.org/en/statistics/>

top countries' PV installation

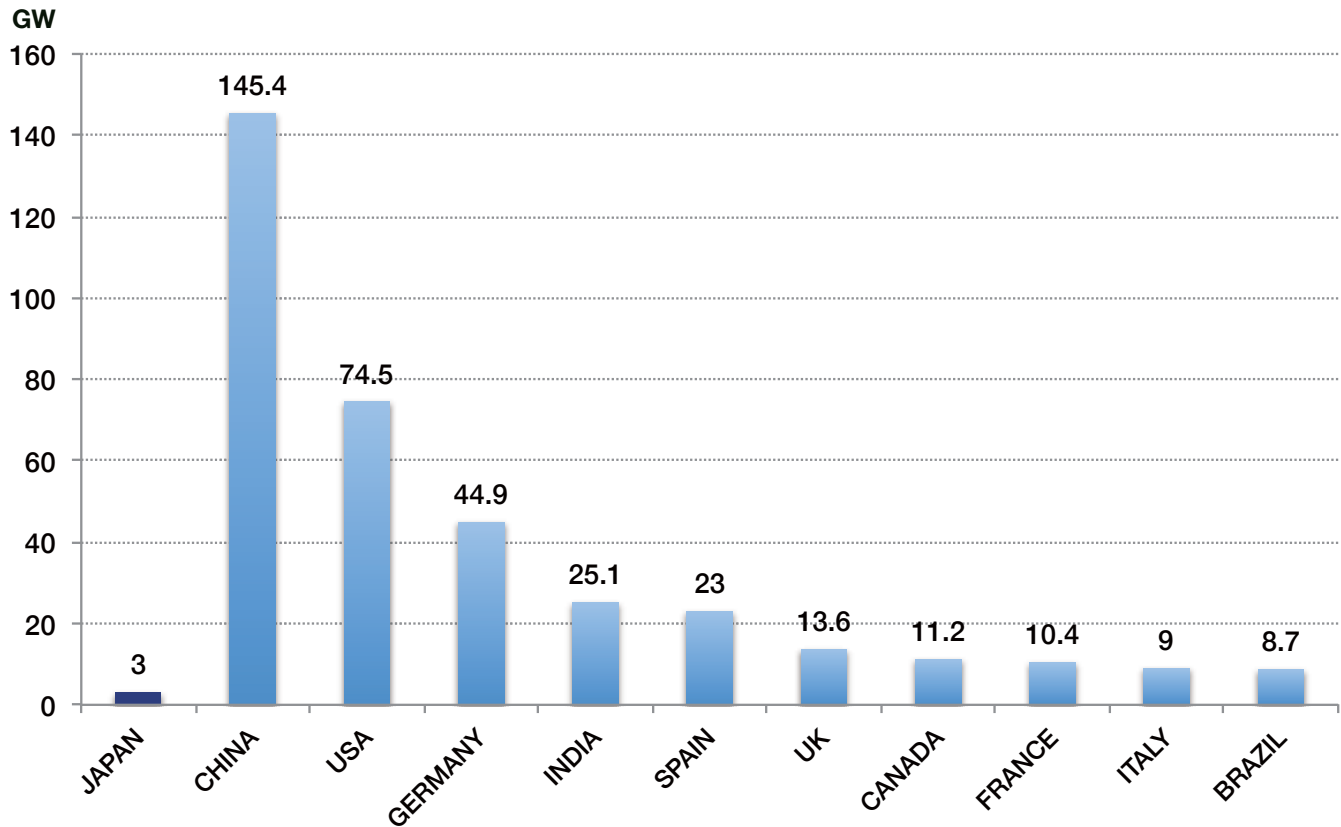
Cumulative Installed Solar Photovoltaic Capacity in Selected Countries in 2015 (GW)



source: BP Statistical Review of World Energy 2016



Cumulative Installed Wind Power Capacity in Selected Countries at the end of 2015 (GW)

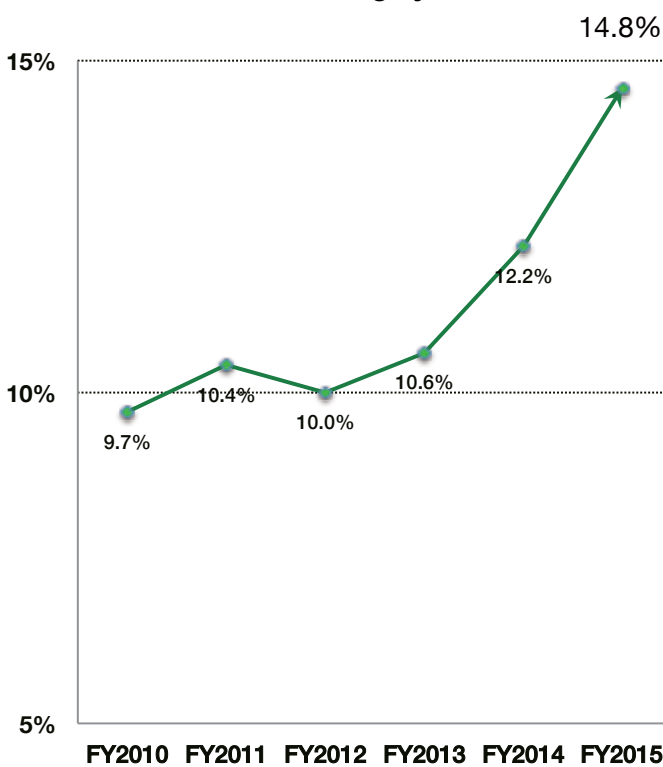


source: Global Wind Energy Council (2016) "Global Wind Report: Annual Market Update 2015"

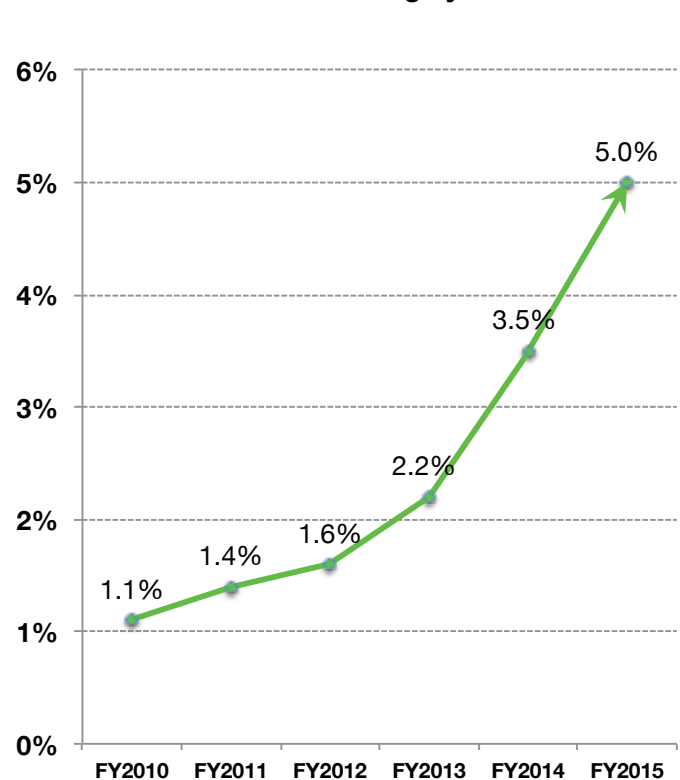
Japan: RE electricity production



renewables in electricity mix including hydro



renewables in electricity mix excluding hydro



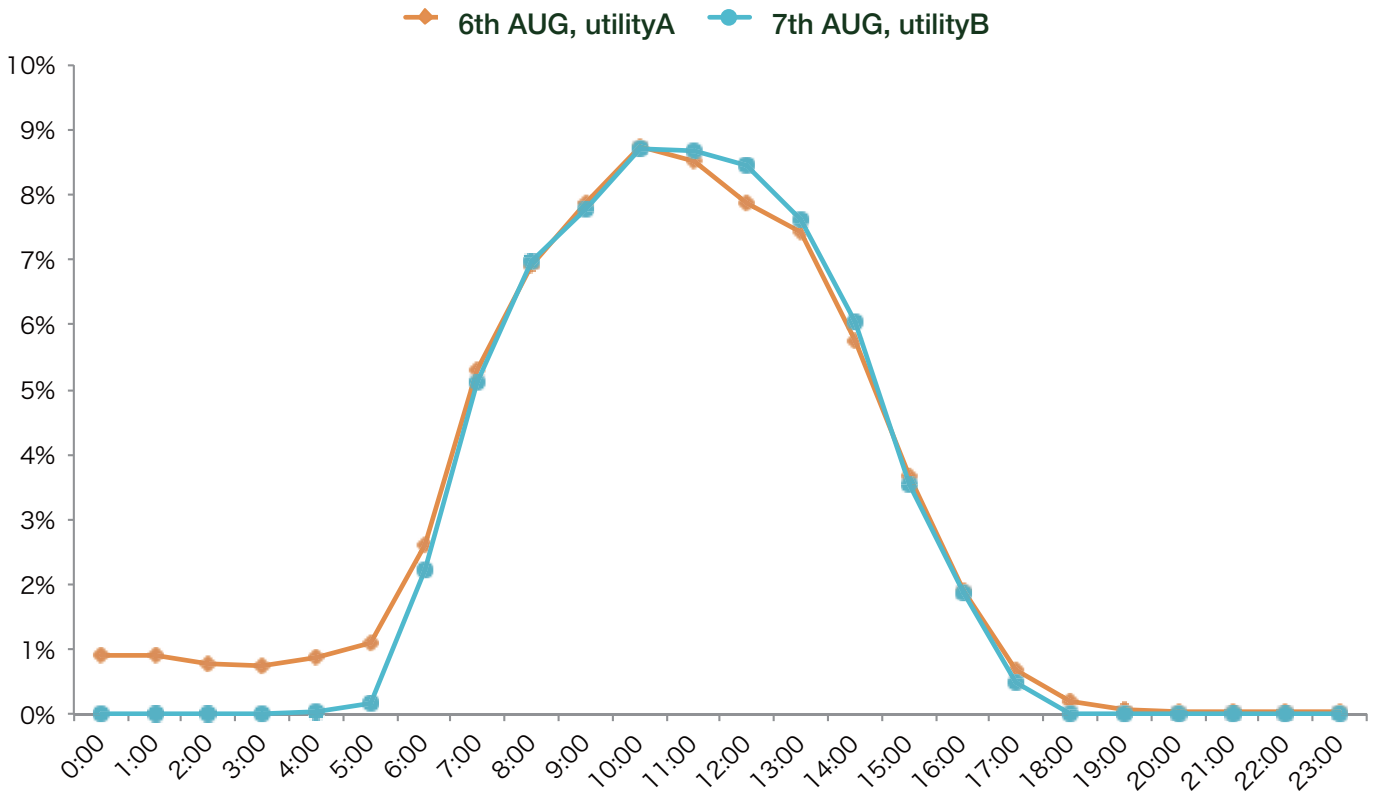
source: 自然エネルギー財団 <http://renewable-ei.org/en/statistics/annual.php>

Japan: RE covers peak demand



PV (and wind) covers 8% at peak demand in 2015

*covers 50% in Kyushu at the time of min. demand

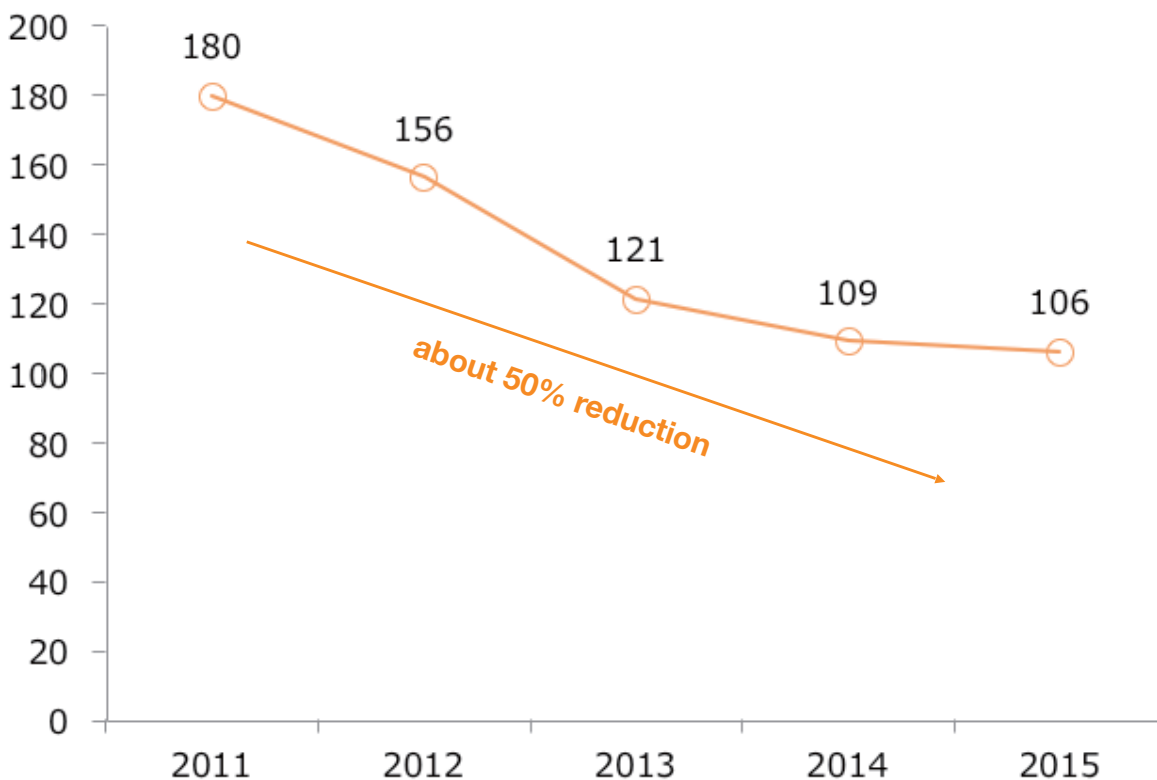


source: JREF based on the data supplied by an utility

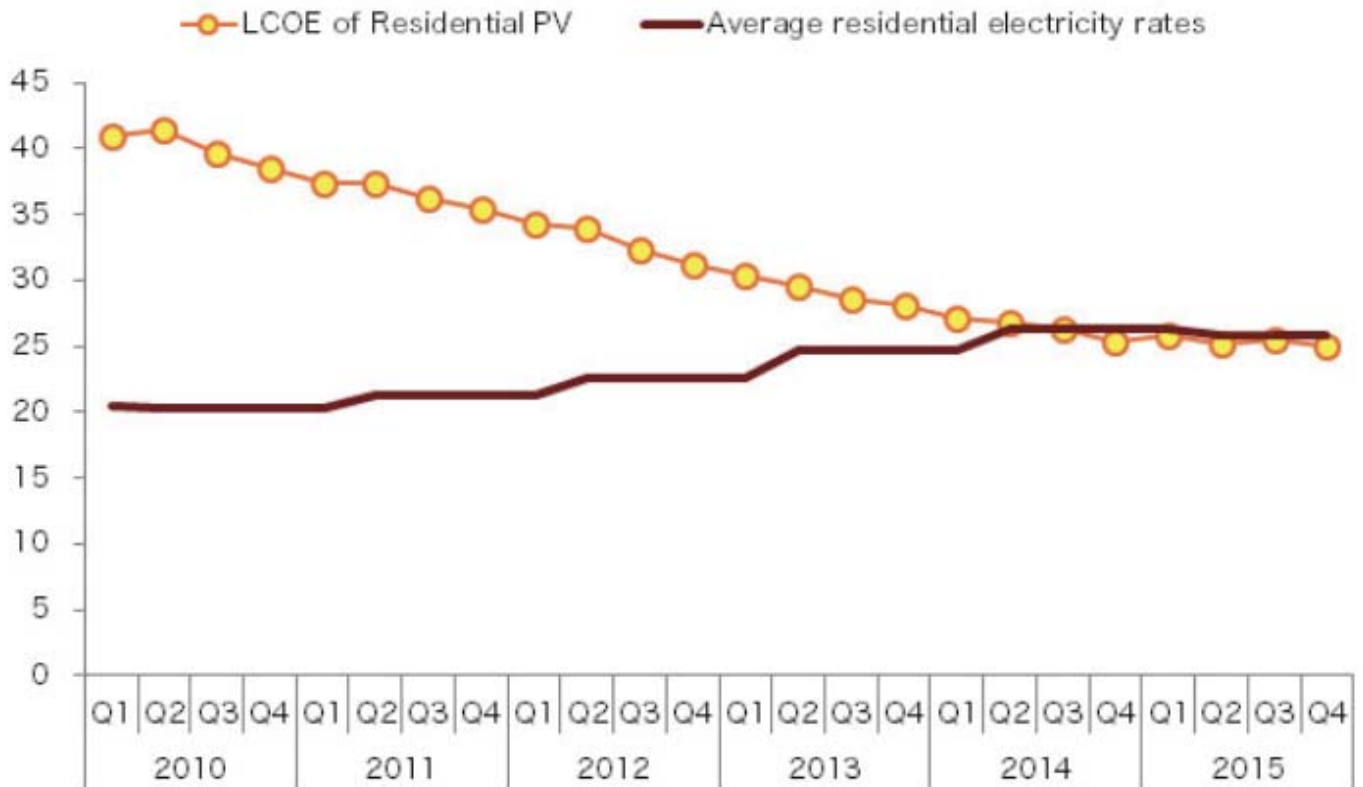
Japan: price of modules is decreasing -slowly



USCents/W Average Sales Prices of Solar PV Modules in Japan



source: 自然エネルギー財団 <http://renewable-ei.org/en/statistics/annual.php>

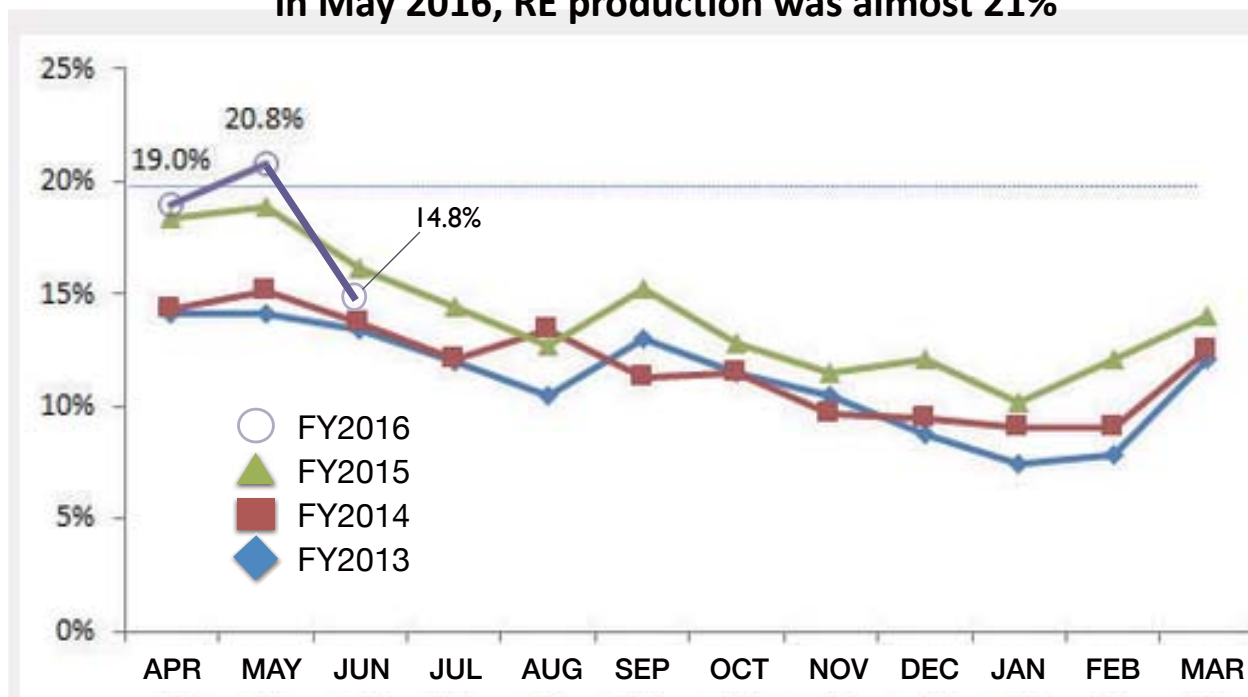


source: 自然エネルギー財団 <http://renewable-ei.org/en/statistics/annual.php>

opportunities: RE electricity production

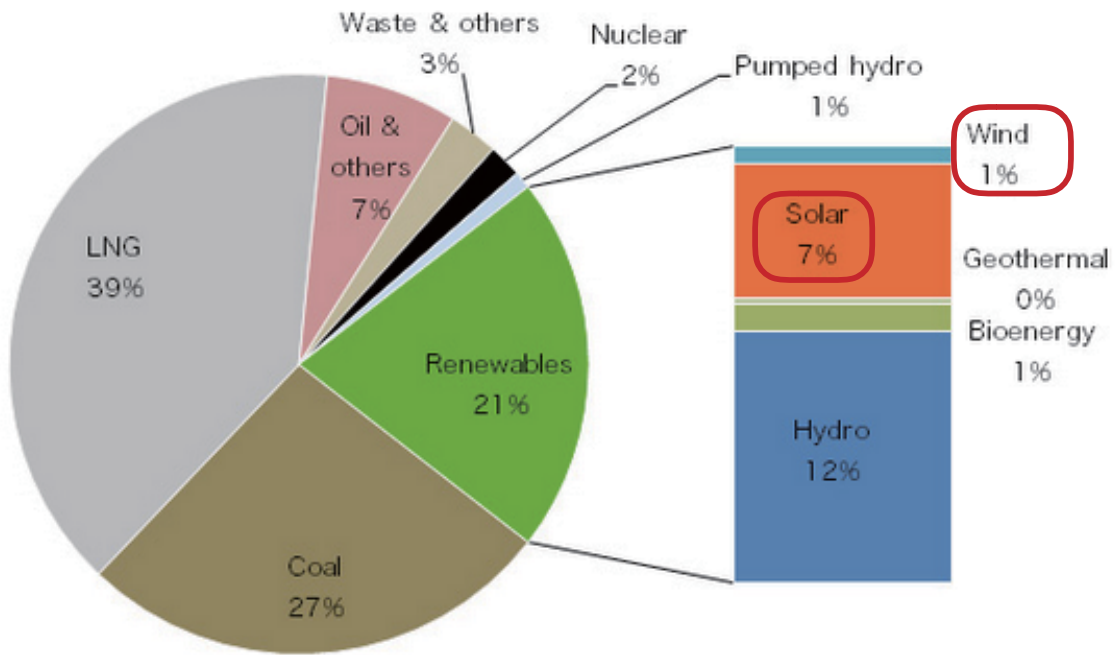


in May 2016, RE production was almost 21%



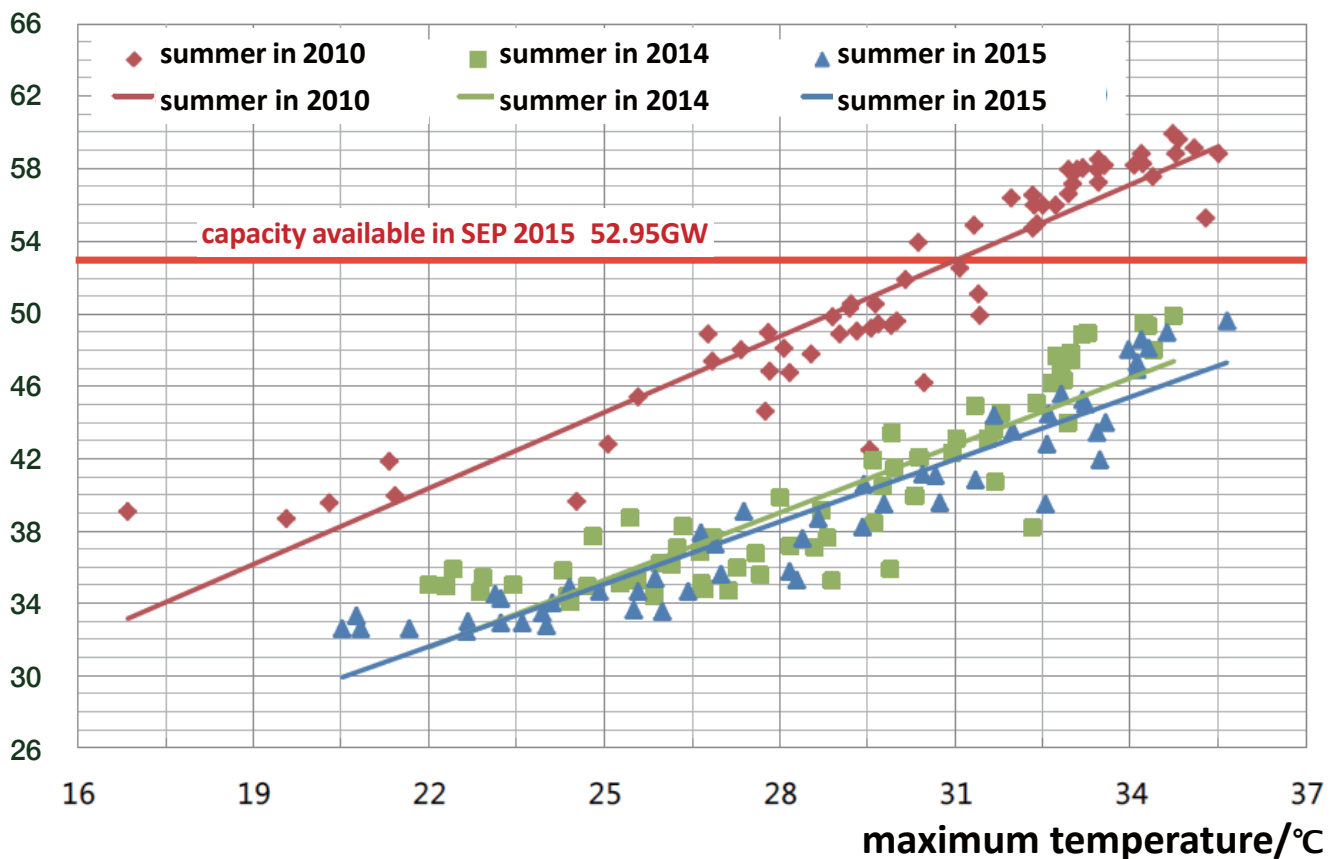
source: 自然エネルギー財団: Renewable Energy Institute

in May 2016, RE production was almost 21%

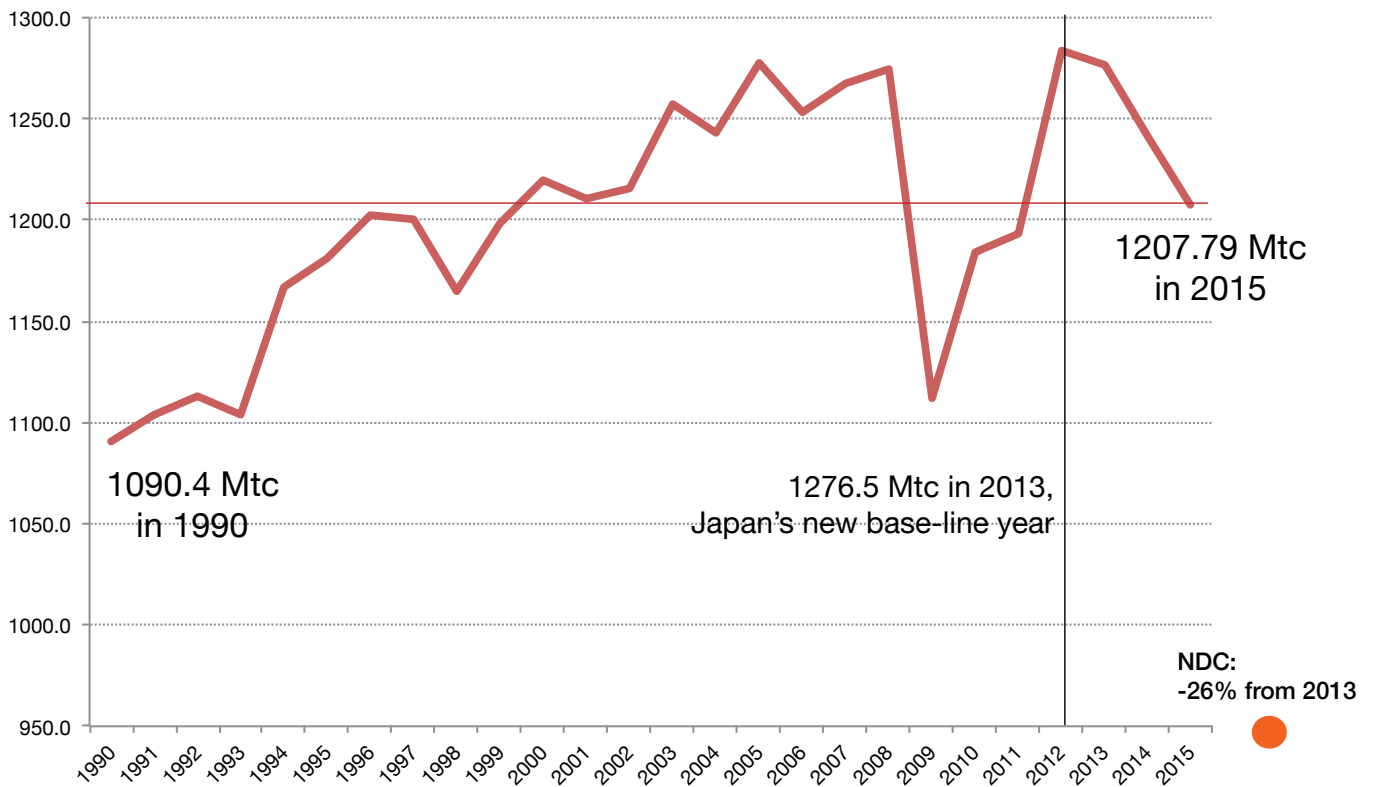


Japan: peak demand has decreased expl. Kanto

peak demand/GW

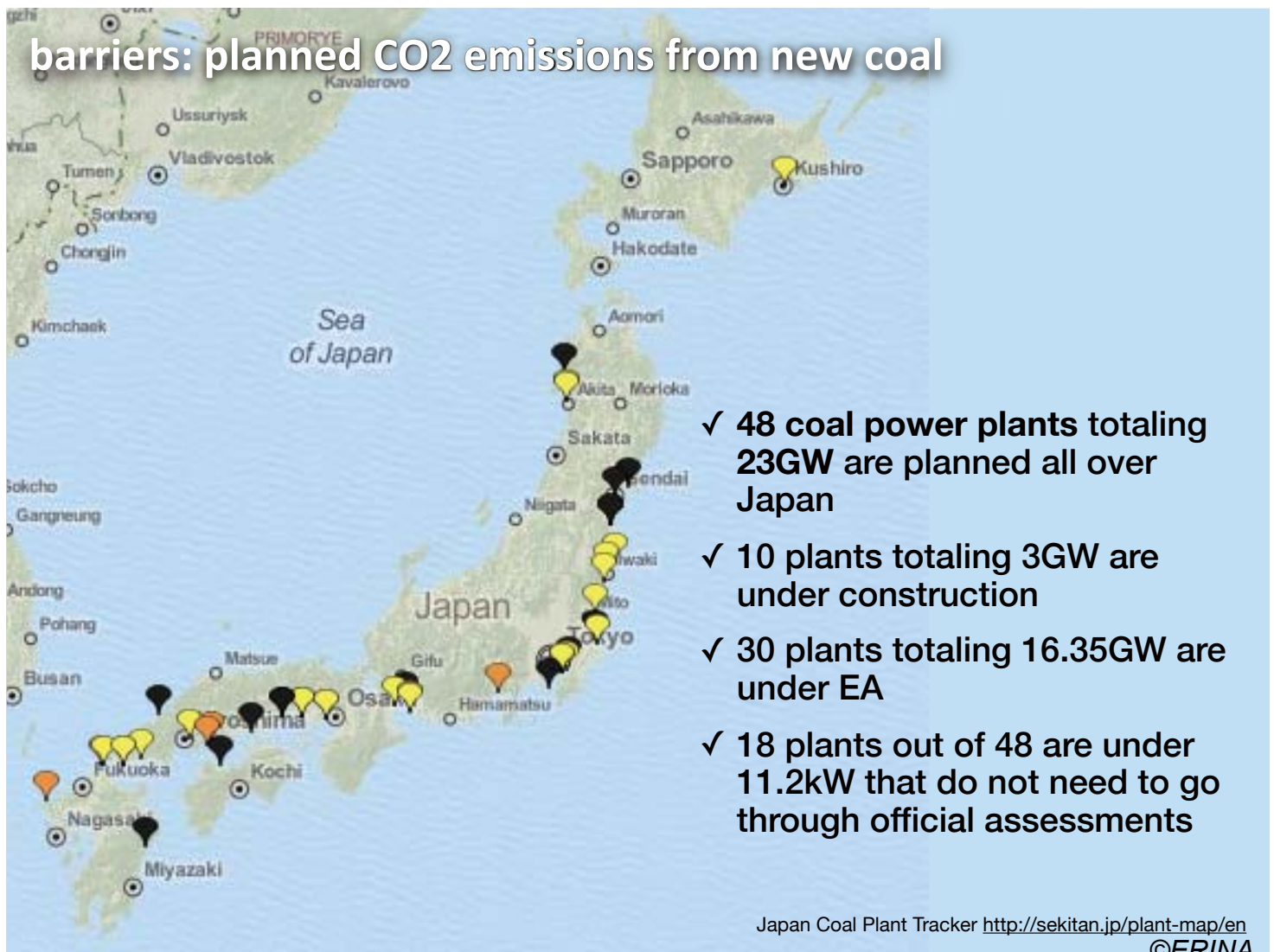


CO2 emissions in Japan 1990-2015



Source: BP statistical review of world energy 2016

barriers: planned CO2 emissions from new coal

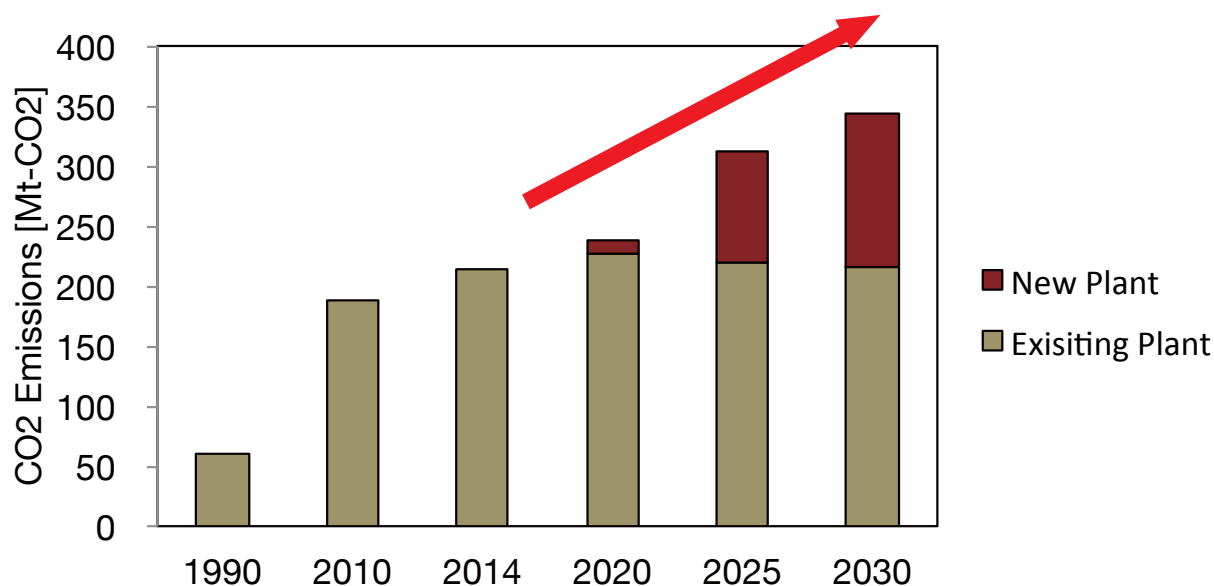


barriers: planned CO2 emissions from new coal



We estimate that planned power plants will result in additional **127 million t-CO2 annual emissions** (9% of the current annual emission of Japan)

The CO2 emissions from the coal power plants will **increase almost six fold from the 1990 level in 2030** if all the planned plants will be operated.



Notes:

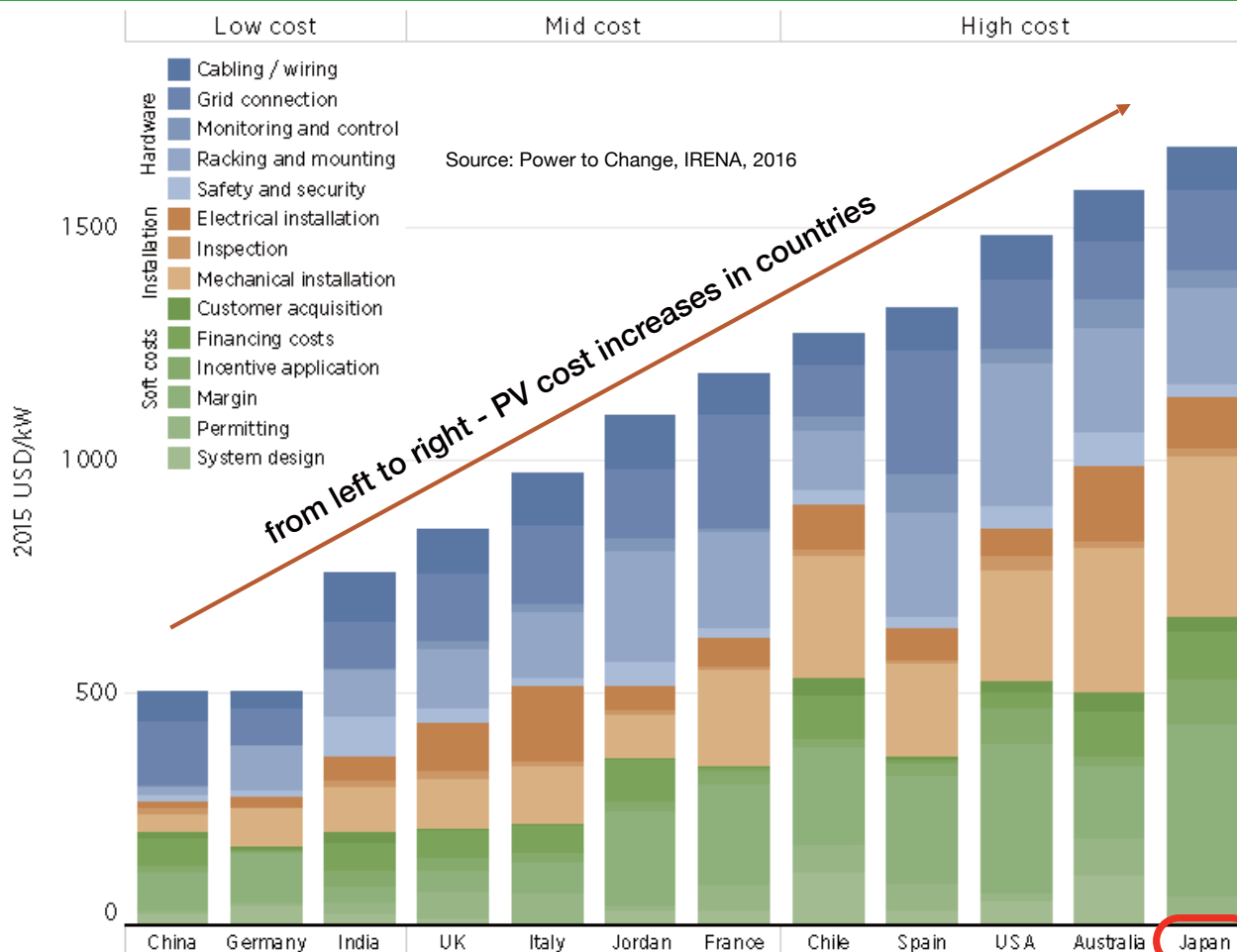
*Planned plants with no operation time will be assumed to start in 2030.

*For existing plants, 60 years operation is assumed if no information about abolishment time

*Capacity factor is estimated as 80%

*Power generating efficiency is assumed as 39% for Subcritical, 40% for SC, 42% for USC, 44% for IGCC

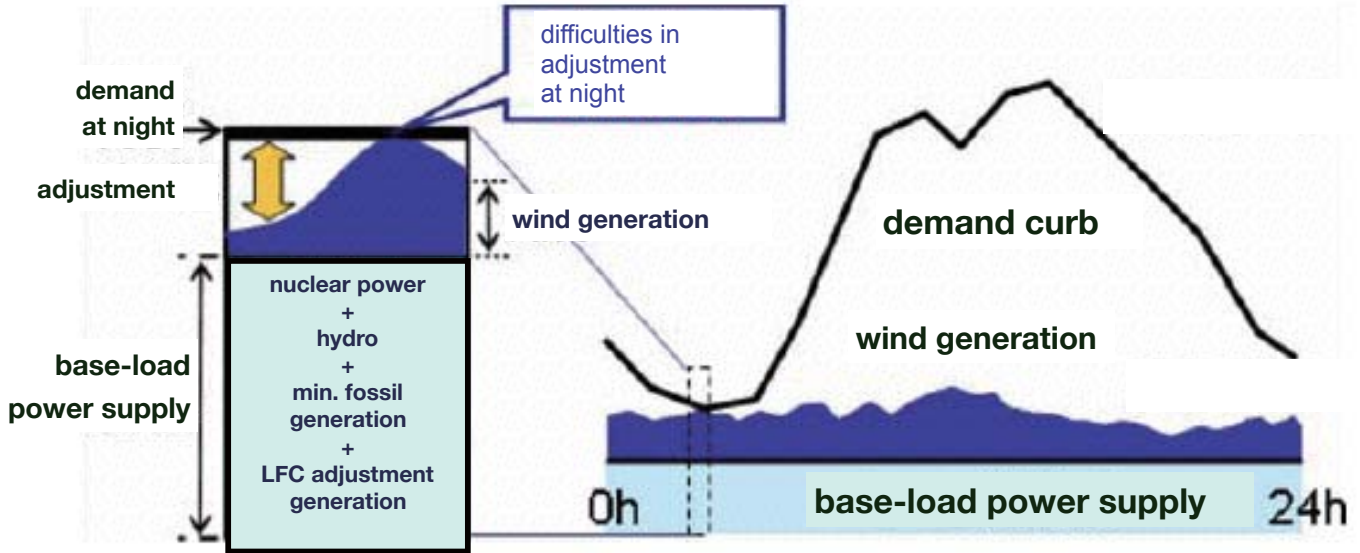
barriers/opportunities?: high costs of RE-PVs



source: IRENA, Power to Change, JAN 2016

Utilities' method to calculate grid capacity with base-load power unlimited curtailment without compensation

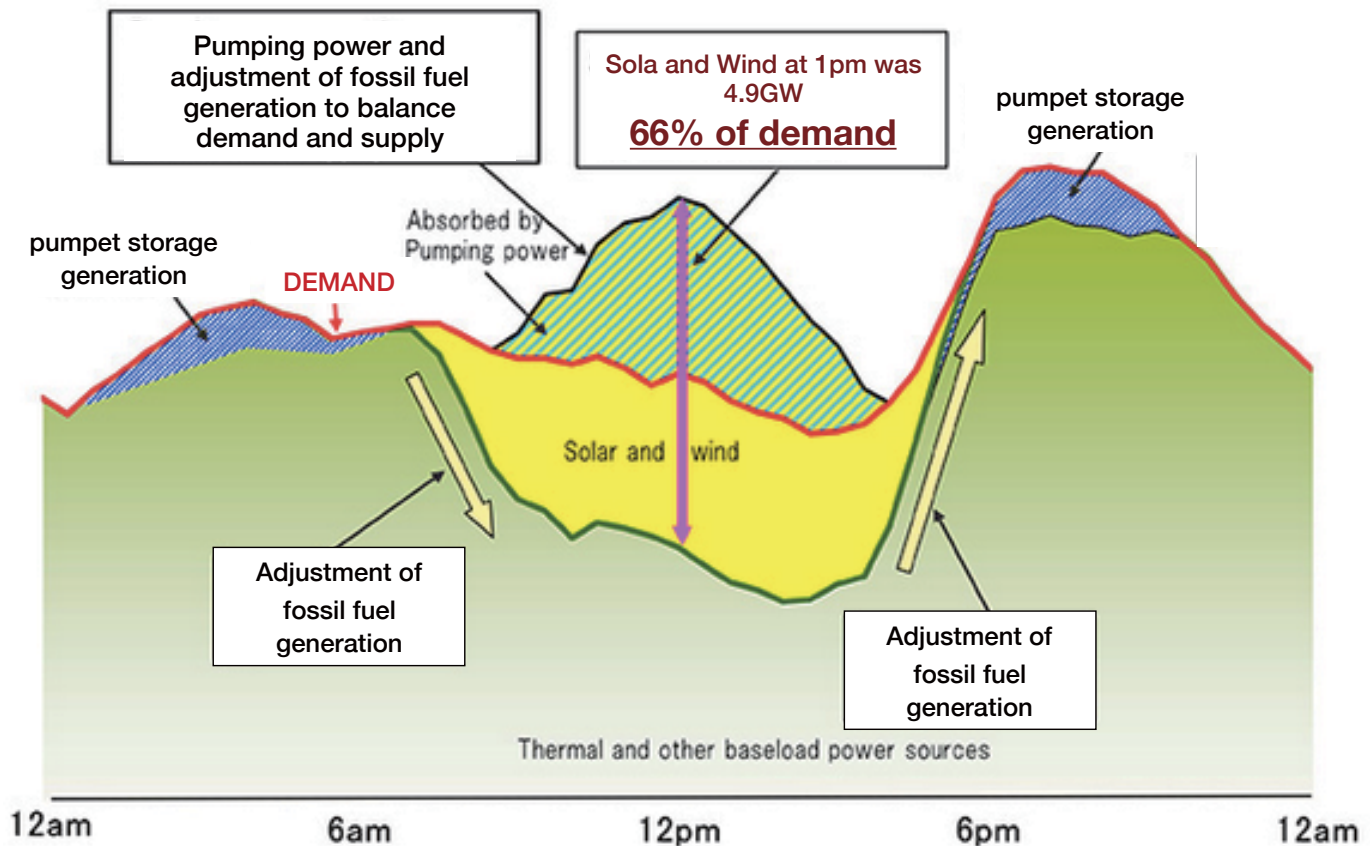
setting the limit to RE integration - according to the current calculation, intermitted renewables bring blackouts



Source: from the data of ESCJ in October 2012, METI 2014

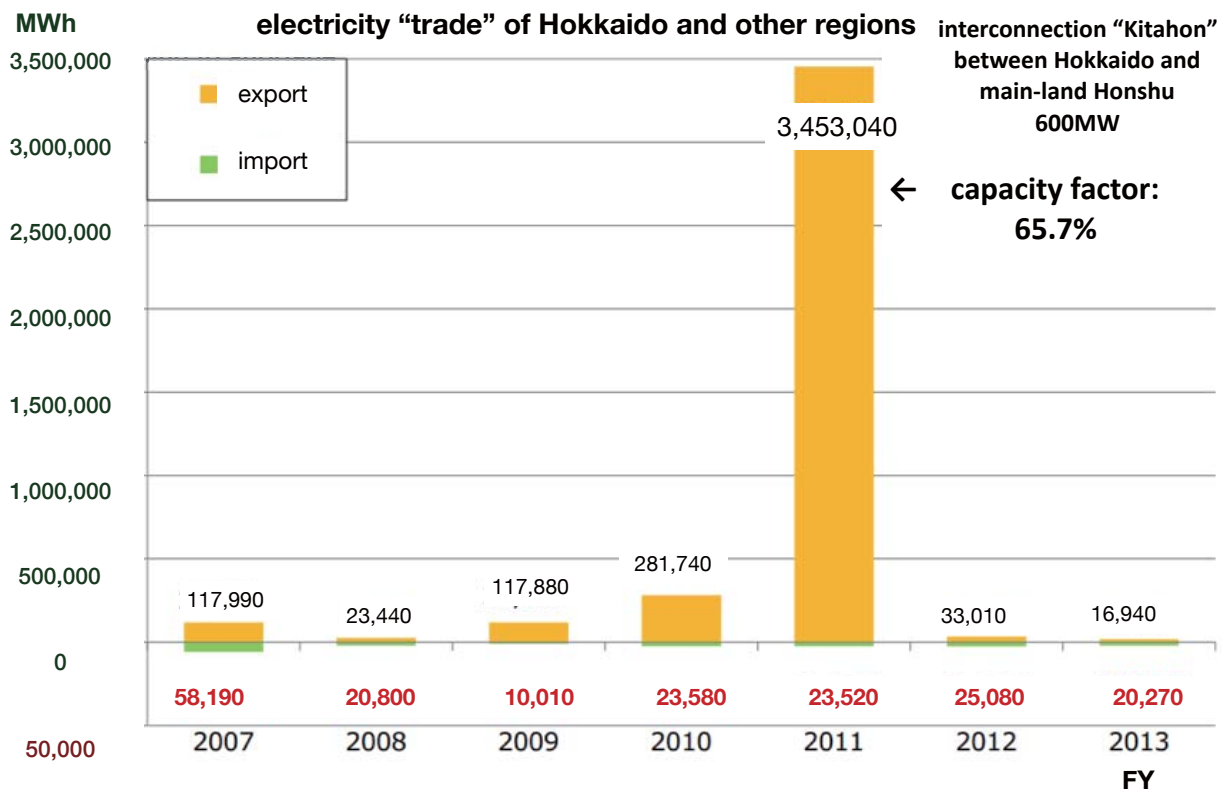
barriers/opportunities?: RE reached 38% a day

38% per day RE in Kyushu Area on 4th May 2016



source: Press Release by Kyushu Electric, July 2016

active management of grid, rather than active construction of grid



source: Hiroshi Takahashi from Fujitsu Research Institute, 17SEP2014 at REI's conference on German Energywende

barriers or opportunities?: policies



Unstable policies;

PV prices (>10kW):

2012:40cents → 2013:36cents → 2014:32cents

→ 2015:29cents → 2016:24cents

for larger PVs, **auctioning will be introduced from FY2017**

Transmission system rules:

FiT basically obliged utilities (TSOs) to buy electricity from RE, but additional statement allows utilities to reject the requests from RE producers

FY2016: introduction of **unlimited curtailment without compensation**

Power system reform;

electricity disclosure is not regulatory demanded to retailers - change??

residential transmission fee is very high 8-9cents, e.g. HVT 2cents

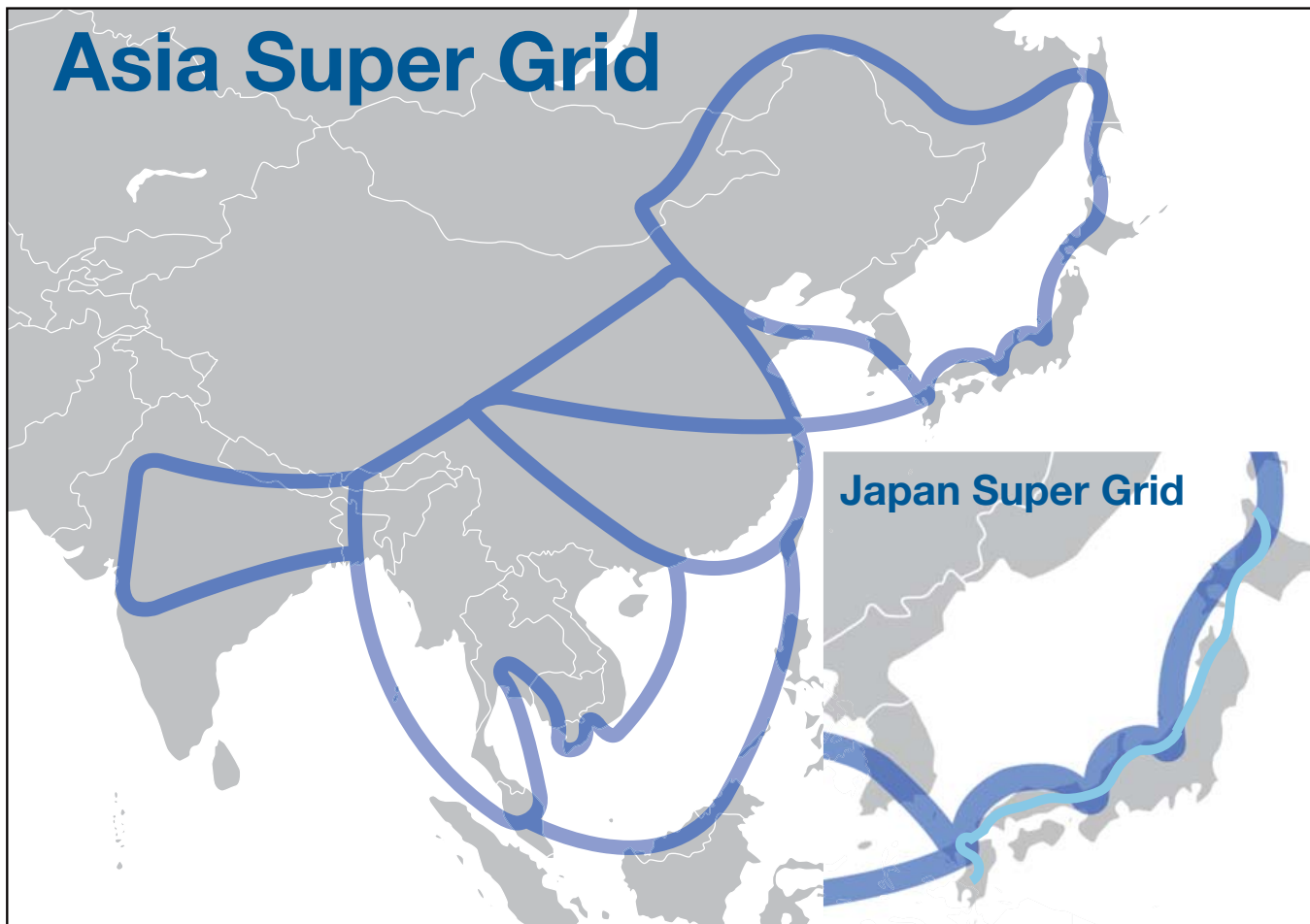
Current big discussion in Japan;

all nuclear decommissioning costs to be put on transmission fee...?

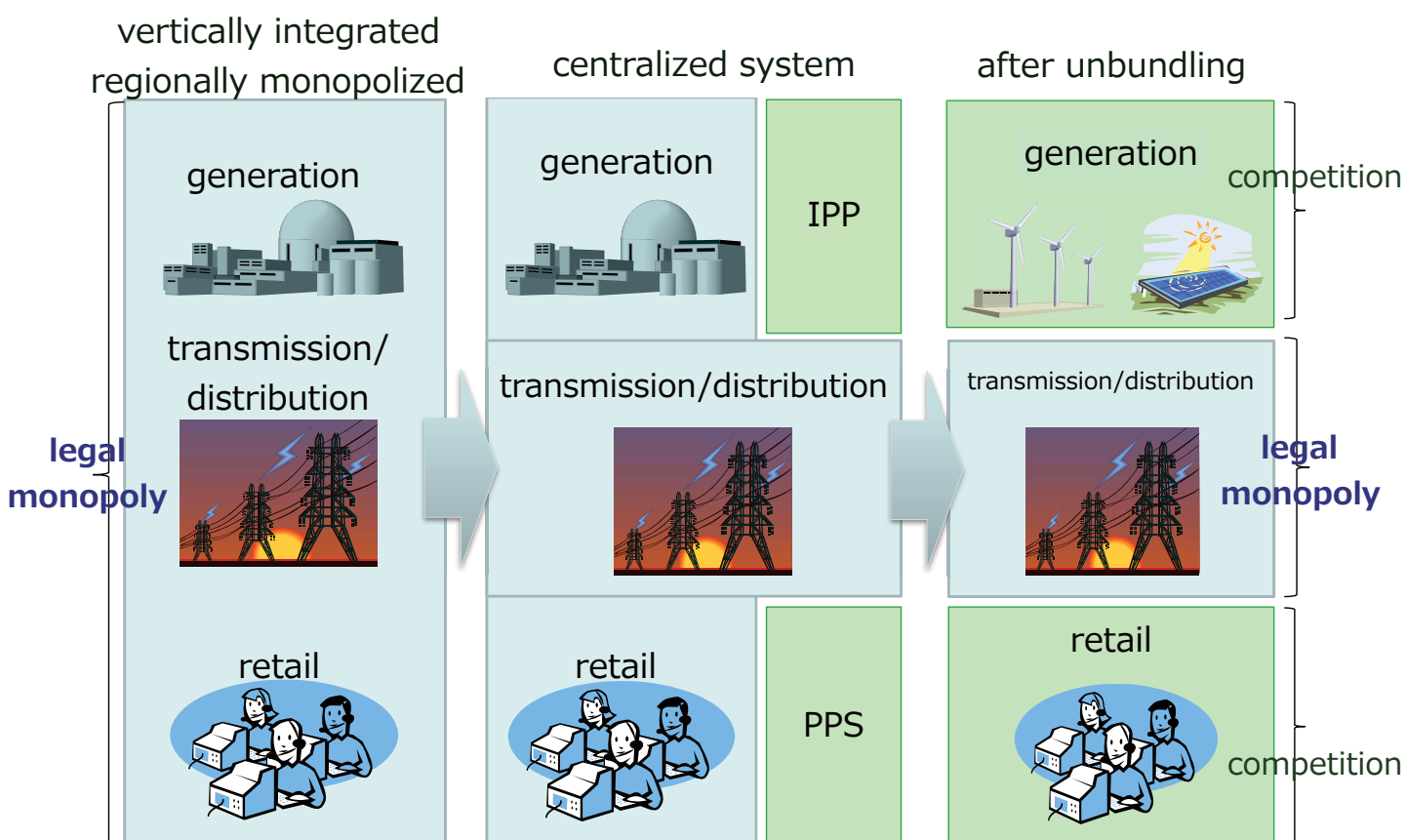
Fukushima accident costs and compensations to be put on transmission fee...?

“base-load” electricity market for liquidity in electricity market...?

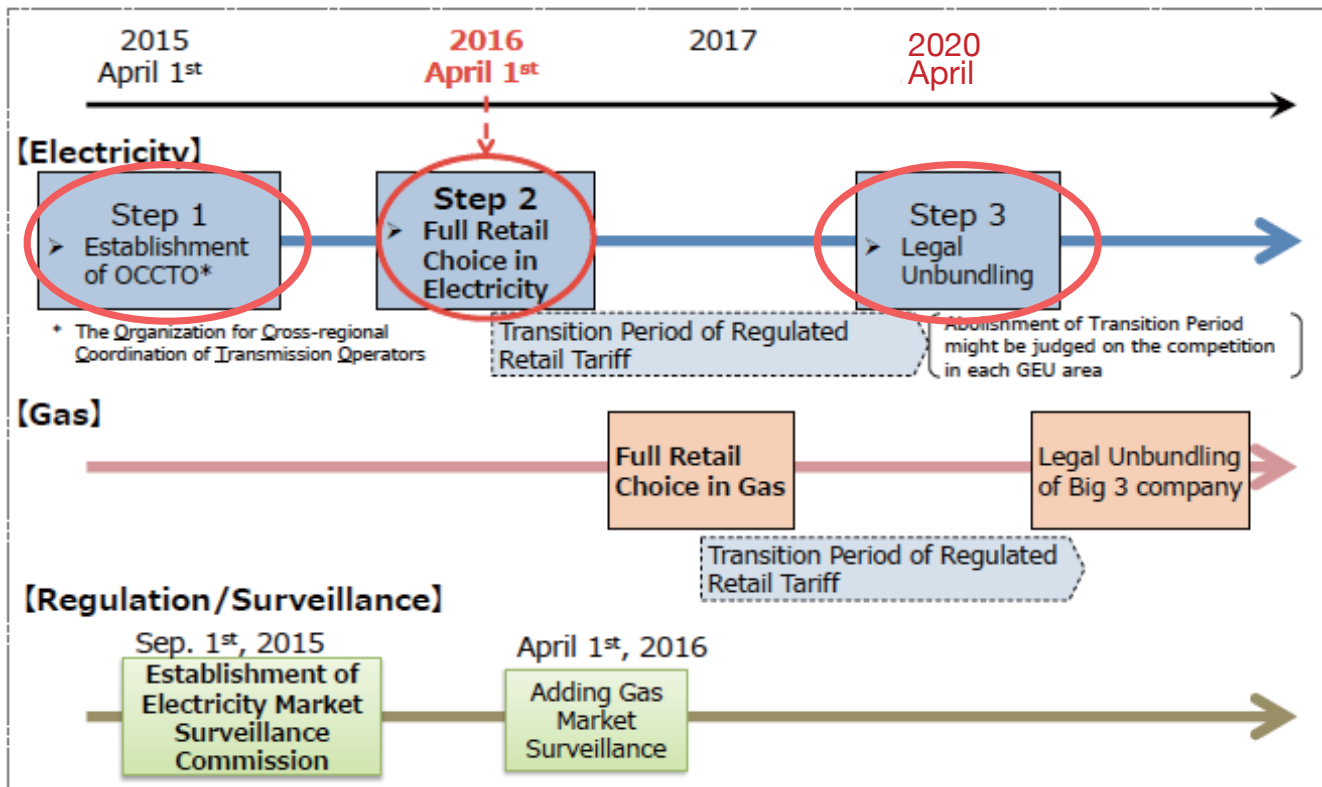
“non-fossil” electricity value market...?



barriers/opportunities?: power market reform



Whole Schedule of 5th Energy System Reform in Japan



Source: Tatsuya Shinkawa, EMSC, METI

opportunities : interconnection -ASG

Studies:

Asia Power Vision

opportunities and barriers of realization of ASG
 organizing workshops and conferences for public awareness and mobilization

Studies:

Japan's possibilities for Asian Interconnection

highlights Japan's difficulties and show the opportunities

International collaboration:

ADB's TA

for Mongolia's RE development and Interconnection

International collaboration:

GEIDCO member

joined as a council member

Japan's situation : interconnection -ASG

**Geologically Japan;**

insular country, with limitation of longitudinal transmission system

weak complementary relationship of electricity mix with neighboring countries

transmission system could be developed in line with power sector reform

Electric system in Japan;

monopolized, vertically integrated

monopoly than competition, regional than cross regional

generation than transmission, insufficient use of regional interconnection

power sector reform will bring the dramatic market change in Japan

Renewable deployment in Japan;

delay in climate change policy

centralized than decentralized

batteries than grid management

**if Japan will be late in responding climate change with cheap RE,
it is a big loss for Japan**

International politics of Japan;

unstable diplomacy with neighboring countries

delayed development of regional market integration and cooperation of free market

discussions and real market practice will change the unstable diplomacy

opportunities and hope**Communities and citizens get together for Renewables****「自然エネルギー協議会」 - 36 Governors Alliance for RE Promotion**

道府県レベルのリーダーシップ：北海道、岩手県、秋田県、山形県、福島県、栃木県、**神奈川県・副会長**、
富山県、山梨県、長野県、静岡県、愛知県、三重県、関西広域連合（滋賀県、京都府、大阪府、兵庫県、和歌
山県、鳥取県、**徳島県・会長**）、奈良県、島根県、岡山県、広島県、山口県、香川県、愛媛県、高知県、**佐賀
県・副会長**、長崎県、熊本県、大分県、宮崎県、沖縄県

Mayors of 18 big cities Alliance**都市レベルのリーダーシップ**：

札幌市、仙台市、さいたま市、横浜市、
川崎市、**新潟市**、相模原市、静岡市、浜松
市、名古屋市、京都市、大阪市、堺市、
神戸市、岡山市、広島市、北九州市、福
岡市

Source:REI

Community Power

■ **先駆的地域**: 北海道市民風車, 飯田おひさま, 富山小水力, 飛騨高山バイオマス, 備前

▲ **ISEP支援地域**:
大湊村, 気仙沼, 会津, 南相馬, 世田谷,
京丹後, 宝塚, 山口

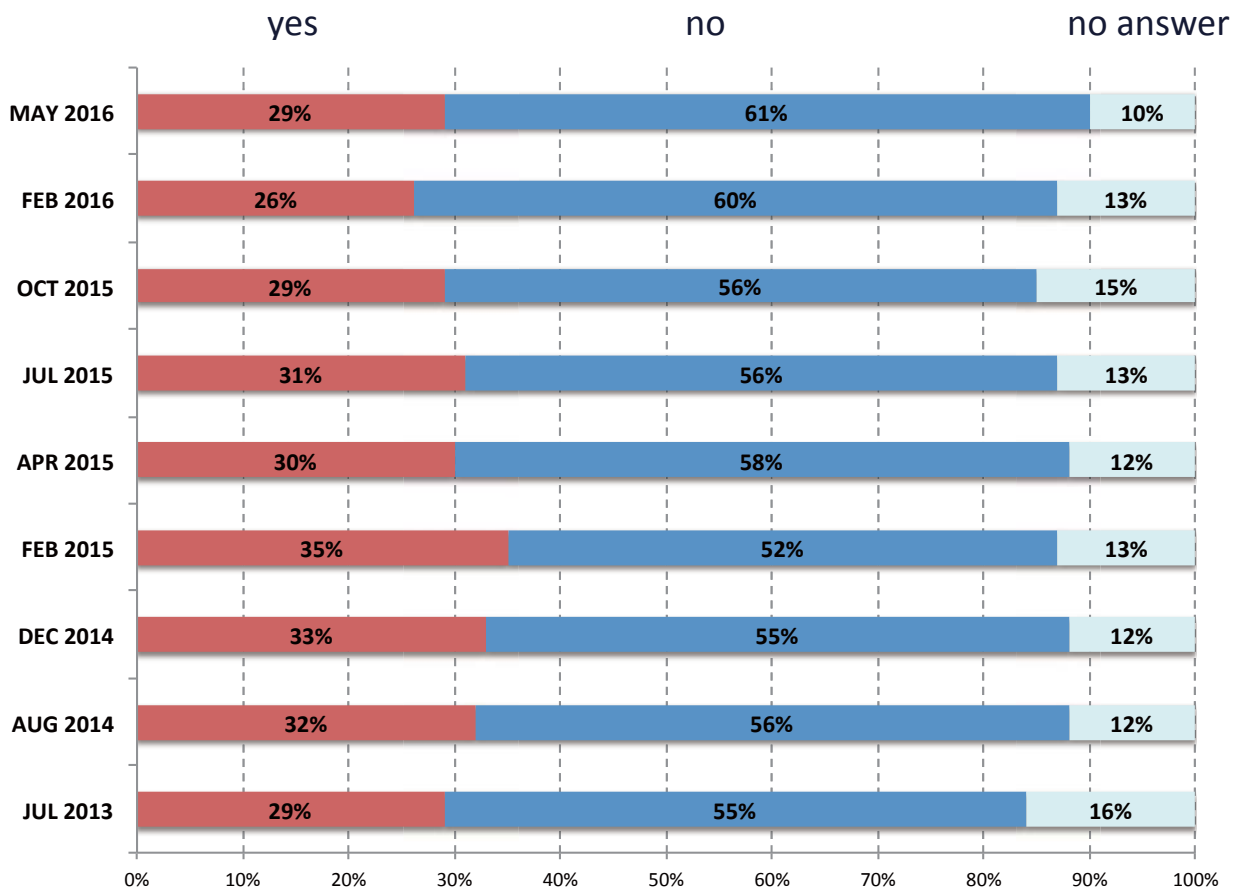
● **環境省 地域主導型**:
北海道, 最上, 福島, さいたま, 調布, 多摩, 小田原, 長野,
静岡, 美作, 徳島, 高知, 小浜, 小国, 南阿蘇

● **環境省&農水省 地域調和型**:
多気, 島田, 塩尻, 吉野,
和歌山, 石垣



Source: Institute for Sustainable Energy Policies

poll on re-starting of nuclear reactors



source: Nihon Keizai Shimbun



Благодарю вас

Paradigm Shift in Energy for Peace in Asia



自然エネルギー財団

RENEWABLE ENERGY INSTITUTE

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