

MS targets: My viewpoint

April 22, 2019

Michinari Hamaguchi

President, Japan Science and Technology Agency



**Japan Science and
Technology Agency**

“There are things we can do for the future.”

Lives of Japanese in 2050

Will traveling to the universe be a reality in 2050?

How about traveling to the deep water or deep underground?

Or will we find a peer Japanese or a house where we least expect it?

Importance of backcasting development

Japanese manufacturing: What is the problem?

The World Economic Forum “Readiness for the Future of Production Report 2018”

- Japan’s strength: **Current manufacturing system infrastructure** (1st)
- Japan’s problems: **Capabilities to change production systems** (16th)
Multi-stakeholder collaboration (20th)
Companies embracing disruptive ideas (42nd)
Female participation in labor force (49th)



Confronted by an aging society and shrinking population, Japan faces **challenging issues** which **require knowledge, technologies, skills, action, and characteristics of individuals and groups** (Challenges related to human capital).

**“New viewpoints in accordance with the changes of the times
are required”
Solution driven
Human-centric
Sustainable
Inclusive**

Source: [Readiness for the Future of Production Report 2018](http://www3.weforum.org/docs/FOP_Readiness_Report_2018.pdf) (http://www3.weforum.org/docs/FOP_Readiness_Report_2018.pdf)

See <https://www.oecd.org/insights/humancapital-thevalueofpeople.htm> for the definition of Human Capital

Sustainability:

In particular, resources which are the lifeblood of our society

- Food production

Simulated meat, insect dishes, ...

- Water resource

Recycled water, ...

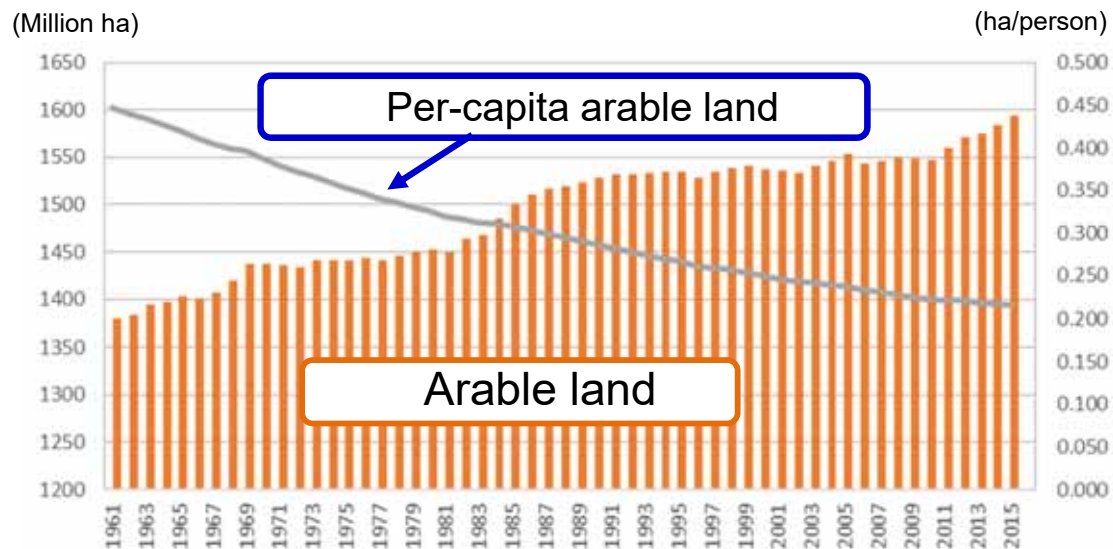
- Energy

Life with lamps and a hearth, ...



1. The current situation facing the world's crop production: Farming limitations/climate change

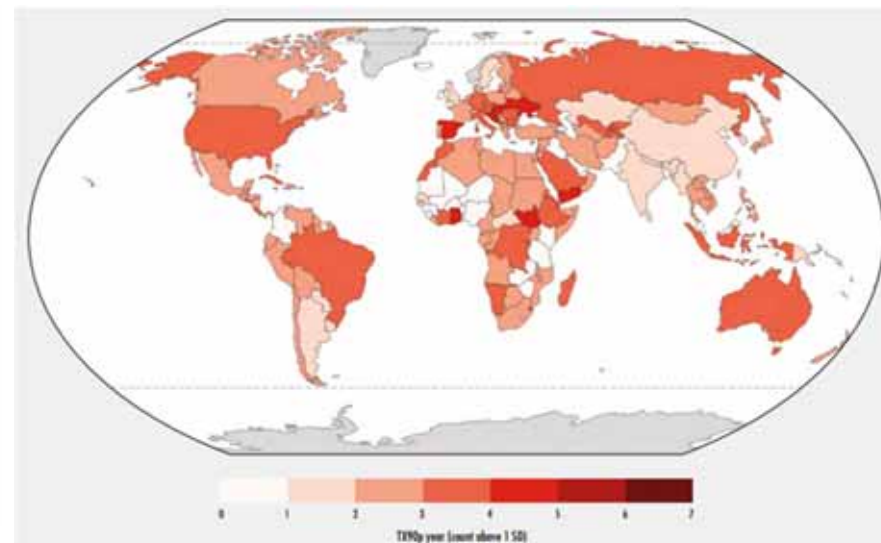
Cultivation of land good for farming is slow



Created by JST based on data from
<http://www.fao.org/faostat/en/#data/RL/visualize>
<https://population.un.org/wpp/>

Rising temperature in crop farming regions

Of the past 25 years (1981-2016), the recent five years (2011-2016) saw extremely high temperatures more often.



Source: <http://www.fao.org/3/I9553EN/i9553en.pdf>

Fig.17 "Number of Years with Frequent Hot Days over Agriculture Cropping Areas"

- Per-capita arable land is steadily declining. Cultivation of land good for farming is behind population growth.
- It is estimated that drought caused by the 2015-2016 El Niño which occurred in Central America was the worst in the preceding 10 year period, causing loss of 50%-90% of the crop yield. (*)

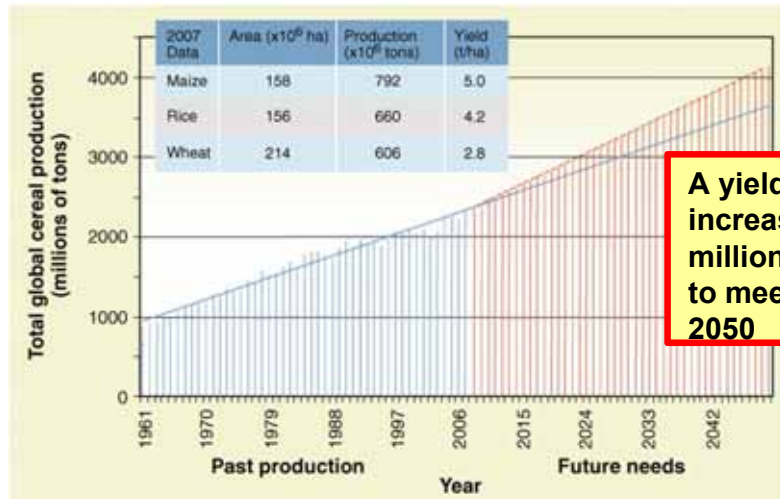


In 2017, 124 million people in 51 countries and regions were at a critical level where prompt and stable supply of food was not available, and the number is on the rise compared to the estimate for 2015 and 2016. (*)

(* FAO, the State of Food Security and Nutrition in the World, 2018 <http://www.fao.org/3/I9553EN/i9553en.pdf>)

2. The current situation facing the world's crop production: Reconciliation between producing crops and using resources

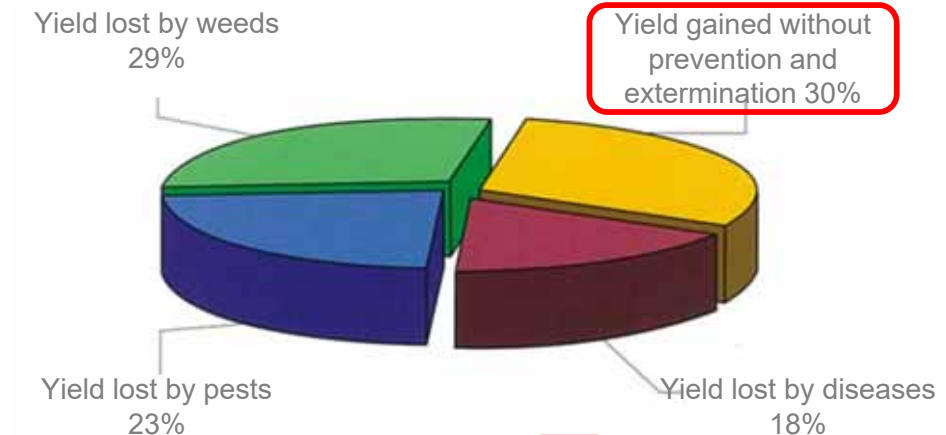
A yield must increase to meet demand



A yield must increase by 500 million tons or more to meet demand in 2050

Source: "Breeding Technologies to Increase Crop Production in a Changing World"
Tester and Langridge, Science(2010), 327 (5967): pp.818-822 Fig.1

Yield loss caused by pests/weeds in the world

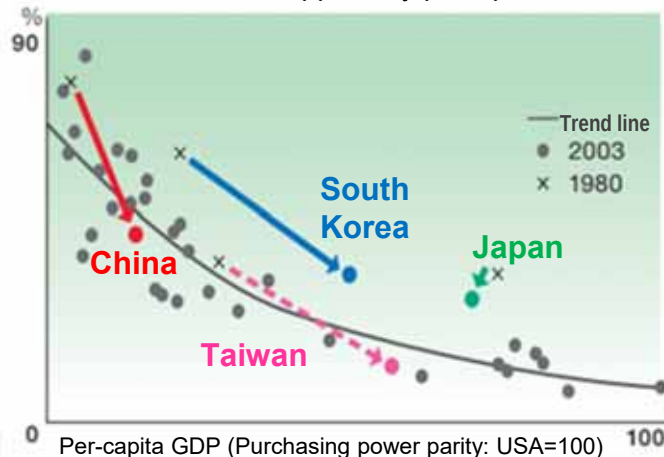


Source: "Loss of crops caused by pests and weeds" A1 the 2008, Japan Plant Protection Association)

Original thesis: [Oerke\(1994\), "Crop Production and Crop Protection -Estimated Losses in Major Food and Cash Crops-"](#)
<https://ci.nii.ac.jp/ncid/BA25242706>
http://www.jppa.or.jp/tecinfo/data/sonsitsu_2008.pdf

Economic development reduces people's dependency on principal food

Figure 1: Relationship between economic development and rate of calorie supplied by principal food



- A yield must increase further more to meet future demand.
- It is said that **70%** of the yield would be lost without controlling weeds, pests, and diseases. Innovation in cultivation management and breeding technology is required.
- People become less dependent on principal food as economy develops. People are shifting to consumption of animal food, production of which requires more resources (Dietary transition). Feed crops must be also produced more.

Crop production must aim for reconciliation with resource consumption in addition to more yield.

Source: "Challenge of dietary transition towards a recycling-oriented society" A3
Kazuhiko Kobayashi, Graduate School of Agricultural and Life Sciences, The University of Tokyo

PR magazine "Yayoi" Spring issue (2009) <http://www.a.u-tokyo.ac.jp/pr-yayoi/48.pdf>

スライド 6

- A1 原文：「病虫害と雑草による農作物の損失」
出典の文献名は暫定訳となっております。ご確認ください。
A5, 2019/05/09
- A3 原文：「循環型社会に向けた食遷移への挑戦」
出典の文献名は暫定訳となっております。ご確認ください。
A5, 2019/05/09

3. The current situation facing use of water resources: Food/population and water

Consumption of water resources in the world

Water consumption and per-capita consumption in the world in 1950 and 1995

	1950		1995		Rate of increase	
	Total (1) (km ³ /year)	Per capita (2) (L/day/p)	Total (3) (km ³ /year)	Per capita (4) (L/day/p)	(3)/(1) (%)	(4)/(2) (%)
Agricultural water	1,124	1,235	2,504	1,231	223	100
Industrial water	182	200	714	351	392	176
Daily life water	53	58	354	174	668	300
Total	1,359	1,493	3,572	1,756	263	118
Population	2.49 billion	-	5.57 billion	-	224	-

Data: I. A. Shiklomanov, Assessment of Water Resources and Water Availability in the World, 1996 (World Meteorological Organization)

Source: Diversity of irrigation in the world Towards sustainable water use and creation of environmentally sound water cycle

(Report by Planning Task Force, Agriculture/Farming Village Development Dept., Farming Village Promotion Subcommittee, Council of Food, Agriculture and Forestry Policies, Ministry of Agriculture, Forestry and Fisheries, March 2003)
http://www.maff.go.jp/j/nousin/keityo/mizu_sigen/pdf/panf02_j.pdf

Abundant water required for production of 1kg of agricultural or livestock products

Product	Water (m ³)
Rice	3.6
Soy beans	2.5
Wheat	2.0
Beef	20.7
Pork	5.9

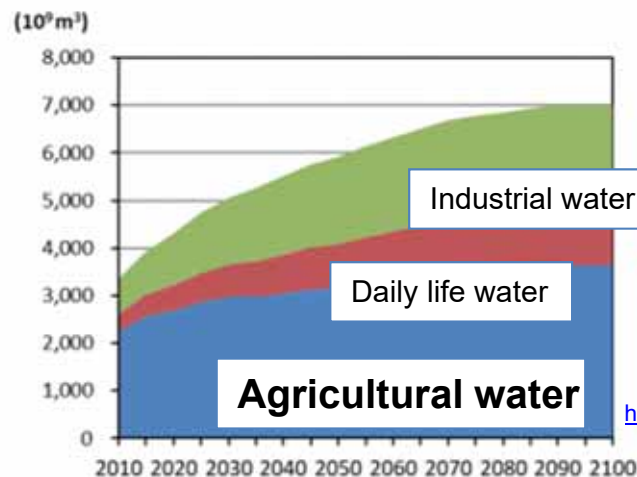
1m³ = 500ml plastic bottles X 2,000

Sources: T. Oki, M. Sato, A. Kawamura, M. Miyake, S. Kanae, and K. Musiake "Virtual water trade to Japan and in the world" *Virtual Water Trade*, Edited by A.Y. Hoekstra, Proceedings of the International Expert Meeting on Virtual Water Trade, Delft, The Netherlands, 12-13 December 2002, Value of Water Research Report Series No.12, 221-235, February 2003.

Created based on the website of Taikan Oki Lab, The University of Tokyo

<http://hydro.iis.u-tokyo.ac.jp/Info/Press200207/#crop>

Estimated amounts of water consumption in the world



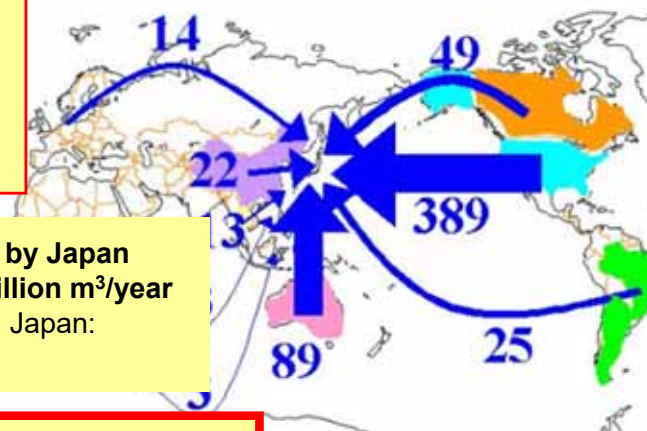
Source: Policy-making proposal towards realization of a low carbon society (Center for Low Carbon Society Strategy, JST, December 2018)
<http://www.jst.go.jp/lcs/pdf/fy2018-pp-02.pdf>

As "virtual water," vast quantities of water come to Japan as agricultural and livestock products are imported

In Japan, we are using a lot of water although indirectly as we import agricultural and livestock products.
→ Japan is closely involved in the issue of water resources.

Others: 33

Virtual water required by Japan
Total import qty: 64 billion m³/year
(Irrigation water used in Japan: 59 billion m³/year)



While available water resources are limited, there are concerns over possible water depletion resulting from increasing demand for agricultural water.

スライド 7

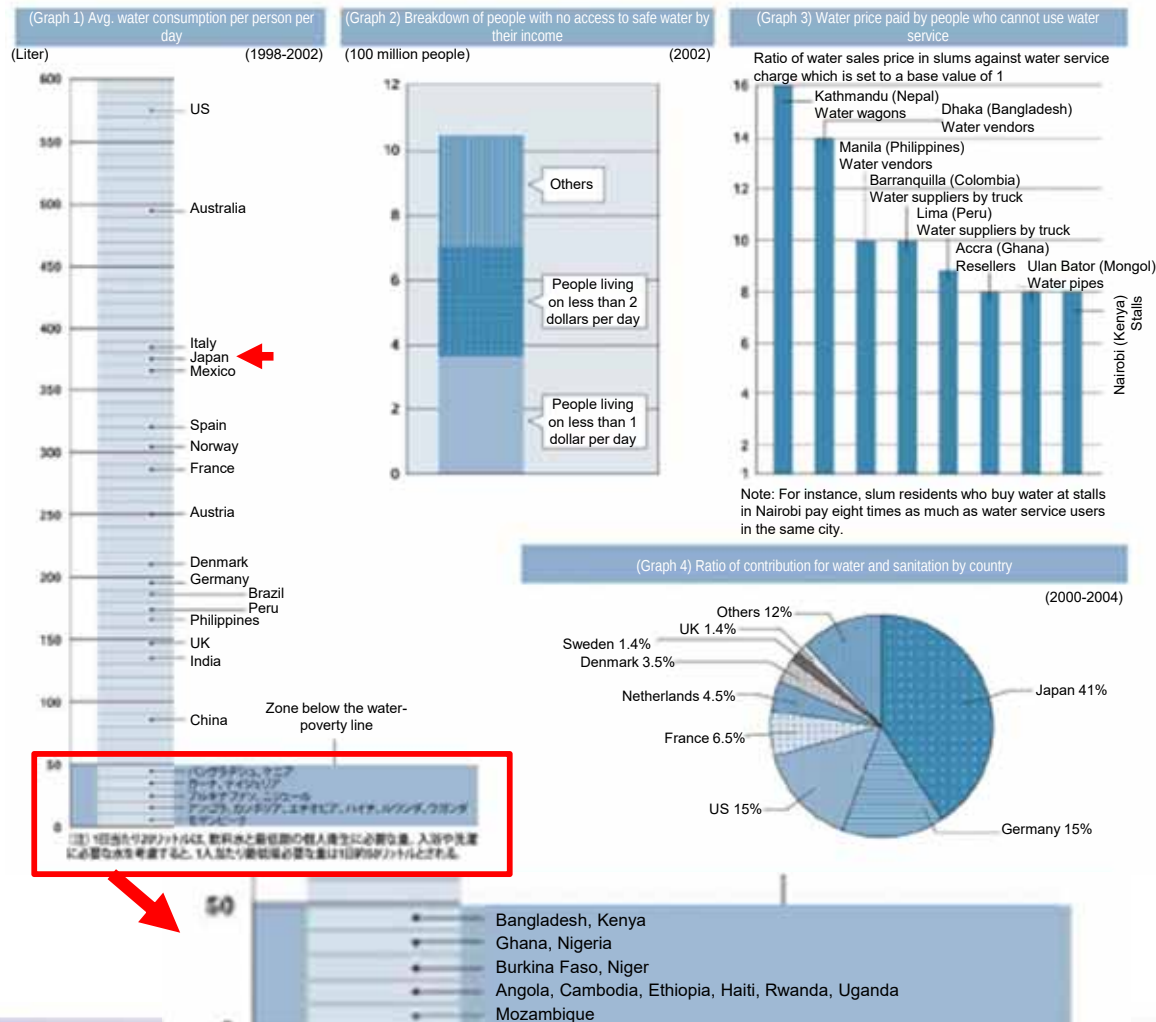
- A4 原文：「低炭素社会の実現に向けた政策立案のための提案書」
出典の文献名は暫定訳となっております。ご確認ください。
A5, 2019/05/09
- A5 原文：「出典：世界のかんがいの多様性 持続的な水利用と健全な水循環の形成に向けて（農林水産省食料・農業・農林政策審議会 農村振興分科会農業農村整備部企画小委員会報,2003年3月）」

出典の文献名、審議会名、報告会名はそれぞれ暫定訳となっております。ご確認ください。
A5, 2019/05/09

4. The current situation facing use of water resources: Use of water and poverty

B Disparity related to water and international cooperation DATA

Source: UNDP "Human Development Report 2006", the website of Ministry of Foreign Affairs (<http://www.mofa.go.jp/>)



Note: Twenty liters of water per day are necessary for drinking and minimal personal hygiene. If bathing and laundry are taken into account, a person needs at least around 50 liters of water per day.

The poor have to pay more for water

According to the World Health Organization (WHO), the United Nations Children's Fund (UNICEF), and other institutions, a person needs to secure at least 20 liters of water per day from a water source within a kilometer from their home. However, there is a wide disparity in water consumption. People who live far from a water source often secure less than five liters of water, way below the minimum requirement. What is worse, their water is not safe. Around two-thirds of people who have no access to safe water are poor people who live on less than two dollars per day. Half of them get by with less than a dollar a day. The poor use less water because they have to carry heavy water for a long distance or because they cannot afford water connection fees. Poor families have no choice but buy water that is not safe at high price from stalls and water vendors in an informal market.

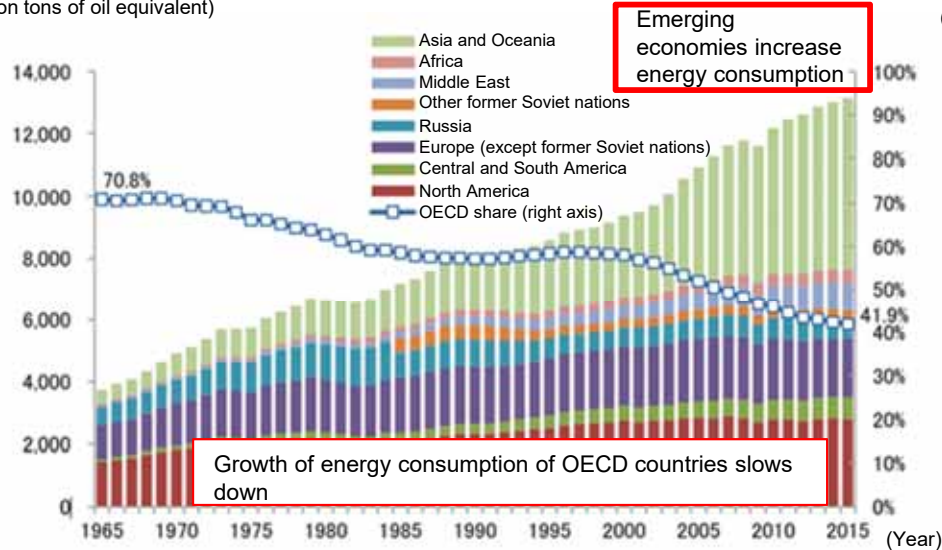
Japan has advocated the access to water for everybody as a human right to sustain life and made a huge contribution so far. More efforts are expected of the international community to get the world on track to achieve MDGs.

Excerpt from JICA material

5. The current situation facing energy consumption: Compatibility with CO2 reduction

Changes in the world's energy consumption

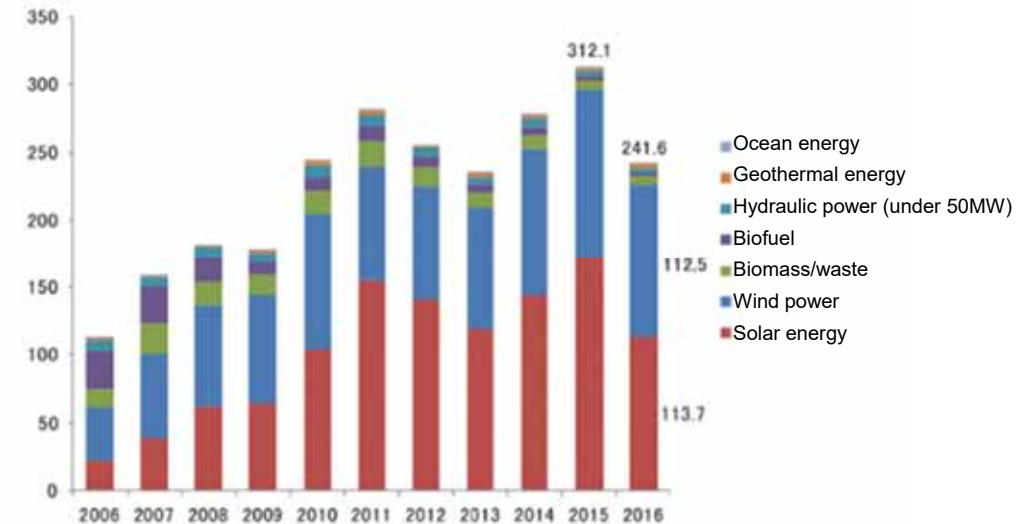
(Million tons of oil equivalent)



Source: 221-1-1, Japan's Energy White Paper 2017, Agency for Natural Resources and Energy. The chart shows primary energy consumption. <https://www.enecho.meti.go.jp/about/whitepaper/2017html/2-2-1.html>

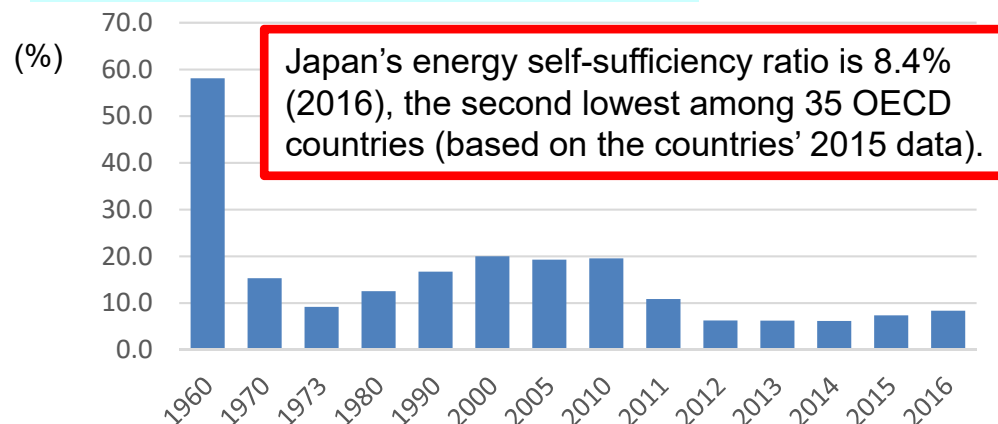
Trend of investment in renewable energies in the world

(Billion USD)



Source: 222-2-10, Japan's Energy White Paper 2018, Agency for Natural Resources and Energy <https://www.enecho.meti.go.jp/about/whitepaper/2018html/2-2-2.html>

Japan's energy self-sufficiency ratio



Source: Created by JST based on data from 211-4-1, Japan's Energy White Paper 2018, Agency for Natural Resources and Energy <https://www.enecho.meti.go.jp/about/whitepaper/2018html/2-1-1.html>

The increase in the use of renewable energies in 2018 resulted in the reduction of CO2 by 215Mt during the same year. The increased use is accounted for mainly by the transition to renewable energies at power plants. A significant contribution by China and Europe.

(IEA, Global Energy and CO2 Status Report <https://www.iea.org/geco/emissions/>)

Technology must be developed which reduces CO2 emissions while meeting increasing energy demand caused by economic development.

Instead of a summary, ...

1) There are things we can do for the future. SDGs & Society5.0



Society 5.0 for SDGs

Keidanren
Policy & Action

Society 5.0 offers a new growth model with a view of "solving social issues" as well as "creating a better future", which **contributes to the achievement of SDGs**



2) All issues are mutually related. Solution-driven research is necessary. Research which clearly presents solutions will create a future