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Japanese Energy Policy after Fukushima
- Running Hard to Stand Still? -

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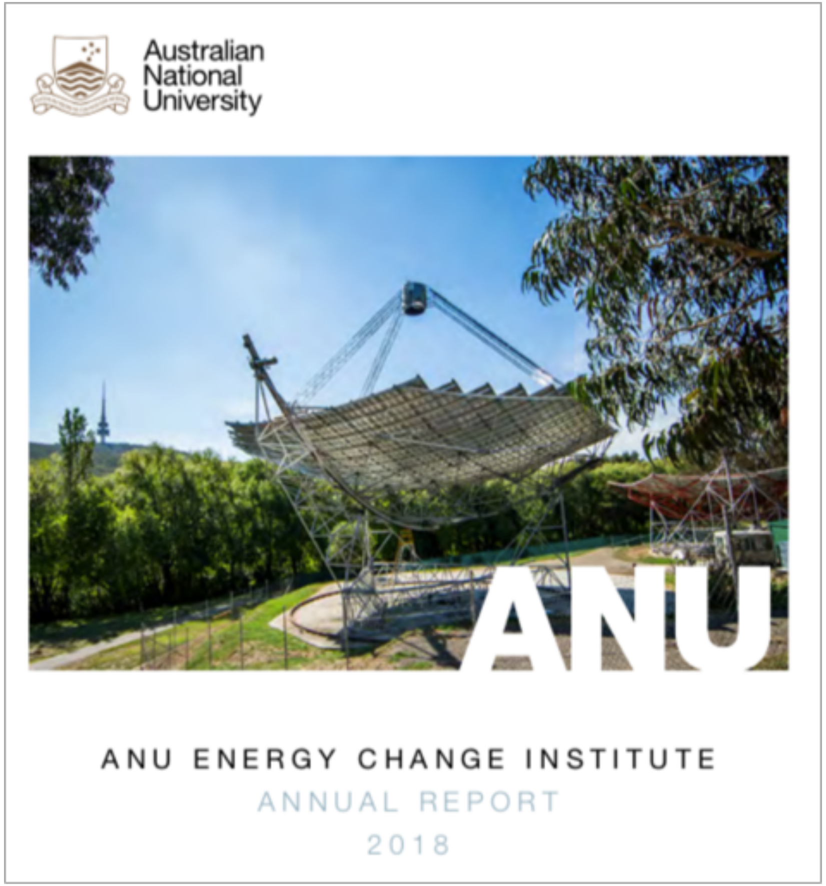
SPRU, University of Sussex
24 January 2019

Australian National University



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ANU ENERGY CHANGE INSTITUTE

ANNUAL REPORT

2018

GOVERNANCE

Members of the ECI Executive team and Grand Challenge Steering Committee.

The ECI comprises more than 150 academic staff and their postgraduate research students, bringing the total complement close to 300 researchers.

The wider ECI membership meets every year at the Annual Business Meeting, which establishes the activity for the coming year. This year the ABM coincided with an ECI Grand Challenge kick-off workshop on 6 April 2018.

ECI Executive

Operationally, the ECI is governed by an Executive comprising representatives from ANU Colleges:

Professor Ken Baldwin – Director
ANU College of Science

Professor Andrew Blakers *(Alternate Dr Matthew Stocks)*
ANU College of Engineering & Computer Science

Professor Kylie Catchpole *(Alternate Dr Fiona Beck)*
ANU College of Engineering & Computer Science

Professor Yun Liu *(Alternate Professor Colin Jackson)*
ANU College of Science

Dr James Prest - Education Convenor *(Alternate Professor Tom Faunce)*
ANU College of Law

Professor Sylvie Thiebaux *(Alternate Dr Lachlan Blackhall)*
ANU College of Engineering and Computer Science

Dr Igor Skryabin – Research and Business Development Manager
ANU College of Science

The Executive meets regularly throughout the year as required.

The strategic directions of the ECI are reviewed each year when the Executive meets with the ECI Advisory Board.

ECI Advisory Board

Professor Armin Aberle
CEO, Solar Energy Research Institute of Singapore

Mr Brad Archer
First Assistant Secretary, Department of the Environment and Energy

Mr Stephen Devlin
General Manager, Evoenergy

Dr Bruce Godfrey
Principal, Wyld Group Pty Ltd

Professor Mark Howden
Director, ANU Climate Change Institute

Dr Sarah Pearson
Chief Innovation Officer, Department of Foreign Affairs and Trade

Source: http://energy.anu.edu.au/files/ECIAnnual%20Report%202018%20%28Interactive%20PDF%29_0.pdf

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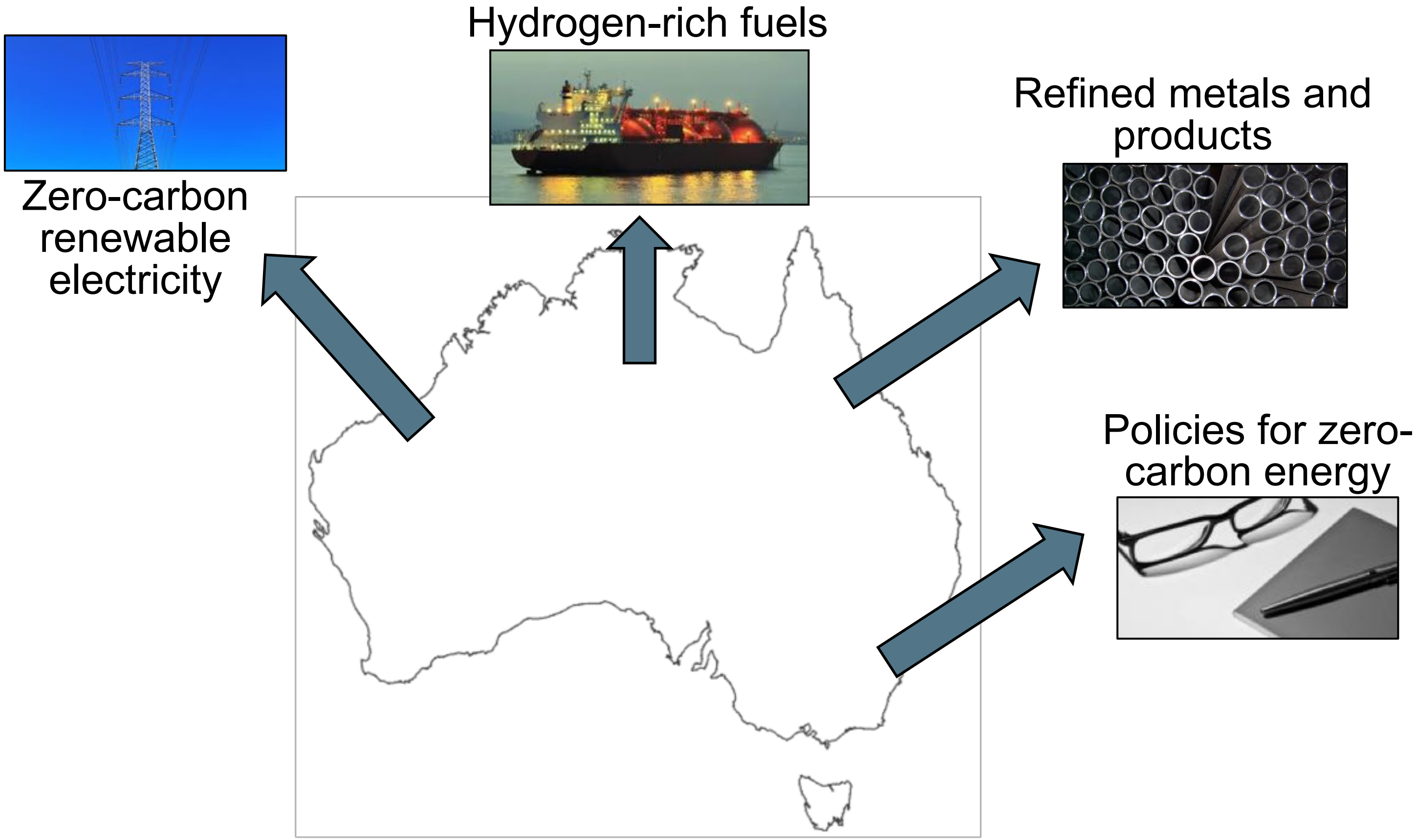
Zero-Carbon Energy for the Asia-Pacific


Hydrogen-rich fuels
Zero-carbon renewable electricity
Refined metals and products
Policies for zero-carbon energy

Where are we at with emissions?

Where are we at with policy?

Where are we likely to be going?

Japan's Nationally Determined Contribution (NDC)

- Japan ratified the Paris Agreement on 8 November 2016
- Emissions reduction target of 26% below 2013 levels by 2030, or 18% below 1990 levels by 2030

2. Energy mix used for the bottom-up calculation of the emission reduction target

	FY 2030
●Final energy consumption	326 M kl
(Energy efficiency measures)	50 M kl

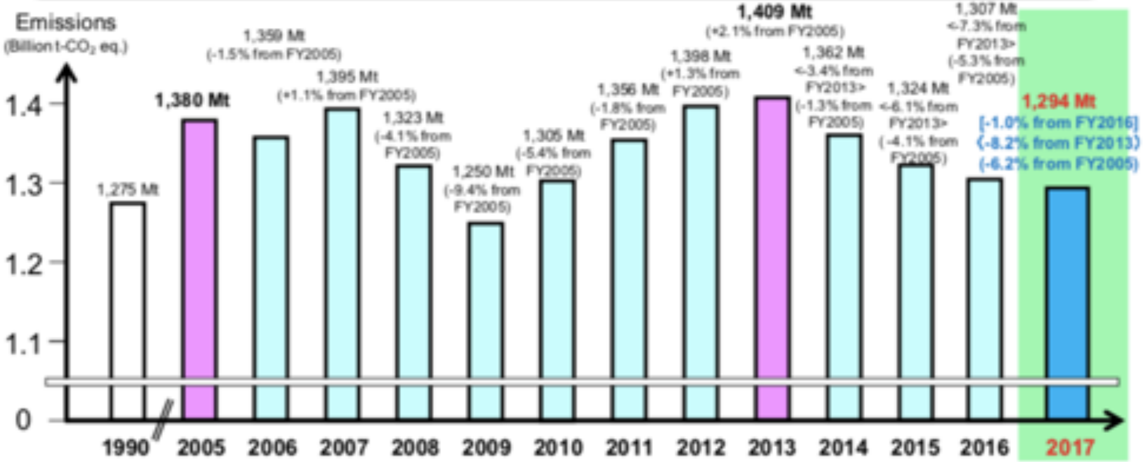
●Total power generation	approx. 1065 billion kWh
Renewables	approx. 22-24%
Nuclear power	approx. 22-20%
Coal	approx. 26%
LNG	approx. 27%
Oil	approx. 3%
(within renewables)	
Solar	approx. 7.0%
Wind power	approx. 1.7%
Geothermal	approx. 1.0-1.1%
Hydro power	approx. 8.8-9.2%
Biomass	approx. 3.7-4.6%

Source: Japanese Government, "Submission of Japan's Intended Nationally Determined Contribution (INDC)"

Japan's total greenhouse gas emissions in fiscal year (FY) 2017 (Preliminary figures)

Japan's total greenhouse gas (GHG) emissions in FY2017 (preliminary figures) were 1,294 Mt CO_2 eq. (1.0% decrease as compared to FY2016; 8.2% decrease from FY2013; and 6.2% decrease from FY2005 levels)

- The main factor for the lower emissions in FY2017 as compared to FY2016 is the decrease in energy-related CO_2 emissions due to the increase in the share of non-fossil fuels within the domestic energy supply brought by the wider adoption of renewable energy such as solar and wind power and the resumption of nuclear power plant operation, despite the increase in hydrofluorocarbon emissions from refrigerants that substitute for ozone-depleting substances.
- The main factor for the decrease in emissions in FY2017 as compared to FY2013 is the decrease in energy-related CO_2 emissions due to the increase in the share of non-fossil fuels within the domestic energy supply brought by the wider adoption of renewable energy such as solar and wind power and the resumption of nuclear power plant operation, and the decrease in energy consumption, despite the increase in hydrofluorocarbon emissions.
- The main factor for the decrease in emissions in FY2017 as compared to FY2005 is the decrease in energy-related CO_2 emissions owing to the decrease in energy consumption, despite the increase in hydrofluorocarbon emissions.

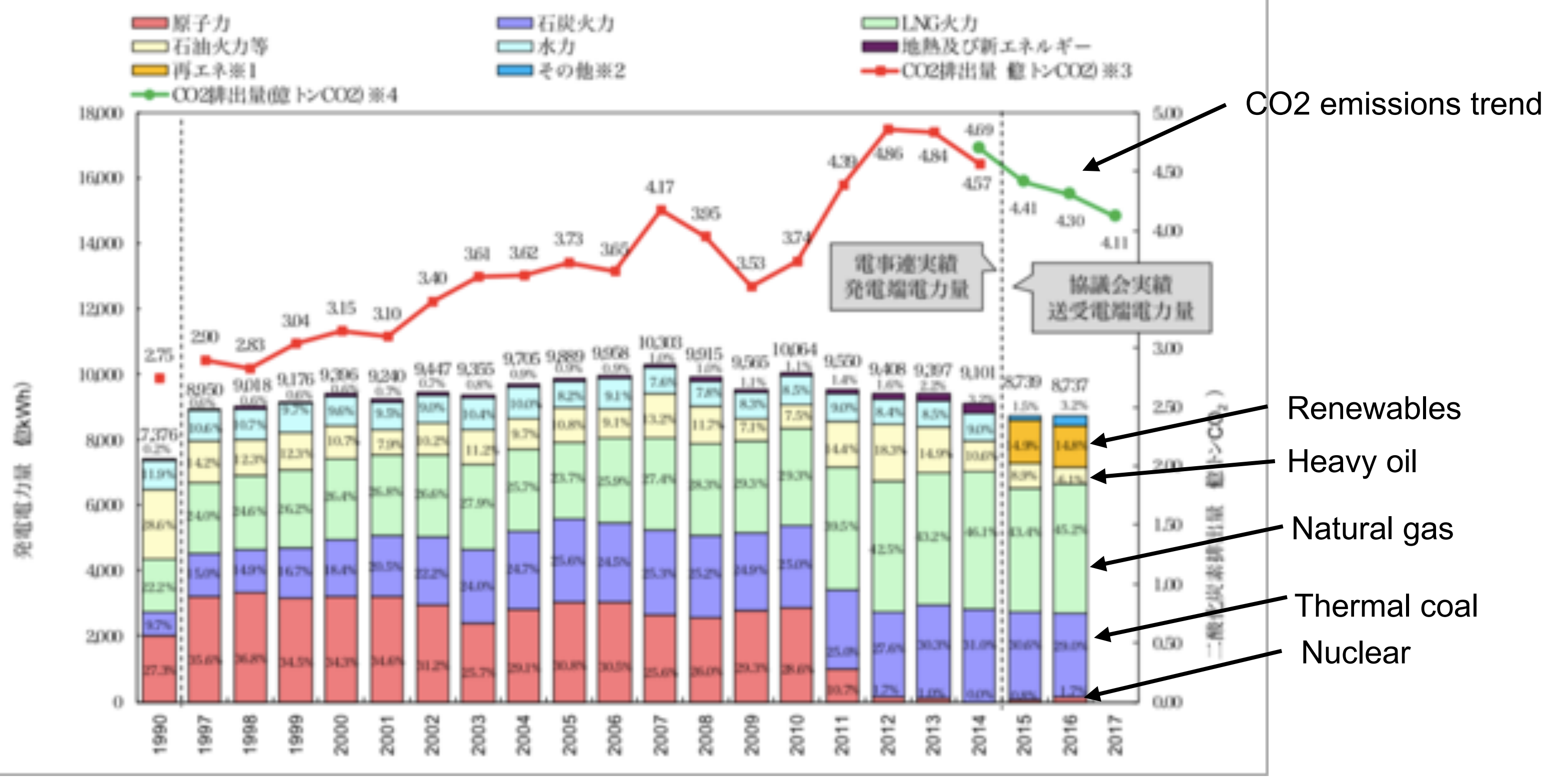


1. These preliminary figures for FY2017 were estimated based on annual figures in various statistics. Some annual figures from FY2016 were temporarily used in place of FY2017 figures that have yet to be released. Moreover, some estimation methodologies are currently being reconsidered in order to make more accurate estimations of emissions. As such, the final figures to be released in April 2019 could differ from the preliminary figures in this summary. Removals by forest and other carbon sinks will also be estimated and announced at the time of the final figures.
2. Total GHG emissions in each FY and percent changes from previous years (such as changes from FY2013) do not include removals by forest and other carbon sinks from activities under the Kyoto Protocol.

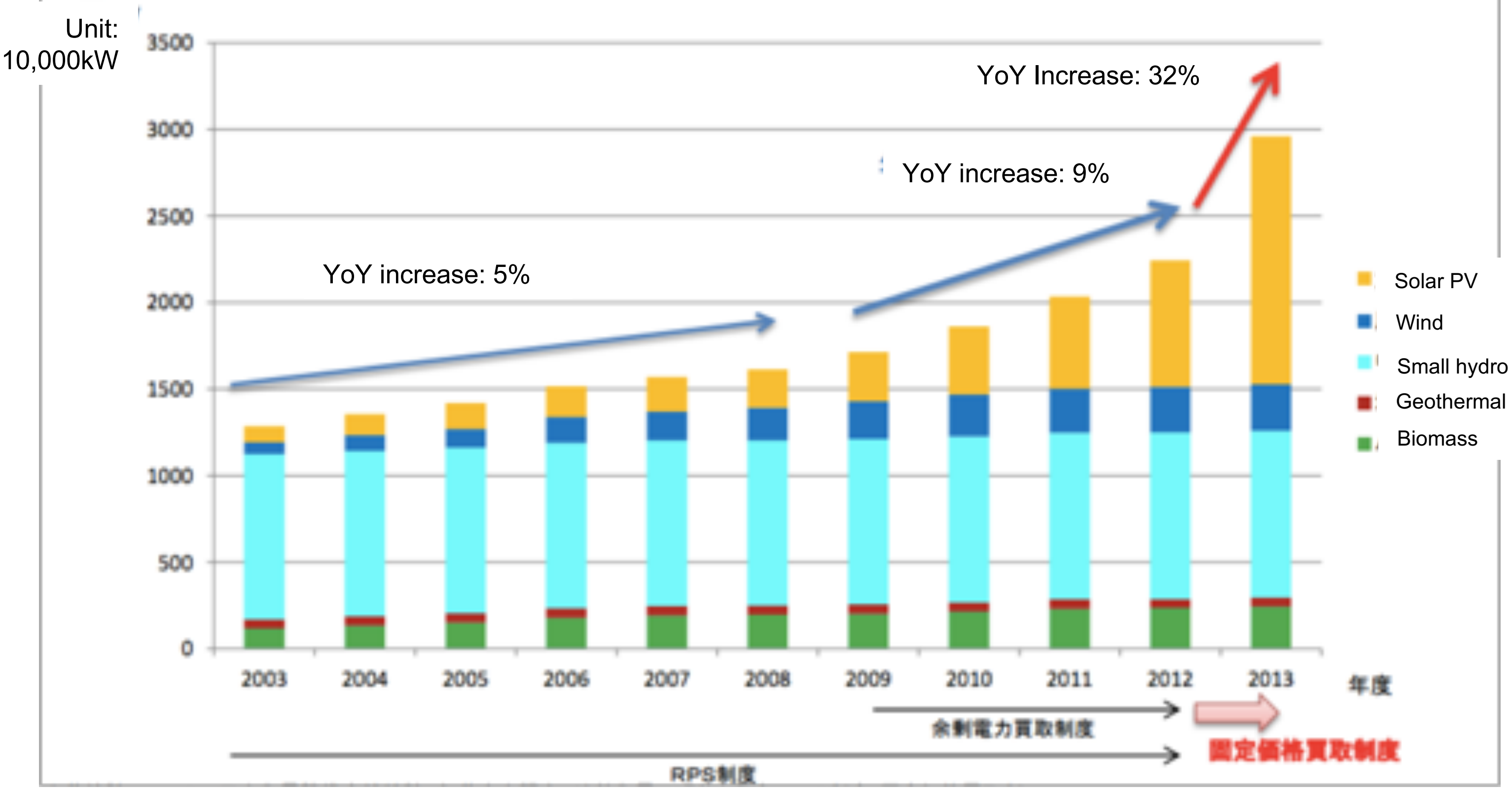
Figure 1 Japan's national greenhouse gas emissions in FY2017 (preliminary figures)

Source: National GHG Inventory of Japan (http://www.env.go.jp/press/files/en/784.pdf)

CO2 emissions from power sector

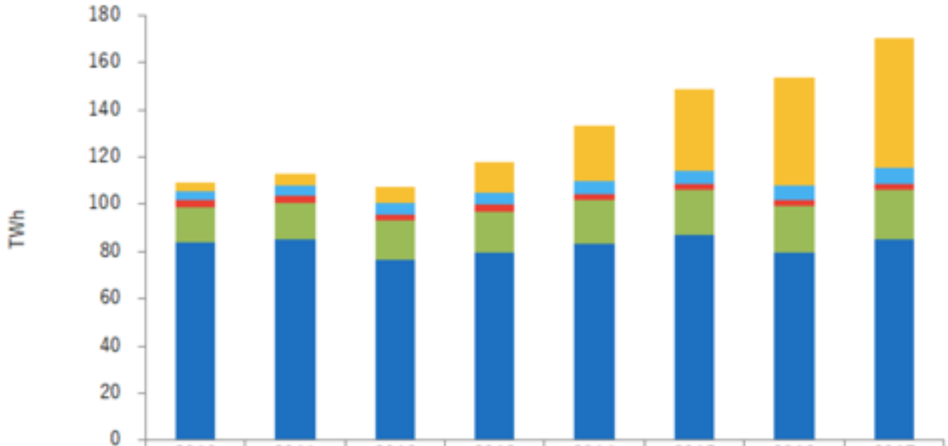


Installed renewables capacity (excluding large hydro)



Source: http://www.meti.go.jp/committee/sougouenergy/shoene_shinene/shin_ene/pdf/001_03_00.pdf

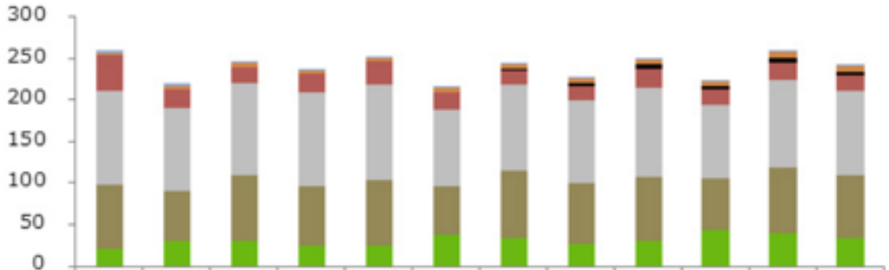
Trends of Renewable Electricity Production



	2010	2011	2012	2013	2014	2015	2016	2017
Solar	4	5	7	13	23	35	46	55
Wind	4	5	5	5	5	6	6	6
Geothermal	3	3	3	3	3	3	2	2
Bioenergy	15	16	17	18	18	19	20	22
Hydropower	84	85	77	79	84	87	79	85

Source： METI/ANRE "Total Energy Statistics" (accessed on 22/11/2018)

Trends in Total Electricity Production (TWh)



	2014				2015				2016			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Pumped hydro	3	3	2	1	1	1	1	1	1	1	2	2
Waste & others	3	4	4	4	4	5	5	5	6	7	8	8
Nuclear	0	0	0	0	0	0	1	4	5	4	5	4
Oil & others	42	22	20	23	28	21	17	17	22	19	22	20
Gas	114	101	111	112	115	93	103	101	108	88	105	101
Coal	76	59	79	73	79	58	82	72	78	62	79	76
Renewables	21	31	30	24	25	38	34	27	29	43	39	33
Total	258	218	247	237	251	216	244	227	250	225	260	243

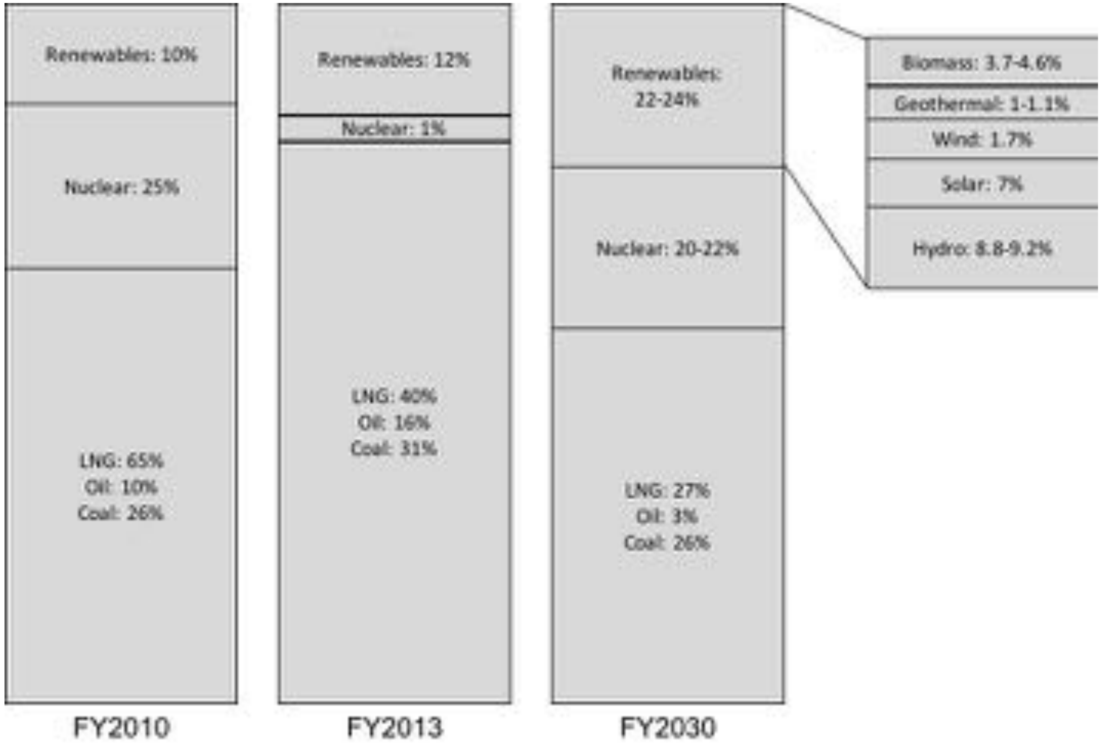
Source: REI, based on METI/ANRE “Monthly Report on Electricity Statistics”

Where are we at with renewables?

Where are we at with policy?

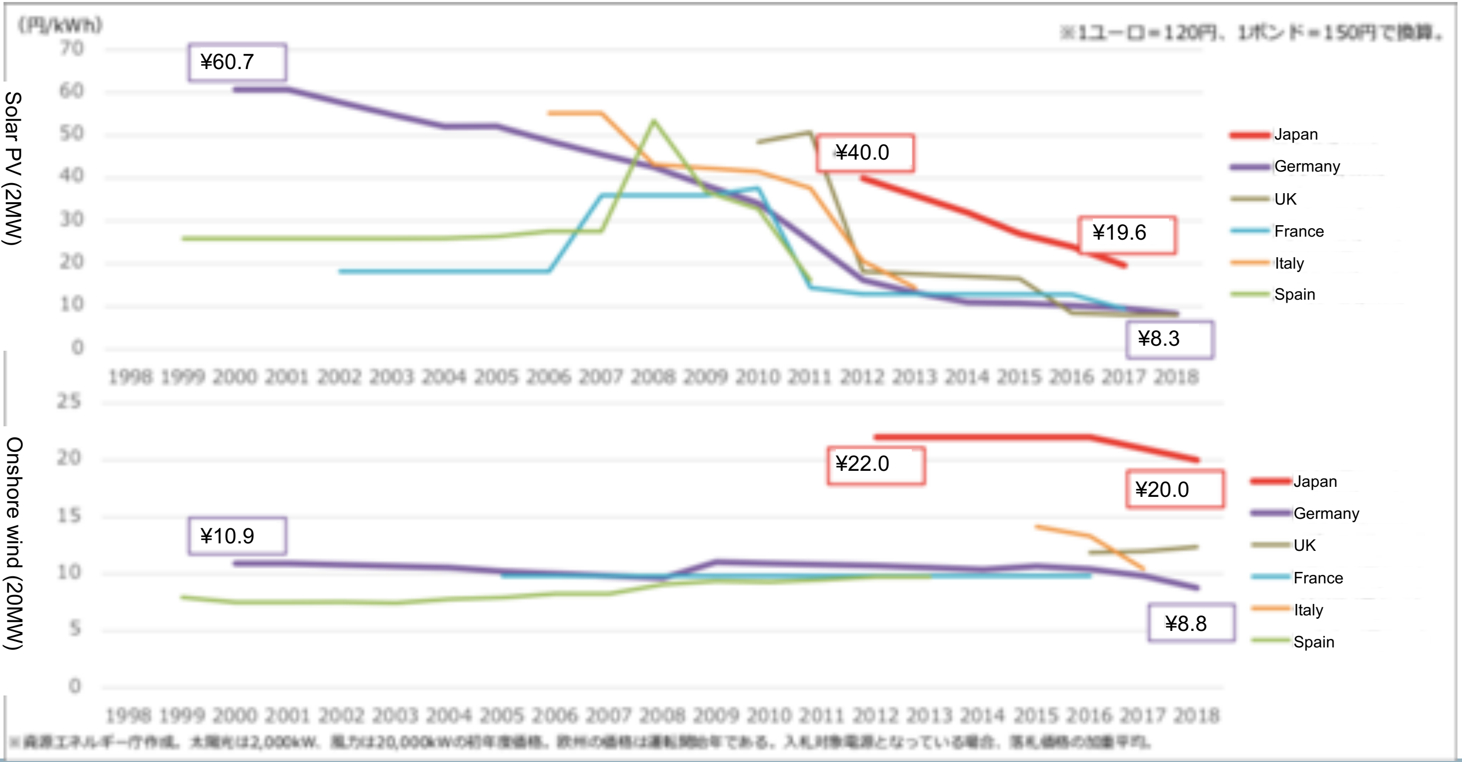
Where are we likely to be going?

Long-term Targets for Renewable Energy in Electricity Sector



Source: ANRE, Long Term Supply-Demand Projection, July 2015

Estimated cost comparison: Japan vs. European markets



Source: ANRE

Estimated cost comparison: distribution across projects

Mega-solar (>2MW) estimated LCOE

機械的・簡易的に計算したLCOE	No. of projects
7円/kWh未満	1 件
7円/kWh～8円/kWh	4 件
8円/kWh～9円/kWh	26 件
9円/kWh～10円/kWh	88 件
10円/kWh～11円/kWh	119 件
11円/kWh～12円/kWh	384 件
12円/kWh～13円/kWh	922 件
13円/kWh～14円/kWh	2,004 件
14円/kWh～15円/kWh	3,571 件
15円/kWh～16円/kWh	5,410 件
16円/kWh～17円/kWh	7,422 件
17円/kWh～18円/kWh	8,797 件
18円/kWh～19円/kWh	10,212 件
19円/kWh～20円/kWh	11,887 件
20円/kWh以上	102,213 件
Total	153,060件

Onshore wind

機械的・簡易的に計算したLCOE	No. of projects
7円/kWh未満	1 件
7円/kWh～8円/kWh	0 件
8円/kWh～9円/kWh	2 件
9円/kWh～10円/kWh	4 件
10円/kWh～11円/kWh	8 件
11円/kWh～12円/kWh	6 件
12円/kWh～13円/kWh	5 件
13円/kWh～14円/kWh	3 件
14円/kWh～15円/kWh	2 件
15円/kWh～16円/kWh	5 件
16円/kWh～17円/kWh	6 件
17円/kWh～18円/kWh	2 件
18円/kWh～19円/kWh	0 件
19円/kWh～20円/kWh	1 件
20円/kWh以上	5 件
Total	50件

Source: ANRE

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Policy Roadmap 2018: Committee System

2018 Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sept. Oct. Nov. Dec.

Northern Tohoku Bidding Process

1 Working Group on Transmission Issues (from 17 December 2017; end date TBD)

Topics: transmission system congestion, "connect and manage", reserve capacity

2 Subcommittee on Large-scale Introduction of Renewable Energy and Next Generation Network (from 30 September 2017; end date TBD)

Topics: cost competitiveness, long-term interconnection issues, "connect and manage" system design, info disclosure

3 Round Table for Studying Energy Situations (from 9 August 2017; end 31 March 2018)

Topics: long-term targets for 80% GHG reduction to 2050

4 Strategic Policy Committee (from 24 July 2013; standing committee)

Topics: review of Basic Energy Strategy, including renewables' cost competitiveness, management of intermittency

5 Committee for Calculating Procurement Prices (from 6 July 2012; standing committee)

Topics: annual review of FIT rates, FIT system design (cost-related issues)

Financial incentives under FIT (23/3/18)

Dominated by solar PV

- Solar PV 90% of registrations under FIT
- 31,000 projects estimated to be registered but not operating

Household burden high and increasing

- FY2016 cost estimated at 2.3 trillion yen, rising to 3.7–4 trillion by 2030

⇨ Deregister projects without interconnection agreements

⇨ Tender for utility-scale solar capacity

⇨ Longer FIT guarantees for projects with EIA (wind, biomass, geothermal)

Financial incentives under FIT

<table>
<tr><th></th><th>FY12</th><th>FY13</th><th>FY14</th><th>FY15</th><th>FY16</th><th>FY17</th><th>FY18</th><th>FY19</th><th>FY2030 Target</th></tr>
<tr><td rowspan="2">Solar Power (>10kW;20yr)</td><td rowspan="2">¥40</td><td rowspan="2">¥36</td><td rowspan="2">¥32</td><td>¥29</td><td colspan="3">Auction (>2MW)</td><td rowspan="2">TBD</td><td rowspan="2">¥7</td></tr>
<tr><td>¥27</td><td>¥24</td><td>¥21</td><td>¥18</td></tr>
<tr><td rowspan="2">Solar Power (<10kW;10yr)</td><td rowspan="2">¥42</td><td rowspan="2">¥38</td><td rowspan="2">¥37</td><td>¥33</td><td>¥31</td><td>¥28</td><td>¥26</td><td>¥24</td><td rowspan="2">Market (by 2020)</td></tr>
<tr><td>¥35</td><td>¥33</td><td>¥30</td><td>¥28</td><td>¥26</td></tr>
<tr><td>Onshore Wind (>20kW;20yr)</td><td colspan="5">¥22</td><td>¥21</td><td rowspan="2">¥20</td><td rowspan="2">¥19</td><td rowspan="2">¥8-9</td></tr>
<tr><td>Onshore Wind (<20kW; 20yr)</td><td colspan="6">¥55</td></tr>
<tr><td>Bottom-mounted Offshore (20yr)</td><td colspan="6" rowspan="2">¥36</td><td colspan="2">¥36</td><td>¥8-9</td></tr>
<tr><td>Floating Offshore (20yr)</td><td colspan="2">¥36</td><td></td></tr>
</table>

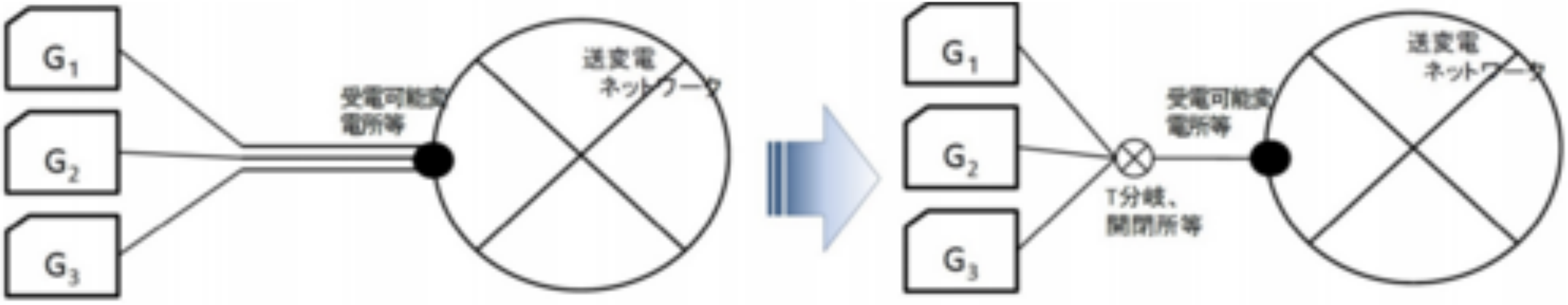
Transmission: “Japan-style” connect & manage

- Symbolic of shift away from “baseload” to “dispatchable” power model.

	Previous method of calculation	Direction of reform	Status
Calculation of available capacity	Assume existing generation at full capacity	Calculate actual usage	5,900MW spare cap identified nationally
Reserve	Secure 50% of grid cap	Emergency curtailment	40,400MW available capacity identified
Non-firm connection	Not available	Allow non-firm connection	Under planning

Market Design – Grid Interconnection

Until Now *From Now*



Market Design – Three Phased Power Market Reform

Column

Overview of the Reforms of the Electric Power System

The following revisions to the Electricity Business Act related to the reforms of the electric power system were passed into law in November 2013.

Phase 1: Enforced in April 2015

(1) Establishment of the "Organization for Cross-regional Nationwide Coordination of Transmission Operators" (Enhancement of nationwide grid operation)

Phase 2: Enforced in April 2016

(2) Full deregulation of entry into the electricity retail sector Abolishment of wholesale regulations

Phase 3: Should be implemented in April 2020

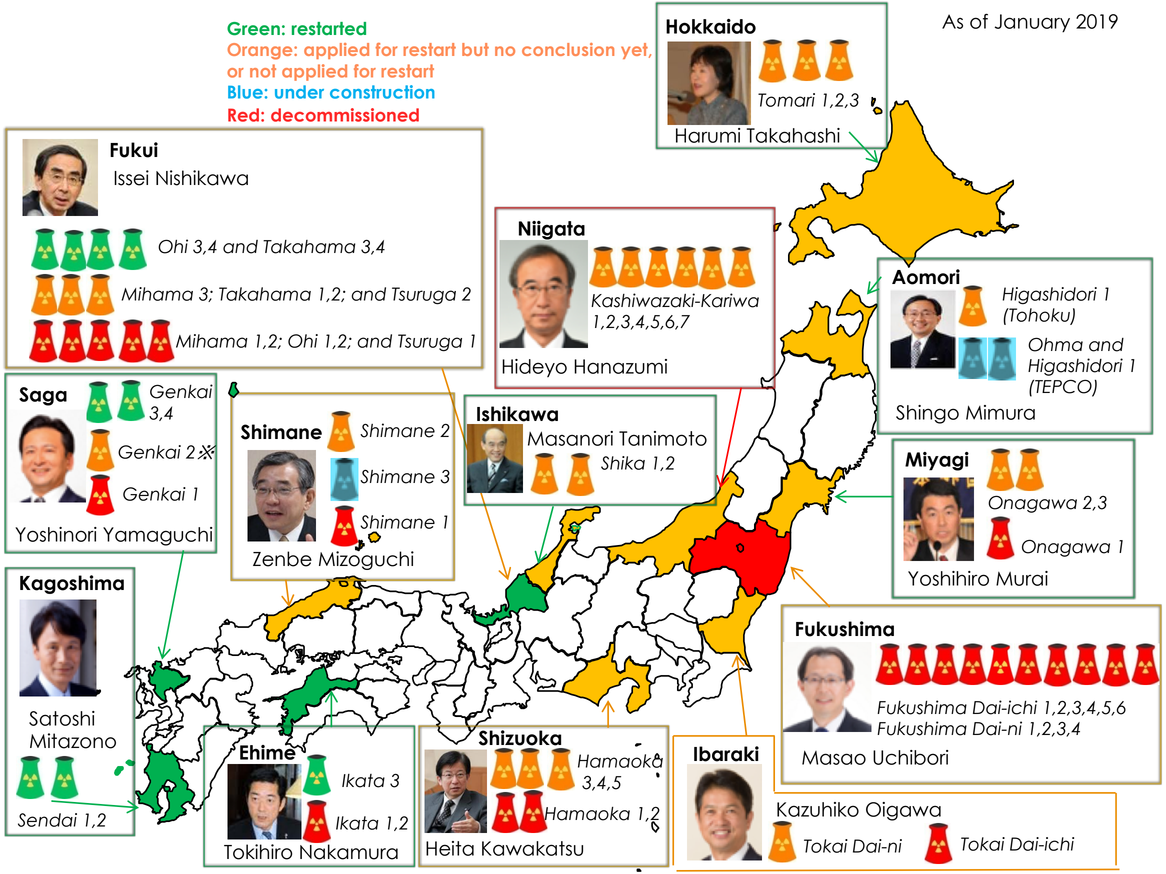
(3) Implementation of the legal unbundling of the electricity transmission and distribution department (for ensuring further neutrality)

(4) Abolishment of the retail price regulations

Where are we at with renewables?

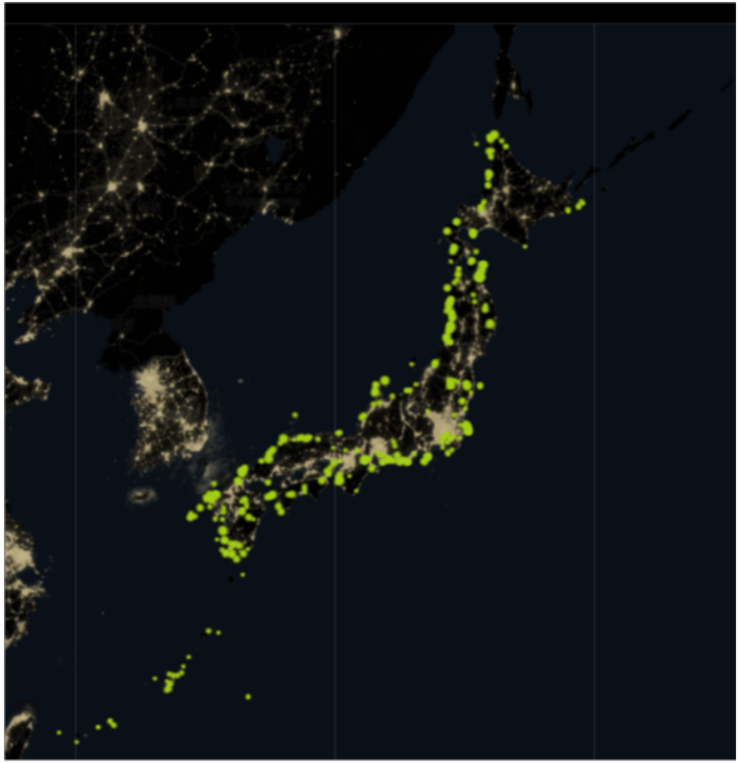
Where are we at with policy?

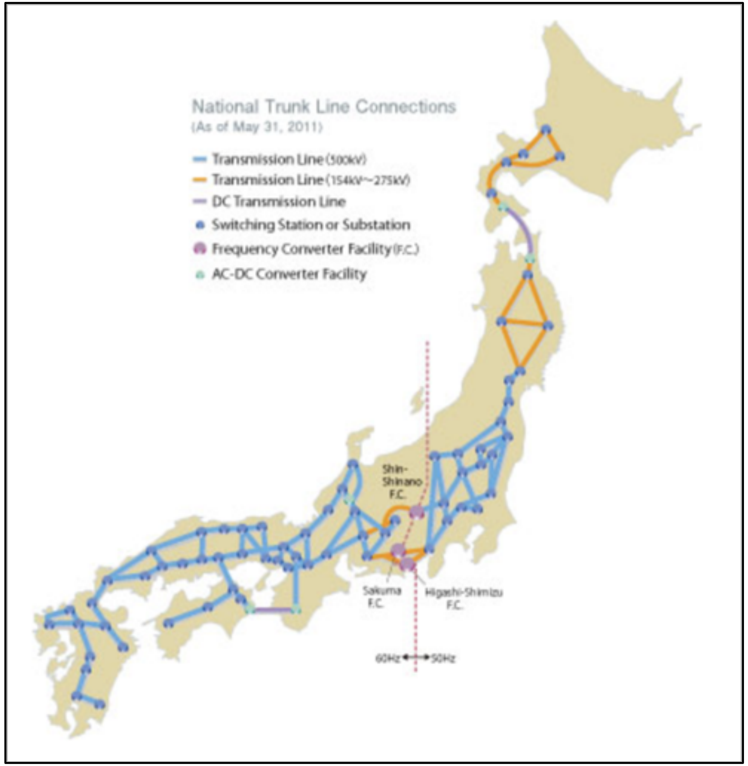
Where are we likely to be going?



As of January 2019
Green: restarted
Orange: applied for restart but no conclusion yet, or not applied for restart
Blue: under construction
Red: decommissioned
Hokkaido
Tomari 1,2,3
Harumi Takahashi
Fukui
Issei Nishikawa
Ohi 3,4 and Takahama 3,4
Mihama 3; Takahama 1,2; and Tsuruga 2
Mihama 1,2; Ohi 1,2; and Tsuruga 1
Niigata
Kashiwazaki-Kariwa 1,2,3,4,5,6,7
Hideyo Hanazumi
Aomori
Higashidori 1 (Tohoku)
Ohma and Higashidori 1 (TEPCO)
Shingo Mimura
Saga
Genkai 3,4
Genkai 2※
Genkai 1
Yoshinori Yamaguchi
Shimane
Shimane 2
Shimane 3
Shimane 1
Zenbe Mizoguchi
Ishikawa
Masanori Tanimoto
Shika 1,2
Miyagi
Onagawa 2,3
Onagawa 1
Yoshihiro Murai
Kagoshima
Satoshi Mitazono
Sendai 1,2
Fukushima
Fukushima Dai-ichi 1,2,3,4,5,6
Fukushima Dai-ni 1,2,3,4
Masao Uchibori
Ehime
Ikata 3
Ikata 1,2
Tokihiro Nakamura
Shizuoka
Hamaoka 3,4,5
Hamaoka 1,2
Heita Kawakatsu
Ibaraki
Kazuhiko Oigawa
Tokai Dai-ni
Tokai Dai-ichi

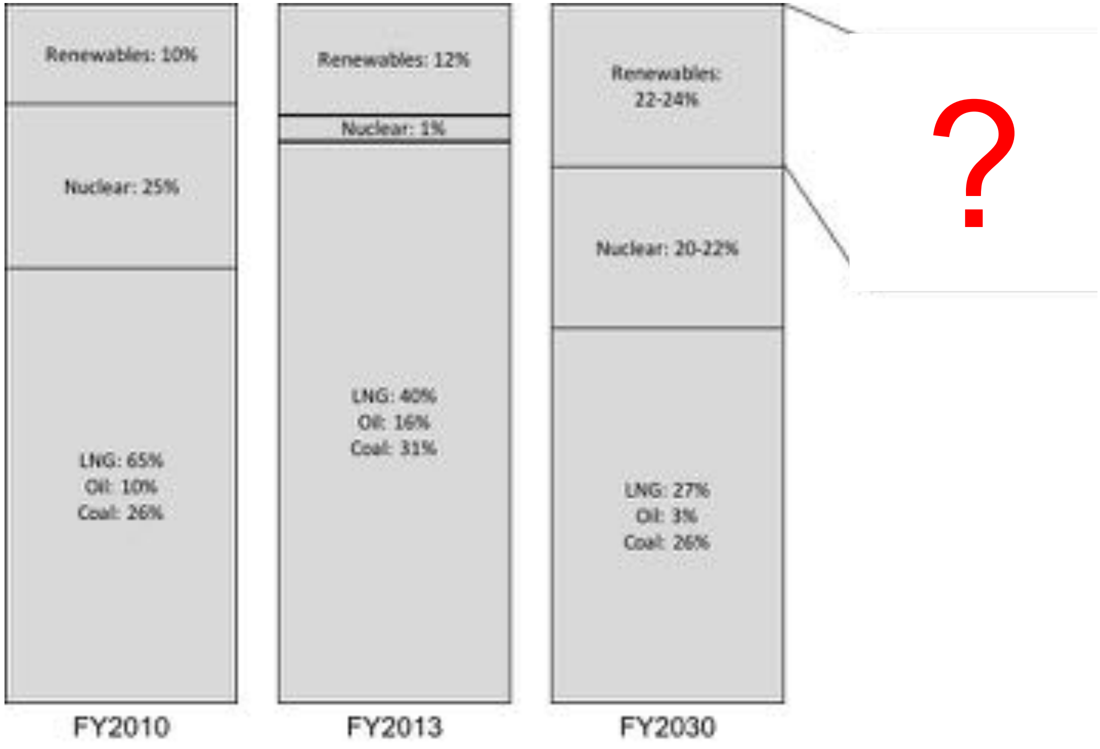
Market Design – Grid Interconnection





Source: FEPC, http://agora.ex.nii.ac.jp/earthquake/201103-eastjapan/energy/electrical-japan/type/7.html.ja

Long Term Energy Supply-Demand Projection



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Business and Politics 2018; 20(4): 467–491

Jonas Meckling* and Llewelyn Hughes

Global interdependence in clean energy transitions

Abstract: The global energy industry is transforming as governments invest in clean energy technologies to address climate change, enhance energy security, and strengthen national competitiveness. Comparative research on clean energy transitions highlights the domestic drivers and constraints of clean energy transitions. This article contends that we need to understand the effects of global interdependence on clean energy transitions. Shifts in forms of interdependence between firms—influenced by the rise of global supply chains—have new implications for policy choices made by governments. Governments face more complex demands from domestic industries facing global economic competition, and act strategically in response to the actions of other governments, including sub-national actors, and firms in the global economy. We suggest that research on interdependence in clean energy transitions benefits from an analytical focus on mechanisms of transnational change such as cross-national and multi-level policy feedback and cross-national policy sequencing. Global interdependence has important implications for economic and environmental outcomes, affecting the durability of competitive advantage, and influencing the pace of the diffusion of clean energy technologies.

Keywords: interdependence, energy transition, industrial policy, business-government relations

NEWSLETTER

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Why Japan Deserves Some Praise on Climate

Japan Chair Platform

Llewelyn Hughes

June 19, 2015

Japan has been on the receiving end of some sharp criticism in the wake of the recent G7 meeting for its stance on climate change. Japanese prime minister Shinzo Abe announced a target of cutting greenhouse gas emissions of 26 percent below 2013 emission levels by 2030, which is equivalent to 18 percent less than 1990 emissions. This falls short of what is needed to keep the risk of catastrophic climate change to reasonable levels.

Despite this, the criticism of Japan is largely unfair. Japan's energy supply remains in turmoil following the Fukushima disaster of March 11, 2011. And regardless of international pledges, all governments face the reality that transforming energy systems takes time and requires overcoming domestic obstacles to change. The truth is that Japan cannot be a pathbreaker on climate change. But by keeping its target within the range of those announced by others, it has ensured that other countries cannot use Japan as an excuse for shirking.

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Recharging Japan's energy policy

10 May 2018

Author: Llewelyn Hughes, ANU

Under the Paris Agreement on climate change the Japanese government committed the country to a reduction in greenhouse gas (GHG) emissions of 25.4 per cent by 2030 compared to 2005. In 2015 Japan's GHG emissions were 5 per cent lower than 2005. But emissions remain 4 per cent higher than in 1990.

Is Japanese energy policy running hard to stand still?

Like many countries, Japan is moving too slowly to cut its GHG emissions. Fuel combustion for power and heat generation represents about one-third of the country's total GHG emissions and coal-fired power is a little under half of this amount. Japan is in the final stages of reviewing its mid-term targets for energy and reports suggest the 2030 targets for the power sector will not be substantially revised.

http://www.eastasiaforum.org/2018/05/10/recharging-japans-energy-policy/