19th FNCA(MLM) Country Report
Current Status of Nuclear Energy in Japan

I) Nuclear Energy-(Power)

1) Strategic Energy Plan and Energy Mix as of 2030
2) Restart of Nuclear Power Plants in Japan
3) Strategic Energy Plan (-relating to Nuclear Fuel Cycle)
4) FUKUSHIMA Up- Date

II) Nuclear Energy-(Application to agriculture)

1) Economic Scale of Radiation Utilization
2) Application to agriculture
3) Recent topic of application (Heavy Ion Beam)

Strategic Energy Plan and Energy Mix as of 2030

Strategic Energy Plan

(Cabinet Decision in July 2018)

I. Nuclear power is an important base-load power source as a low carbon and quasi-domestic energy source, contributing to stability of energy supply-demand structure.

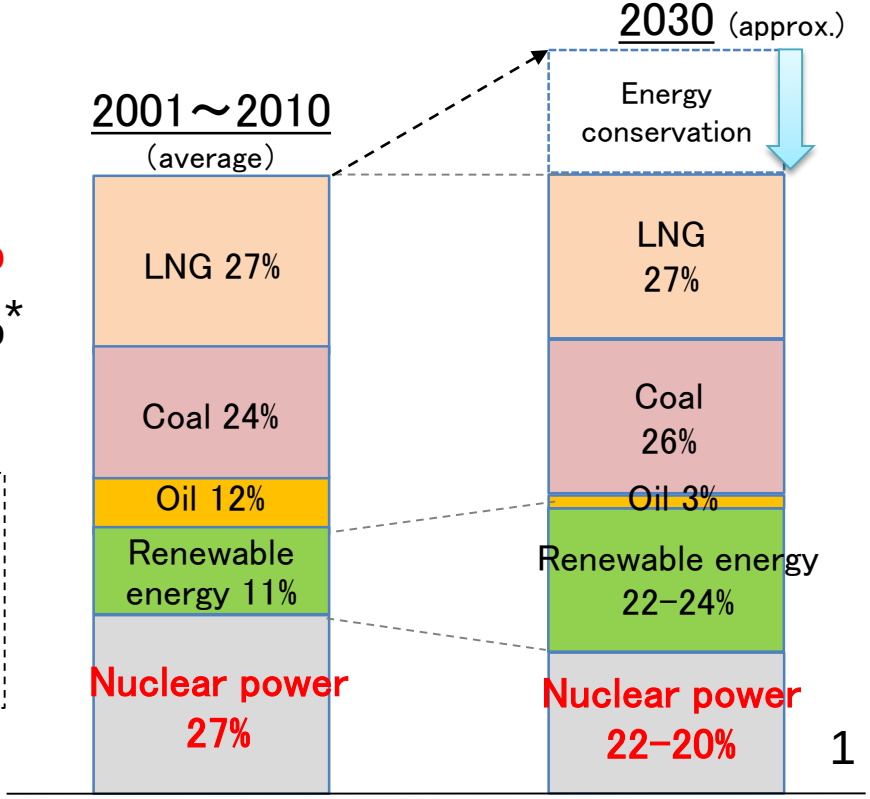
II. Dependency on nuclear power generation will be lowered to the extent possible by energy saving and introducing renewable energy as well as by improving the efficiency of thermal power generation, etc.

III. The basic policy of Japan is to promote a nuclear fuel cycle that reprocesses spent fuels and effectively utilizes the plutonium retrieved, from the viewpoint of effective utilization of resources and reduction of the volume and harmfulness of high-level radioactive waste.

Target of electricity generation

	2010	2013	2016	2030
Nuclear	**29%**	**1%**	**2%**	**20~22%**
Renewable	**10%**	**11%**	**14%**	**22~24%***
Thermal	**61%**	**88%**	**84%**	**56%**

* Geothermal 1.7~4.6 %
Biomass 3.7~4.6 %
Wind 1.7 %
Solar 7.0 %
Hydro 8.8~9.2 %



【Source】extracted (preliminary translation) from documents released in the 11th Long-term Energy Supply and Demand Outlook, Subcommittee, Advisory Committee for Natural Resources and Energy, METI

Restart of Nuclear Power Plants in Japan

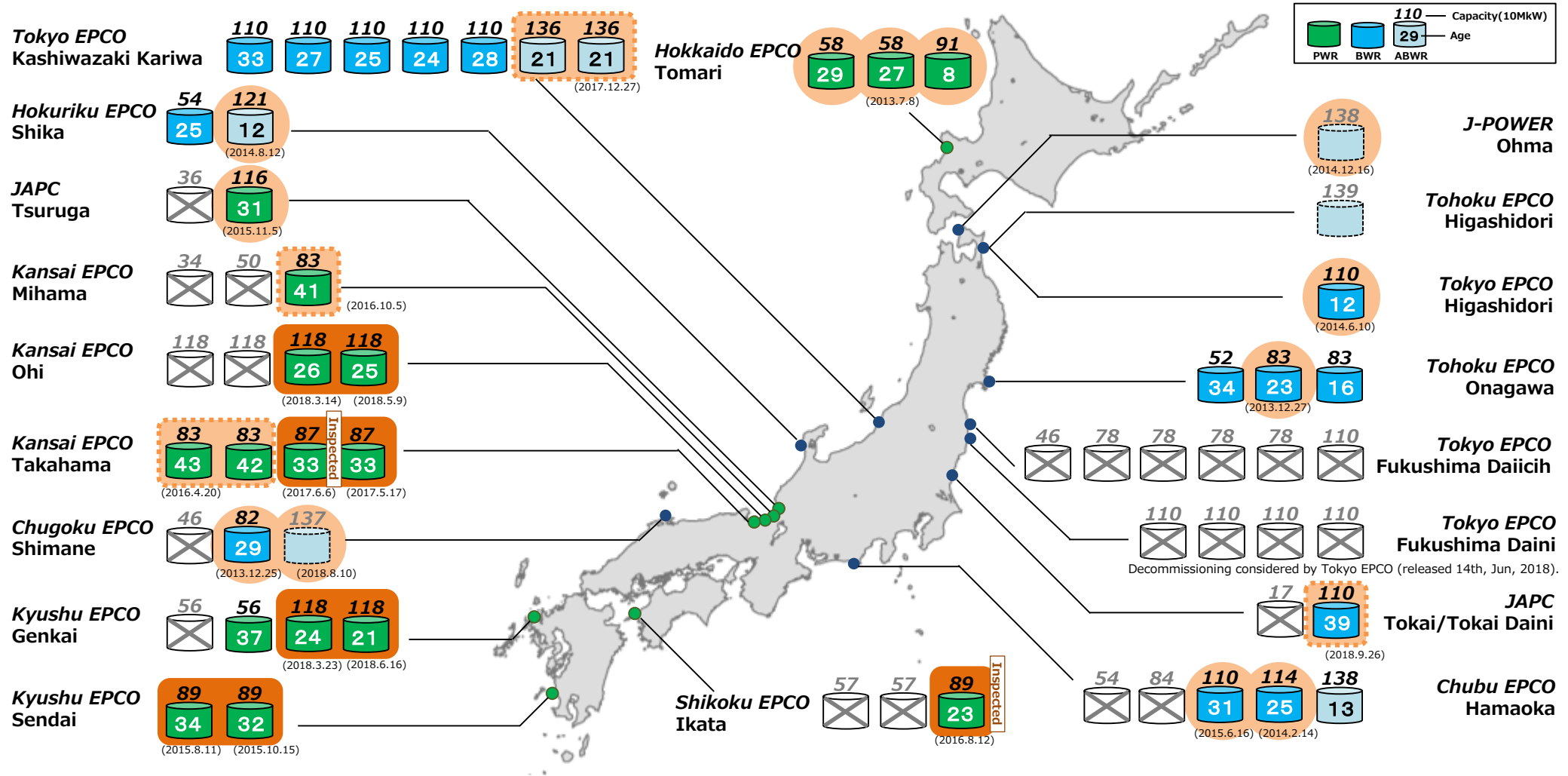
Restarted
9 reactors
(Date of Restart)

In Operation : 7 reactors
Inspected : 2 reactors

Under Safety Construction
Permitted by NRA for Changes in Reactor Installation
6 reactors
(Date of Approval)

Under NRA Review
12 reactors
(Date of Application)

already decided/predicted to
Decommission
22 reactors



Strategic Energy Plan (relevant parts of the Nuclear Fuel Cycle)

Promotion of the nuclear fuel cycle

- The basic policy of Japan is to promote a nuclear fuel cycle that reprocesses spent fuels and effectively utilizes the plutonium etc. retrieved, from the viewpoint of effective utilization of resources and reduction of the volume and harmfulness of high-level radioactive waste.
- Specifically, GOJ will promote plutonium use in LWRs, and proceed with such measures as completion of the Rokkasho Reprocessing Plant, construction of a MOX fuel fabrication plant, and completion of the Mutsu interim storage facility on the underlying premise of ensuring safety.

Plutonium Management

- The Japanese government remains committed to the policy of not possessing plutonium without specific purposes on the premise of peaceful use of plutonium and work to reduce of the size of plutonium stockpile, thereby contributing to nuclear non-proliferation and steadily proceeding with such efforts while gaining international understanding.
- In order to achieve this policy effectively, the government will appropriately manage and utilize plutonium through further promotion of plutonium use in LWRs and the Government's involvement based on the framework of the Spent Nuclear Fuel Reprocessing Implementation Act newly introduced in 2016 while paying due consideration to an appropriate balance between the separation and utilization of plutonium.

R&D of Fast Reactors

- Furthermore, under a roadmap to be developed pursuant to the "New Policy for Fast Reactor Development in Japan" (the decision by the Ministerial Council for Nuclear Power in December 2016), the government will promote R&D of fast reactors through international cooperation with the United States and France.

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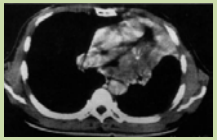
Economic Scale of Radiation Utilization in Japan (2015)

For medical science/treatment

Heavy ion therapy (¥14bn)

Image diagnosis : ¥1,460bn
Radiation oncology : ¥140bn
Breast cancer Therapy:¥20bn

PET･CT Cancer Exar
150M



For Medical Science and Health Care ¥1,910bn (44%)

For agriculture

Mutation Breeding

Germination Control for potatoes

- Food irradiation
- Radiation measurement etc.

For Agriculture ¥240bn (5%)

¥4,370bn

For industry

Equipment/System :
¥390bn

- Accelerator
- Diagnostic X-ray device
- Other radiation devices for

Semiconductor processing
¥1,230bn

For Industry ¥2,220bn (51%)

Radiological sterilization
¥310bn

- Syringes
- Vacuum Blood collection tube
- Artificial Jaw/born

Measurement/Inspection
¥180bn

- Radiological instrument
- NDI

Polymer Processing for Radial Tires etc.
: ¥110bn

The categories radiation technology is applied in agriculture (2015)

Category	Object of the application	Value(in ¥100M)	Ratio
Mutation Breeding	Rice	2,453	88.0%
Mutation Breeding	Soybeans, Wheat, Barley, Enoki-Mashroom, Carnation, Chrysanthemum, Lawn, Pears,Peach	86	3.1%
The use of RI/Radiation Analysis	Radiation Analysis and others	145	5.2%
Pest Control	Melon Fly Eradication (in Okinawa/Amami/Ogasawara Islands)	74	2.6%
Sterilization	Food Packing Materials/Feed for Labo animals	26	0.9%
Food Irradiation	Sprout Control for Potatoes	9	0.3%

91.1%

Ion-beam Mutagenesis

RIKEN Beam Mutagenesis Group
Director
D. Agr. Tomoko Abe

dianthus
Original
'Olivia White Eye'

Heavy ion irradiation

DNA double-strand breaks

Nucleus in plant cell

DNA repair

Mutants

New cultivar

'Olivia Purele White'

Advantages of ion-beam breeding

- **Low dose, high mutation rates, and wide variation**
- **Irradiation treatment can be given to various plant materials**
- **Irradiation time between seconds to a few minutes**
- **The time span for breeding can be shortened to 3 years**

New cultivars developed from ion-beam irradiations

New flower color *Senetti*

Lavender bicolor

New flower color *Torenia*

Summer Splash Yellow

New flower color *Petunia*

Surfinia Pure White

New flower color Cherry blossom

Nishina Zao

Perpetual flowering

Nishina Otome

Saitama Yeast G strain
Saitama Yeast H strain

Dwarf Millet

Nebarikko No.2

Late flowering Edible *Chrysanthemum*

Kiku Meigetsu

Tearless Onion

Smile Ball

RIBF (Radio Isotope Beam Factory) of Institute of Physical and Chemical Research (RIKEN)

Salt-resistant rice in Miyagi prefecture

C-ion irradiation

(Apr. 2011)

Miyagi pref. Furukawa Agricultural Experimental Station

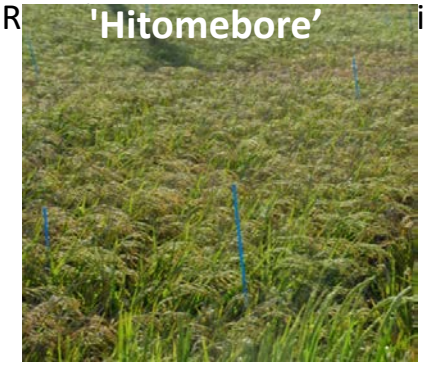
(M_2 seeds harvest at Oct. 2011)

Good taste
Original cultivar in Miyagi pref.

Hitomebore
Manamusume

Selection of the salt-resistant lines in saline paddy field (1/4 sea water concentration)

(R ing at



368 lines X 16plants
=5888 plants

351 lines X 16 plants
=5616plants

Salt-resistant line
Tall, green leaf, filled grain

73 salt-resistant candidate lines (Oct. 2012)
13 salt-resistant lines (Oct. 2013)
4 salt-resistant lines (Oct. 2015)
1 salt-resistant line (Oct. 2016)

	Panicle No./m^2	Grain
Yield (kg/a)		
Manamusume	363	60.7
H1583	414	63.0

Tsunami-affected Paddy field in Ishinomaki

Thank you for your attention