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Green Energy Transition
towards 100% Renewable Energy Future Japan

4 OCT 2022
25th REFORM Group Meeting, Salzburg

Mika Ohbayashi
Director, Renewable Energy Institute

Energy transition: whatever happens, the direction hasn't changed

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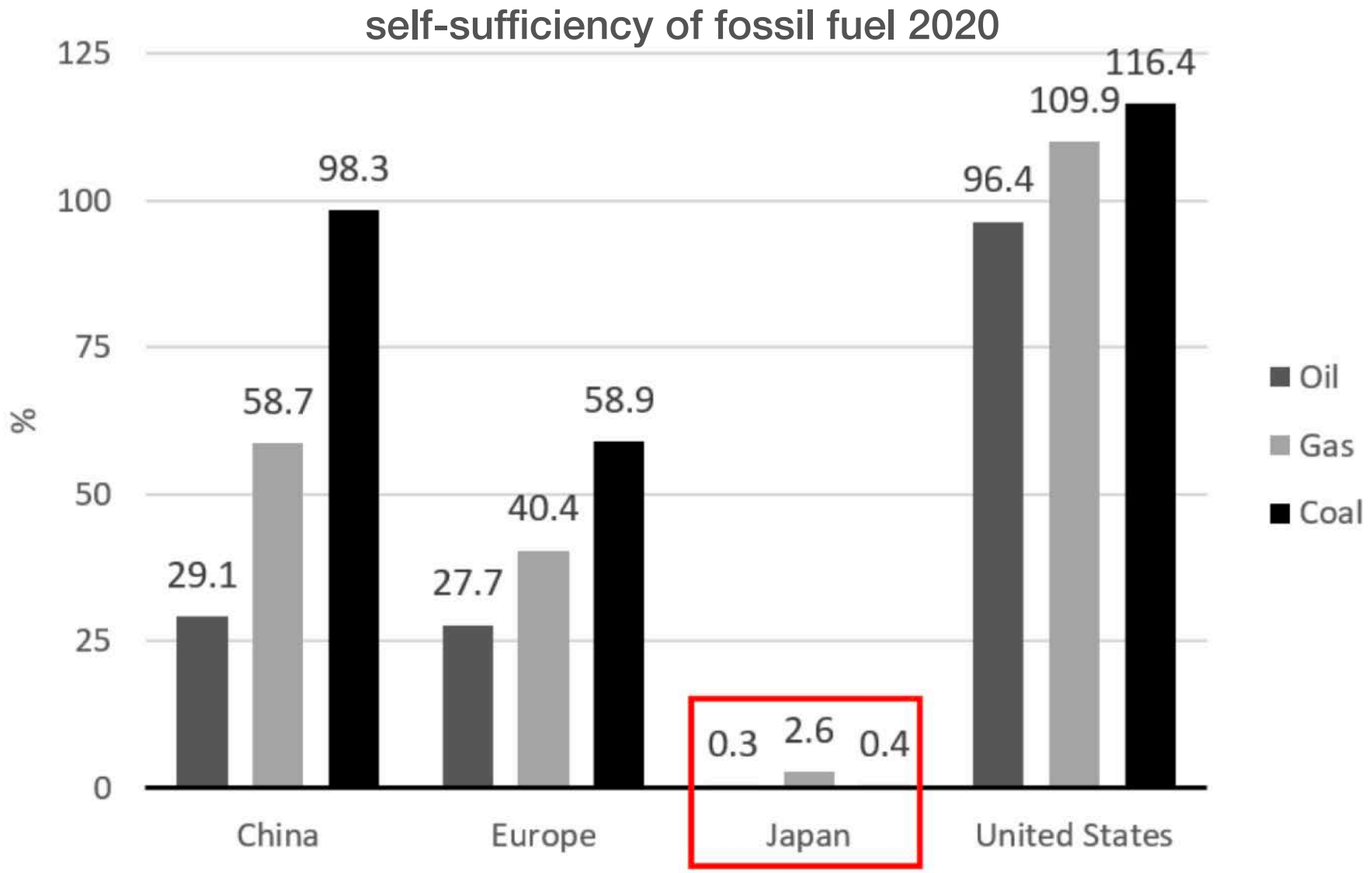
The Russia's invasion war has prompted major countries to "accelerate the decarbonisation" of their economies. Acceleration of energy saving and renewable energy is common.

Energy security strategies of countries in response to the Russia's invasion war

		Fossil fuel procurement diversification	Energy saving Energy efficiency	RES	Nuclear power
IEA	**A 10-Point Plan to Reduce the European Union's Reliance on Russian Natural Gas, March 3, 2022**	✓	✓	✓	✓
EU	**RE Power EU, March 8, 2022**	✓	✓	✓	
Germany	**Energy Security Progress Report, March 25, 2022, BMWK Easter Package, April 6, 2022 - adopted**	✓	✓	✓	
France	**National Recovery and Resilience Plan, March 16, 2022**	✓	✓	✓	✓
UK	**British Energy Security Strategy, April 6, 2022**	✓	✓	✓	✓
USA	**a speech by President Joe Biden, March 31, 2022**	✓	✓	✓	?
Japan	**a speech by PM Kishida, April 8, 2022 Clean Energy Strategy, METI, May 13, 2022**	△	?	△	✓

source) reports and decision from countries

What is the energy crisis facing Japan?



source: REI from BP Statistics and IEA data

Around the world - renewables are the cheapest new electricity

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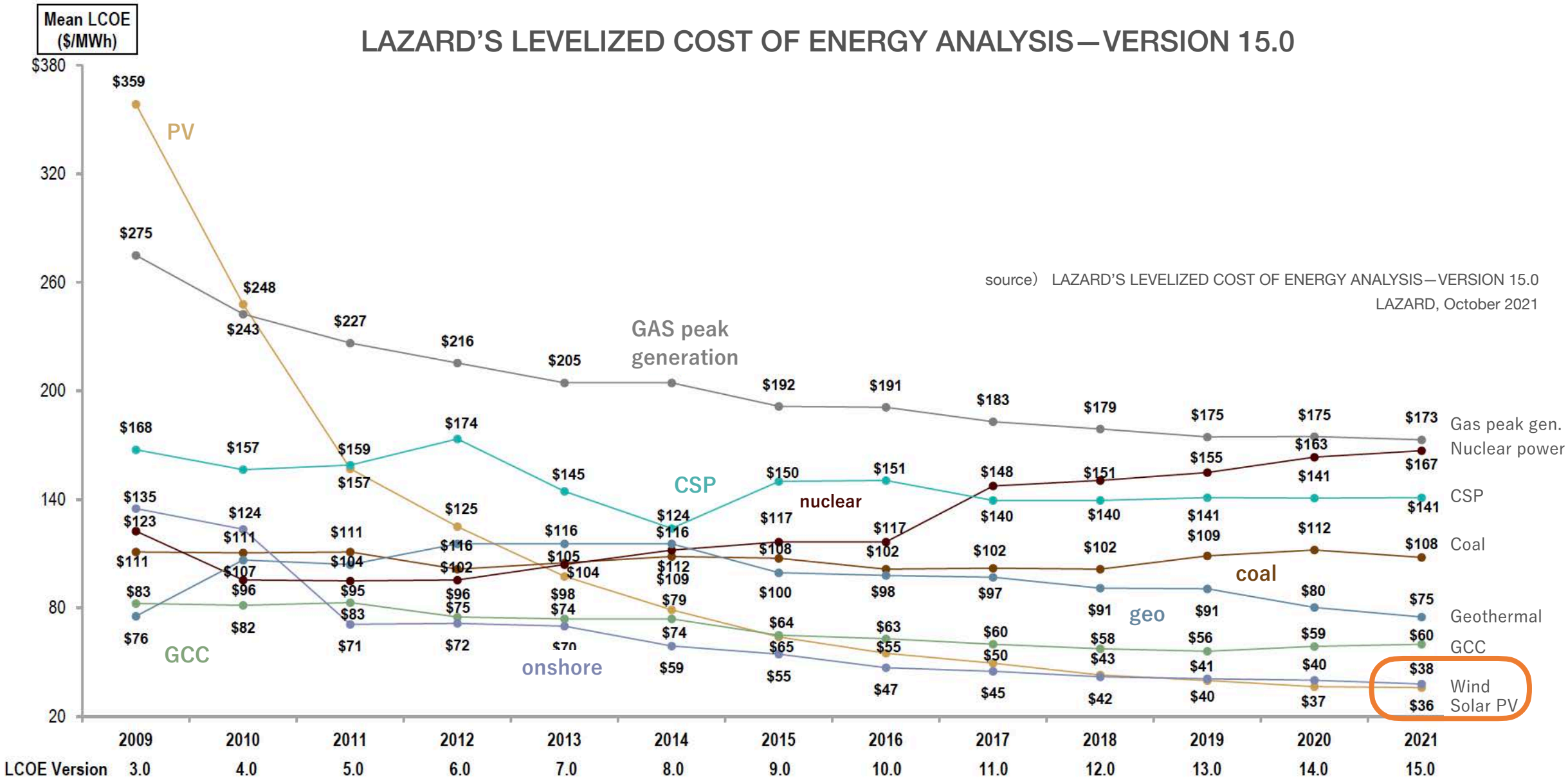

source） LAZARD'S LEVELIZED COST OF ENERGY ANALYSIS—VERSION 15.0
LAZARD, October 2021

What is the energy crisis facing Japan?

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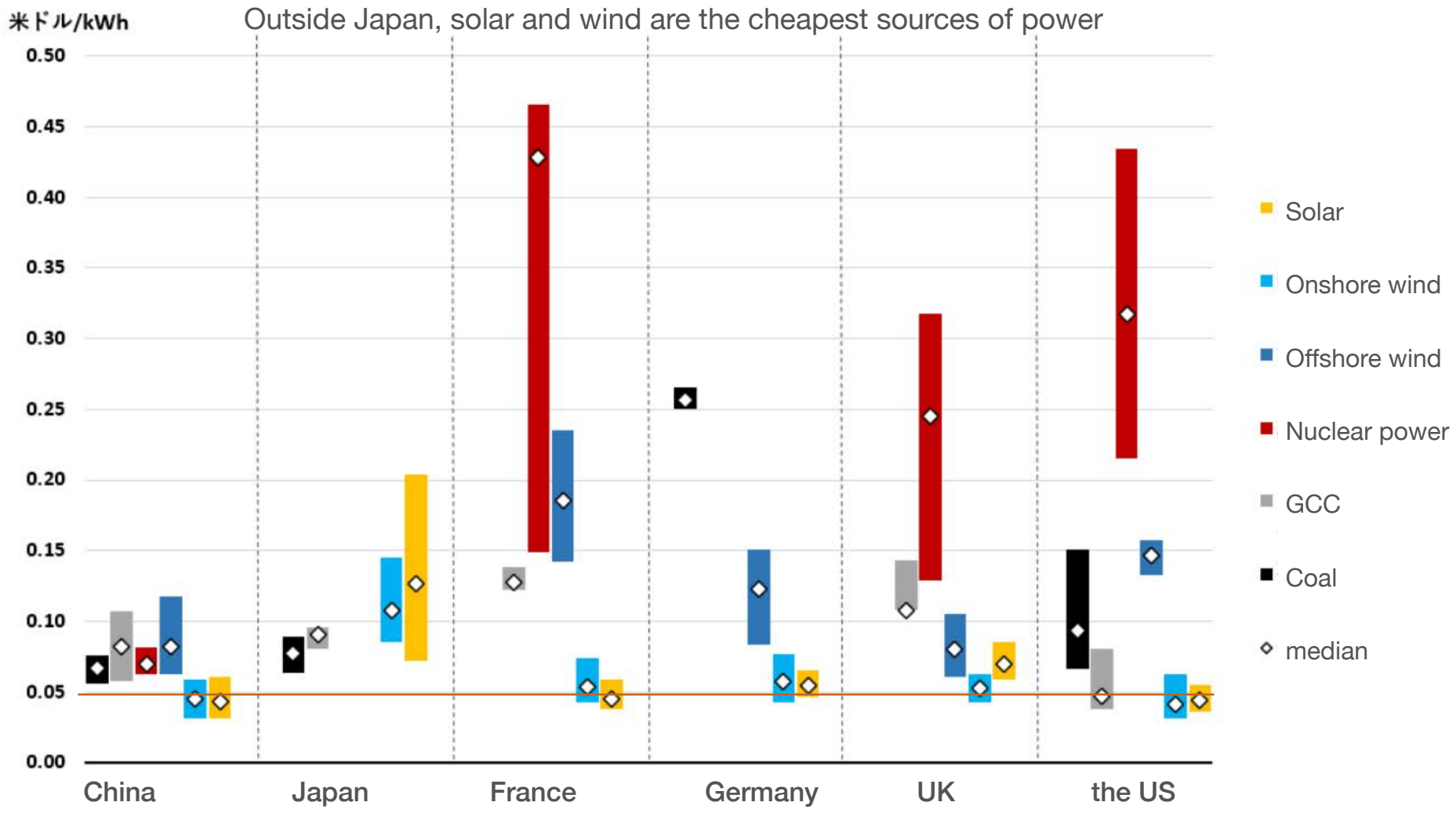
Levelized Cost of Electricity of Selected Countries in 2H of 2021



source: BloombergNEF, Levelized Cost of Electricity 2H 2021, 16May2022

What is the energy crisis facing Japan?

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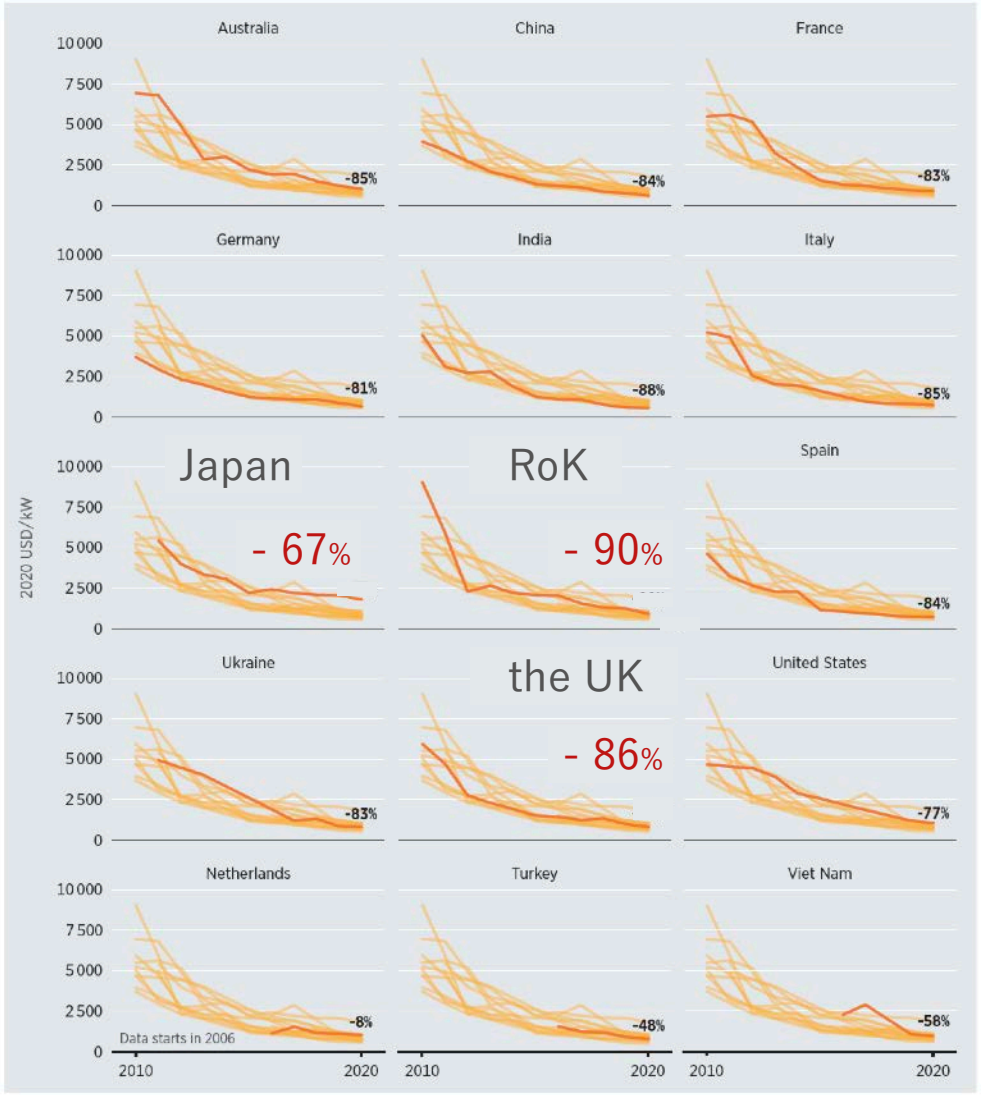
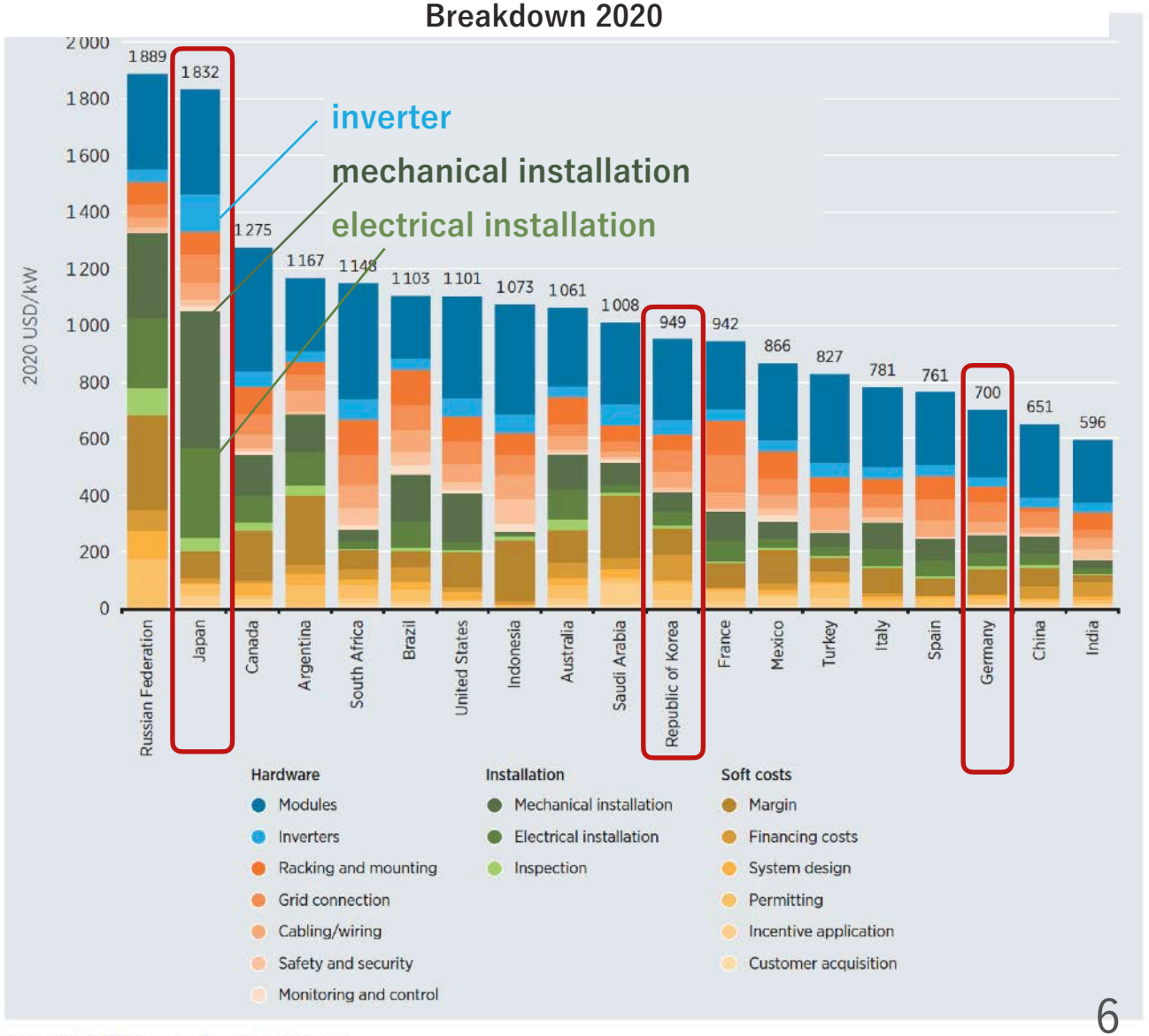
Percentage of diminishing costs of large-scale PV installations in major countries 2010-2020



Cost of utility scale solar PV installations in various countries Breakdown 2020



Source: IRENA Renewable Cost Database

6

What is the energy crisis facing Japan?

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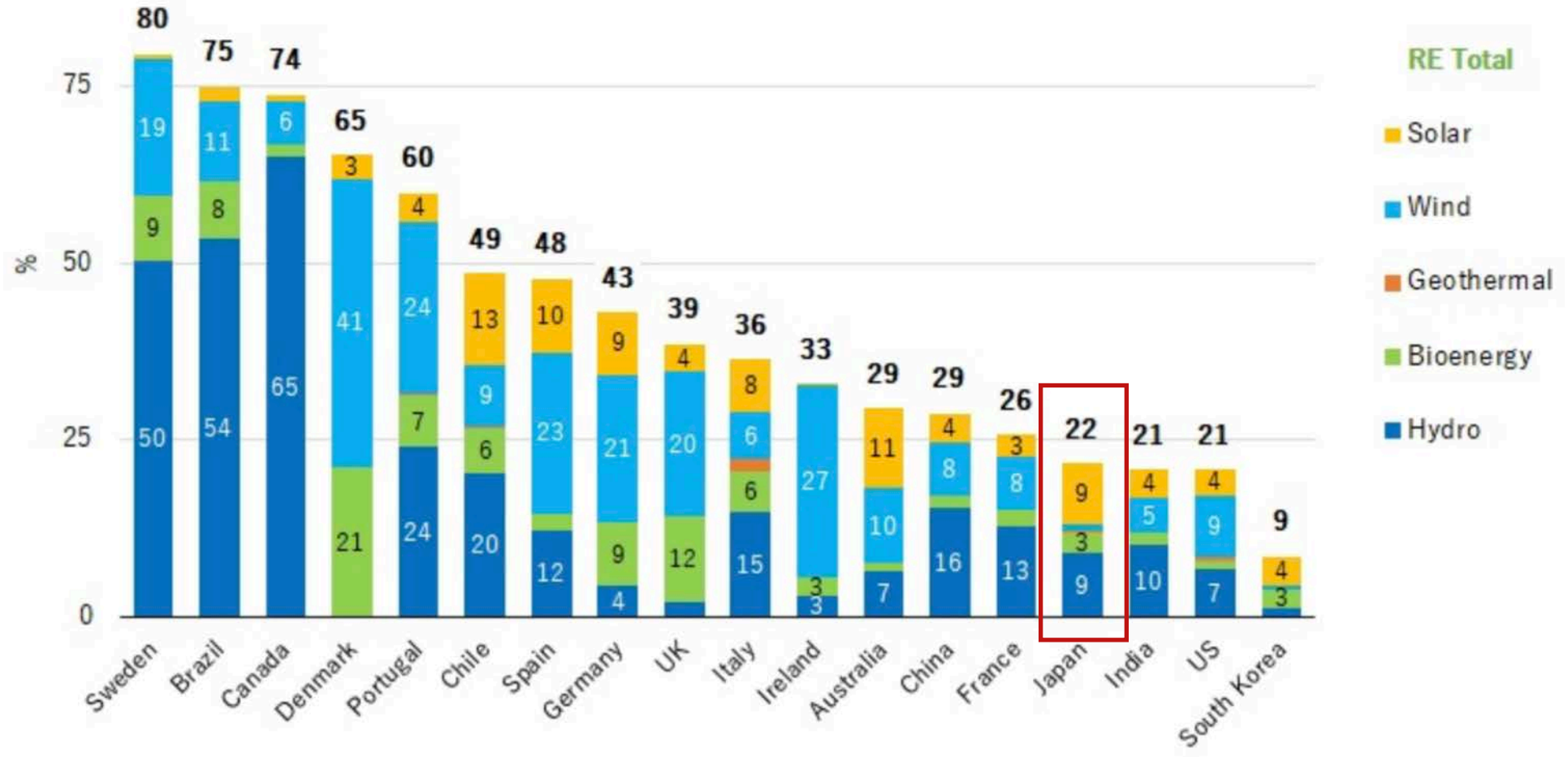
RE Share in Electricity Consumption of Selected Countries

<2021>

As of 18 March 2022



- Notes: Electricity consumption = electricity generation + imports - exports. Based on "net" generation.
- Sources: IEA, Monthly Electricity Statistics: Data up to December 2021 (March 2022) (downloaded March 16, 2022).

Japan's renewable energy status

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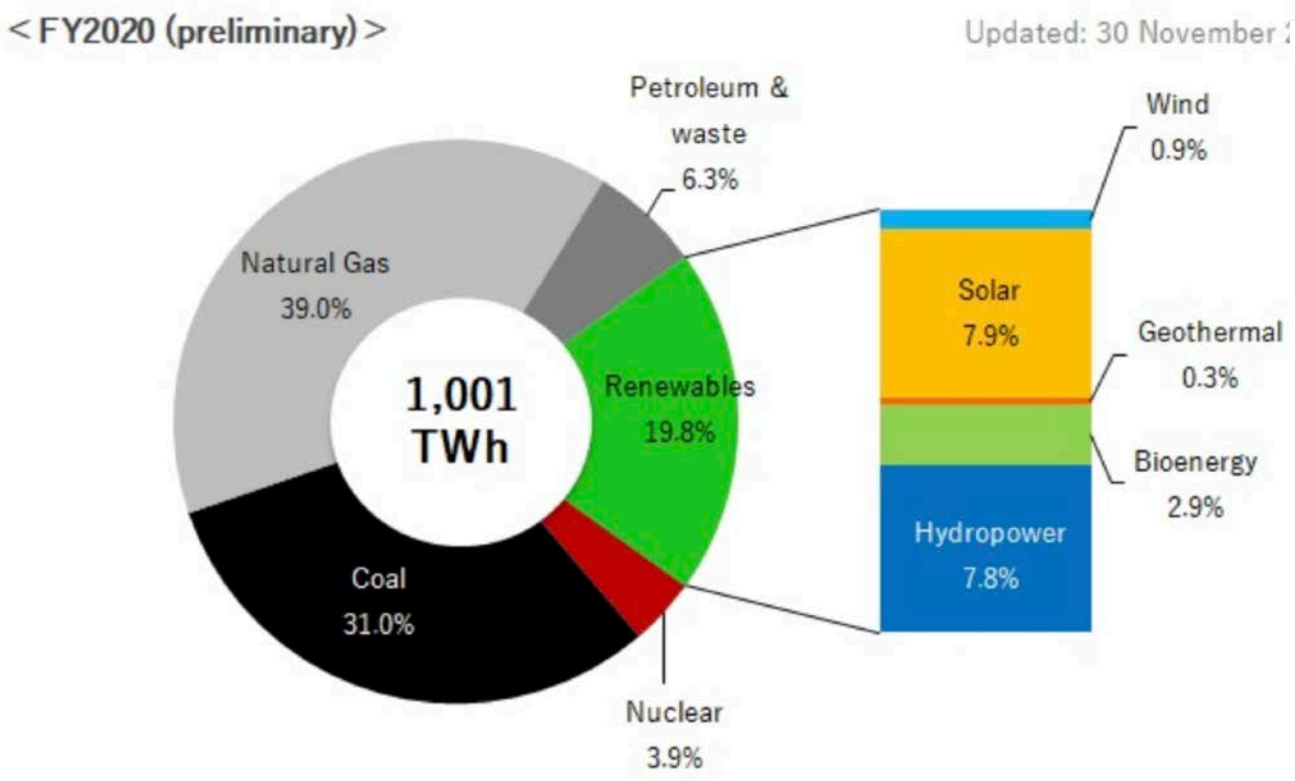
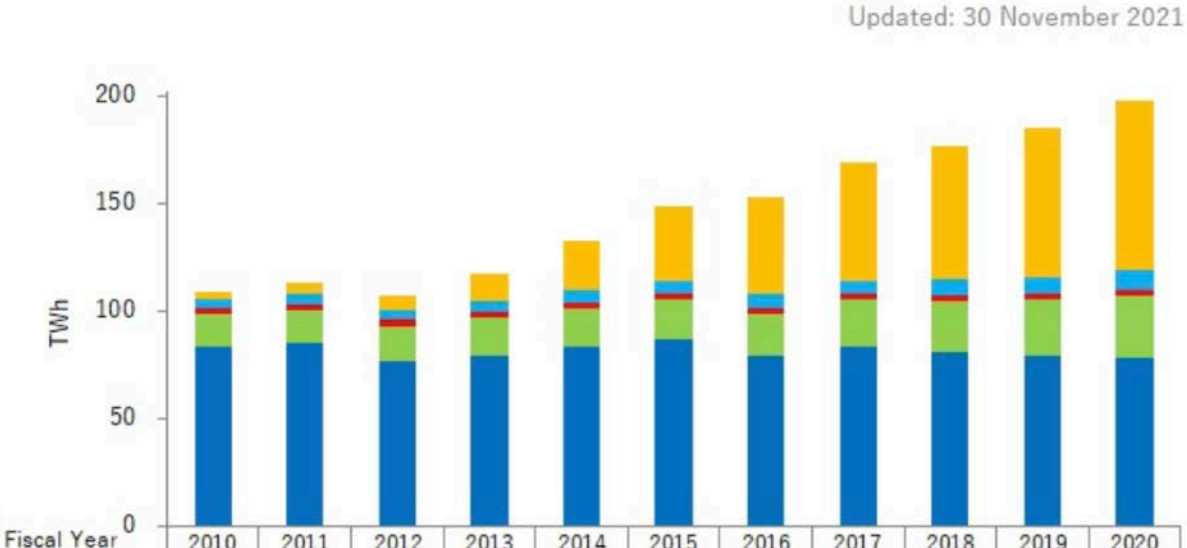
Electricity Generation Mix



Source: METI/ANRE "Total Energy Statistics"

Trends of Electricity Generation from Renewable Sources

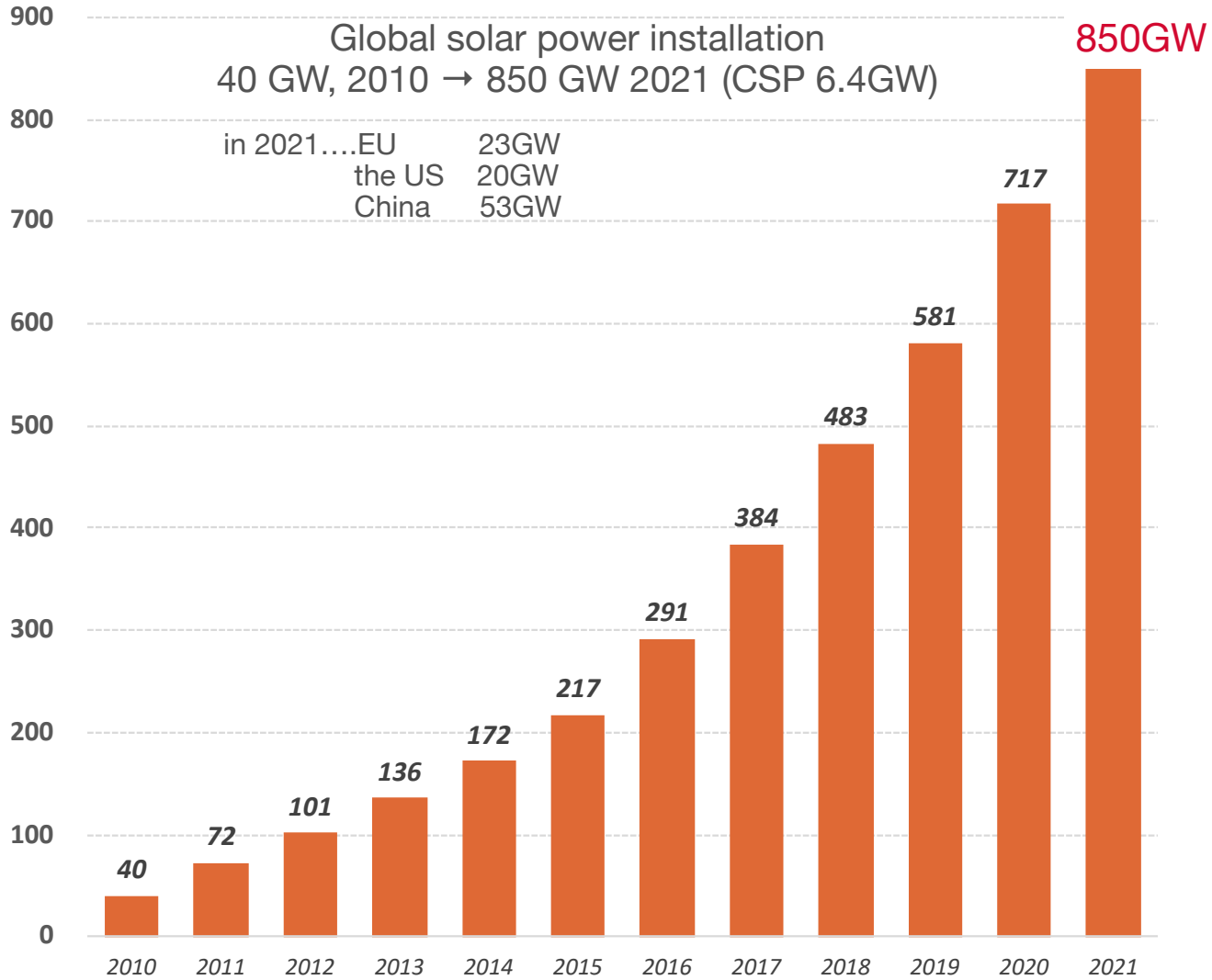


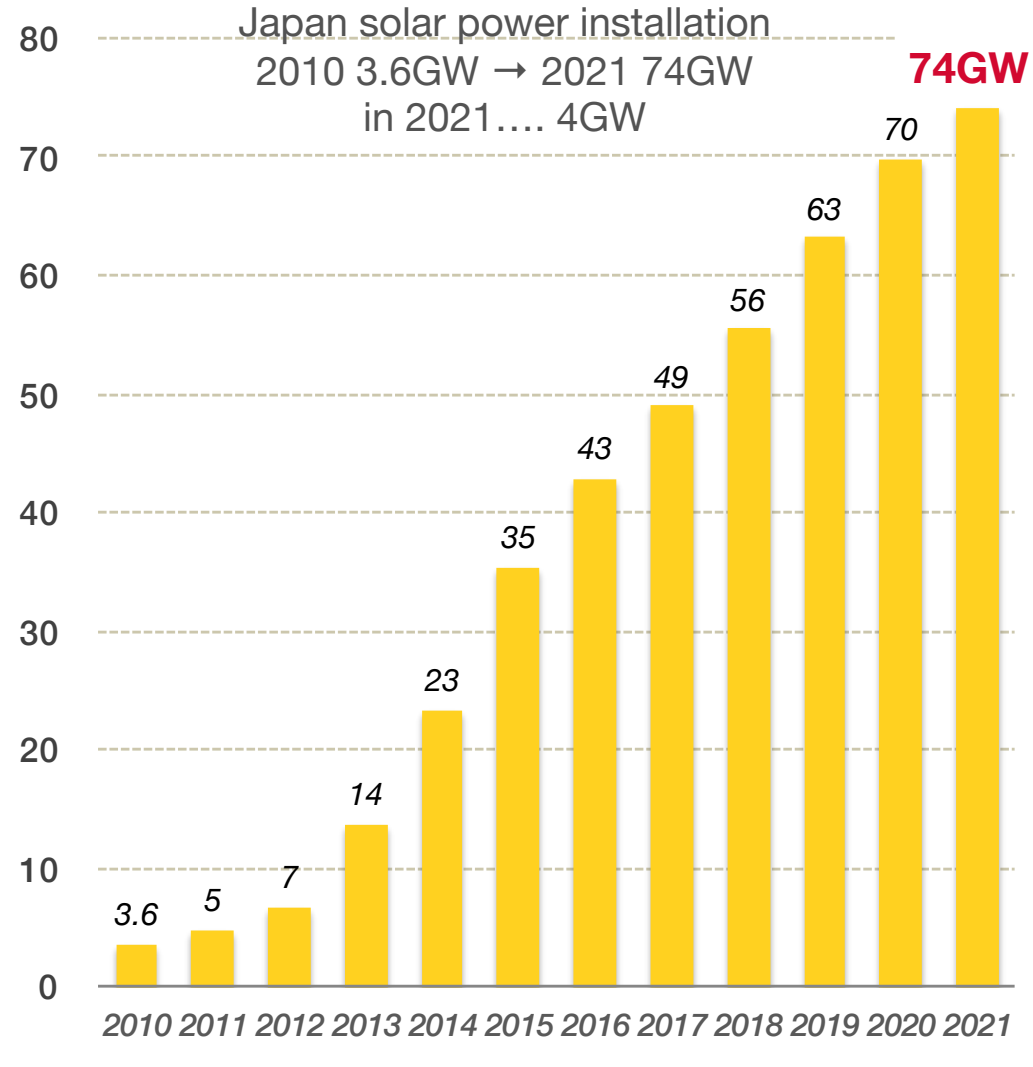
Fiscal Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Solar	4	5	7	13	23	35	46	55	63	69	79
Wind	4	5	5	5	5	6	6	6	7	8	9
Geothermal	3	3	3	3	3	3	3	2	3	3	3
Bioenergy	15	16	17	18	18	19	20	22	24	26	29
Hydropower	84	85	77	79	84	87	79	84	81	80	78
Total	109	113	107	118	133	149	154	170	177	186	198

Source: METI/ANRE "Total Energy Statistics"

Energy Transition - solar PV installation

Solar is taking over everything in the world. The cost of PV solar has fallen by 90% in the last decade, and the cost of concentrated solar power (CSP) has also come down

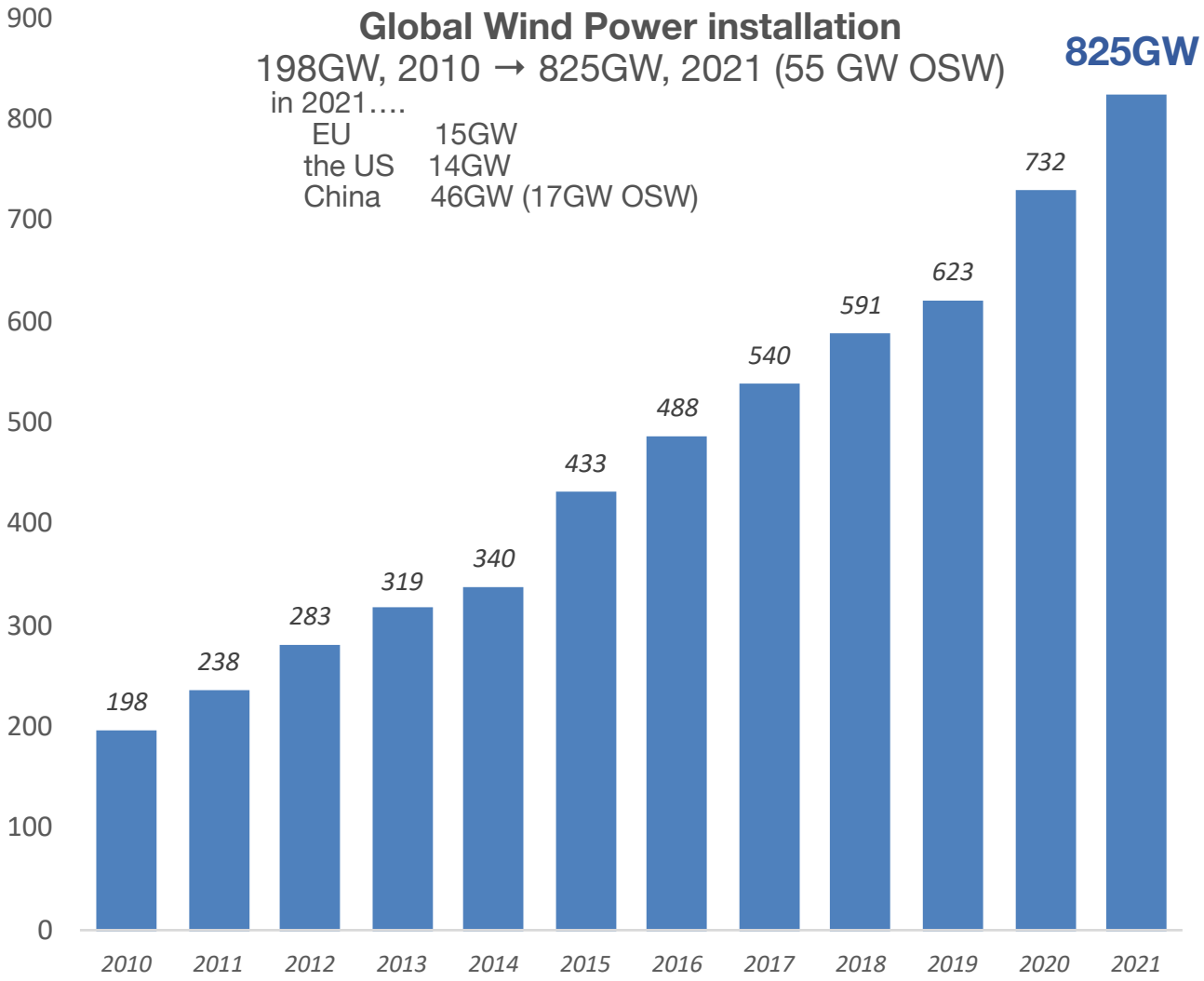




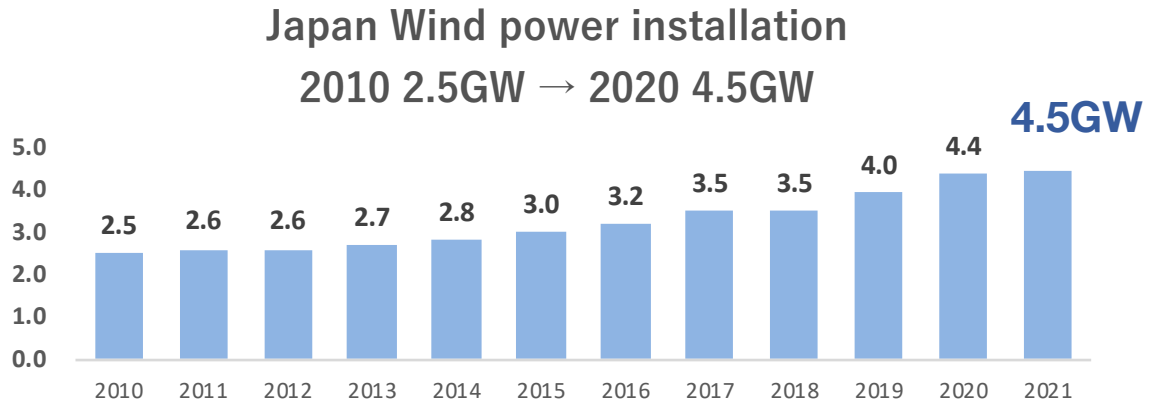
source）BP Statistics (2022), IRENA (2022), Renewable Energy Capacity Statistics 2022

Energy Transition - onshore wind power installation

Wind power has expanded steadily. It was already a competitive power source, but its cost has been further halved in the last decade. In recent years, OSW has expanded the market.



出典）IRENA (2022), Renewable Energy Capacity Statistics 2022



Solar for electricity sales became serious business after the introduction of the Feed-in Tariff Act in 2012.

On the other hand, the market for wind power has been affected by difficulties in connecting to the grid, as well as by changing policies such as subsidy schemes and revisions to legislation.

2000: Long-term purchase menu by power companies
2003: RPS law comes into force
2007: Revised Building Standard Law
2009: Regional new energy promotion projects
2009: Project to promote the introduction of new energy in the region, and the end of the project to support new energy businesses
2012: FIT Law enacted (July), Environmental Impact Assessment Law enacted (November)

出典）IRENA (2021), Renewable Power Generation Costs in 2020

Japan's lagging development of renewable energies

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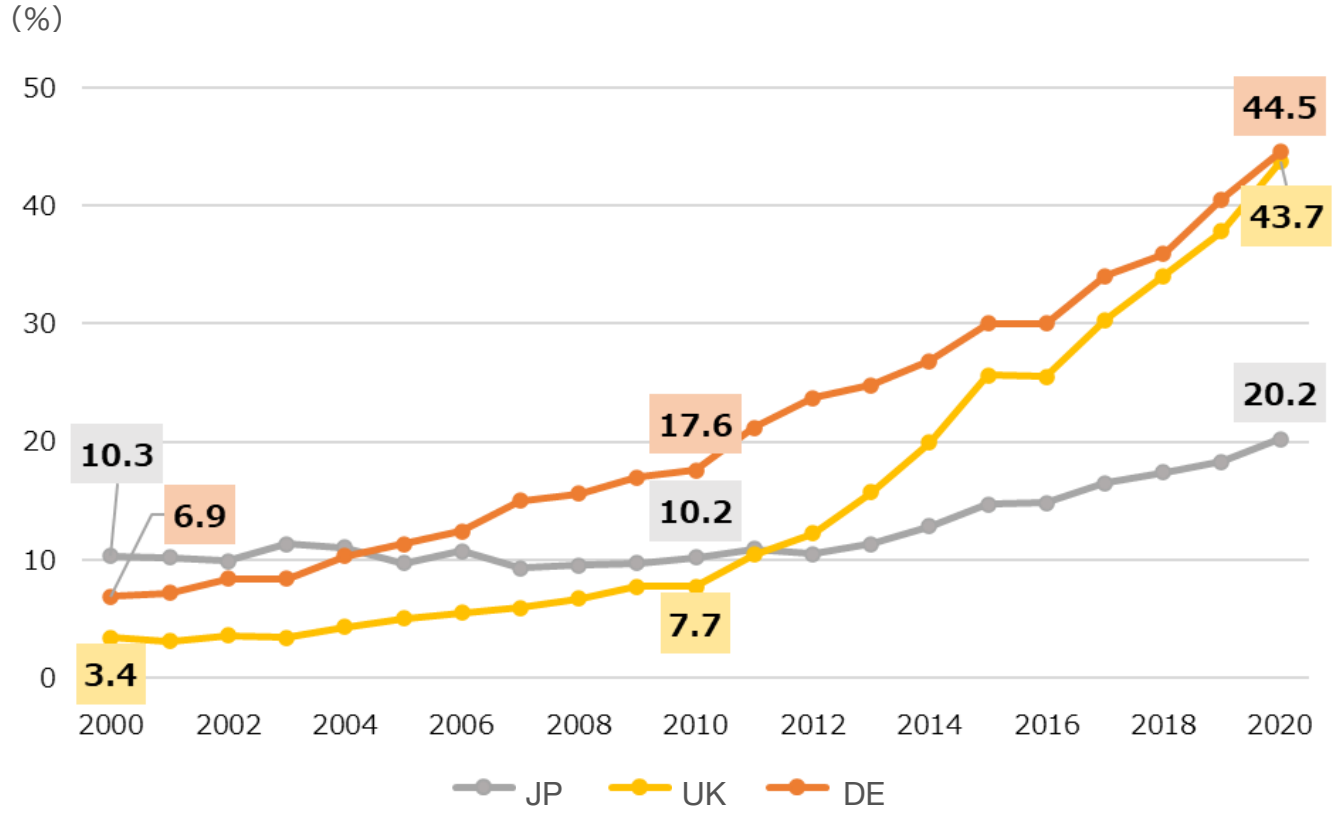
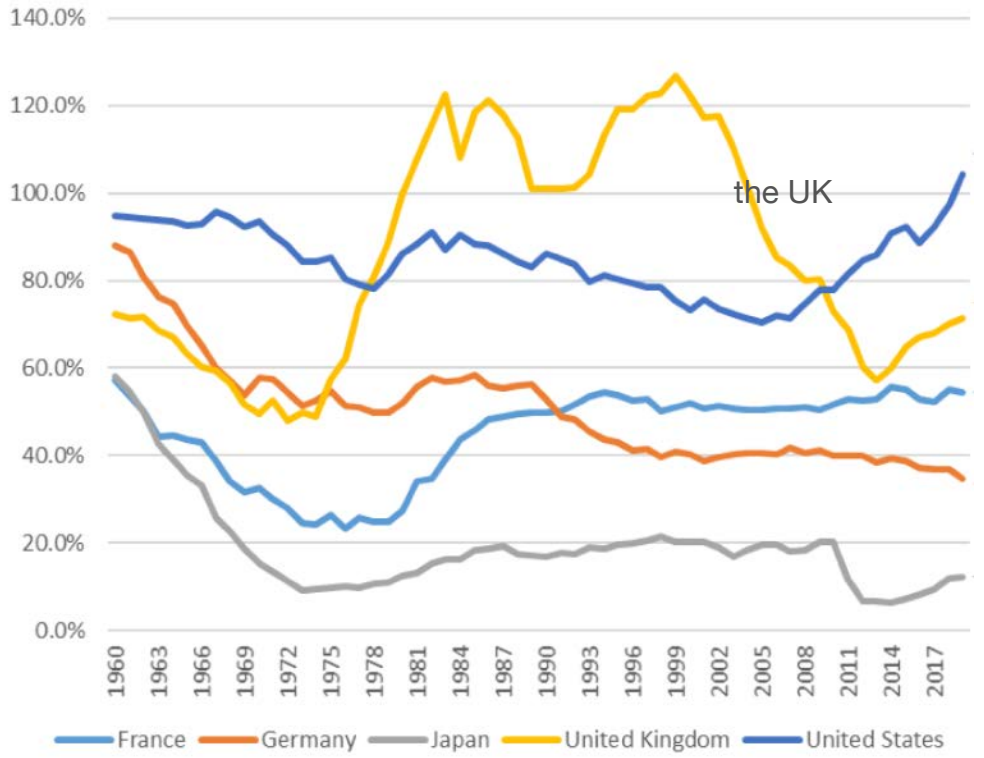
Over the past 20 years (2000-2020), the share of renewable energy sources
- Japan increased by 10 percentage points (10.3% → 20.2%)
- The UK increased by 40 percentage points (3.4% → 43.7%)
- Germany increased by 38 points (6.9% → 44.5%)

The UK's self-sufficiency rate, which declined as a result of lower production from North Sea oil fields, will turn upward with the expansion of renewables such as offshore wind power. Germany's self-sufficiency rate has not changed, but the decline in nuclear power has been compensated for by increased renewables.

Share of renewables in Japan, the UK, Germany 電



Energy self-sufficiency



Compiled by REI from Enerdata "World Energy & Climate Statistics - Yearbook 2021".

Source; Basic Policy Sub-Committee, 38th Meeting, METI/ANRE

Rising fossil fuel prices cost the country

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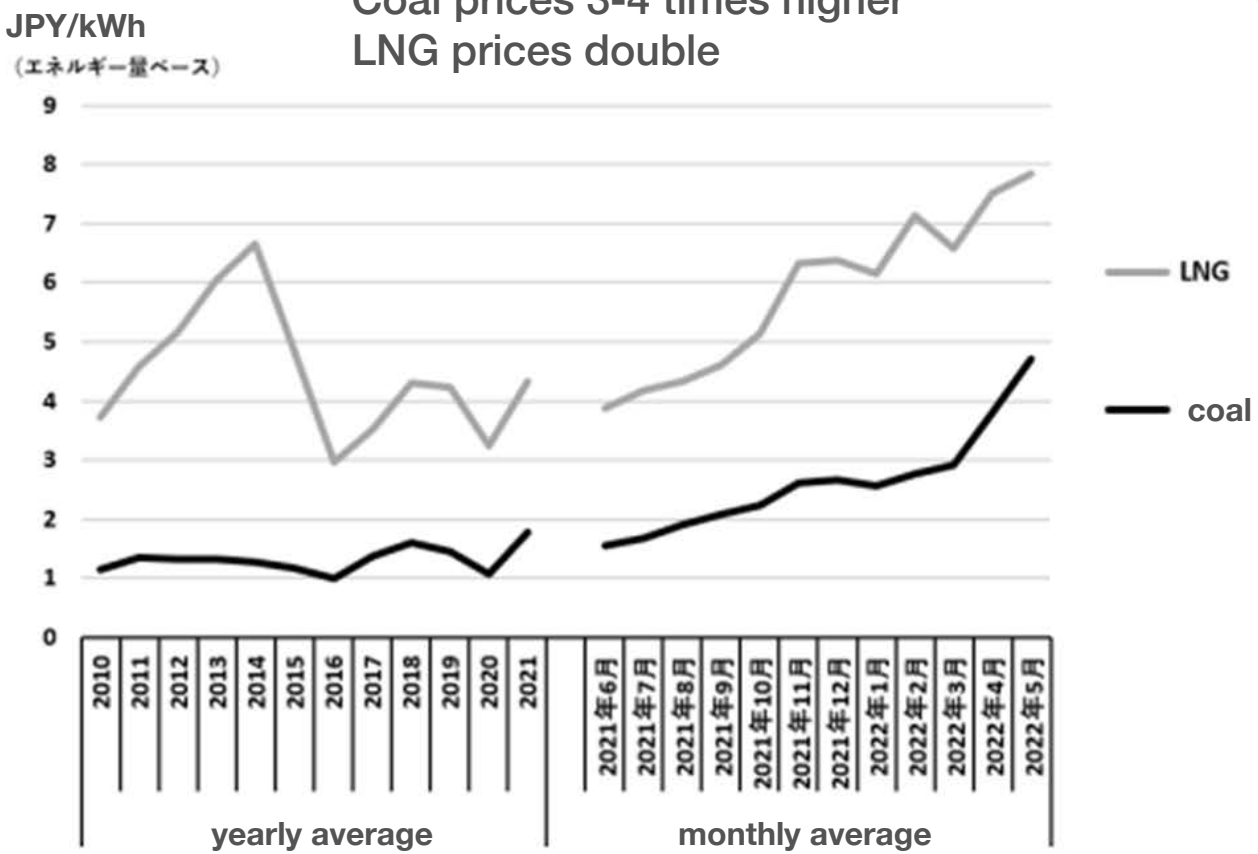
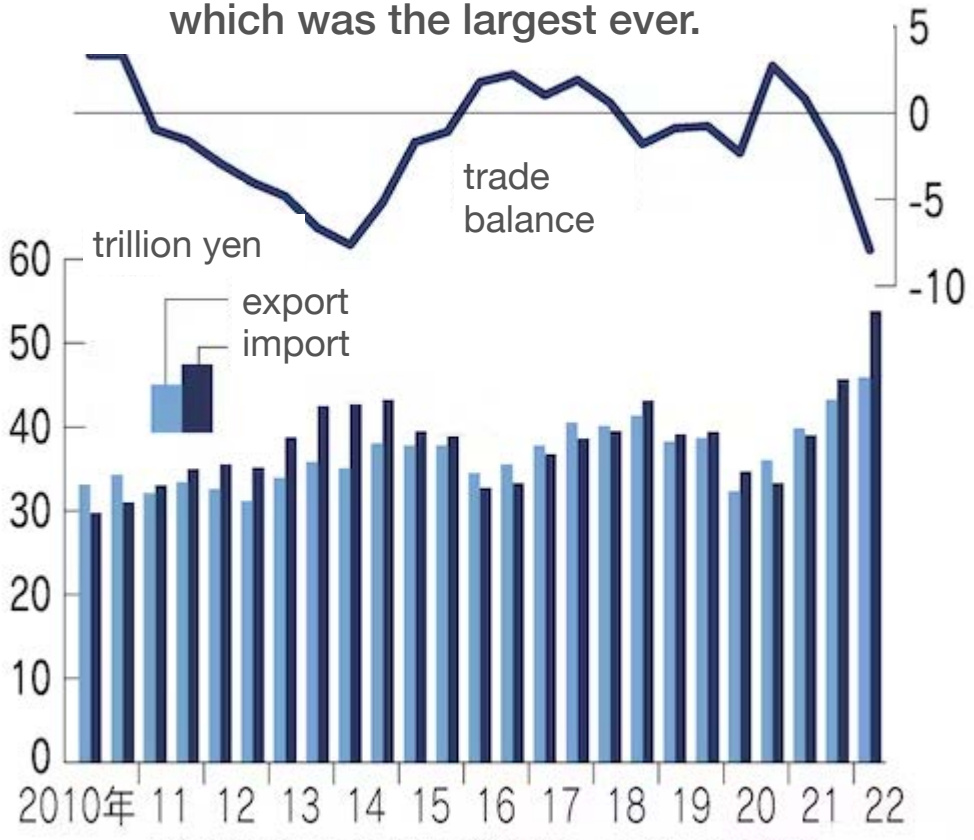
Coal prices 3-4 times higher
LNG prices double



source: MAFF, Trade Statistics of Japan: Steam Coal and LNG (2022 年 6 月 29 日時点)

The deficit exceeded the first half of 2002 which was the largest ever.



* 2H2022 is preliminary results, from MAFF

source: Nikkei Shimbun, 21 July 2022

Where Japan's greenhouse gas emissions come from?

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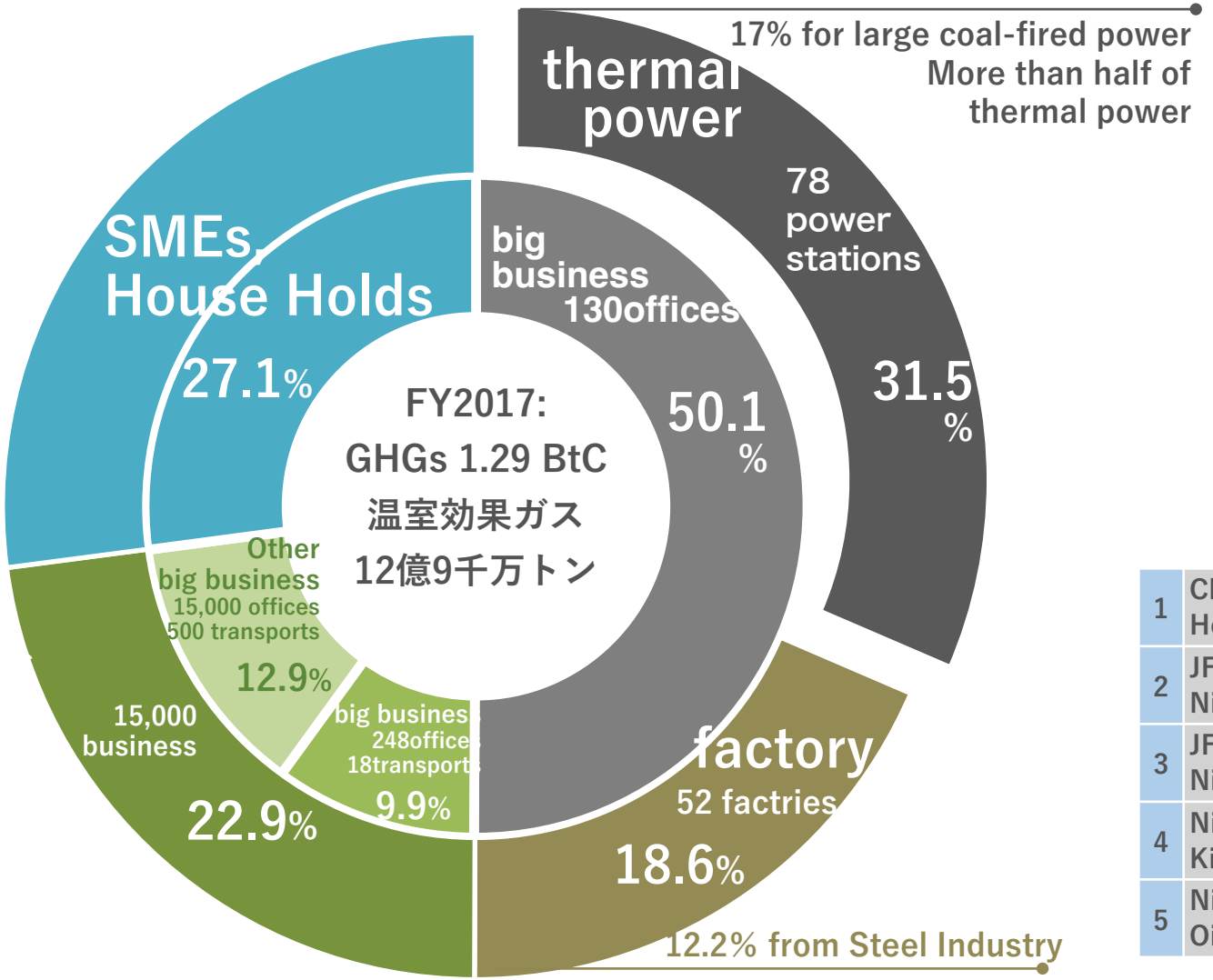
Half of Japan’s GHGs come from 130 facilities and offices.



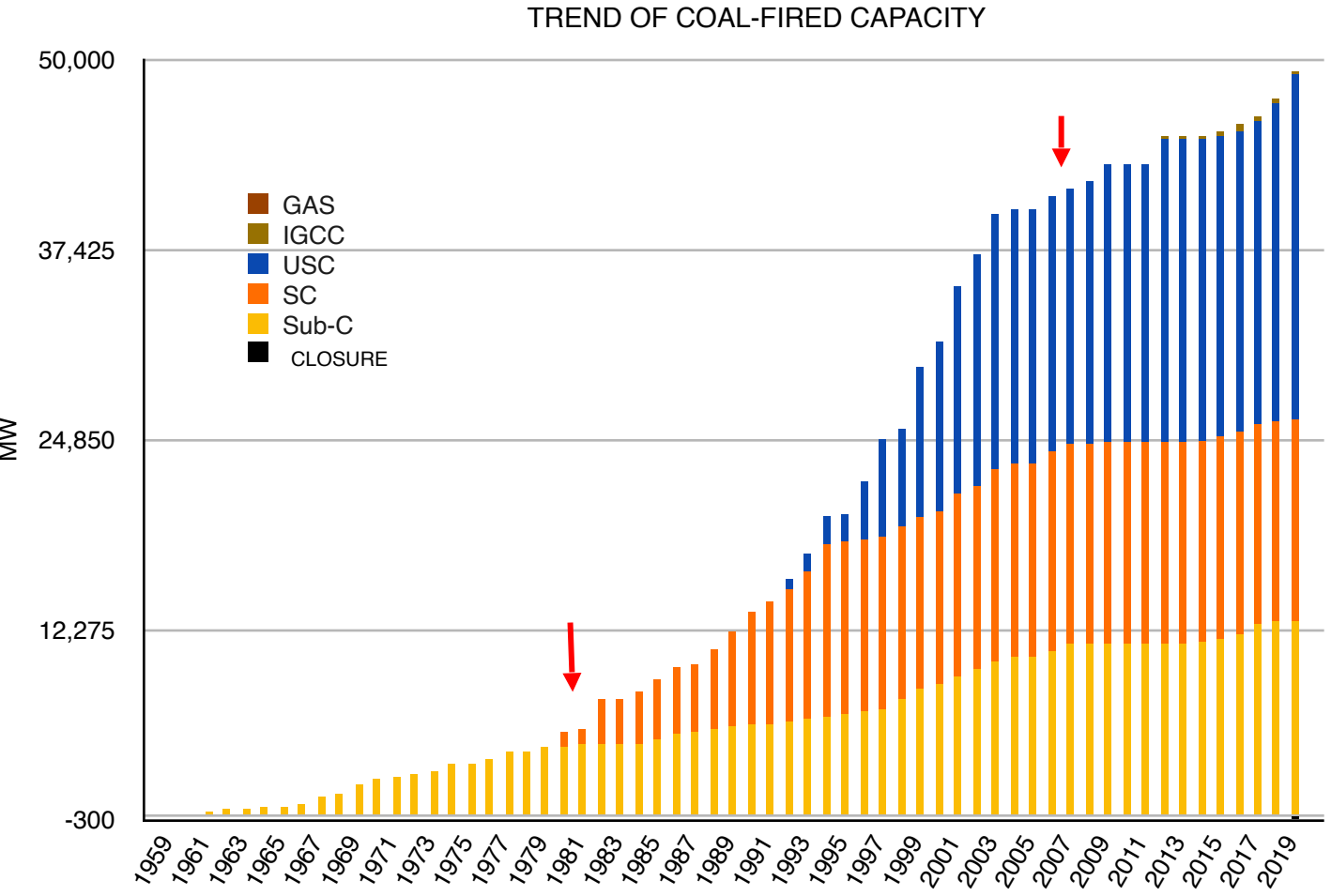
- Half of Japan's greenhouse gas emissions come from 130 very large facilities.
- Of these, 78 are thermal power stations, accounting for about one third of Japan's emissions.
- More than half of thermal power emissions are from coal-fired plants, the majority of which are 38 large coal-fired plants. The majority comes from 38 large coal-fired power stations.
- The second largest source of emissions is from the steel industry. 16 sites, accounting for 12.2% of Japan's total.

TOP 10 emitters

1	Chubu PCO.（現JERA）Hekinan Coal Power	coal power 25.45Mton	6	Nippon Steel Nagoya	steel factory 14.21Mton
2	JFE Steel Nishinihon Fukuyama	steel factory 21.58Mton	7	Kobe Steel Kakogawa	steel factory 13.79Mton
3	JFE Steel Nishinihon Kurashiki	steel factory 18.29Mton	8	Nippon Steel Kashima	steel factory 12.51Mton
4	Nippon Steel Kimitsu	steel factory 15.81Mton	9	Tohoku PCO. Hara-machi	coal power 12.44Mton
5	Nippon Steel Oita	steel factory 15.07Mton	10	TEPCO F&P（現JERA） Hitachi-Naka	coal power 12.29Mton

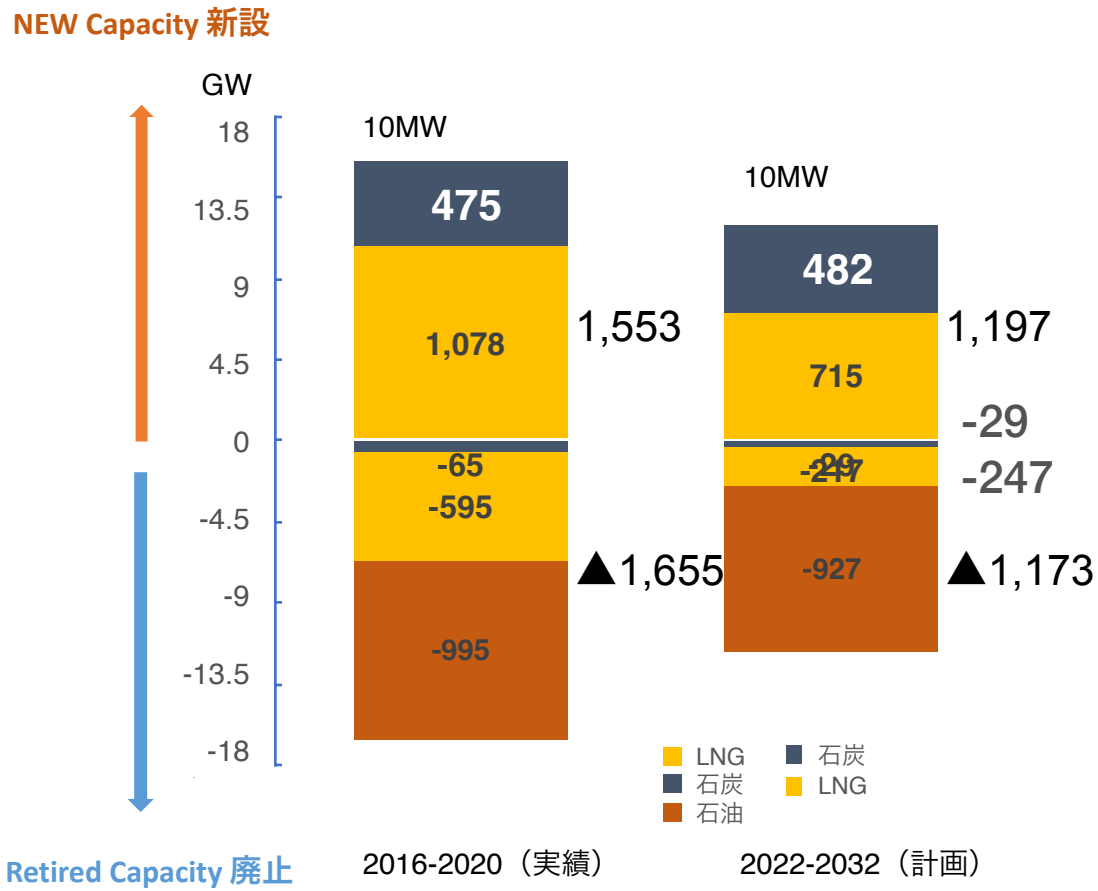
Source：Kiko Network: 気候ネットワーク　日本の大口排出源の温室効果ガス排出の実態 温室効果ガス排出量算定・報告・公表制度による 2017年度データ分析、2021年5月
気候ネットワークブログ、CO2排出量ランキング！日本で一番たくさんのCO2を出しているのはどこのだれ？　2021年8月　https://www.kikonet.org/kiko-blog/2021-08-31/4492より作成

Coal-fired installed capacity consistently increasing - approximately another 5 GW under construction in 2022



Source：Japan Beyond Coal

- 5,200 MW exist that have been in operation for more than 40 years
- Approximately 14,500 MW of new installations not yet past 15 years (depreciation period)



Source: data from the ANRE, prepared from OCCTO Supply Plan Summary (2022).

Renewable energy targets of EU countries and Japan by 2030

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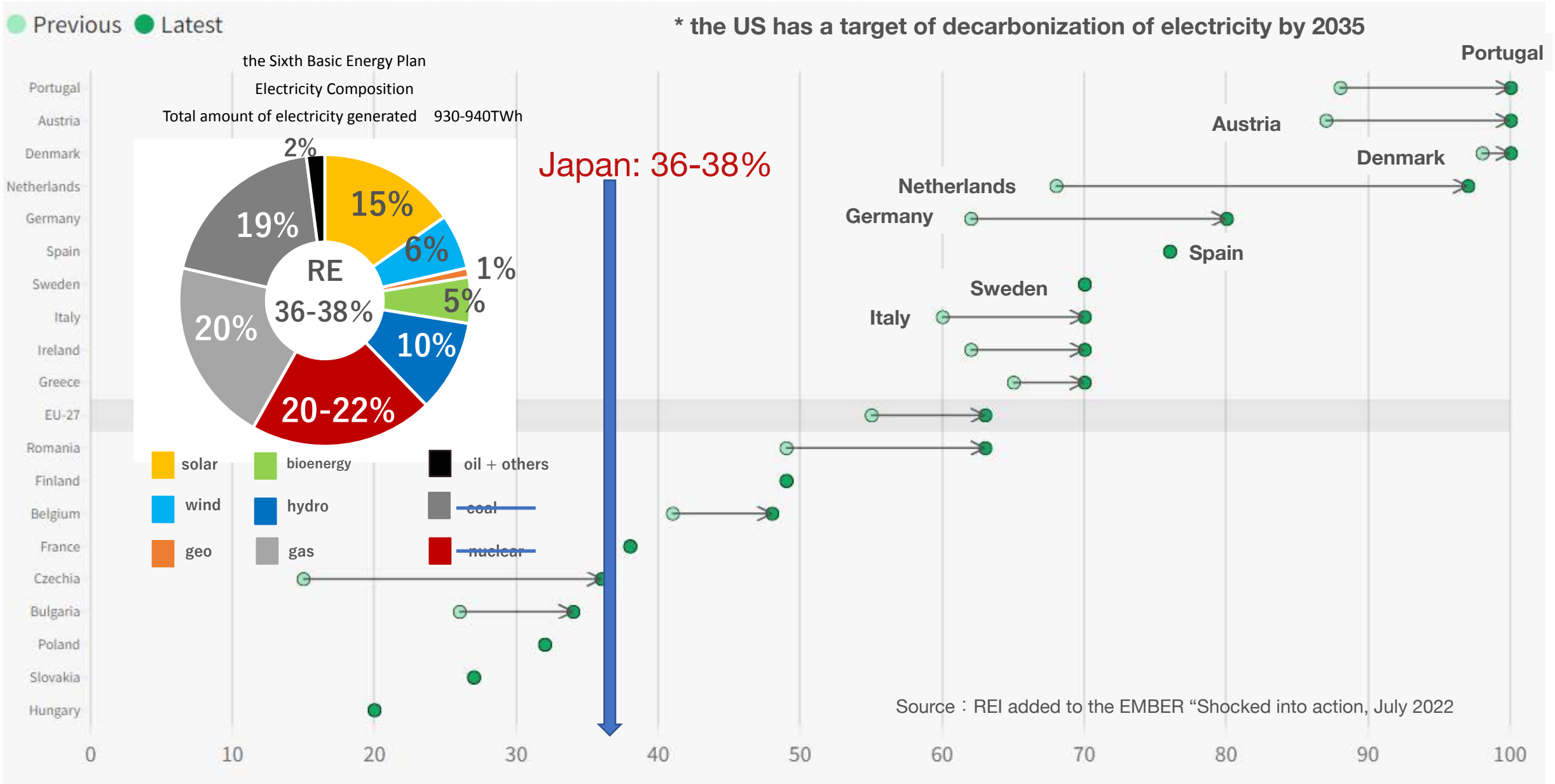

Source：REI added to the EMBER “Shocked into action, July 2022

Enhancement of decarbonization in Asia with Japan's leadership

Mr. President,

To bring about a decarbonized society, Japan will introduce renewable energy as much as possible, and lead the way in the clean energy transition, with a particular focus on Asia.

Since solar power plays a major role in the transition to renewables in Asia, to help stabilize electrical frequency in the region, converting existing thermal power generations into zero-emission power generation is a necessary path. To this end, Japan, through the Asia Energy Transition Initiative, will develop leading projects worth 100 million USD to transform fossil-fuel-fired thermal power into zero-emission thermal power such as ammonia and hydrogen.

COP26 World Leaders Summit Statement
by Prime Minister KISHIDA Fumio
November 2, 2021

Enhancement of decarbonization in Asia with Japan's leadership

The international community, including Europe, has changed the way it deals with energy. I was at an international conference of the IEA the other day, and the situation has changed to the extent that Europeans are now agreeing with me that we have to think about it while continuing to use coal, whereas they used to bash Japan for using coal so much.

When Prime Minister Kishida mentioned CCUS, ammonia or hydrogen conversion at COP26 last year, he was criticised a lot, but now they are asking him to show them the technology."

Koichi Hagyuda, Former Minister of METI
Source: NHK "Sunday Discussion," 3 April 2022.

A policy speech made by Prime Minister KISHIDA Fumio at the 210th session of the National Parliament Japan, 3rd OCT 2022

*a draft translation by a presenter

<Introduction>

As we approach the opening of the 210th session of the National Parliament, I am renewing my resolve to protect Japan and open up the future.

We will do our utmost to deal with the current high prices of commodities and to revive the Japanese economy. We will resolutely protect peace and stability in Asia and the world through the development of multilayered diplomacy and the drastic strengthening of defence capabilities.

in the first 1 min

High prices on a global scale. A security environment that is rapidly becoming more severe.

The infectious disease crisis that has plagued the world for two and a half years, the energy and food crisis, ***and the climate crisis caused by global warming***.

Russia's invasion of Ukraine, which has been tense for more than six months.

Geopolitical challenges that have shaken the international order. The nuclear non-proliferation regime is undergoing a major change.

Japan is now facing a situation that can be described as a national crisis.

We will decisively and carefully implement our policies, one by one, in order to overcome the historic difficulties facing the world and Japan and to open up the future of our country.

Whatever difficulties we face, we will overcome them if we all work together and move forward step by step.

My recent visit to Fukushima reinforced this belief.

The return of residents to areas that have been considered difficult to return to for a long time.

The removal of import restrictions in 43 out of 55 countries and regions.

The establishment of the Fukushima International Research and Education Organisation, which will serve as a base for the creation of industry.

A town hall official who shared with me his strong desire for reconstruction.

The young people who moved to Fukushima who told me that they wanted to make Fukushima an exciting region.

With the help of many people, Fukushima is making steady progress towards recovery.

We were able to recover from the unprecedented national crisis of the Great East Japan Earthquake. If so, we will surely be able to overcome the difficulties we are facing now. I am convinced of this.

Let us look to the future of our country and move forward together.

And 25 mins brah brah… continues…

Japan's unclear future with zero emission thermal + nuclear power

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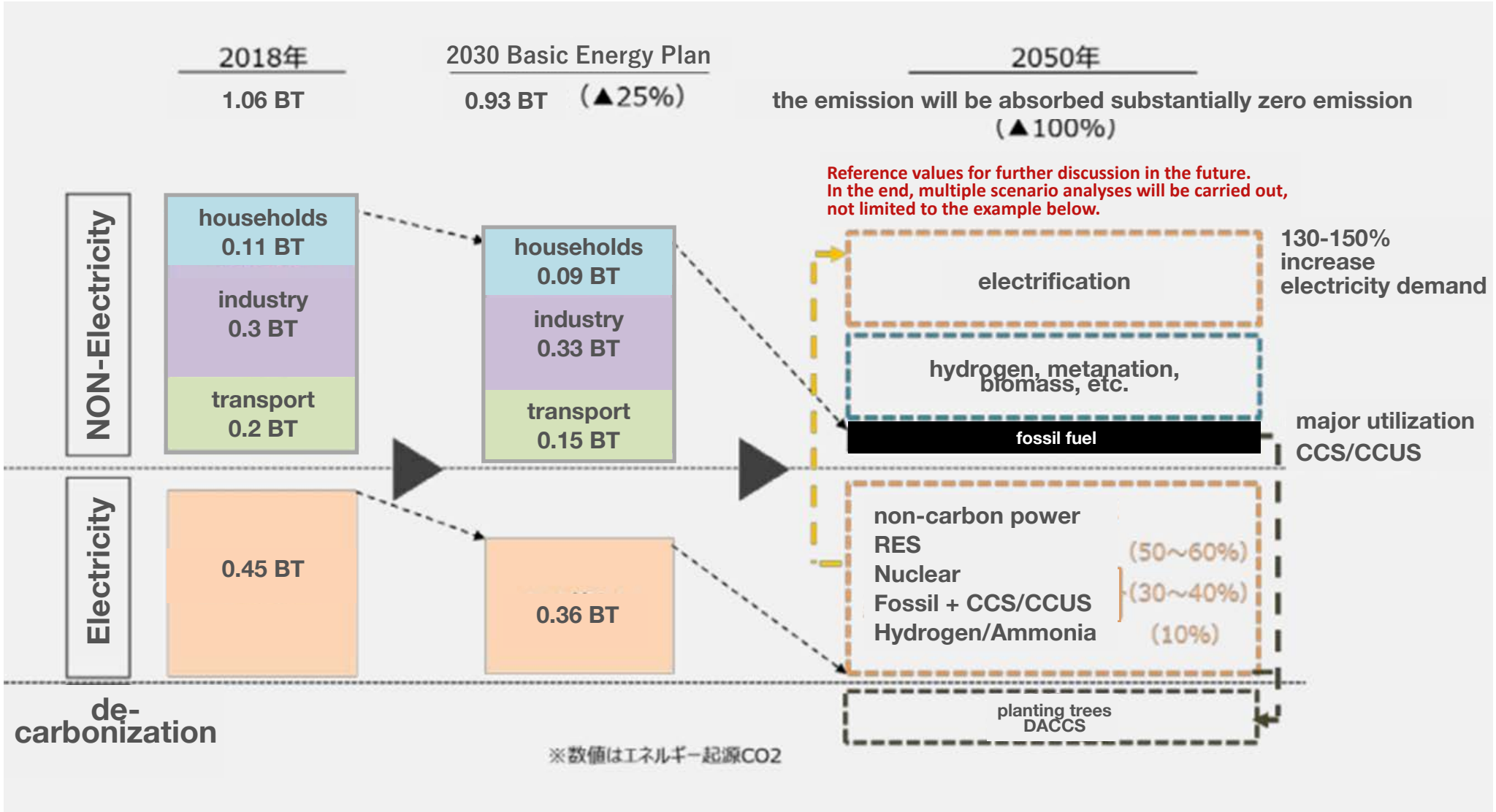
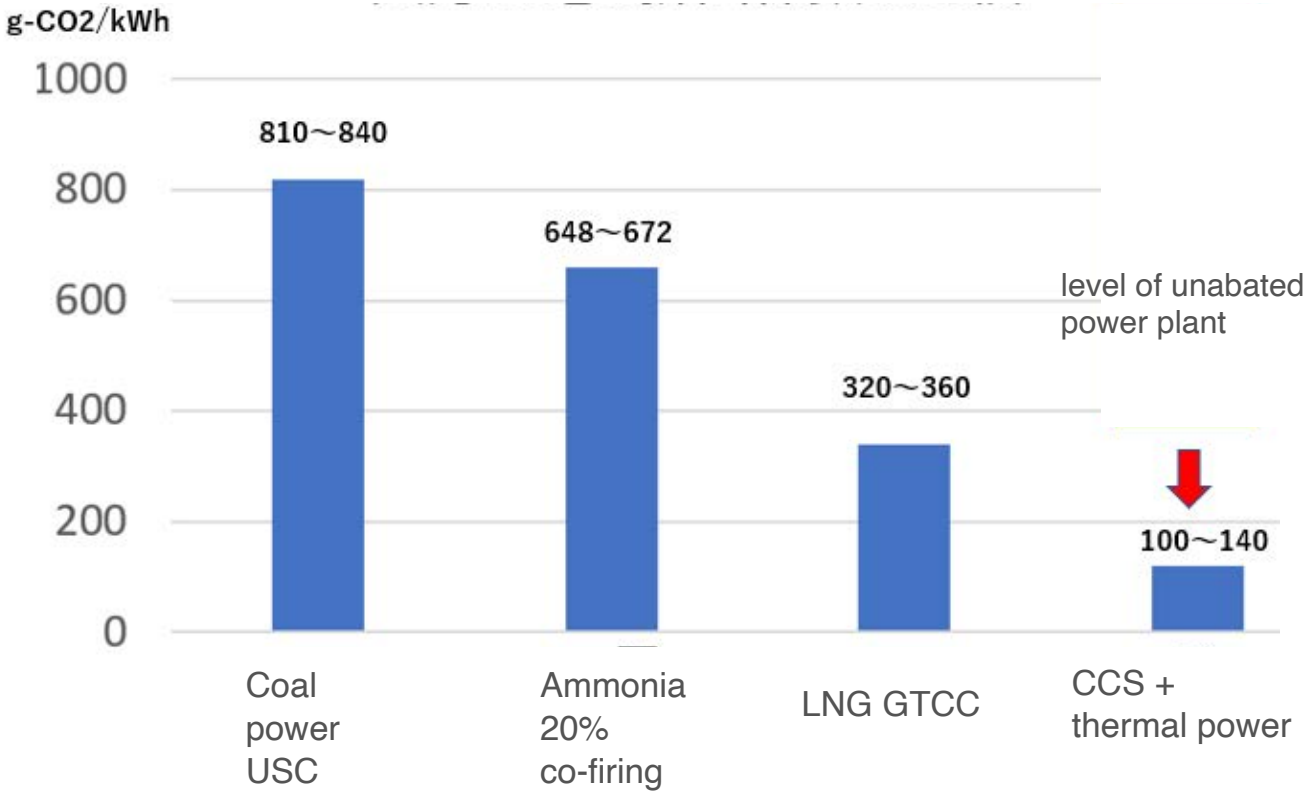
'Zero emission thermal power' + nuclear: up to 30-50%, centered on CCS



source) METI (2020), Green Growth Strategy for 2050 Carbon Neutralization

Japan's unclear future with "zero-emission thermal power"

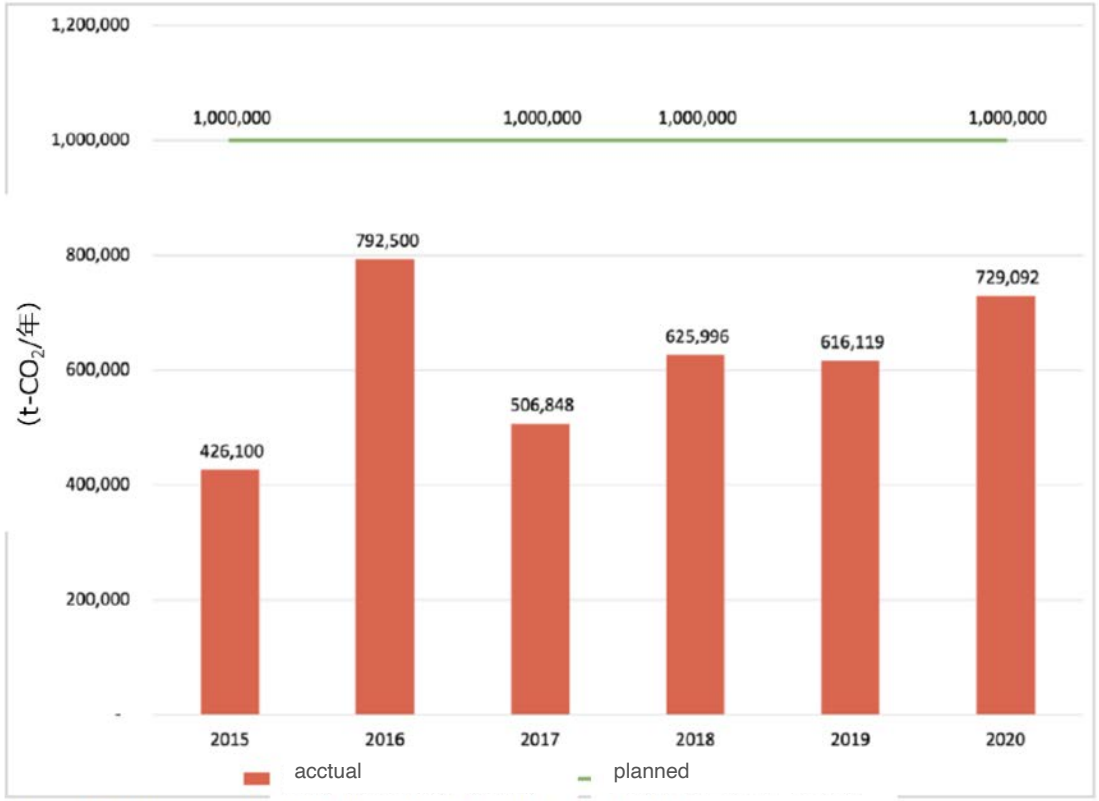
Ammonia-fired power must be increased to 85% co-firing to to reach the required level of reduction.



出典：以下の資料より自然エネルギー財団作成。USCとGTCCは平成27年度版環境白書のデータ。20%混焼は、USCの排出係数の80%とした。CCS付き火力はIEA "Energy Technology Perspectives 2017"。
グラフは排出係数の中間値で作図。

There is only one CCS-fired power track record in the world. In its track record, the target of 90% recovery was not achieved, and a recovery rate of only 60%.

CO2 recovery at the Boundary Dam power station (planned and actual)



Source: SaskPower's Monthly Boundary Dam 3 Status Updates.

Japan’s unclear future with “zero-emission thermal power”

Globally, the 31 commercial-scale CCS projects realised so far, 28 have involved onshore storage and 22 EOR(enhanced oil recovery).

In Japan, there are no suitable sites on land, and EOR is not feasible → the most expensive unknown sub-seabed storage is required;

- Not a single concrete storage site has been found,
- CO2 shipping technology not yet established,
- At least 1,200 CO2 transport vessels and up to 5,000 vessels are needed (based on METI’s calculation)
- Need to assess seismic risk posed by CO2 sequestration

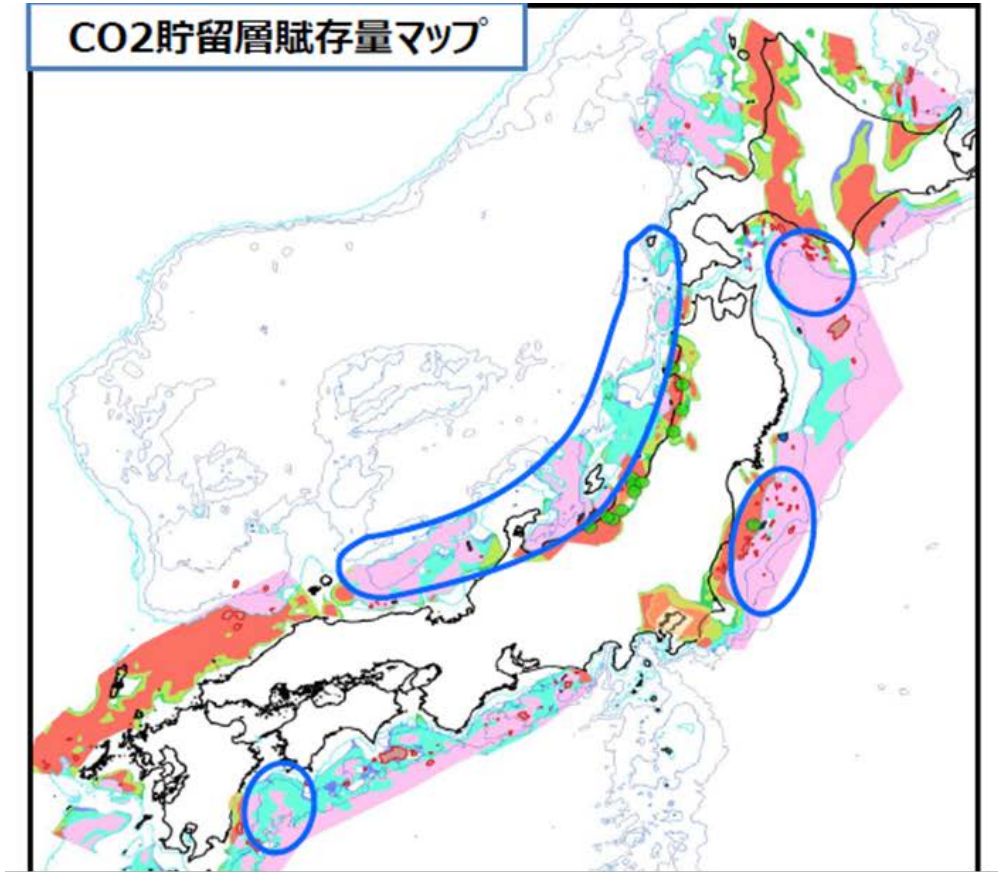


Figure 14 Material of the Session of Resources and Fuel, Subcommittee on Oil and Natural Gas (13th meeting)

Source: Excerpt from the Resources and Fuel Department, Agency for Natural Resources and Energy, "Direction of Oil and Natural Gas Policy Looking toward 2030/2050 (Draft)" (February 15, 2021), Session of Resources and Fuel, Subcommittee on Oil and Natural Gas (13th meeting), Material 3, Pages 27 and 33

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Securing suitable sites for CCS

- There is considerable potential for CCS storage in Japan, but in addition to economic efficiency and social acceptability, **the implementation of CCS requires compliance with multiple laws and regulations,* and there are challenges such as complicated procedures and excessive cost burdens.**
- On the other hand, the EU, Australia, the United States, and others **are developing legal frameworks for CO_2 storage based on the laws and regulations of national and local governments.**
- In addition, **there are suitable sites for CCS with high potential and low cost** in countries other than Japan, **especially neighboring Southeast Asian countries.**

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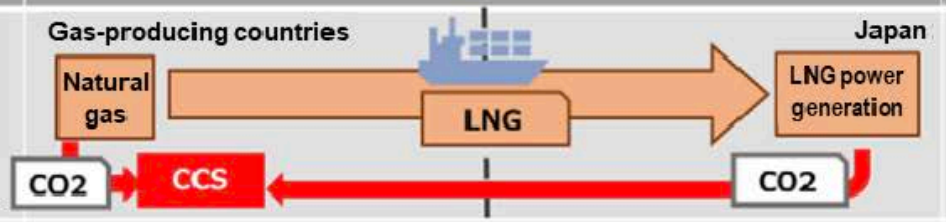
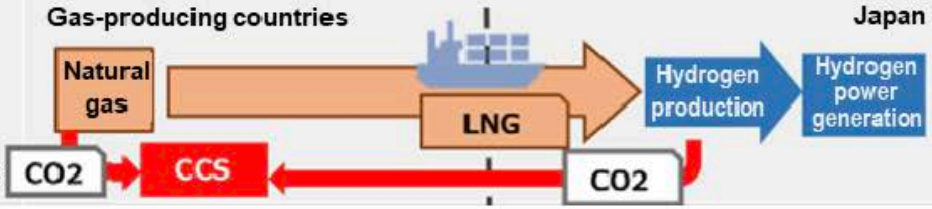
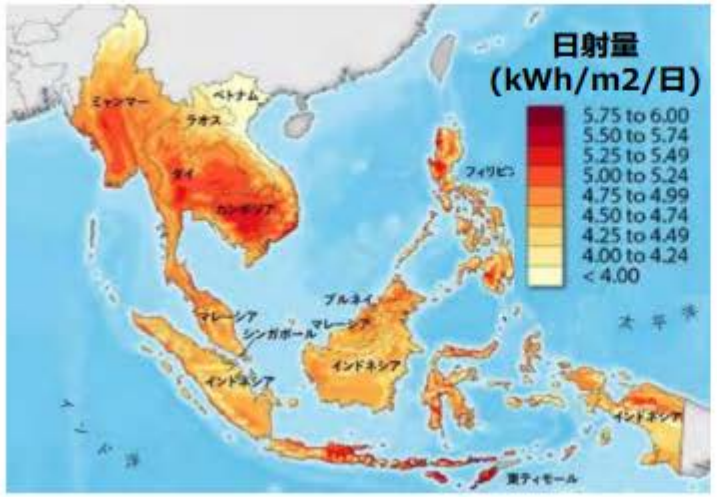
Establishment of a system to introduce and secure suitable sites for hydrogen, ammonia, and CCS toward carbon neutrality by 2050

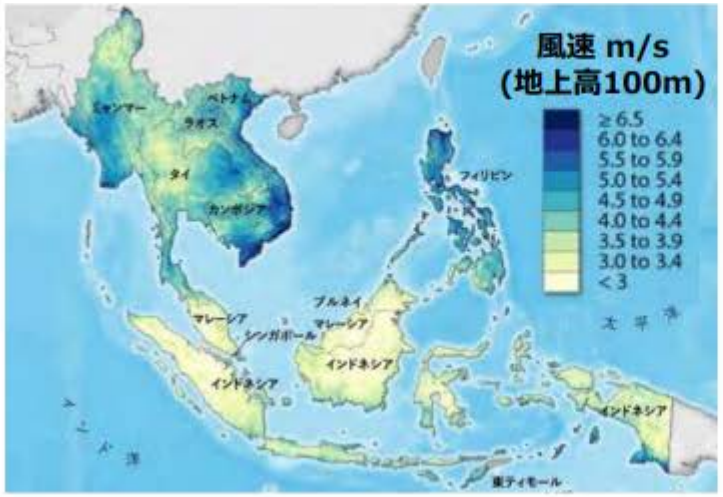
Type	Scheme	Benefits and Challenges
(1) LNG + CCS [Overview] • LNG is imported from overseas to generate power with gas in Japan. • CO_2 emitted by LNG combustion is collected and utilized by CCS overseas.		**Benefits** • Can use existing infrastructure **Challenges** • Securing suitable sites for CCS Must collect low-concentration CO_2
(2) LNG → hydrogen **[Overview]** • LNG is imported from overseas to produce hydrogen in Japan. • CO2 is collected from hydrogen production and utilized by CCS overseas		**Benefits** • Can use existing infrastructure **Challenges** • Securing suitable sites for CCS

Renewable energy potential is well represented in South-East Asia

Potential of Solar Power in SEA



Potential of Wind Power in SEA



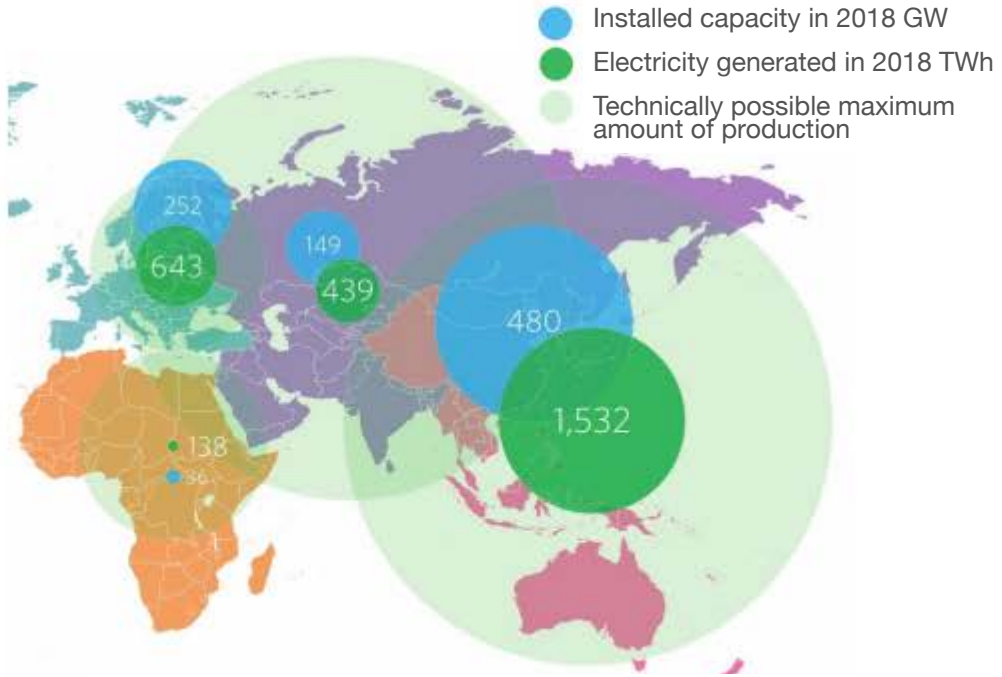
The entire South-East Asia region has very high irradiance, averaging more than 1,500-2,000 kWh/㎡ year, with a potential capacity factor of more than 20%.

As for wind power resources, there are areas along the sea coast and inland in Myanmar, the Philippines, Thailand and Vietnam where average wind speeds of 6-7 m/sec are available, and where operation rates of more than 30% can be expected.

Source) REI, “Renewable Energy to Replace Coal Power in Southeast AsiaPragmatism to Deliver a Sustainable Bright Future,” 2019 + USAID 2019 + NREL “Renewable Energy Opportunities in Select Southeast Asian Countries 2019

Installed Amount and Potential of Hydro Power

Southeast Asia has some of the world's leading hydropower potential. Indonesia and Myanmar have potential of 75 GW and 50 GW respectively. Significant room for growth in Cambodia, Laos and Malaysia. Development needs to take environmental and social impacts into account.



Source) International Hydropower Association, “Hydropower Status Report,” 2019

Japan’s unclear future with “zero-emission thermal power”

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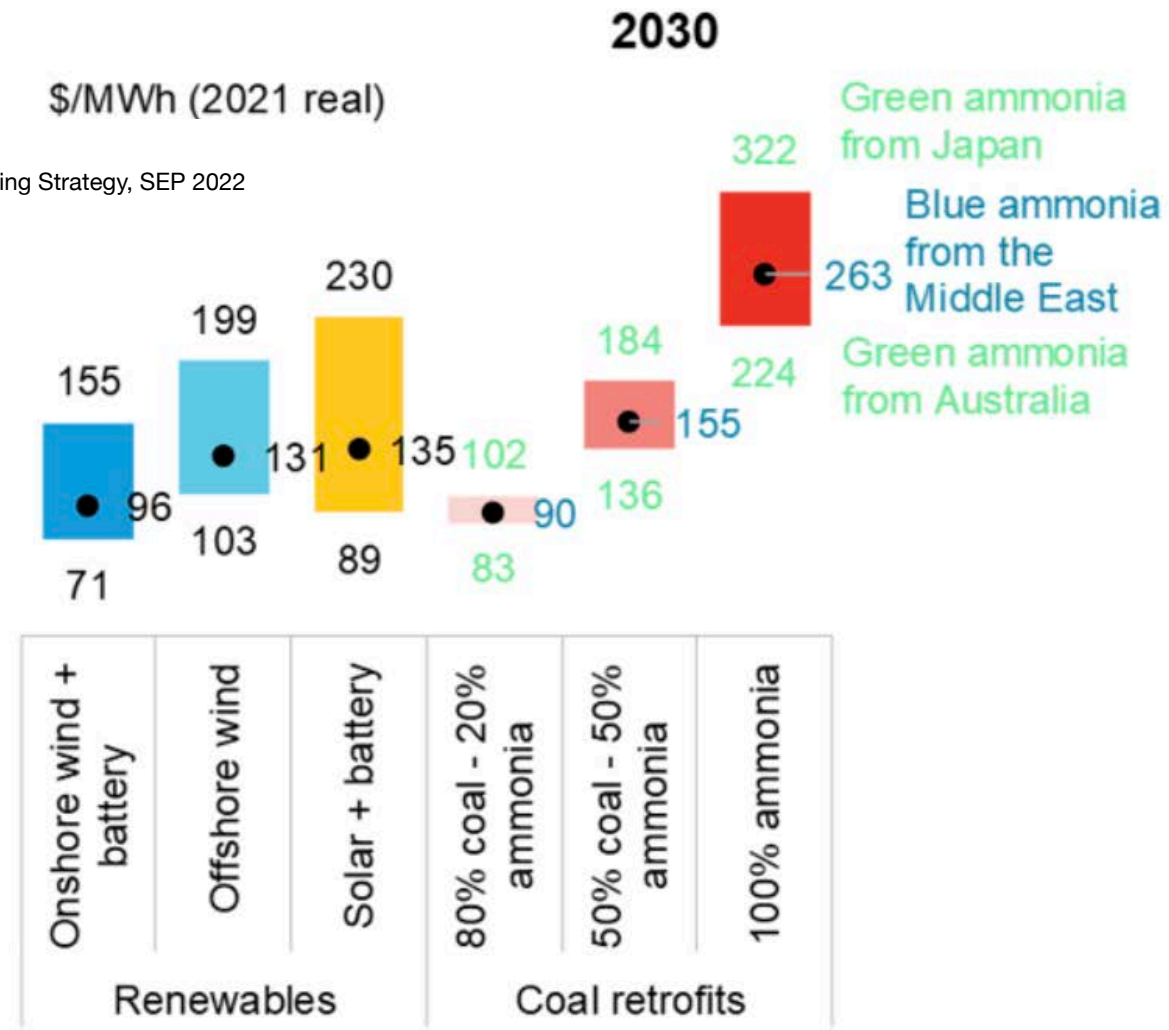
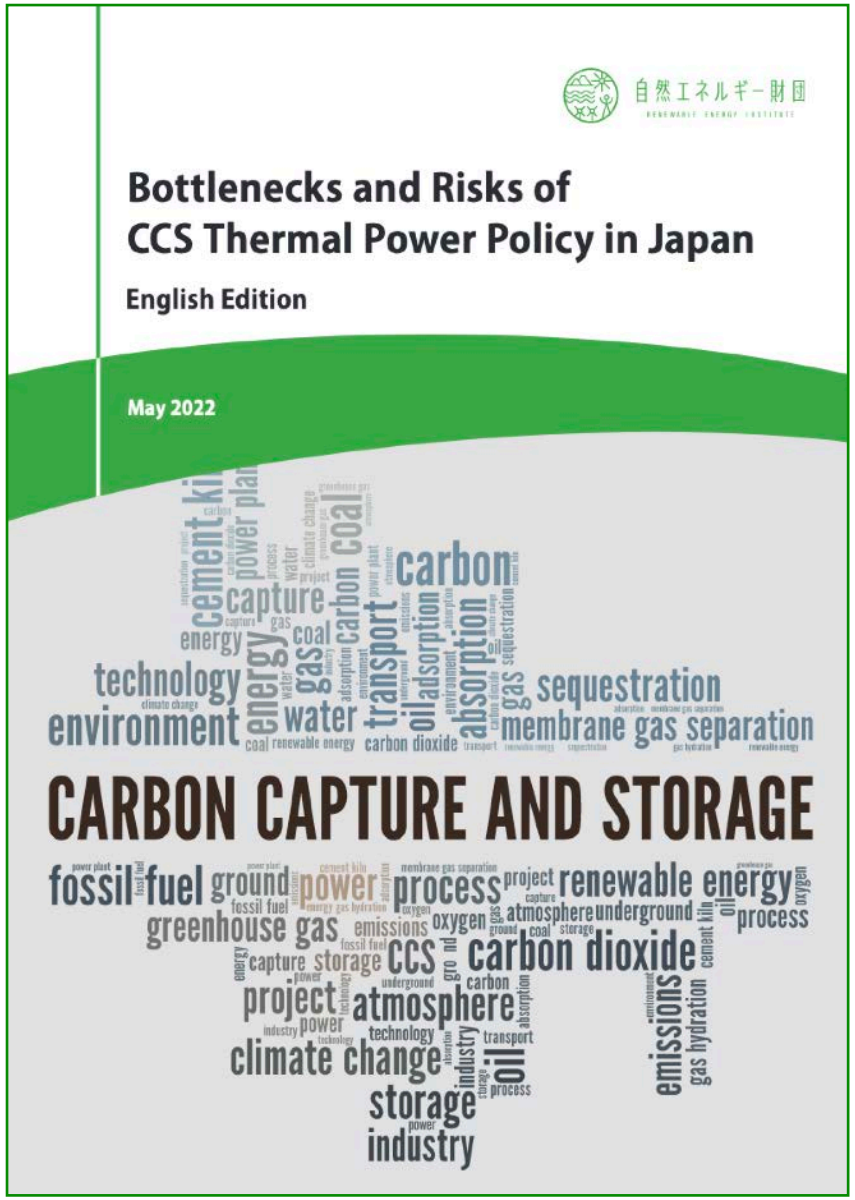
Figure 1: Comparison of levelized cost of electricity in Japan in 2030

Source) BNEF, the cost analysis of Japan's Ammonia-Coal Co-Firing Strategy, SEP 2022



Source: BloombergNEF. Note: Four hours duration for energy storage systems.

Japan’s unclear future with “zero-emission thermal power”



“Bottlenecks and Risks of CCS Thermal Power Policy in Japan,”
REI, May 2022
https://www.renewable-ei.org/en/activities/reports/20220520.php

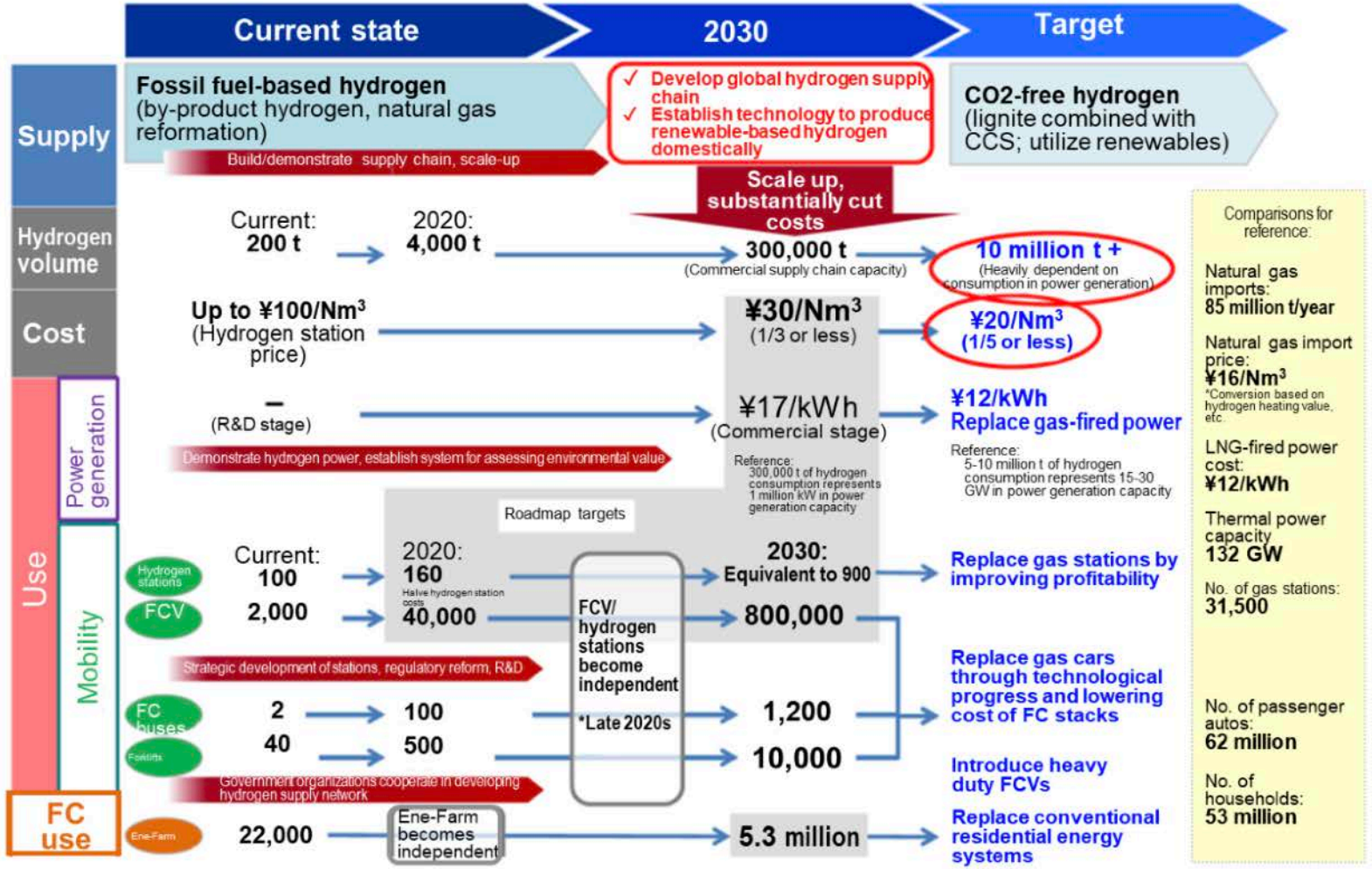
“With efforts towards achieving a decarbonized society becoming ever more pressing globally, the goal of 90% electricity generation from renewables is widely considered to be the benchmark by 2050. In contrast, the Government of Japan is focusing on developing 'zero-emission thermal power' and will continue to use fossil fuel power generation until at least 2050. At the heart of this is thermal power generation equipped with Carbon Capture and Storage (CCS).

This report points out five bottlenecks of relying on CCS, including incomplete CO_2 capture, high costs, and limited geographical conditions for CO_2 storage in Japan, and introduces how CCS is treated compared to renewables in the global decarbonization strategy, including the latest IPCC report released in April 2022.

It is our hope that this report will contribute to constructive discussions on the decarbonization of Japan's electricity supply, as the Government of Japan is on track to submit a bill to promote the development of CCS in the current parliamentary session, with the goal of making CCS a reality by 2030.”

Japan's unclear future with "purple, grey, blue, green hydrogen"

Figure 10. Scenarios in the Basic Hydrogen Strategy



Source: "Basic Hydrogen Strategy Summary," METI (December 2017), translated into English by REI.
https://warp.da.ndl.go.jp/info:ndljp/pid/11049177/www.meti.go.jp/press/2017/12/20171226002/20171226002.html

Japan's unclear future with "purple, grey, blue, green hydrogen"

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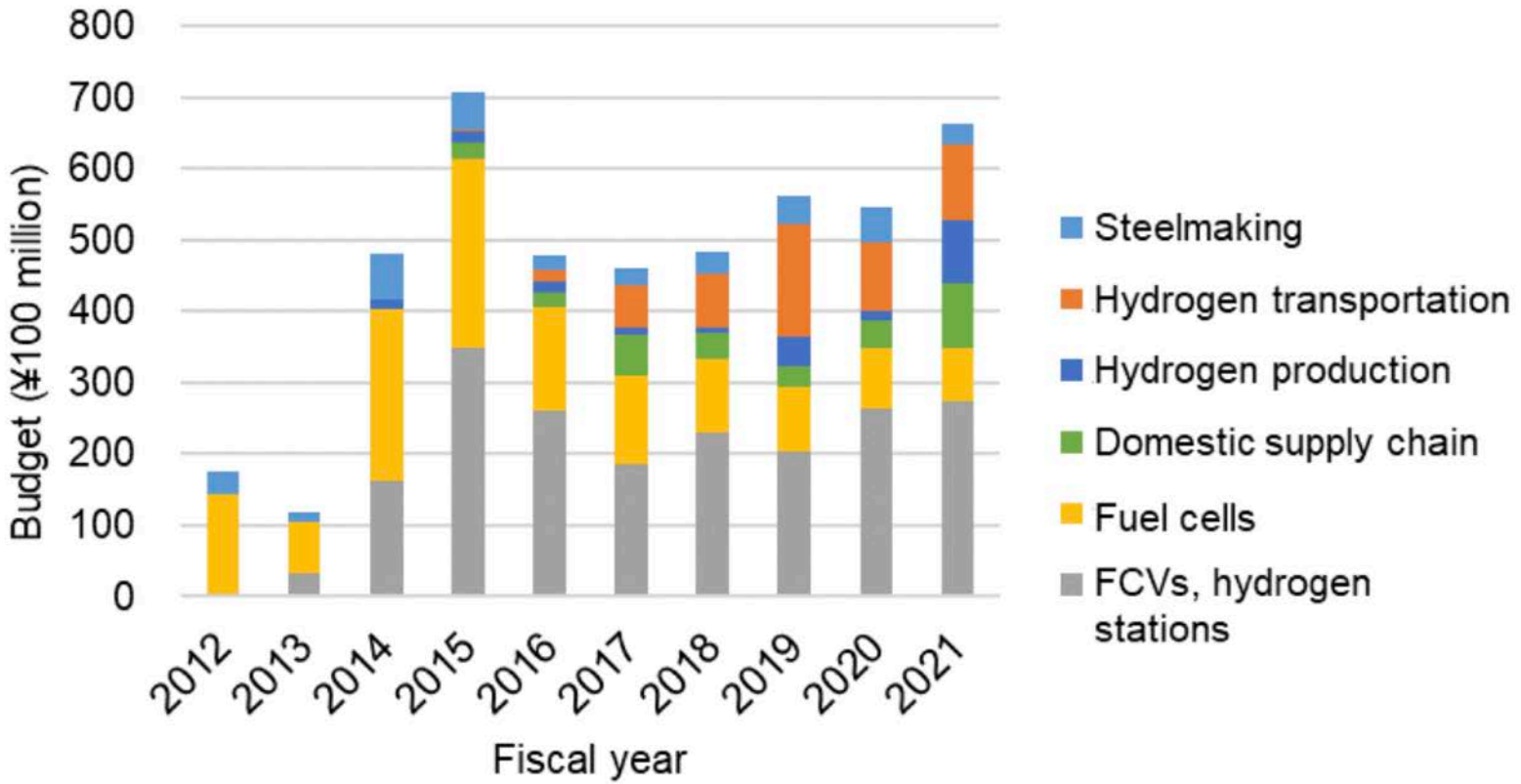
Figure 11. Changes in Hydrogen Budget by Application



Source: Totaled by Renewable Energy Institute based on METI and MOE review sheets
https://www.meti.go.jp/information_2/publicoffer/review.html
https://www.env.go.jp/guide/budget/spv_eff/review.html

Table 2. Main Electrolyser Companies and Development Status

	Main companies	Type	Product	Max capacity MW	Efficiency %	Results	Production capacity	Equipment cost $/kW	Target
Europe	Thyssenkrupp nucera (Germany)	Alkaline	○	20 MW	78.2*	Delivered over 600 units (10 GW)	1 GW/year		5 GW/year (2025)
	Siemens Energy (Germany)	PEM	○	17.5 MW	75	Delivered several dozen MW, received order for 50 MW			3 GW/year (2025)
	Nel (Norway)	Alkaline, PEM	○	85 MW	79.9* Alkaline	Delivered 3,500 units (since 1927)	500 MW/year	Approx. $200/kW (2025: $1.5/kg)	10 GW (2025)
	McPhy (France)	Alkaline	○	20 MW	78.2*	Received order for 100 MW unit			1 GW/year (2024)
	ITM Power (UK)	PEM	○	5 MW	70.9	Delivered 100 MW unit	1 GW/year		5 GW/year (2024)
China	PERIC	Alkaline, PEM	○	7.5 MW	81.8* Alkaline	Delivered 1,000 units (since 1984)	300 units/year	$200/kW Proposed to Sinopec	5 GW/year (2025 end)
	Longi Hydrogen	Alkaline	○	7.5 MW	79.9*		1.5 GW (2022 end)	$205/kW Proposed to Sinopec	
	Cokerill Jingli (John Cokerill)	Alkaline	○	6.5 MW	70.3	Delivered 1,000 units (500 MW)	200 MW/year (2021)	$205/kW Proposed to Sinopec	Planning Gigafactory in France
Japan	Asahi Kasei	Alkaline	–	10 MW	70.3	Participated in demonstration project in Germany		$1,200/kW (2022)	$433/kW 2030 Target
	Hitachi Zosen	PEM	○	1 MW	70.3	Delivered several dozen units, received orders for 15 MW		$3,158/kW (2022)	$542/kW 2030 Target

Note: Efficiency is based on higher heating value (HHV). *Stack efficiency

Source: Costs for Chinese companies are based on “Update on Sinopec’s Green Hydrogen Project,” BloombergNEF (May 2022). The rest of the contents were created by the Renewable Energy Institute based on companies’ publicly available information (see References 4 at the end of this report).

Japan's unclear future with "purple, grey, blue, green hydrogen"

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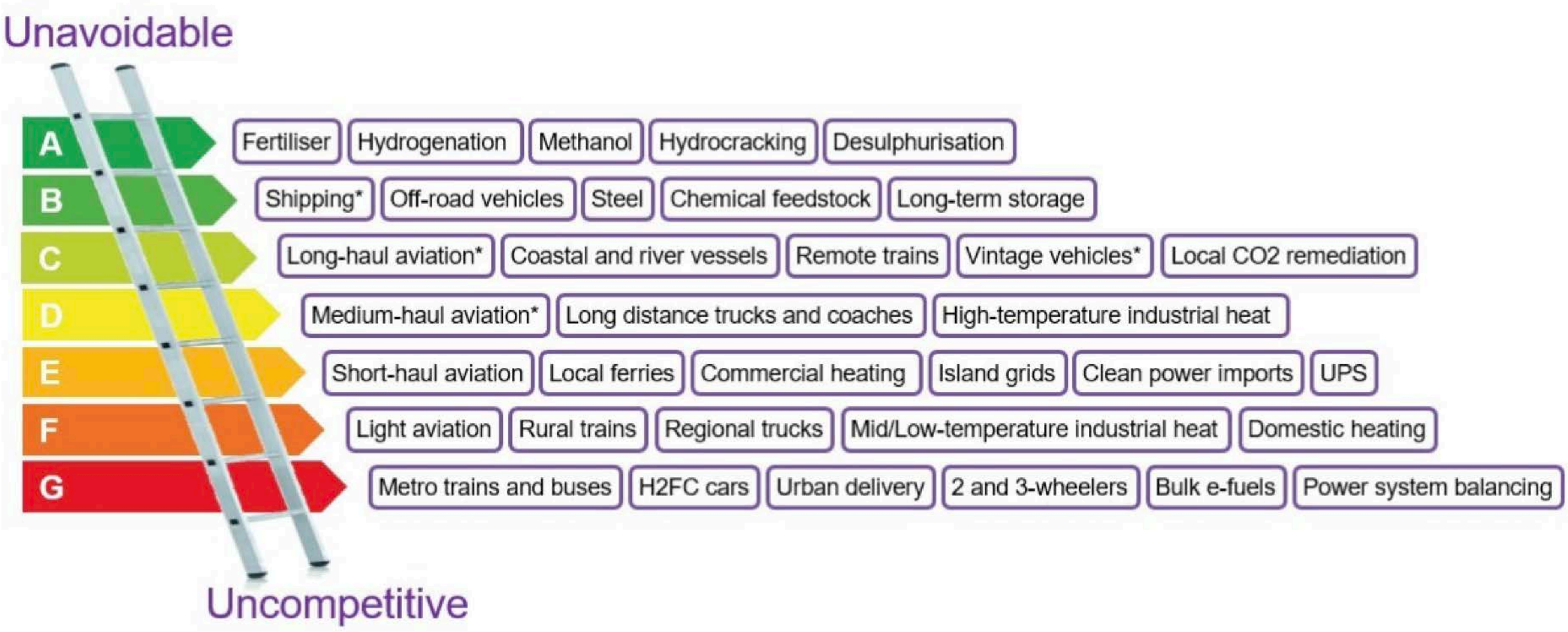
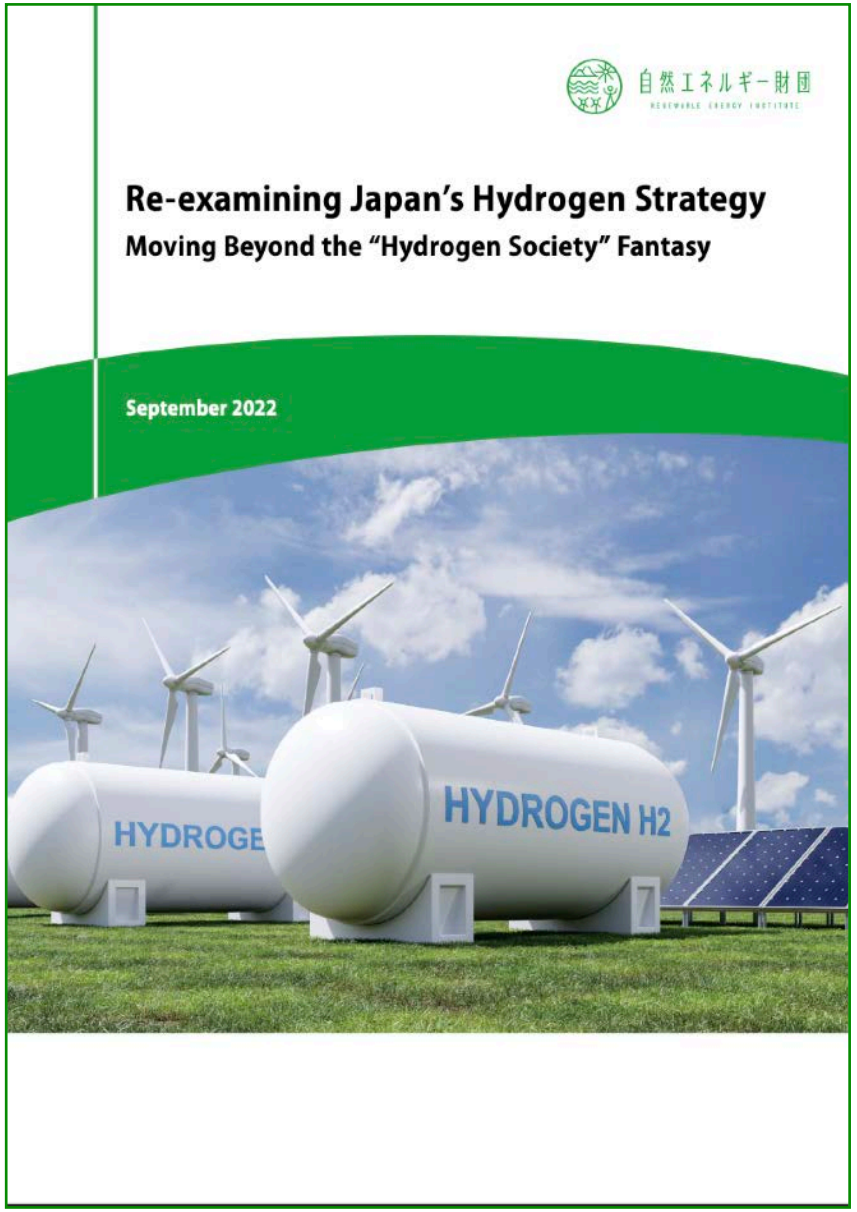


** Via ammonia or e-fuel rather than H2 gas or liquid*

Source: Liebreich Associates (concept credit: Adrian Hiel/Energy Cities)

Japan’s unclear future with “purple, grey, blue, green hydrogen”



“Re-examining Japan’s Hydrogen Strategy
- Moving beyond the hydrogen Society fantasy,” REI, October 2022
https://www.renewable-ei.org/en/activities/reports/20220922.php

“In 2017 the Japanese government became the first in the world to formulate a national hydrogen strategy, declaring that “Japan should lead the globe in hydrogen use.” However, five years later, Japan has performed far below its main goal of increasing uptake of fuel cells and fuel cell vehicles, and Japan’s efforts in producing green hydrogen needed to achieve a decarbonized society have fallen behind those of European countries, China, and other nations.

This report provides an overview of global trends in hydrogen use and production; it examines strategies in Europe, China, Australia and other countries, and identifies the fallacy of the Japanese government’s vision of a “hydrogen society where hydrogen is used in every sector." It also points out the risk that the government's policy of prioritizing gray and blue hydrogen derived from fossil fuels will undermine the efforts of Japanese companies that have been building up to this point.”

GX Executive Committee

Nuclear power plant restart
Suddenly announces policy of building new nuclear power plants

On the other hand, the measures necessary to expand renewable energy also seem to be more aggressive than in the past.

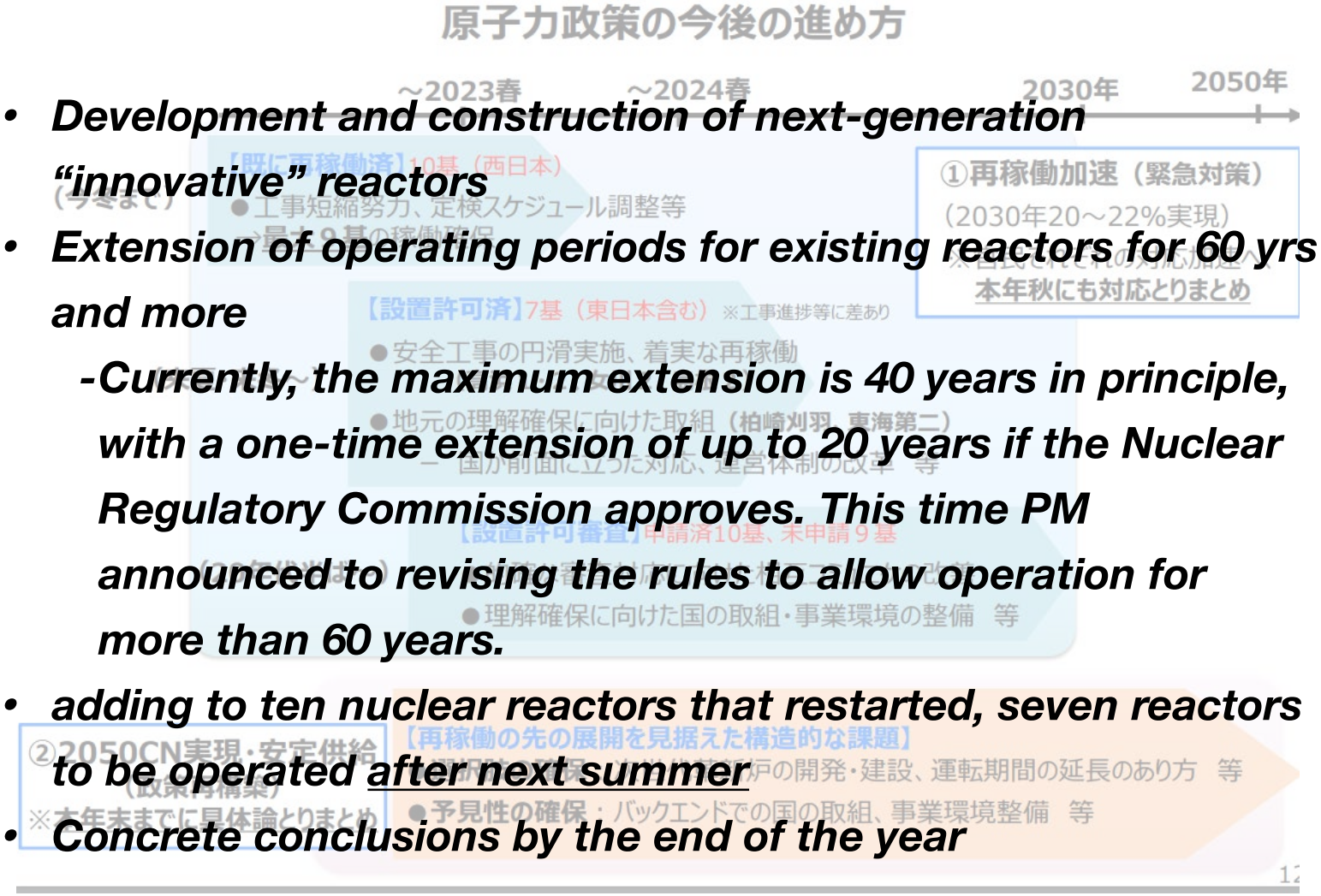
GX League

440 companies participated
Design of a voluntary emissions trading scheme

GX League

Japan's unclear future for 2050 with nuclear power

PM suddenly announced a policy of building new nuclear power stations in August 2022



- ***Development and construction of next-generation "innovative" reactors***
- ***Extension of operating periods for existing reactors for 60 yrs and more***
  - ***Currently, the maximum extension is 40 years in principle, with a one-time extension of up to 20 years if the Nuclear Regulatory Commission approves. This time PM announced to revising the rules to allow operation for more than 60 years.***
- ***adding to ten nuclear reactors that restarted, seven reactors to be operated <u>after next summer</u>***
- ***Concrete conclusions by the end of the year***


日本経済新聞
2022年（令和4年）8月25日（木曜日）
タイ首相 職務停止
任期問題で憲法裁命令
再稼働7基追加
来夏以降
首相、新増設へ転換
次世代原発建設を検討
8月25日
木曜日

Considering the construction of next-generation nuclear reactors

PM turns to new nuclear power plants

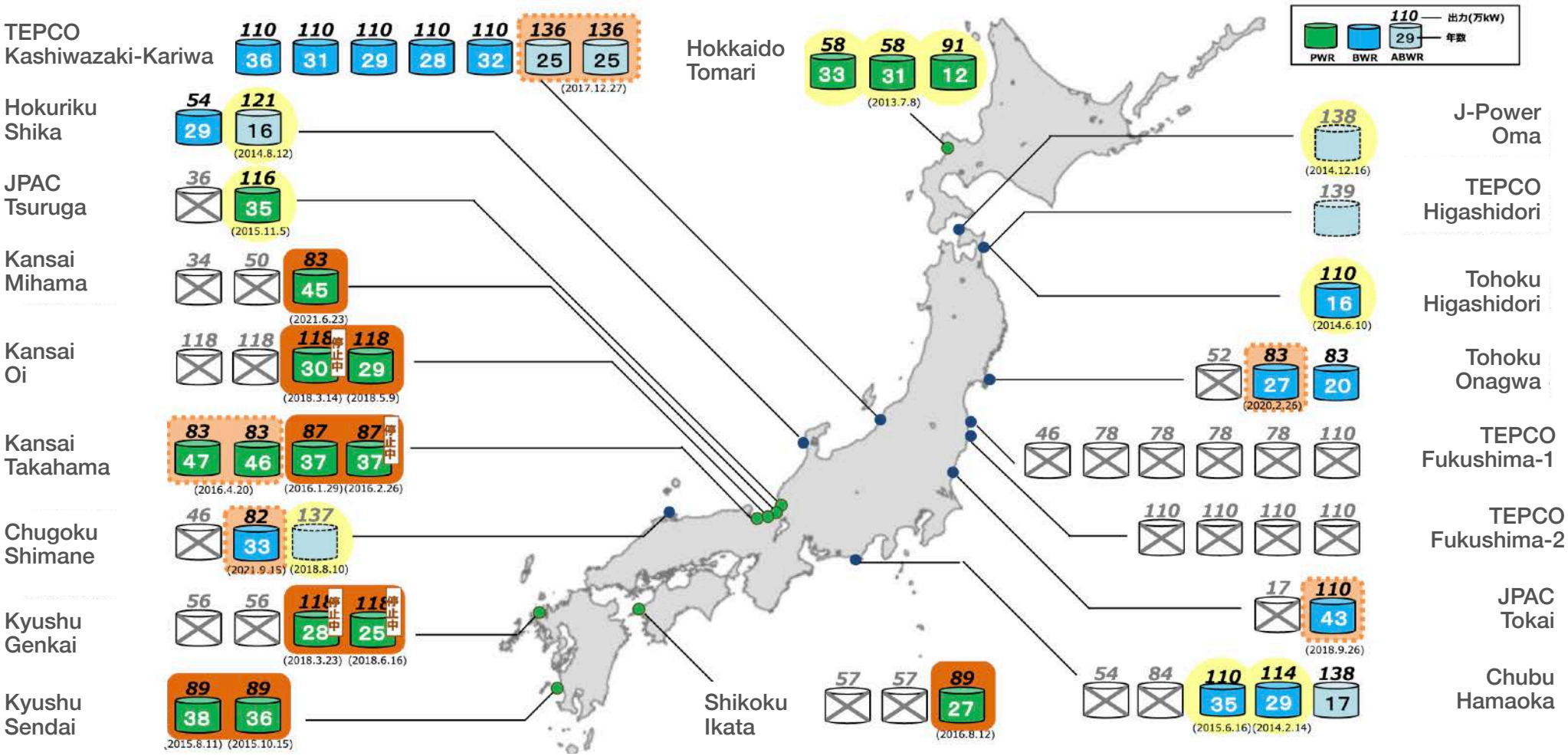
Nikkei Shimbun, 25 AUG 2022

Source: the 2nd meeting of the GX Executive Council, 'Rebuilding Japan's Stable Energy Supply', 24 August 2022

Japan's nuclear power status

as of the 13th SEP 2022

enabled the re-operation	permission	under evaluation	unapplied	shut-down announced
10 reactors	7	10	9	24
operation 6, offline 4	permission date	applied date		



METI/ANRE, "Status of Nuclear Power Plants," + modification by REI, https://www.enecho.meti.go.jp/category/electricity_and_gas/nuclear/001/pdf/001_02_001.pdf

There was once a wonderful time in Japan,
a time of dreams……

some hopes

hope: Japan's huge potential of renewables

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mile stone for 2030

Installed solar power generation (*1): approx. 145 GW

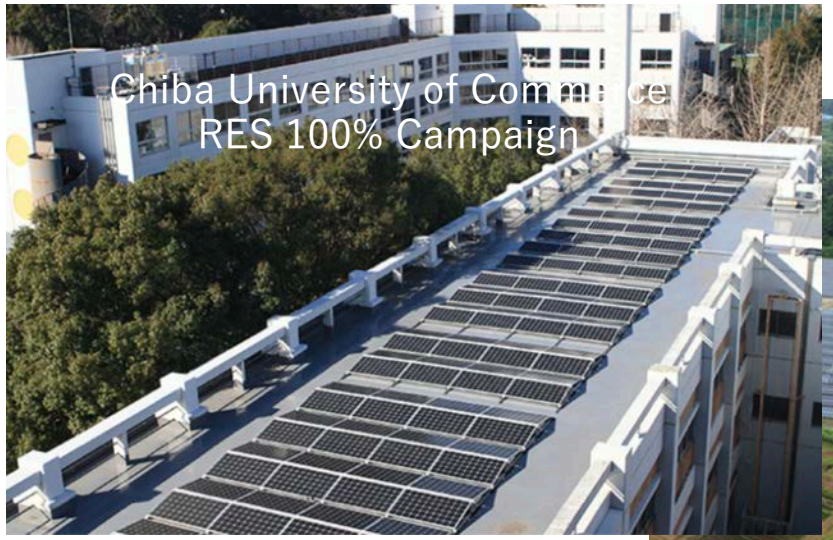
(*1) Scenario to increase electricity supply from renewable energy to 45% by 2030 (REI calculations).
(Renewable Energy Institute, Proposals for the 2030 Energy Mix (Version 1), p28, https://www.renewable-ei.org/pdfdownload/activities/REI_2030Proposal.pdf)

Area of introduction to degraded agricultural land (*2): 75,000 ha.

(*2) The total amount of degraded agricultural land now and to be generated in the future is approximately 540,000 ha, of which approximately 14% (7.5 ha) is assumed to be applied to renewables. (*3) Approximately 150,000 ha of land, including golf courses, lakes and other land that could be converted to renewables, could be used to generate approximately 110 GW. (REI calculations), (Estimated with reference to the REI's Proposals for the 2030 Energy Mix (1st edition), p.29 and below, https://www.renewable-ei.org/pdfdownload/activities/REI_2030Proposal.pdf)

Residential and other roof-mounted: potential of approx. 210 GW (Ministry of the Environment estimate)

http://www.renewable-energy-potential.env.go.jp/RenewableEnergy/doc/gaiyou3.pdf



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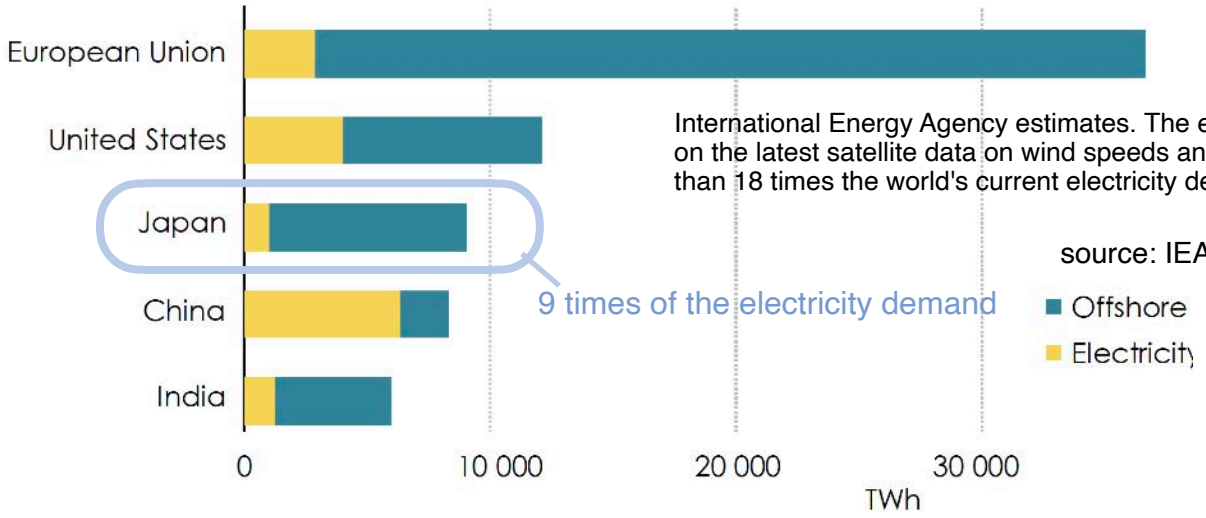
Offshore Wind Vision: 10GW by 2030, 30-45GW by 2040

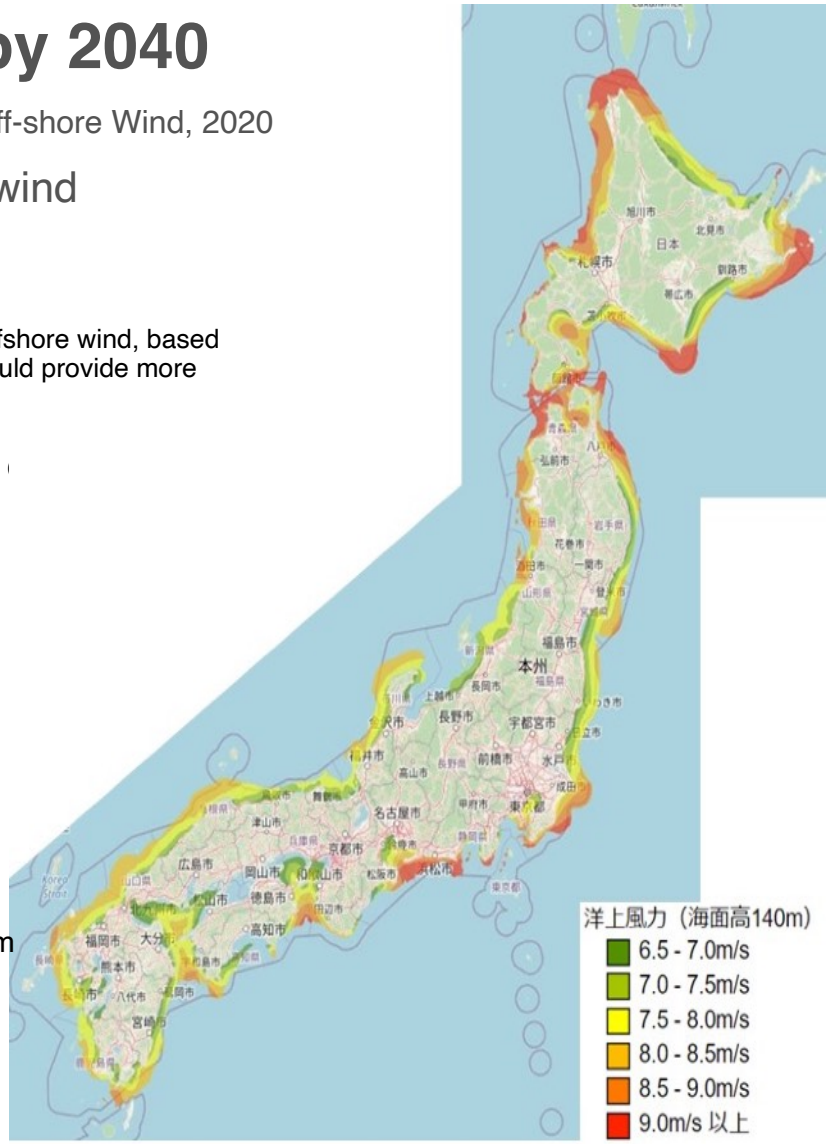
The Public-Private Consultative Committee for Off-shore Wind, 2020

IEA: Electricity demand in countries (2018) and technical reserves of offshore wind



International Energy Agency estimates. The enormous potential of offshore wind, based on the latest satellite data on wind speeds and modern turbines. It could provide more than 18 times the world's current electricity demand.

source: IEA 2019, Offshore Wind



Japan ranks 6th in the world in terms of the distance of its offshore lines (29,751 km). The situation surrounded by the sea is the same as in the UK (12th in the world with 12,429 km) where offshore wind power is installed 10.4 GW (end 2020).

Areas of favourable wind conditions at distances of less than 30km from shore and water depths of less than 200m are mainly in the Tohoku region of Hokkaido, but also in other areas.

Water depth less than 50m: floor-mounted, water depth between 50m and 200m: floating

Wind power output is theoretically proportional to the cube of wind speed

Average annual wind speed of 7.5 m/s: real capacity utilisation of ≈38

Average annual wind speed of 8.0 m/s: real capacity utilisation rate ≈ 42

Annual average wind speed of 8.5m/s: Actual facility utilization rate ≒ 46%

Source: Renewable Energy Information System, Ministry of the Environment

hope: demand side actions

New policies are emerging:

Tokyo Metropolitan Government's new proposal for solar PV obligation for new housing by 2025

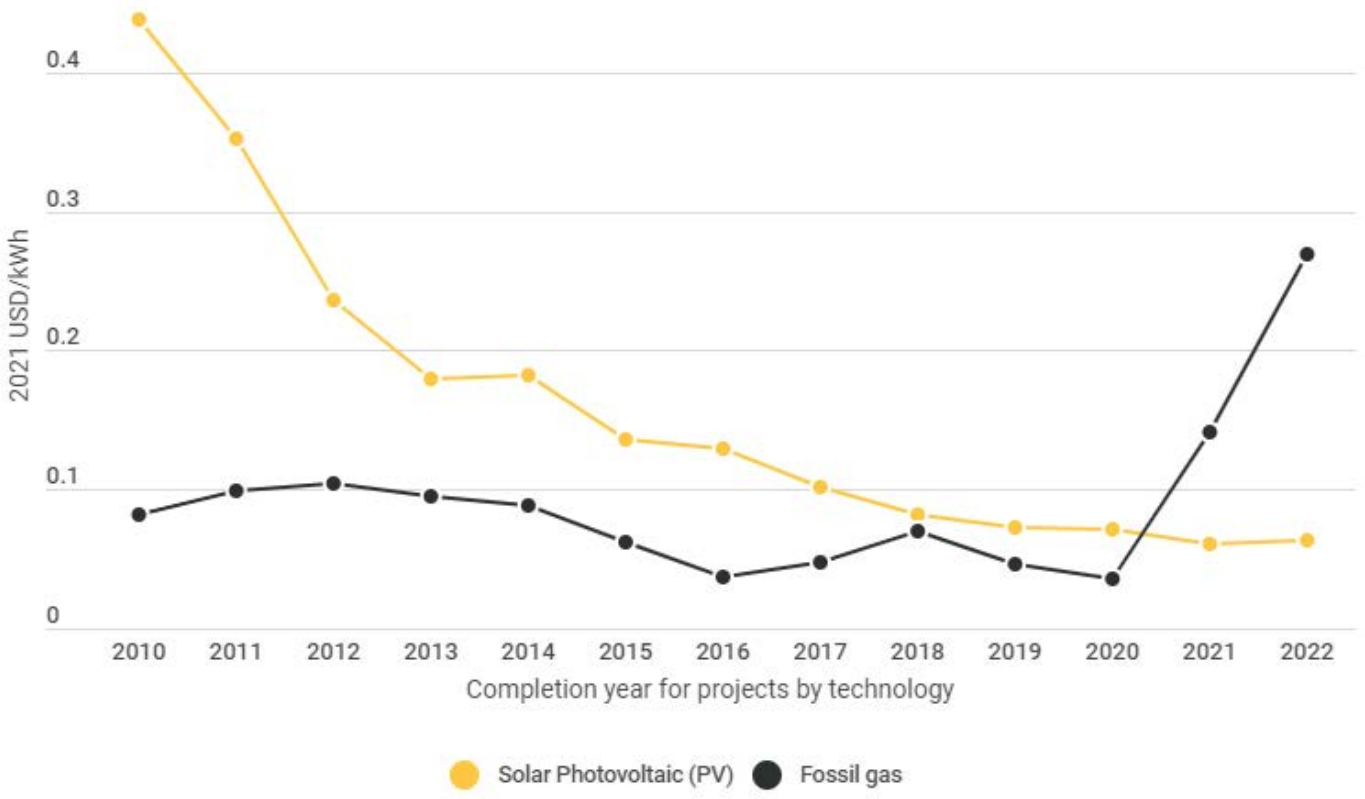
The city of Kawasaki announced the installment of solar PV obligation by 2024

RE100

77 Japanese companies joined out of about 300

hope: fossil vs renewables

In the fossil fuel crisis, the value of switching to solar and wind is even greater



Utility scale solar PV becomes starkly competitive over fuel and CO_2 cost in Europe

Share

IRENA
International Renewable Energy Agency

declining cost of renewables

renewable is becoming cheaper in Japan

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Cost outlook for solar PV in Japan

Estimated equipment costs for solar PV (high voltage and ground-mounted) in 2030, at JPY 85,000 /kWh

Unit cost of electricity generation is estimated at JPY 6.2/kWh for 25-year operation and JPY 5.7/kWh for 30-year operation.

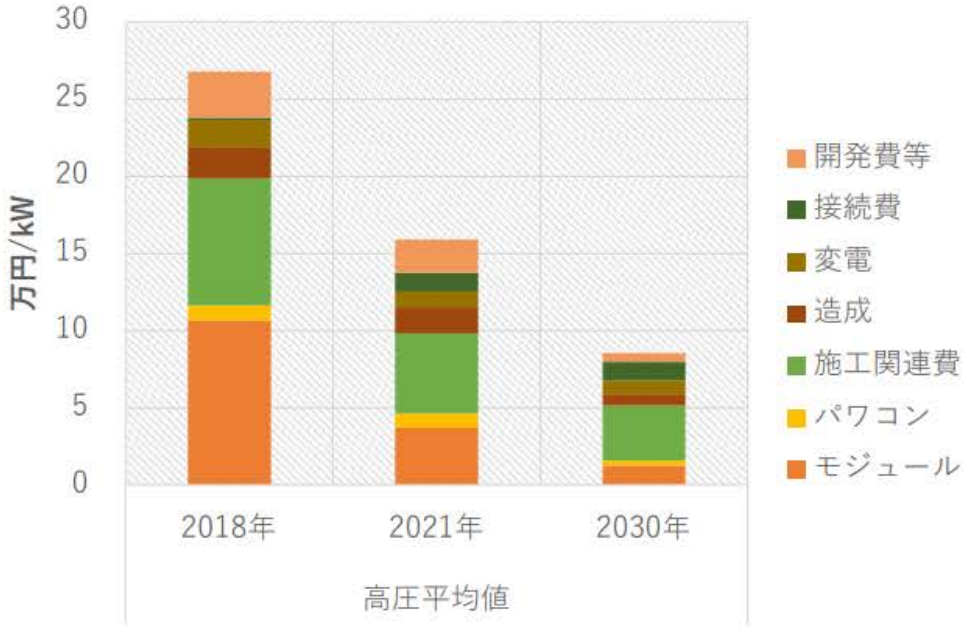


図　太陽光発電の資本費(2030年は推計値)

図　太陽光発電の発電単価(25年運転想定・30年運転)

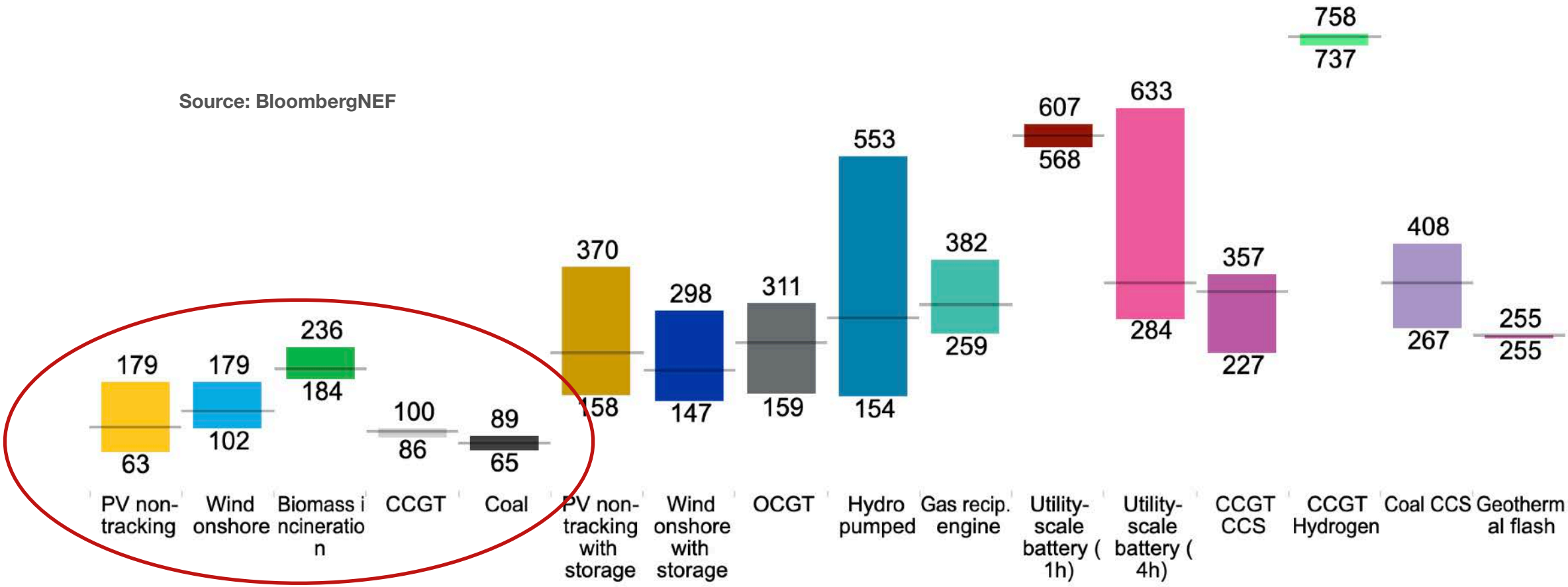
LCOE Comparison and Visualization

Historic LCOE | Current LCOE by Country | Current LCOE by Technology | Forecast LCOE | Fuel Prices

Location: Japan Scenario: Unsubsidized - Current

Current LCOE range ($/MWh, nominal) - Japan, 2022 1H

Source: BloombergNEF

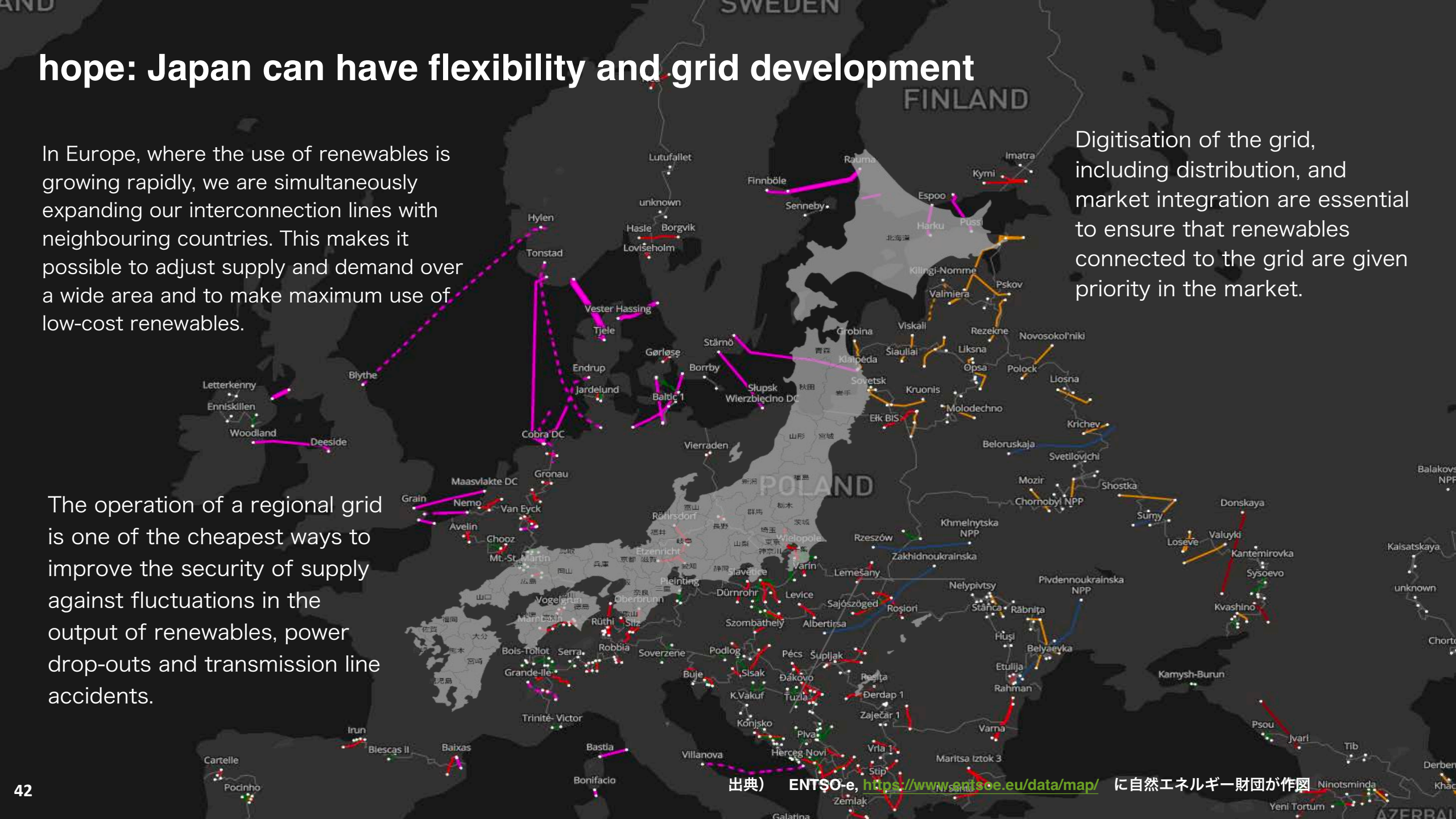


hope: Japan can have flexibility and grid development

In Europe, where the use of renewables is growing rapidly, we are simultaneously expanding our interconnection lines with neighbouring countries. This makes it possible to adjust supply and demand over a wide area and to make maximum use of low-cost renewables.

The operation of a regional grid is one of the cheapest ways to improve the security of supply against fluctuations in the output of renewables, power drop-outs and transmission line accidents.

Digitisation of the grid, including distribution, and market integration are essential to ensure that renewables connected to the grid are given priority in the market.



出典） ENTSO-e, https://www.entsoe.eu/data/map/ に自然エネルギー財団が作図

Big success to make the cabinet approve the Building Energy Conservation Law

Background

- The main pillar of the amendment was a mandatory efficiency standard for all houses and buildings by 2025.
- Based on the discussion at the RE Taskforce under the Cabinet Office last year, there were calls from relevant industries and NGOs for the submission of the amendment.
- However, there were ministry-level decisions not to submit this to the current parliamentary session

RE Taskforce and stakeholders engagements

- Director Mika Ohbayashi and Senior Manager Yuko Nishida played big roles to reverse the ministry-level decisions and make it approve by the cabinet. Signatures were handed to Deputy Chief Cabinet Secretary.

Webinars

- Building Performance Standards for Existing Buildings - The US and Europe example, 17th May
- Building Energy Conservation Law and its amendments, 10th June

Columns

- California's world-leading building decarbonization policy
- Germany Policy and ordinance on mandatory installation of solar PV installations in Berlin

Supported Tokyo's ordinance on mandatory PV installation for homebuilders

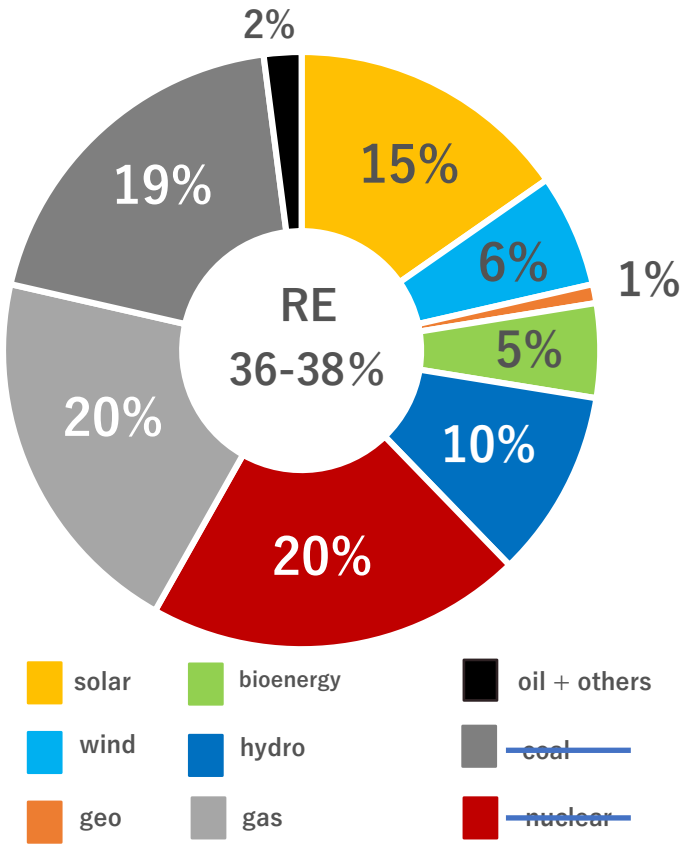
Background
- Teruyuki Ohno, REI Executive Director is a member of the TMG's committee and has been working on this ordinance
- When TMG launched a public consultation on 24th May, a negative campaign against the ordinance was launched on SNS and various media outlets.

Debunking Campaign
- REI called on climate NGOs, youth groups, consumer associations, PV manufacturers, pioneering homebuilders, and experts
- InfoPack: TMG's Obligation for homebuilders to install solar power generation systems, June 2022
- Webinars with other NGOs and experts
- Approached the Japan Consumers' Co-operative Union, the nation's largest consumer organization, who expressed support.
- Media briefing
  - The Asahi Shimbun published an editorial and the Nikkei also published an article in support.

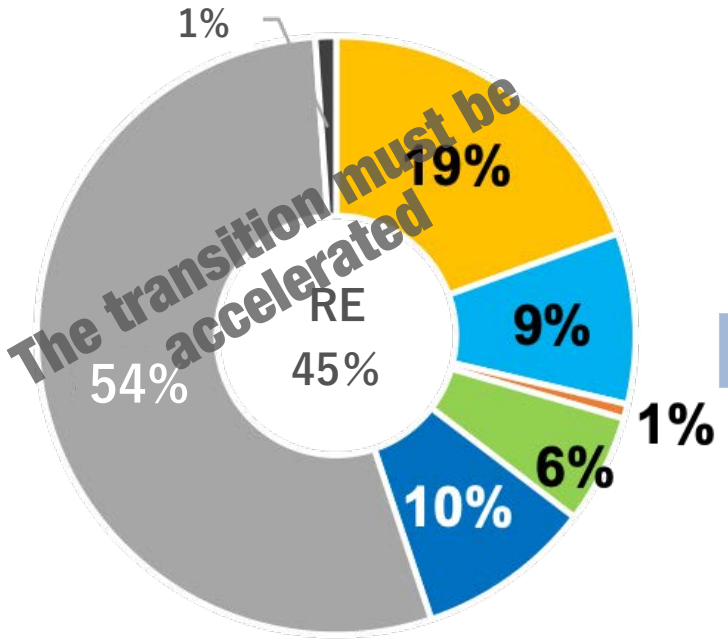
hope: transition in 2030 and decarbonization in 2050

In order to achieve a decarbonized world by 2050, there must be a dramatic increase in renewables and a shift to a sustainable "energy mix" by 2030.

the Sixth Basic Energy Plan
Electricity Composition
Total amount of electricity generated
930-940TWh

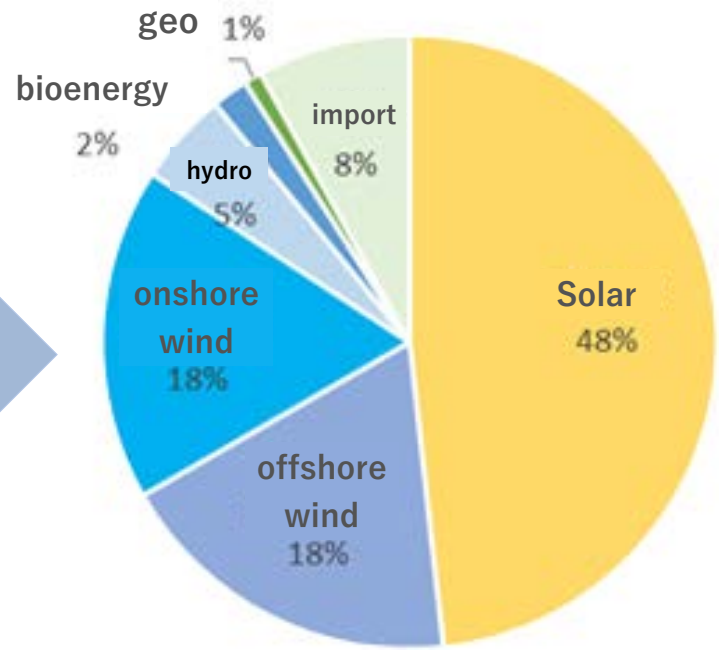


REI for 2030
Total electricity supply 890 TWh



source) REI, 2020

REI: 100 % renewables in 2050
Total electricity supply 1,470 TWh



source) REI-Agora-LUT
Renewable Pathways, 2021
https://www.renewable-ei.org/activities/reports/20210309_1.php

hope: Japan can be 100% renewables

Final energy demand in 2050, Direct and indirect use of renewables electricity (green hydrogen and green synthetic fuels)

1. Changes in energy demand

Assumed 35% reduction by 2050 due to reduced activity and energy conservation, based on population projections of approx. 20% reduction.

Efficiency improvement through the promotion of electrification and energy system efficiency through renewables conversion

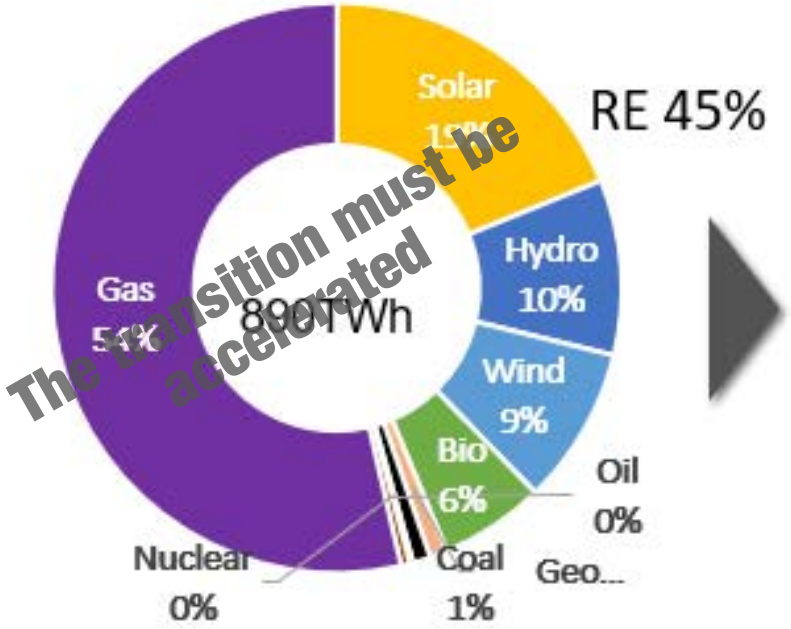
Almost all process and business sectors to be electrified by 2040, EVs in the transport sector, except for heavy users

In the industrial sector, electrification progresses except for high-temperature heat demand

2. Renewables supply 100% of electricity

Electricity supply: 1470 TWh
Solar power: 524 GW
Onshore wind power: 88 GW
Offshore wind power: 63 GW
Hydropower: 22GW

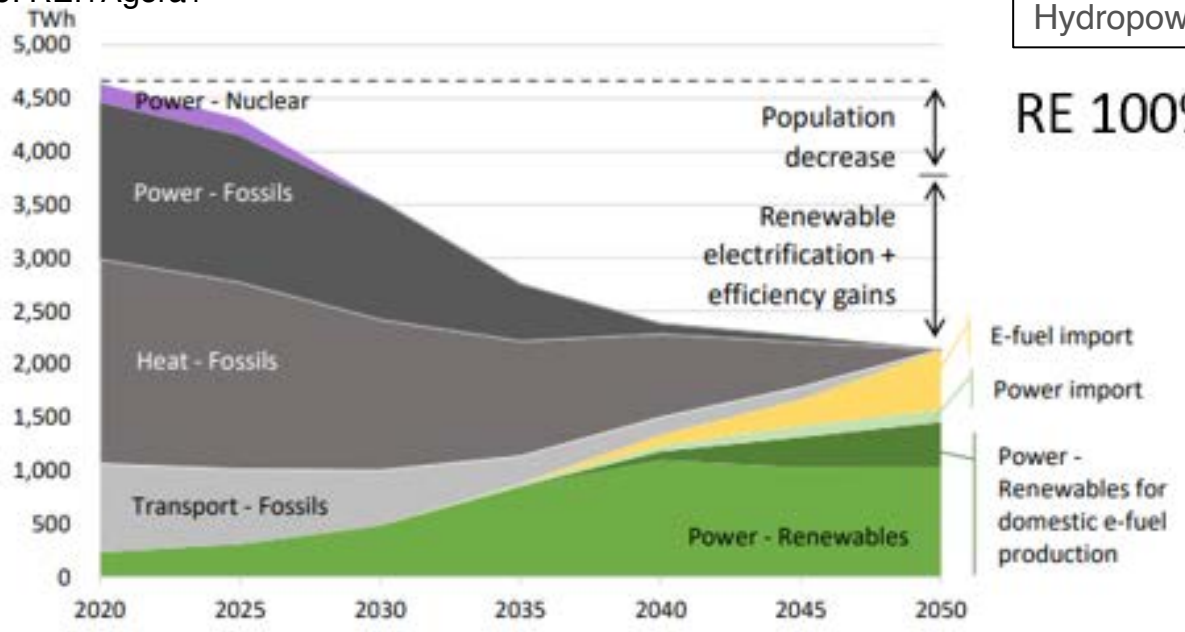
REI Power Scenario 2030



Source: REI (2020) Proposal for 2030 Energy Mix in Japan

Source: REI+Agora+

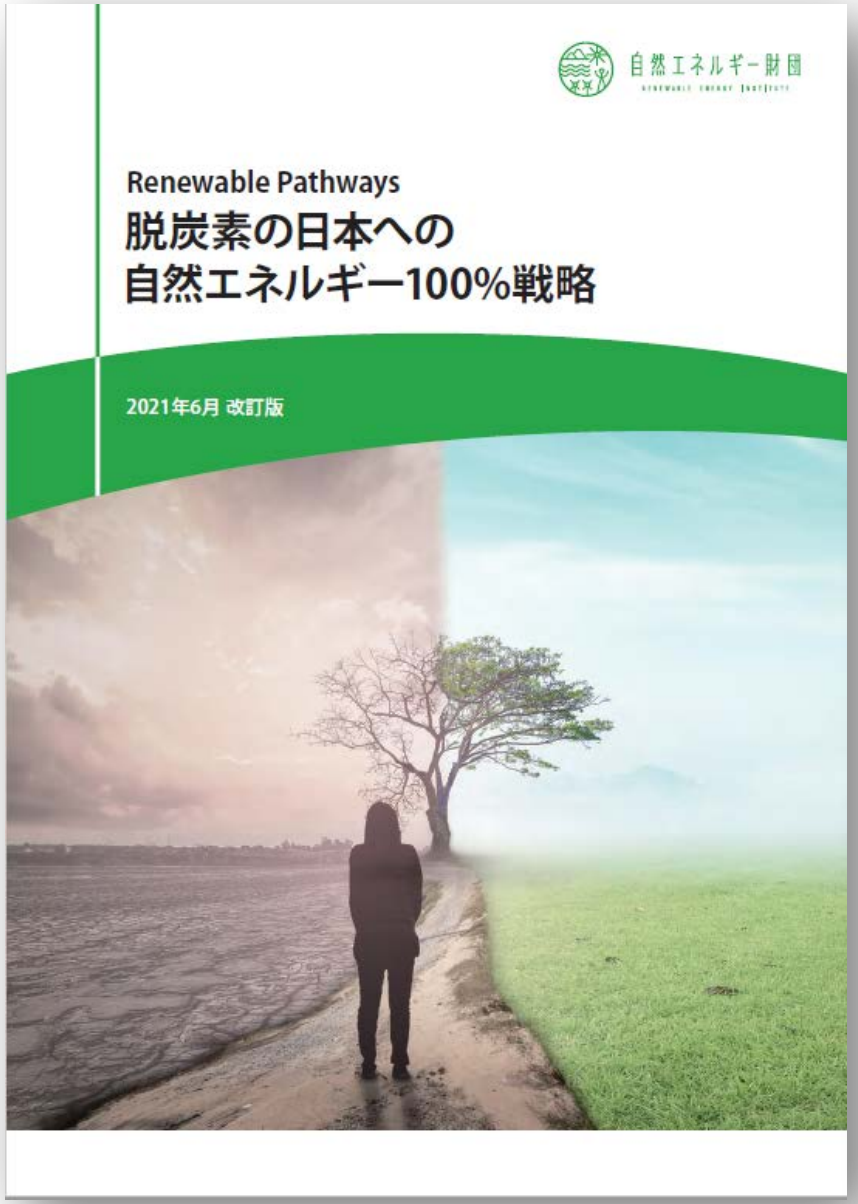
REI Energy Scenario 2050

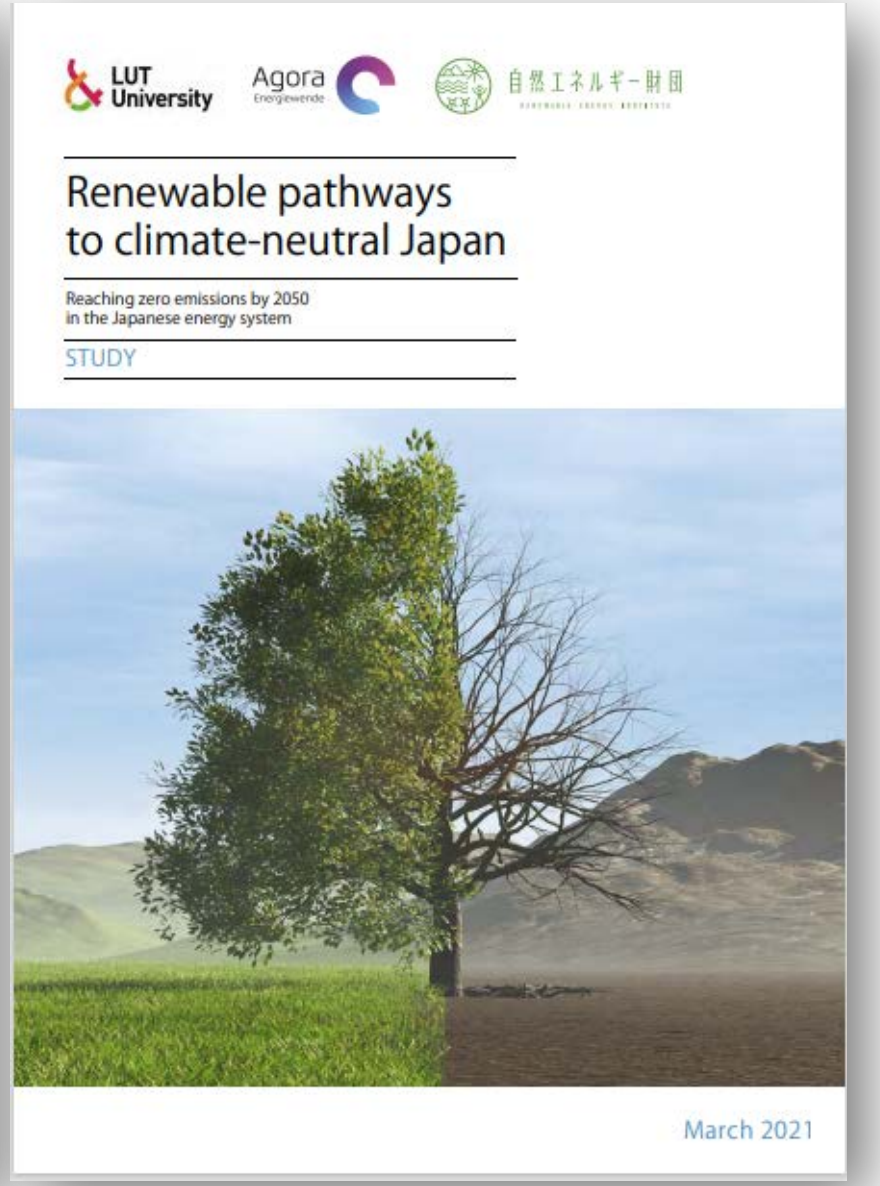


RE 100%

Source: REI+Agora+LUT, Renewable Pathways, 2021 March

A 100% renewables strategy for a decarbonised Japan.





Conducted a joint study with the Renewable Energy Foundation, Agora Energiwende and the Lappeenranta University of Technology.

Agora Energiewende

LUT University

Paradigm Shift in Energy

自然エネルギー財団
RENEWABLE ENERGY INSTITUTE

CONTACT:
Mika Ohbayashi
Renewable Energy Institute
e-mail: m.ohbayashi AT renewable-ei.org

Thank you for the lively discussions.

I have to leave tomorrow morning…

It’s a pity I may miss the exciting discussions on

nuclear and others from tomorrow…

I hope for the tremendous success of the rest of the event!!

MIKA