Seminar 2. From Prototype to Market: Development of marine renewable energy policies and regional cooperation

A PECC International Project
Energy Transition and new Economic models 2013-2014
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MRE: A Perspective of Japan…challenges and progress

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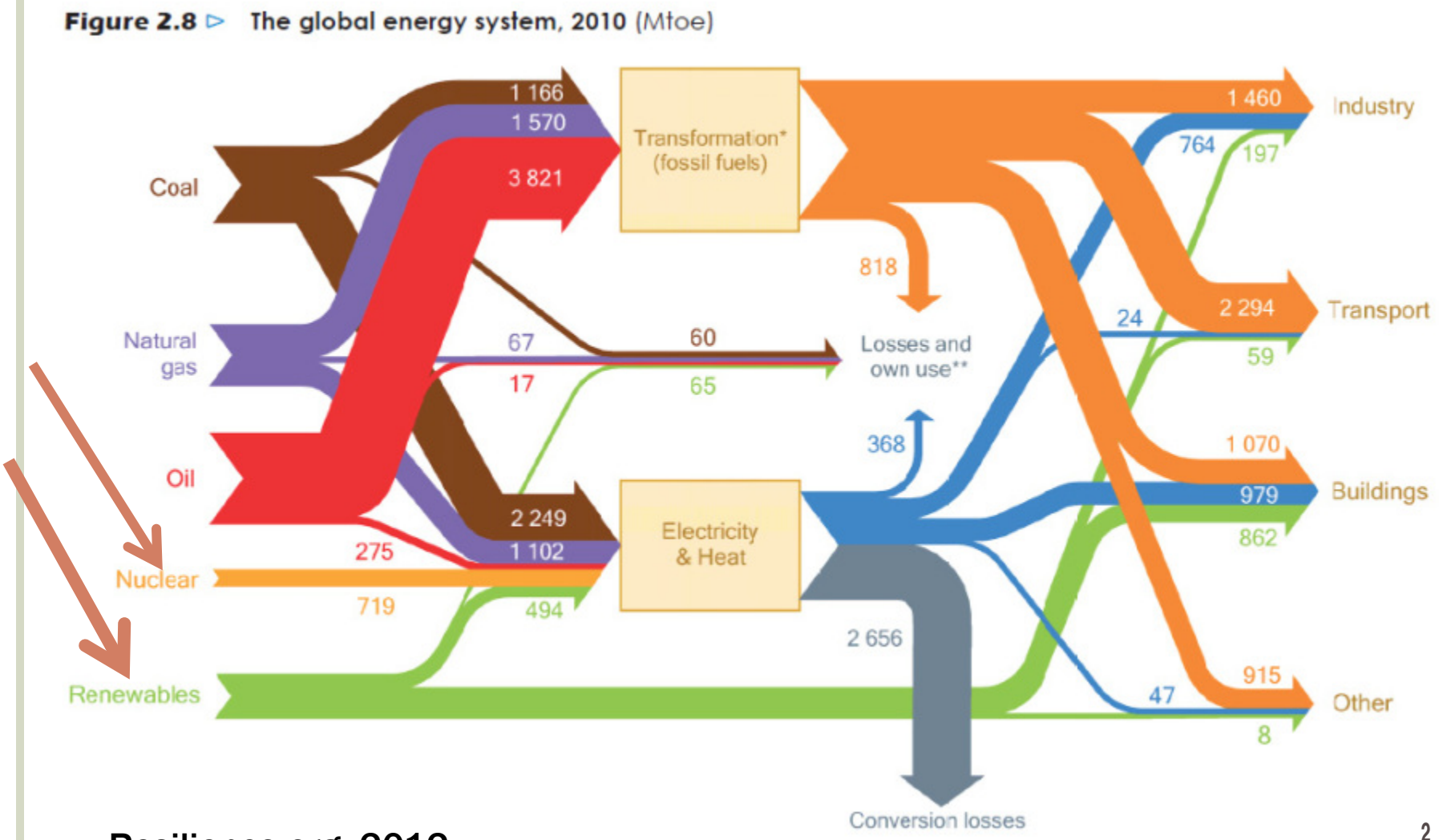
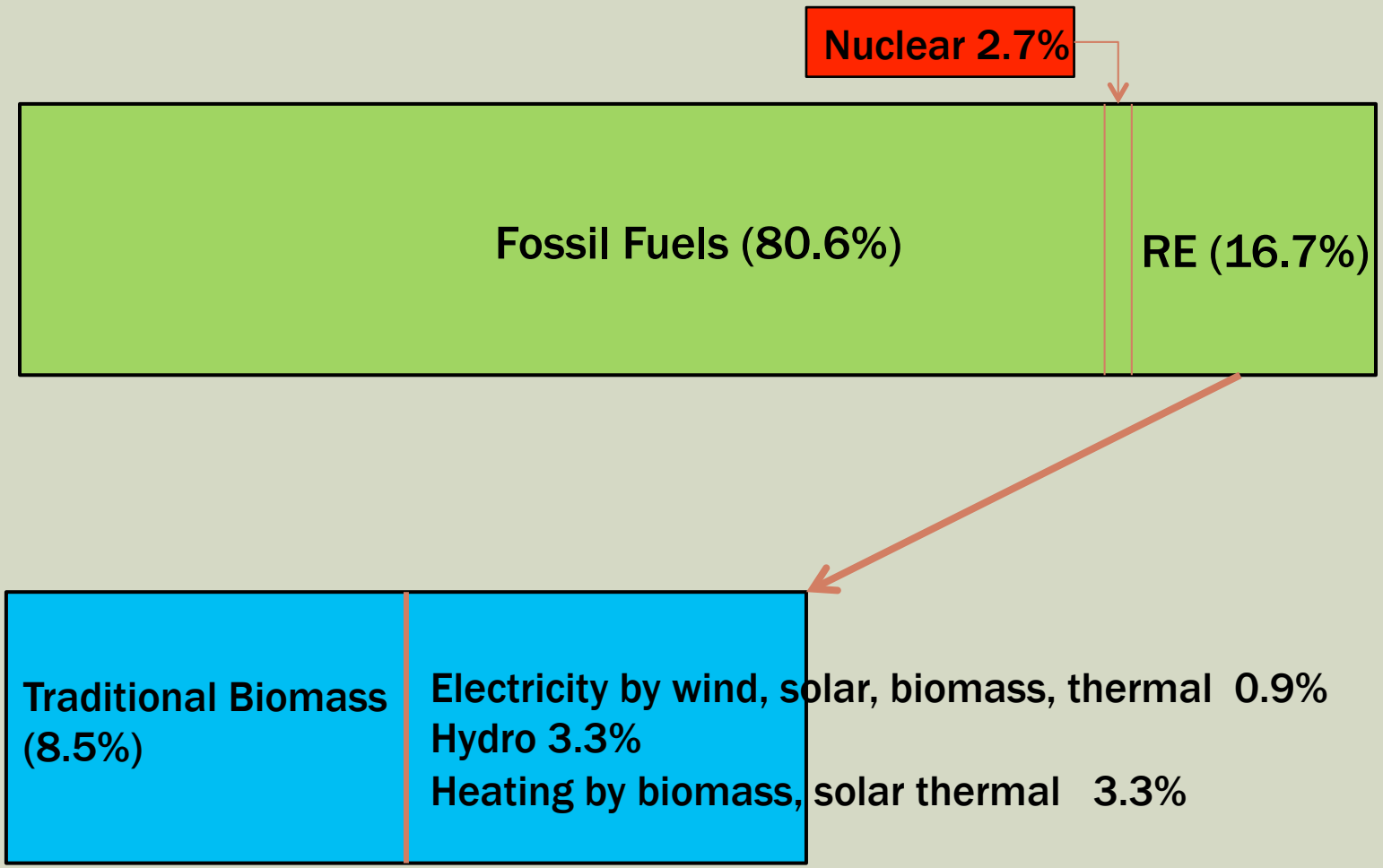
The Global Energy System 2010 (Mtoe)

RE are still a small part of the global mix of energy…but larger than nuclear…

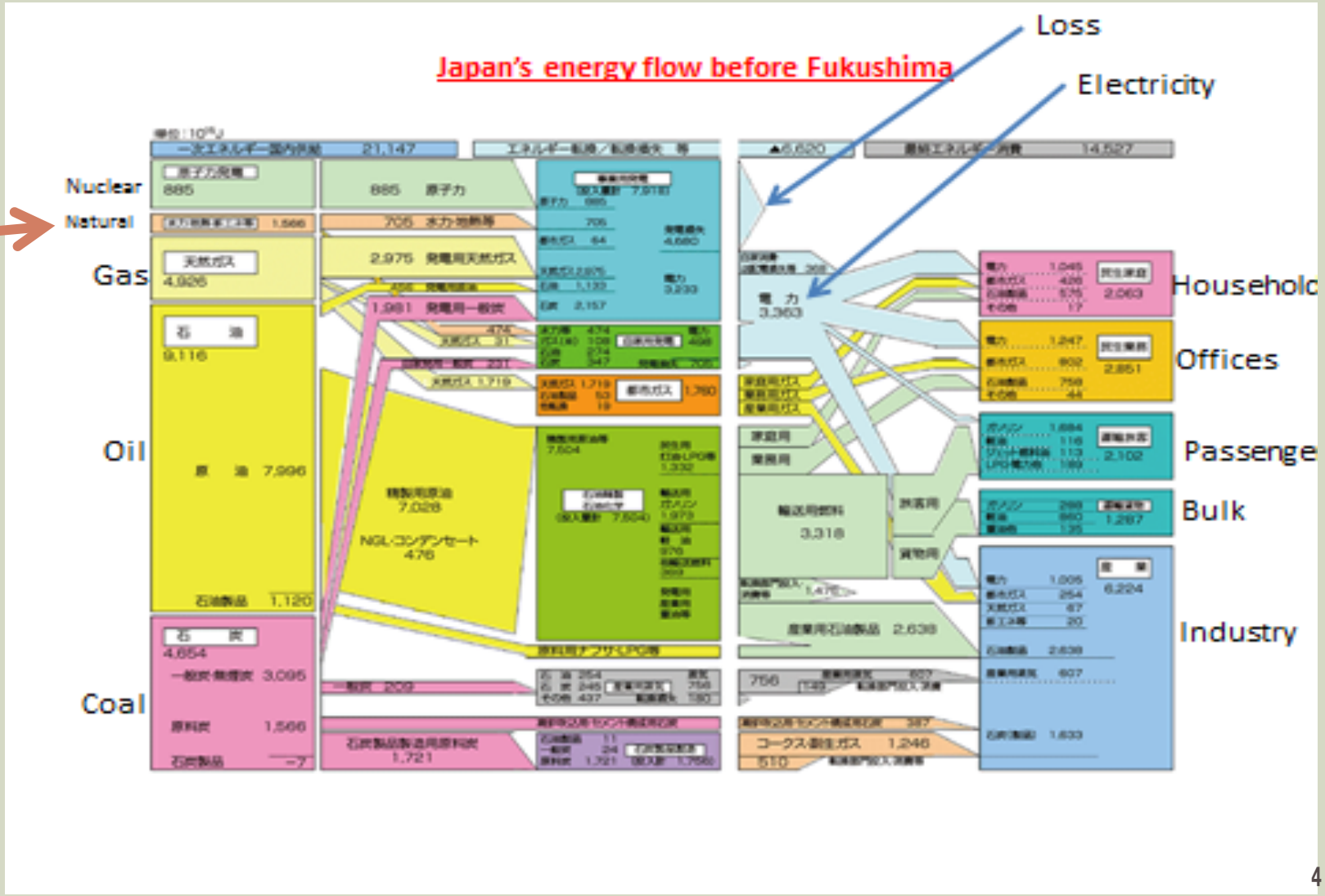


Resilience org. 2012

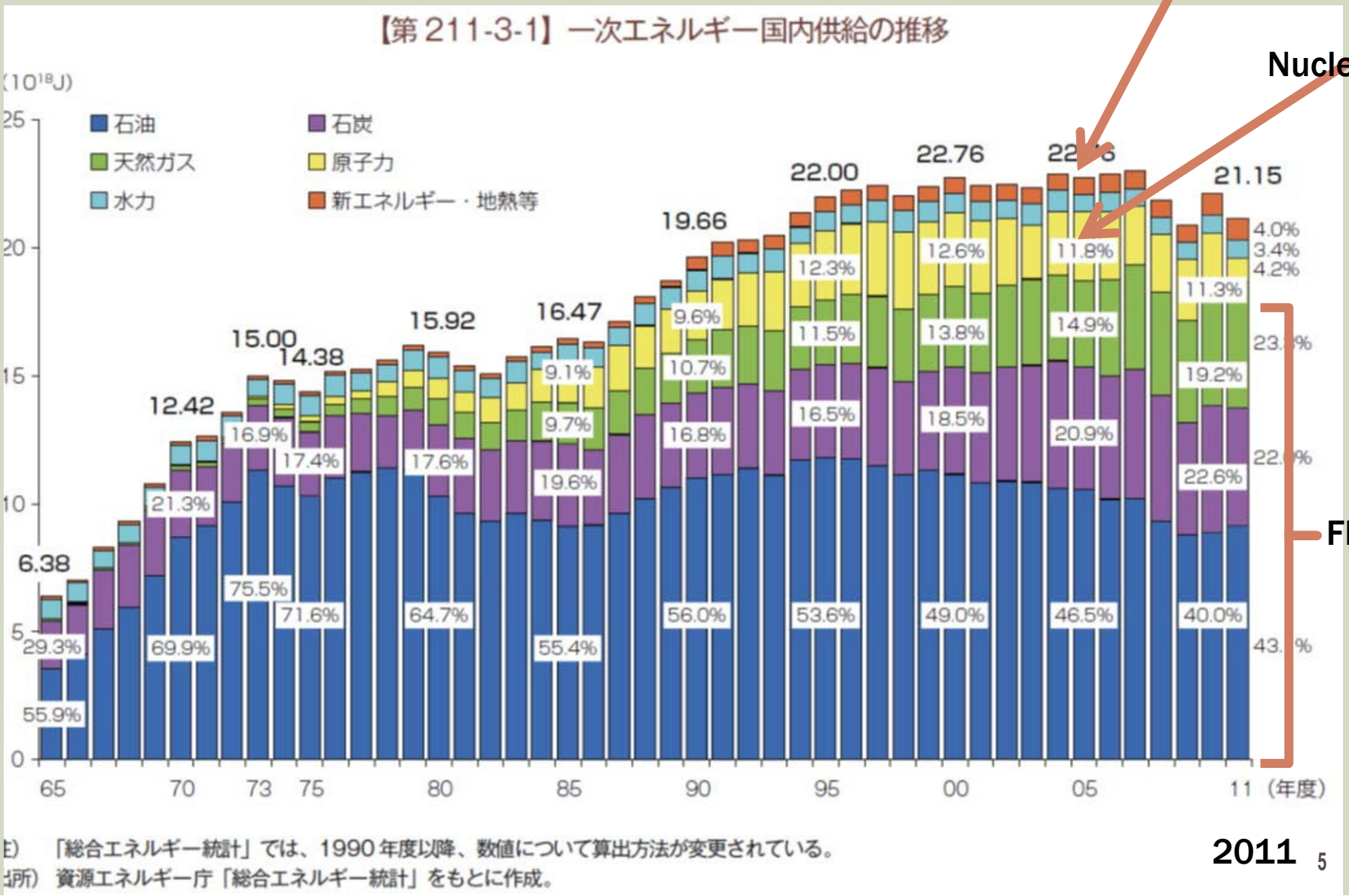
Global Final Energy Consumption 2010



Japan's Energy Flow before Fukushima



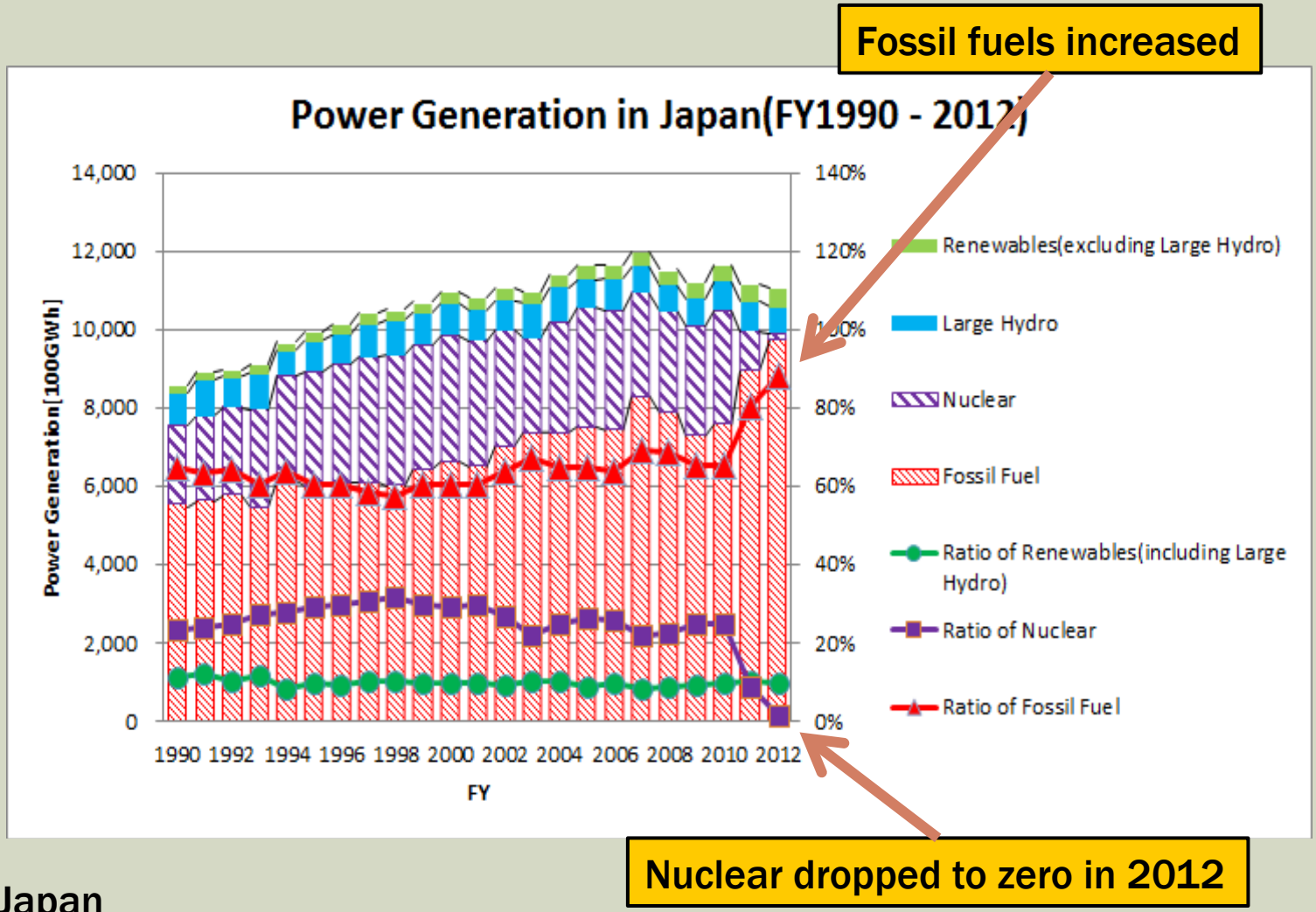
Primary Energy Supply in Japan…1966-2011



注) 「総合エネルギー統計」では、1990 年度以降、数値について算出方法が変更されている。
出所) 資源エネルギー庁「総合エネルギー統計」をもとに作成。

2011

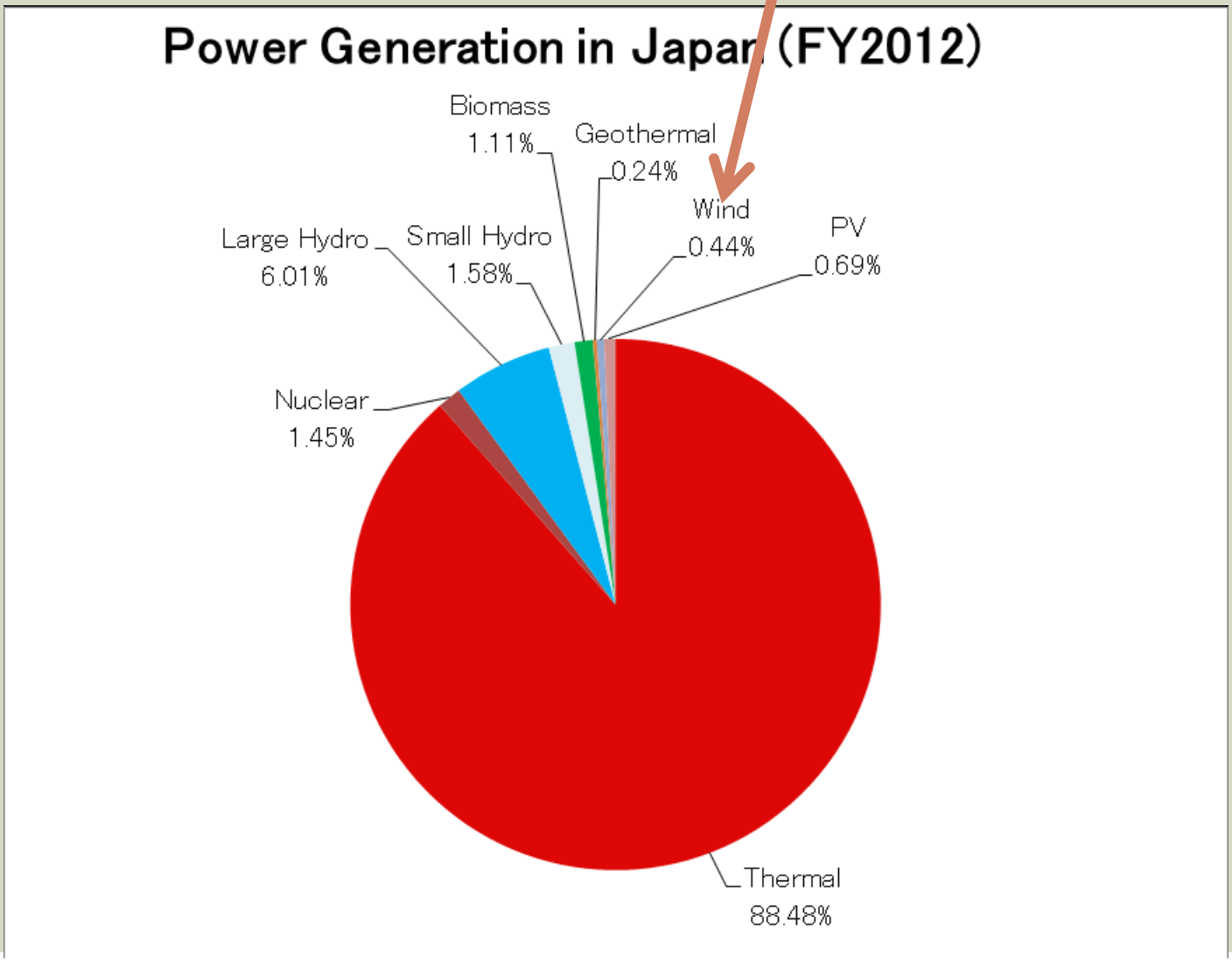
After Fukushima, nuclear dropped to zero and fossil fuels increased dramatically …



ISEP Japan

Power Generation in Japan as of 2012

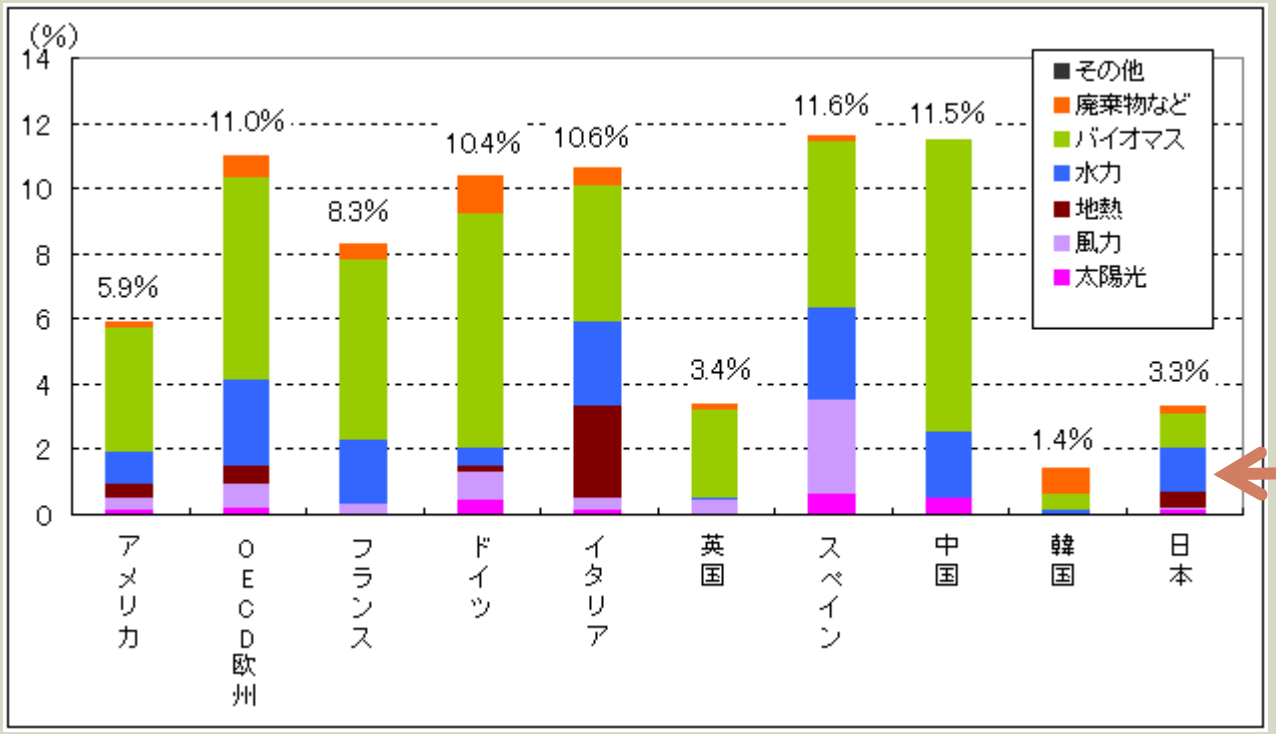
Where is wind and offshore?



ISEP

Share of RE in total primary energy supply of major countries 2010

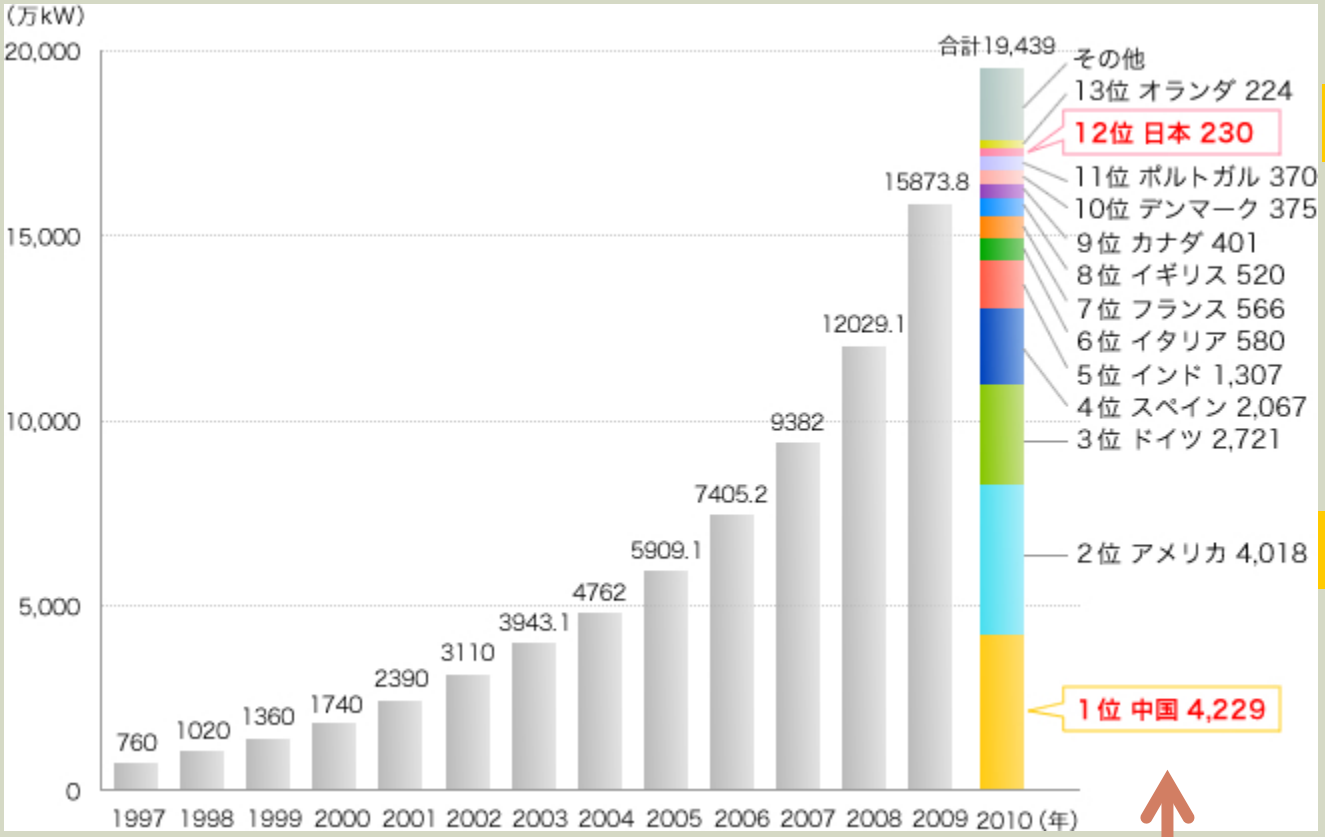
RE in Japan is small in comparison with other economies....



IEA data

Cumulative installed capacity of RE by nations

China is the top runner followed by the US and European countries....
Japan is 12th ....



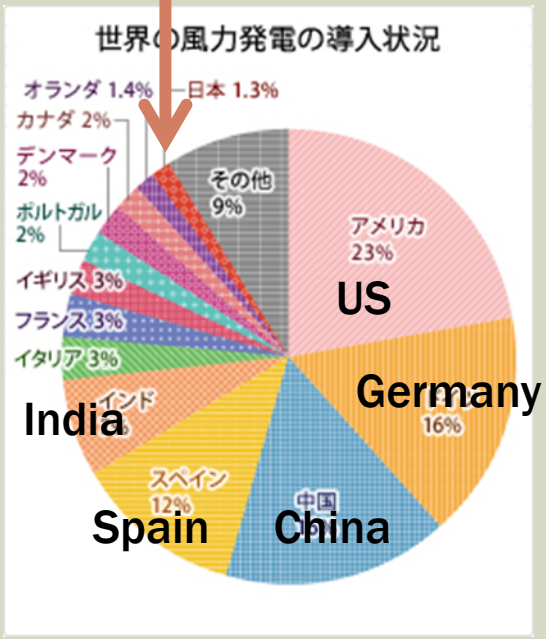
Japan No.12

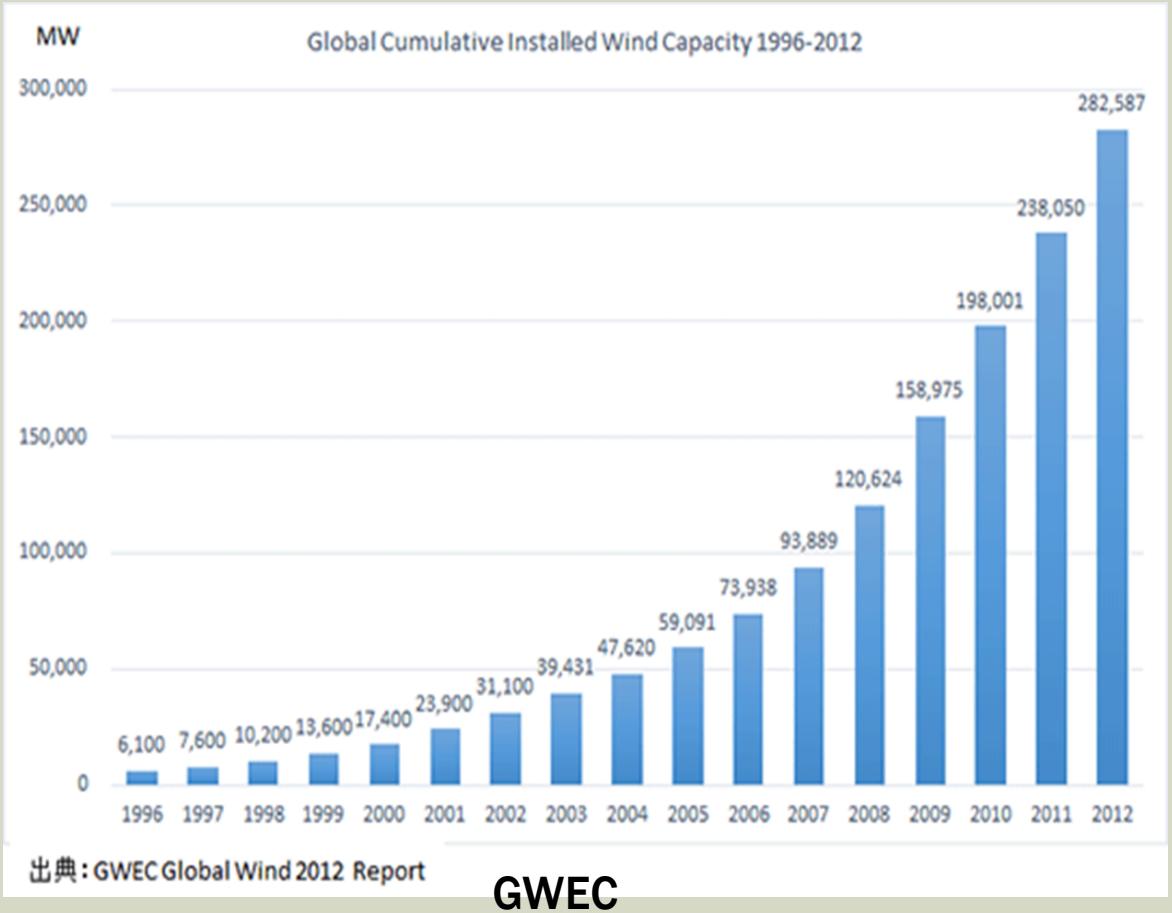
US No. 2

China as number 1...

Global Cumulative Installed Wind Capacity by 2012

Japan 1.3%

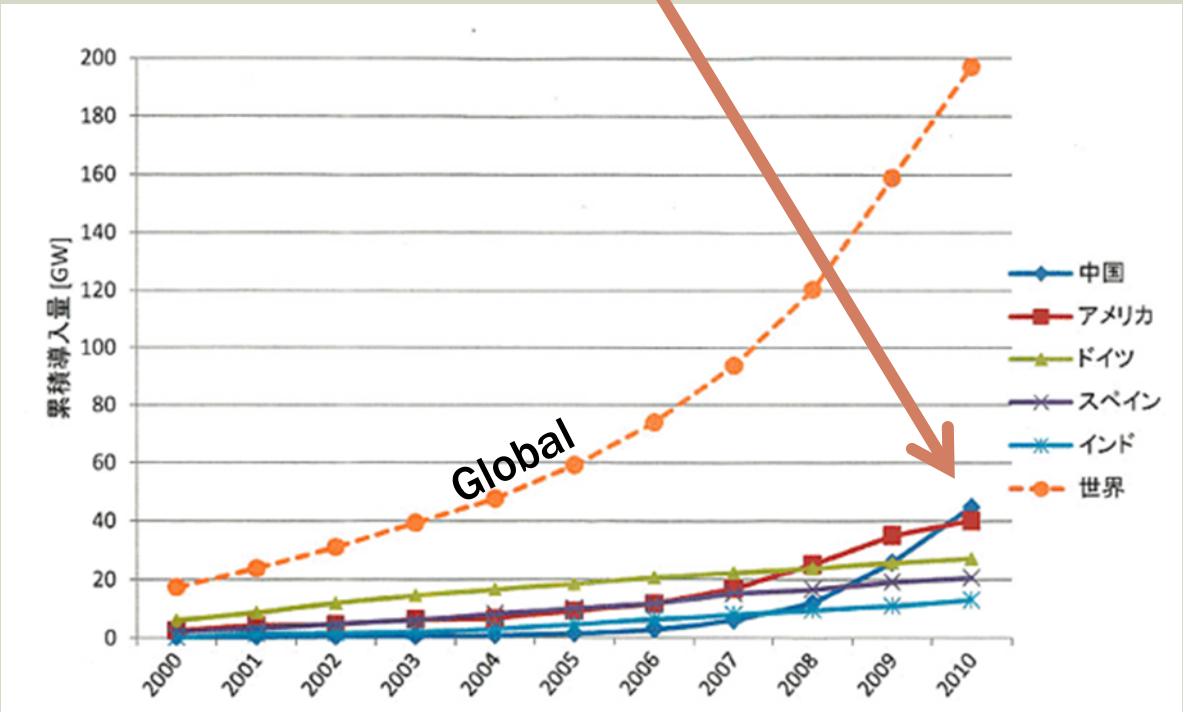




GWEC

Installed capacity of wind energy (2000-2010)

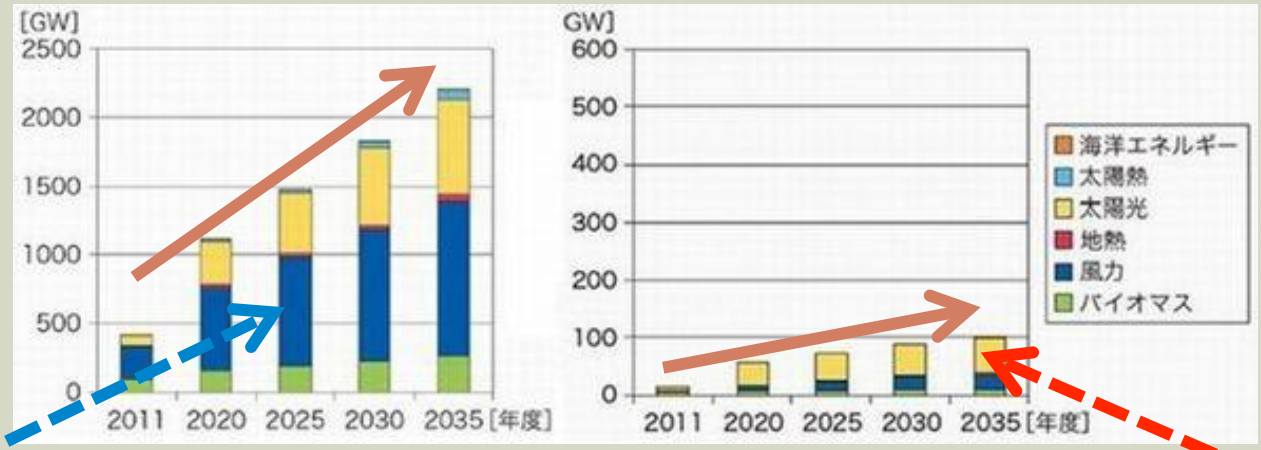
China overtaking the US in 2010....



Global Wind Report 2010, GWEC (2011)」

RE projected installations toward 2035… World and Japan

Japan's projection is far modest than IEA's global projection…



Wind

Global

Japan

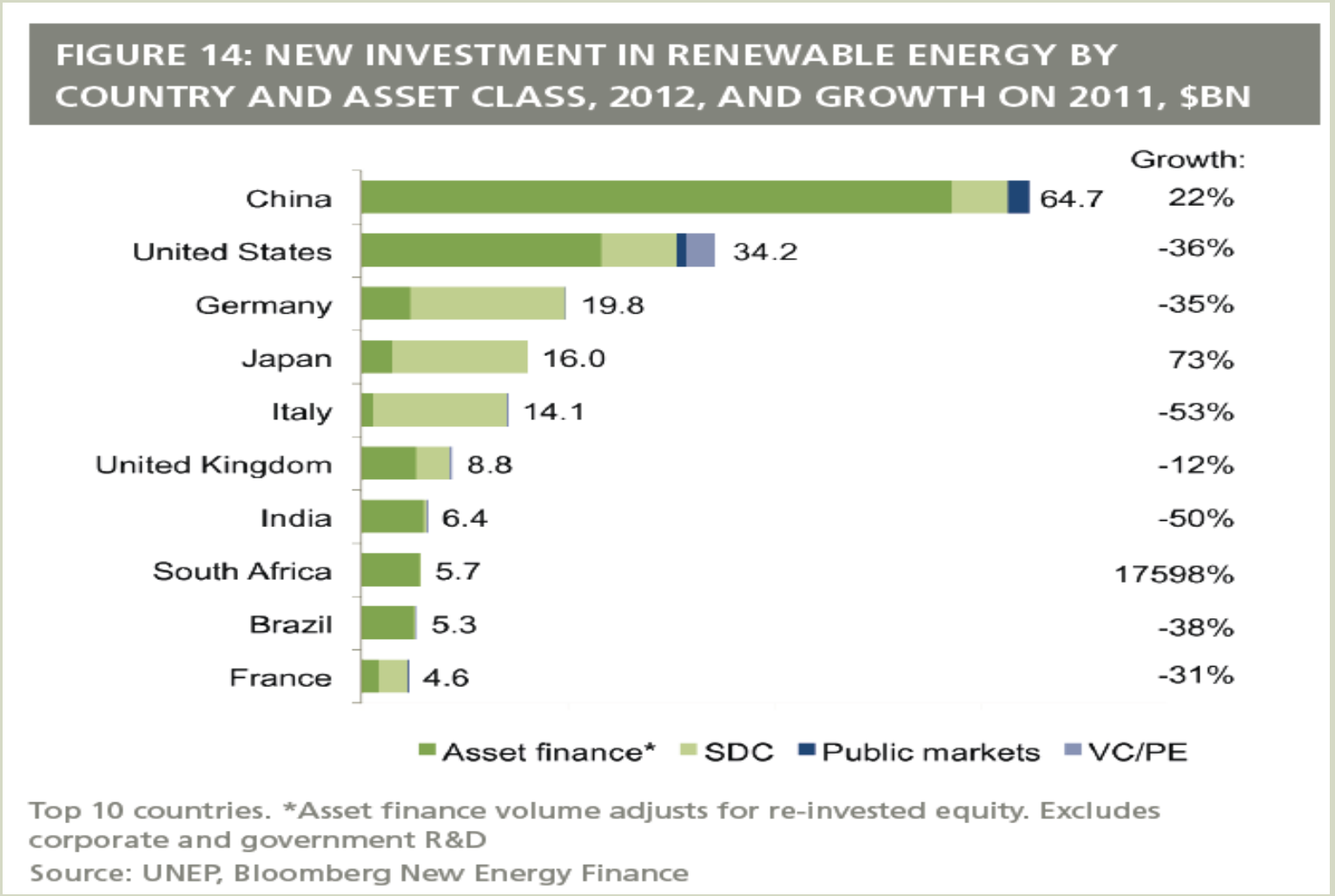
PV

Another point: Wind (blue) is being mainstreamed globally but PV (yellow) is dominant force in Japan…

IEA/NEDO

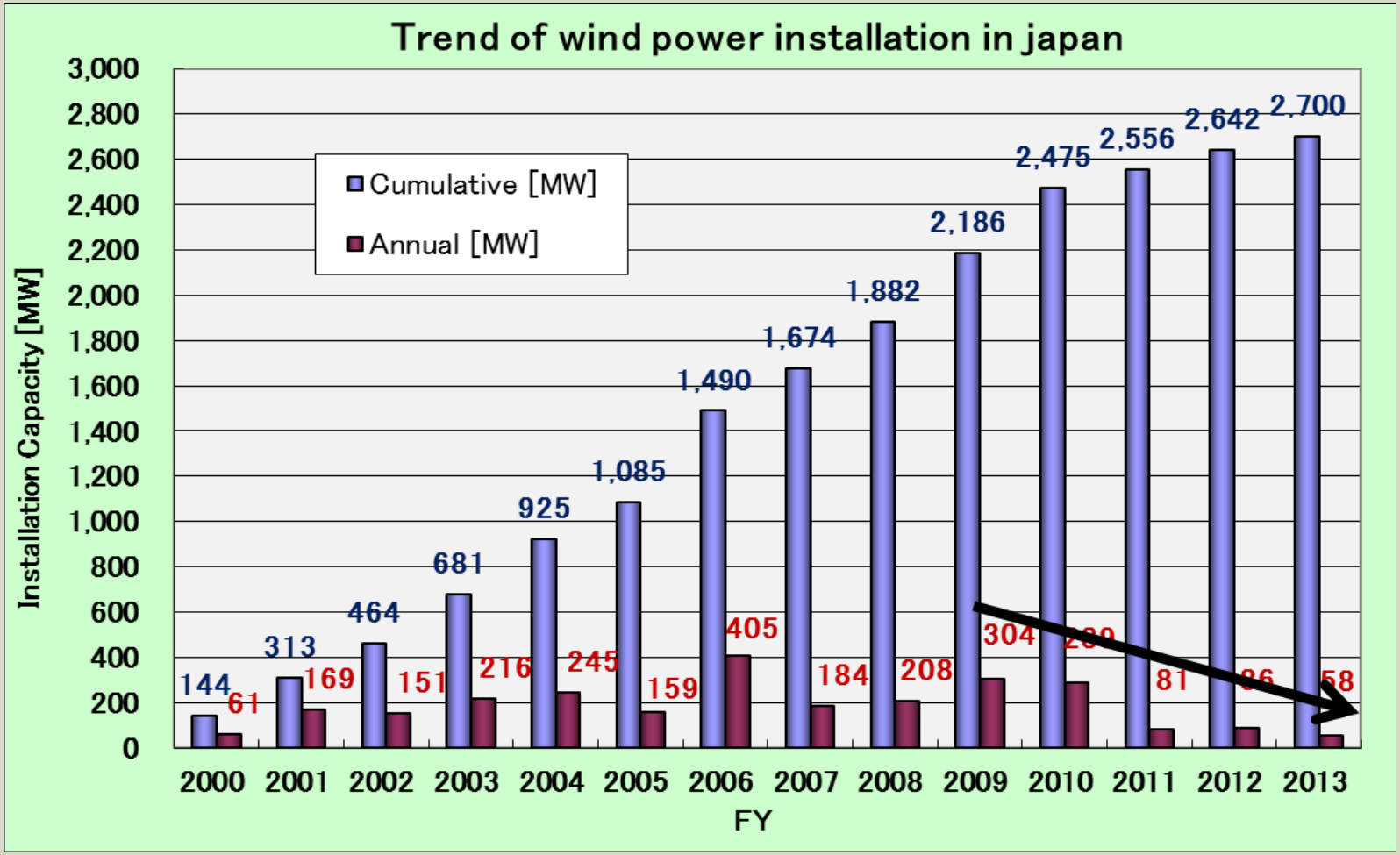
Investment in RE: different picture…Japan is doing its best…

Investment in Japanese market was mostly on solar panels for houses. (2012)



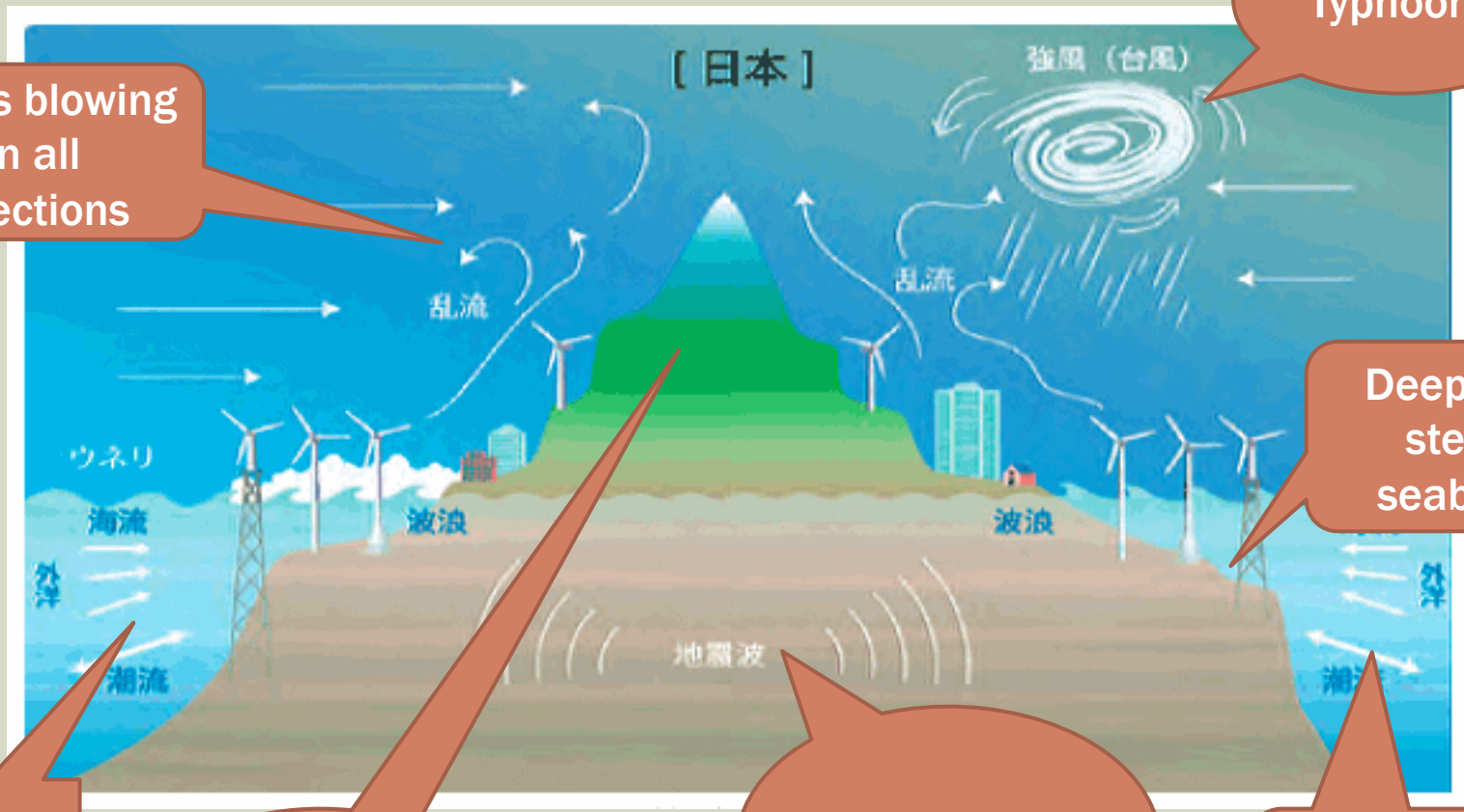
Japan's installed wind capacity 2000-2013

Recent annual decline is due to scarcer onshore locations for wind mills...
Offshore must be new solutions as FIT for offshore wind starting from 2014



Japan as a maritime nation....since centuries ago...

Japan's misfortunes force innovations towards large scale offshore structures



Typhoons

Winds blowing in all directions

Deep and steep seabeds

Strong sea currents

High and steep mountains

Earthquakes

Strong tidal waves

Japan's Exclusive Economic Zone(EEZ) is the sixth largest in the world ....

Projections for offshore wind in Japan is getting bigger....

Theoretical potential....

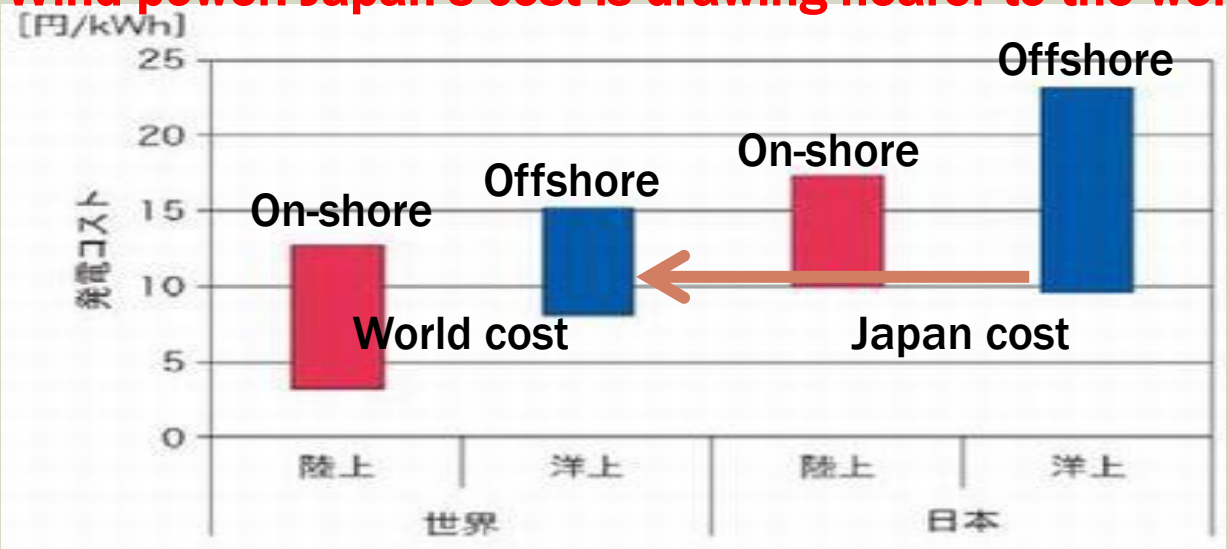
Known theoretical potential =1,600GW(*) which is equal to...

- ▸8 times current entire electricity output of Japan (200GW)
- ▸10 times current global wind electricity output (158GW)
- ▸600 times current wind capacity of Japan (2.5GW)

(*) Prof. Ishihara of Tokyo University

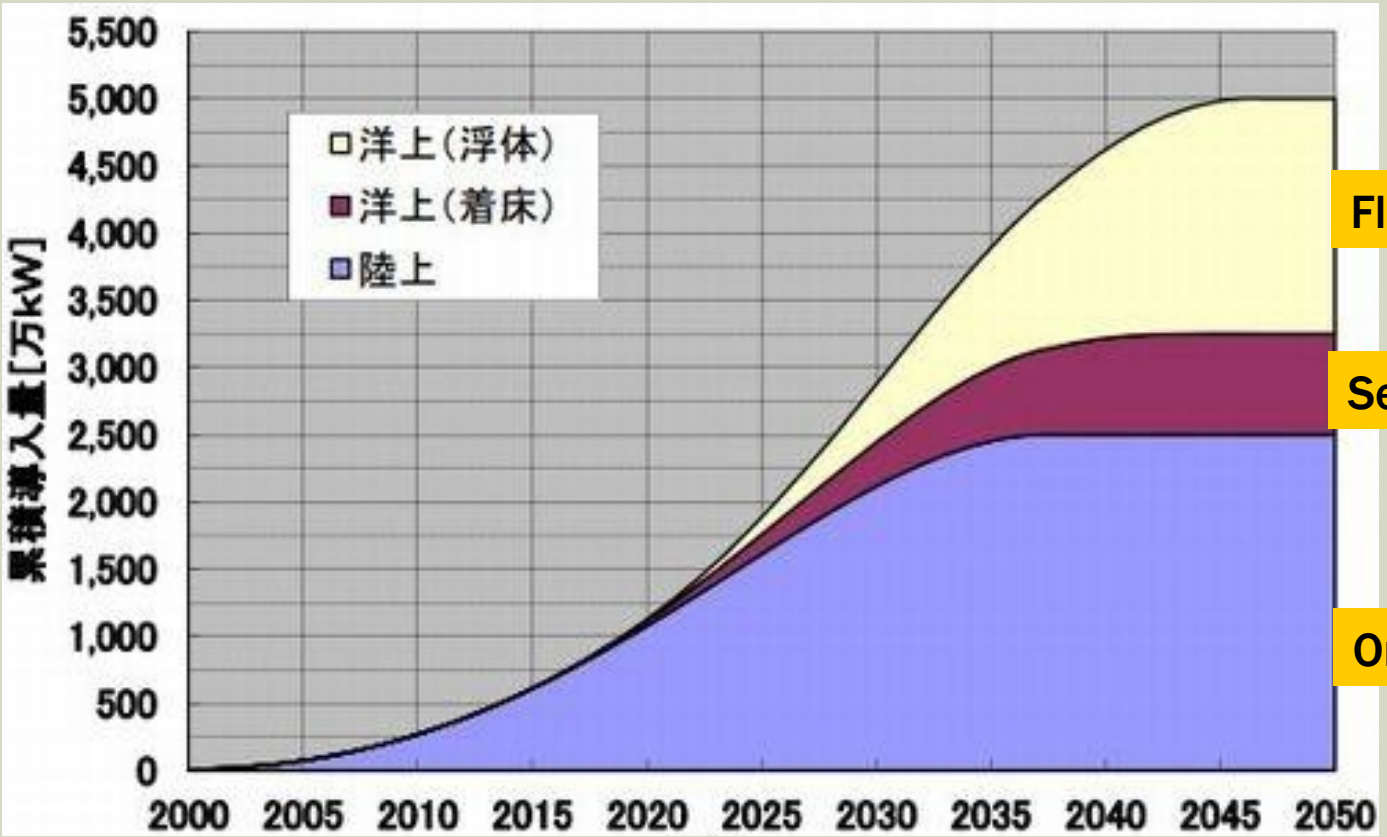
Cost wise....

Wind power: Japan's cost is drawing nearer to the world cost...



NEDO based on IEA

Japan's business forecast for offshore installations by 2050



Floating structures

Sea bed structures

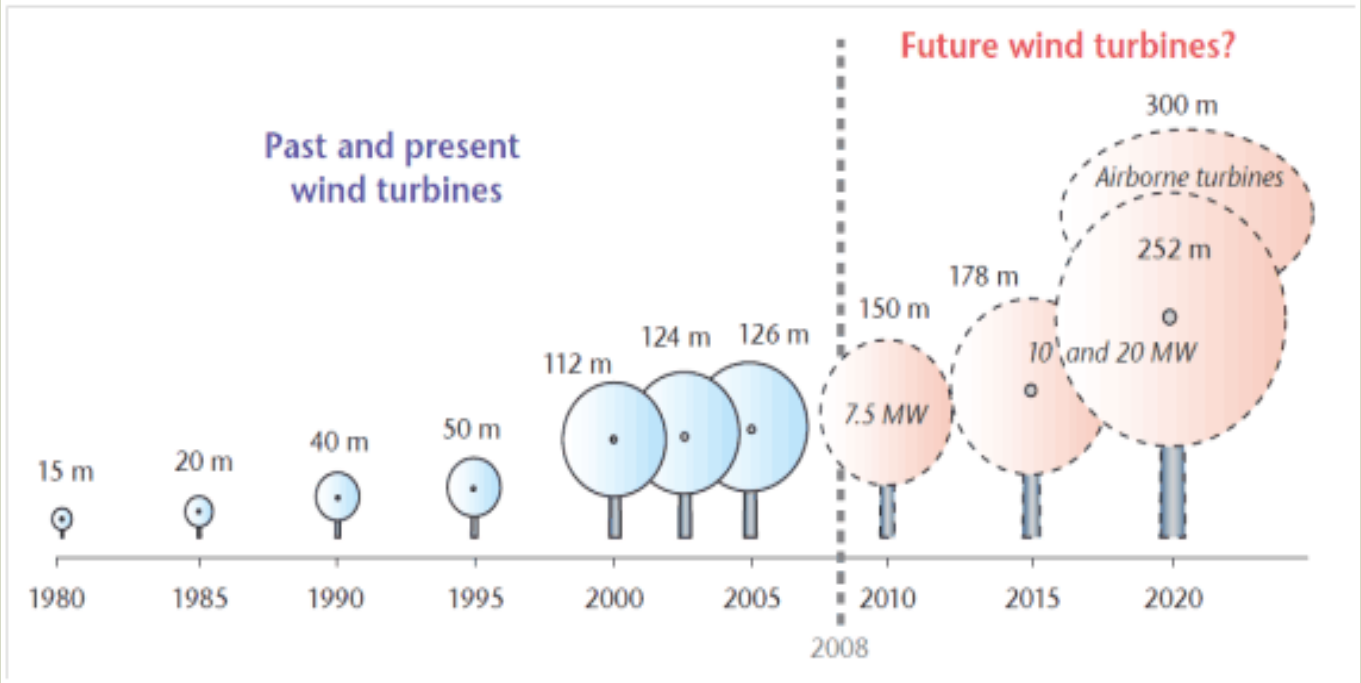
Onshore

	Offshore	Onshore	Total
2010			2.4
2020	0.5	10	11.3
2030	7.6	21	28.8
2040	21.2	25	46
2050	25	25	50

Unit: GW

JWPA

New trend in global competition…
Going to deeper water and turbines getting bigger….



The trend is an opportunities for Japanese technologies which have gone to deep sea due to its natural circumstances…

Projections for wind power in Japan
Prospects are positive

Projections....

Starting from a tiny 2.4 GW, Japan's business sector (JWPA) projects:

11GW (2020), ➡29GW (2030), ➡46GW (2040) ➡50GW (2050)
50GW will represent 10% of total electricity production of Japan in 2050

For this to happen, Japan needs;

-continued FIT needing \50/KWh going beyond current \36
-grid connection and power fluctuation control
-de-regulations
-R&D investment
And many other things...

Offshore wind is more promising simply because the country is tiny but its sea is large...

Positive perspective for offshore wind in Japan
Floating structures in deep seas are the future…

Despite difficulties due to:

deep sea bed, strong ocean currents, typhoons, earthquakes, etc.
and lack of grid connections

New perspectives are emerging since…

–Market trends moving into **deeper waters with bigger mills** in Europe…
this is where Japanese industries are **investing…big scale floating mills**
7MW output with 167m blade aiming at 10MW

–**Oil pressure drive train**: less trouble prone than direct driving system, no gear box which tends to breakdown… enabling the off-shore turbines of larger capacities…

It's getting cost beneficial…FIT plus many factors…

"…10 years ago, no business leaders paid any attention to the offshore wind turbine…"
(Prof. Ishihara of Tokyo University)

http://www.nedo.go.jp/content/100546658.pdf

Fukushima Offshore Wind Power Project …
a project not to be done without Fukushima…

The first phase (2013-2014):

–one 2MW floating wind turbine,

–the world first 25MVA floating substation

–undersea cable

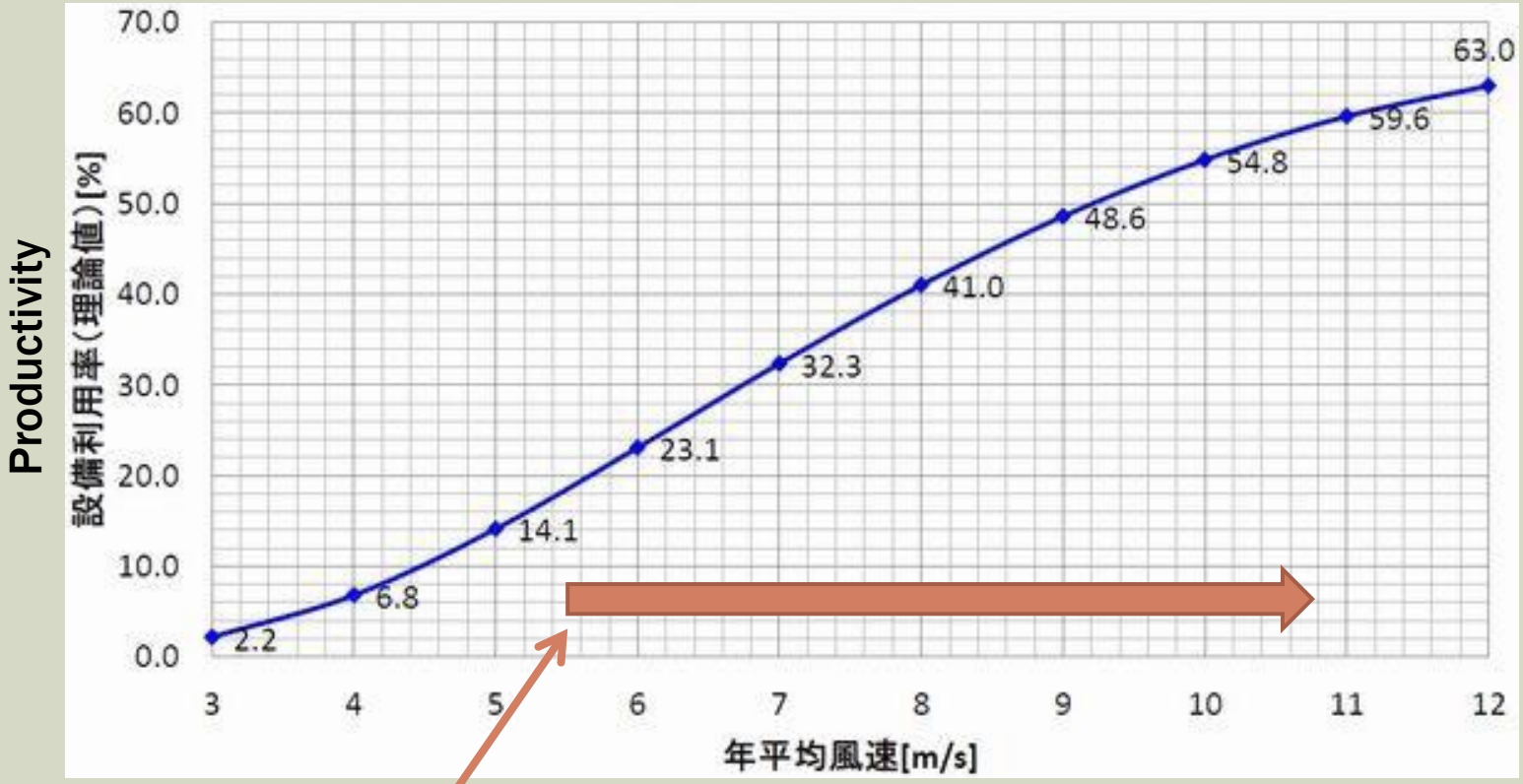
The second phase (2014-2015)

–two world largest 7MW wind turbines on V shape semi-sub floater

Fukushima FORWARD" promises to boost Fukushima recovery and trigger a new national drive to large-scale offshore wind mills…

http://www.fukushima-forward.jp/pdf/pamphlet3.pdf
http://www.fukushima-forward.jp/
Fukushima Forward Consortium HP
https://www.youtube.com/watch?v=k-TGHNkss8Y
https://www.youtube.com/watch?v=-nbhhRto-JE

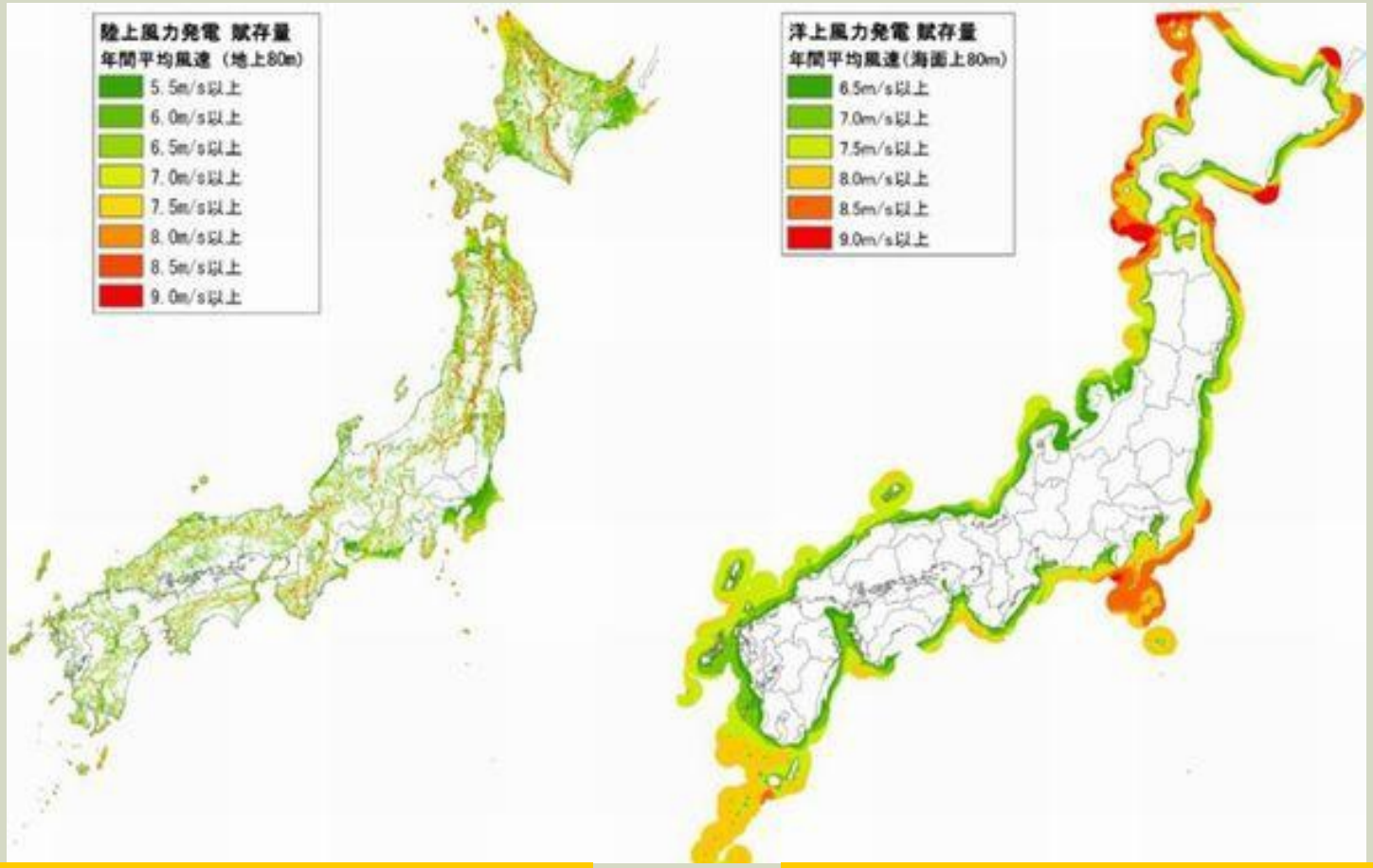
Stronger wind allows higher productivity of wind mills



The minimum wind speed required for power generation is 5.5–6 meters per second…

METI Japan

How Japan is endowed with enabling wind for power generation...



Onshore areas with 5 m/s or more

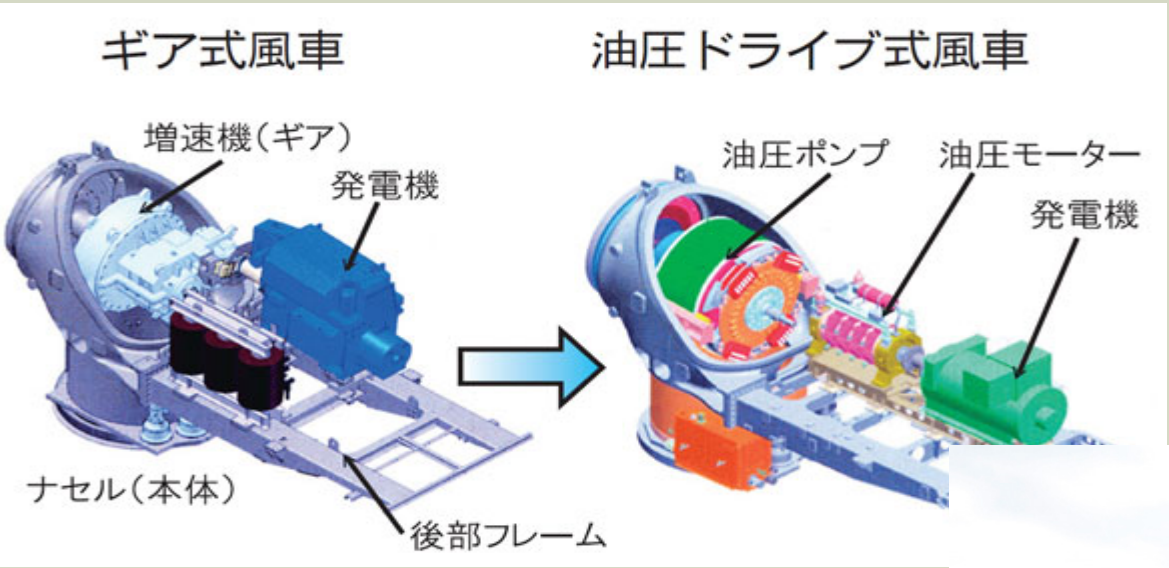
Offshore areas with 6 m/s or more

NEDO

Oil Pressured Drive Train

Conventional gear box

Oil pressure drive train



New maritime resources development: a new avenue for creative development of marine resources…

Actions carried forward by Japan Marine Environmental Creation

New maritime resources development through CO2 fixation based on algae's photosynthesis

High speed, high efficient and massive algae culture in gigantic offshore platforms to produce:

- –biofuels and bio-chemical products
- –rare earths and medical products
- –food, fertilizers etc
- –fertile fishing grounds
- –temperature difference power generation (OTEC)
- –wave activated power generation
- –power generation from tidal wave
- –hydrogen production

“Marine Resources Development” growing into a new smart city concept

Integrating multipurpose mega-floats with onshore communities creating a new “smart city concept” that can thrive with…

- distributed clean electricity
- clean energy supply
- value added productions through maritime resources
- innovations triggered
- job created