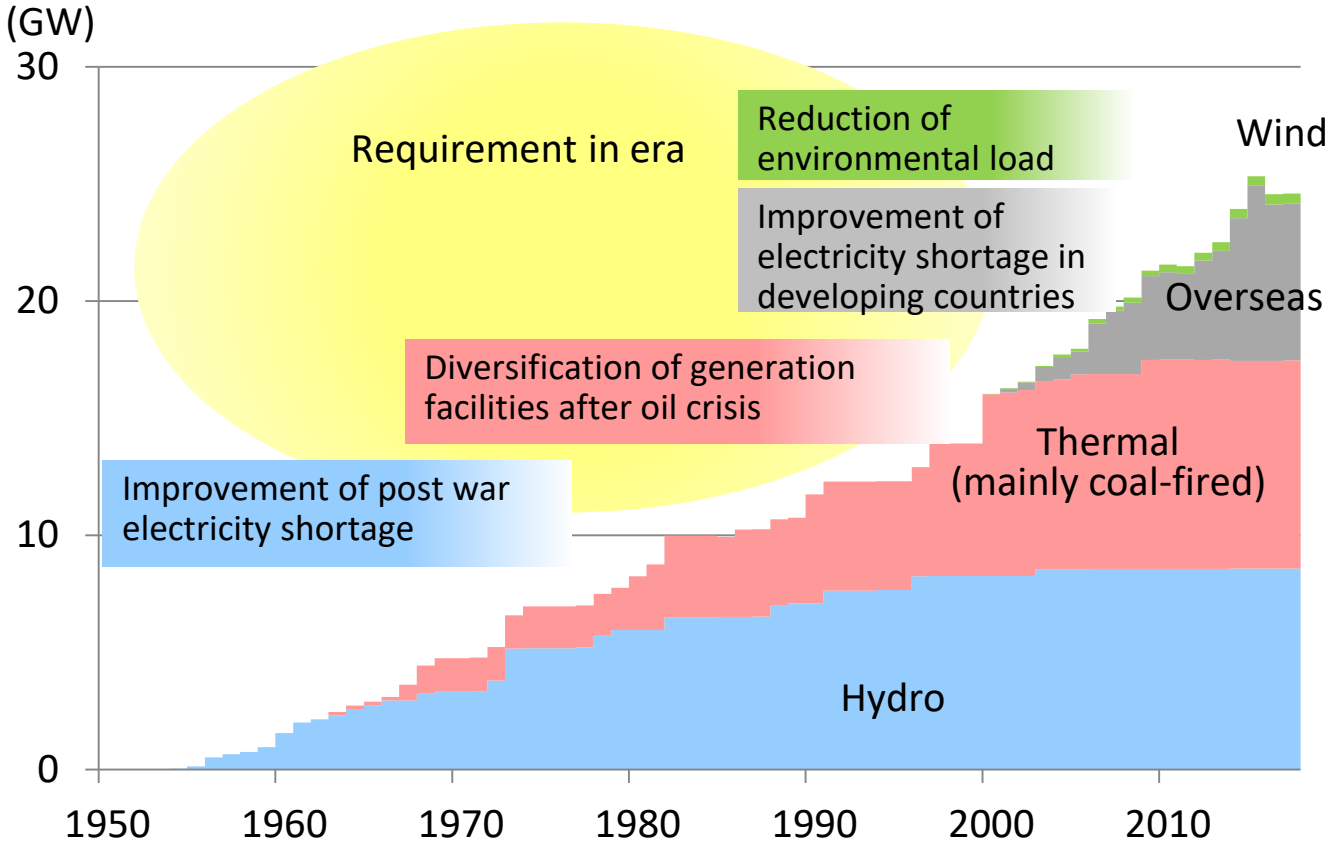
J-POWER’s Challenge for Decarbonization

History of J-POWER's Power Generation Asset Development

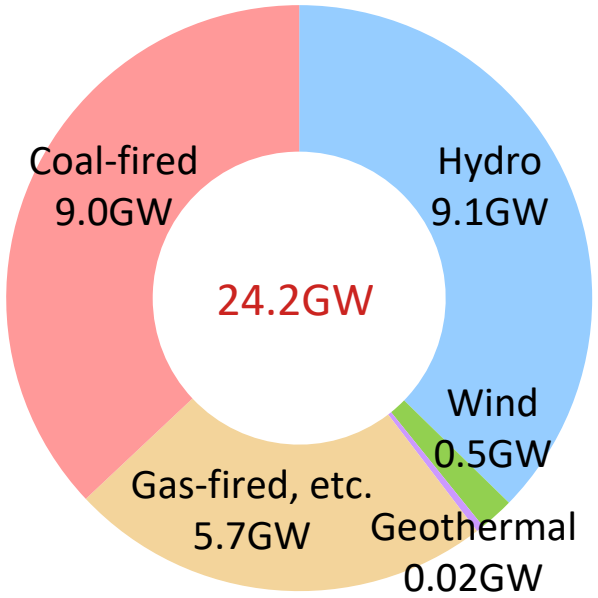
- ✓ J-POWER, based on its corporate philosophy, has developed power generation facilities which suit the social requirement in each era, utilizing cutting edge technologies which mitigate environmental load

Corporate philosophy	Our mission	We will meet people's needs for energy without fail, and play our part for the sustainable development of Japan and the rest of the world
	Our Credo (an extract)	We pursue harmony with the environment, and thrive in the trust of communities where we live and work



Global capacity

As of Jun. 30, 2019



*Capacity shows owned capacity

Aiming for Decarbonization

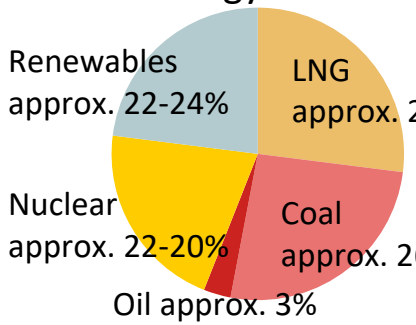
✓ Aiming for further carbon reduction / decarbonization along national policy based on Paris agreement

Paris agreement — Countries set GHG reduction targets, reviewed every 5 years

National policy

2030
GHG reduction by 26%

Energy mix



Renewables mainstreamed

Thermal to be highly efficient

2050
GHG reduction by 80%

Challenge for
energy conversion / decarbonization

- Renewables
- Hydrogen, CCUS
- Nuclear etc.

J-POWER's initiatives

2030
Contribute to achieve intensity target as a member of ELCS* (see page 6)

2050s
Decarbonization of generation by fossil fuel

Expansion of renewable energy
FY2025 Target : New development with 1GW scale

Carbon reduction and decarbonization in coal use

- Development of high-efficiency coal-fired thermal(USC, IGCC)
- Mixed combustion of biomass fuel

→ Develop technologies aiming for zero emissions in the 2050s (CCUS, hydrogen)

Ohma Nuclear Power Plant project

Expansion of renewable energy business overseas

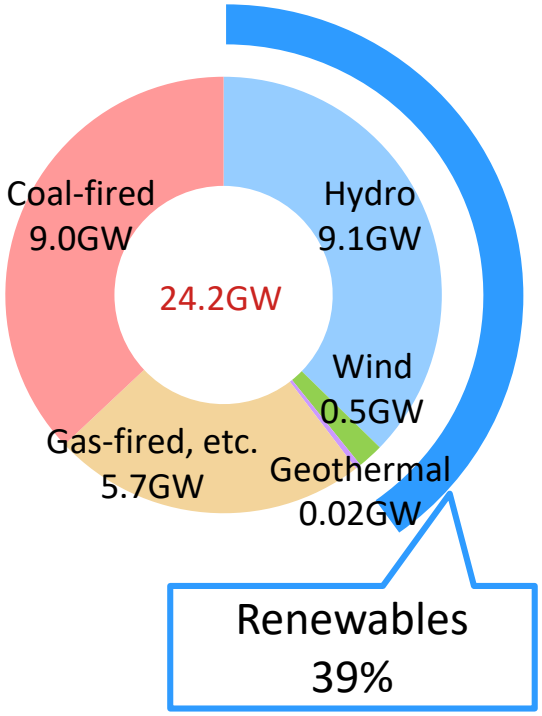
*The Electric Power Council for a Low Carbon Society

Expansion of renewable energy

- With establishing Department of Renewable Energy, contribute to realizing a low-carbon society through renewable energy, as a leader in the business of fully domestically produced and CO_2 free energy
  - Take steps to develop renewable energy capacity such as small- to medium- scale hydroelectric, wind, and geothermal power plants
  - Take steps in technology development aiming for expanding renewable energy
  - Take steps toward long-term stable operation of hydroelectric power plants that will contribute greatly to the stable supply of electricity and reduction of CO_2 emissions

Global capacity

As of Jun. 30, 2019



Expand renewable energy capacity

Hydroelectric

- Increase in capacity through upgrades of major equipment (repowering) at existing plants
- New development of small- to medium- scale hydroelectric plants

Wind

- New development of onshore wind power and steady replacement of existing facilities
- Proceed with offshore wind business

Geothermal

- New development, replacement of existing facilities

FY2025 Target (Renewable energy)

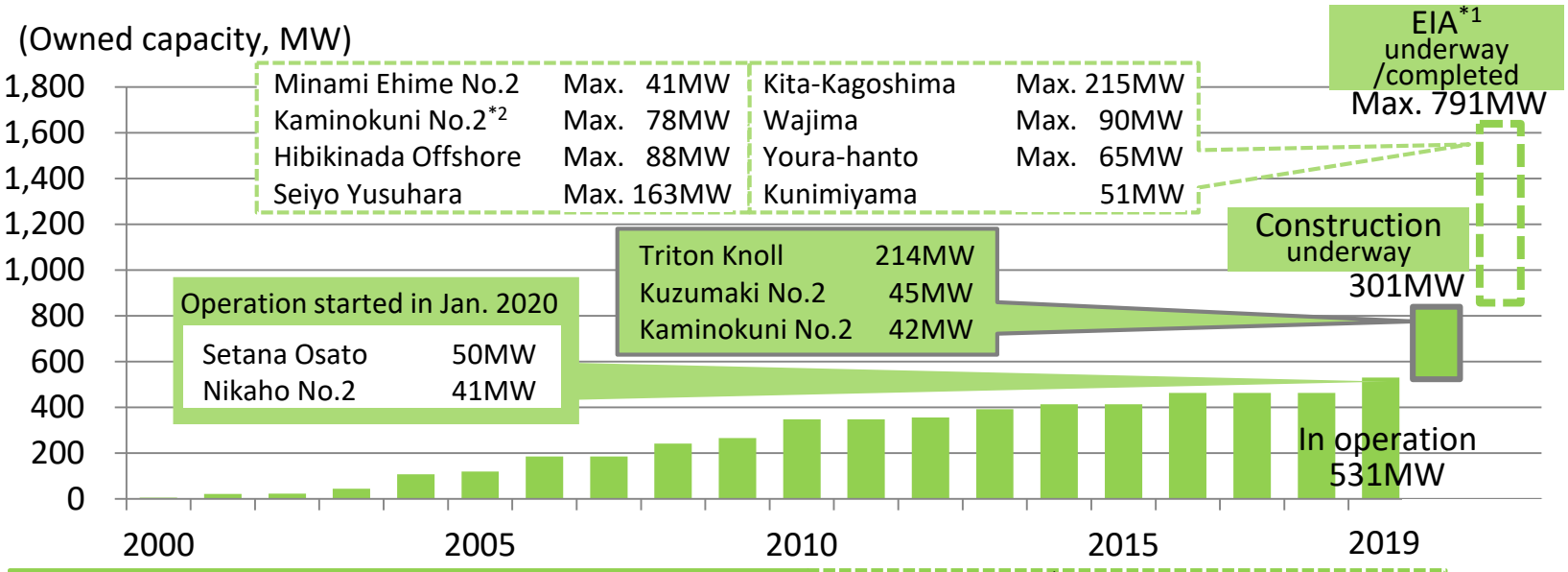
New development with 1GW scale

[Hydroelectric 0.3TWh/year increase*, wind and others 2.5TWh/year increase*]

* Comparison with FY2017

Status of Developing Renewable Energy

Wind



In addition the above, three domestic offshore wind projects outside of port areas are under EIA*1

Saikai Offshore*3	Max. 513MW
Hiyama-area Offshore	Max. 722MW
Awara Offshore*4	Max. 350MW

*1 EIA: Environmental impact assessment *2 Expansion of Kaminokuni No.2 is under consideration
*3 Conducted jointly with SUMITOMO CORPORATION *4 Conducted jointly with Mitsui Fudosan Co., Ltd.

Hydro

Project	Capacity	Note
Shinkatsurazawa/ Kumaoi	21.9MW	Start of operation : FY2022 (planned)
Ashoro Repowering	40.0→42.3MW	Completion of construction : FY2022 (planned)*5

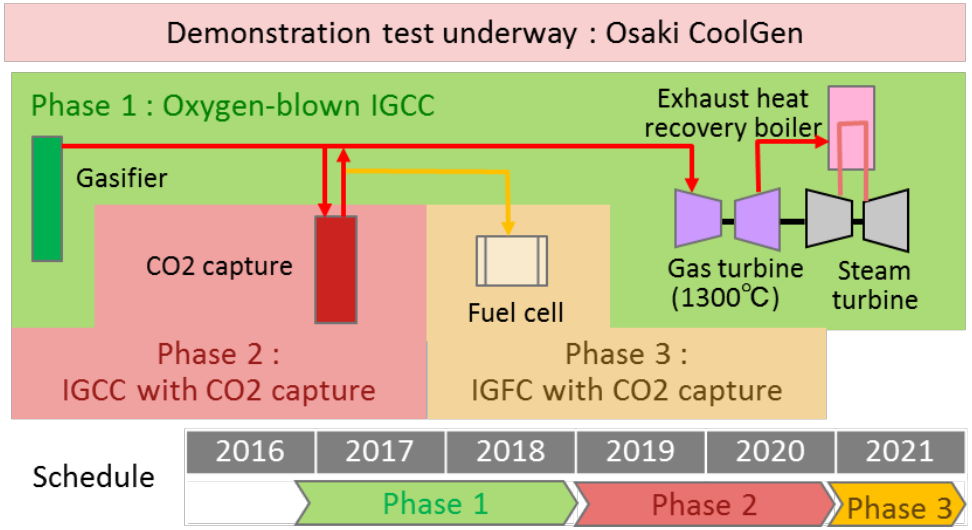
*5 Operation with increased output is planed to start after improvement of nearby grid

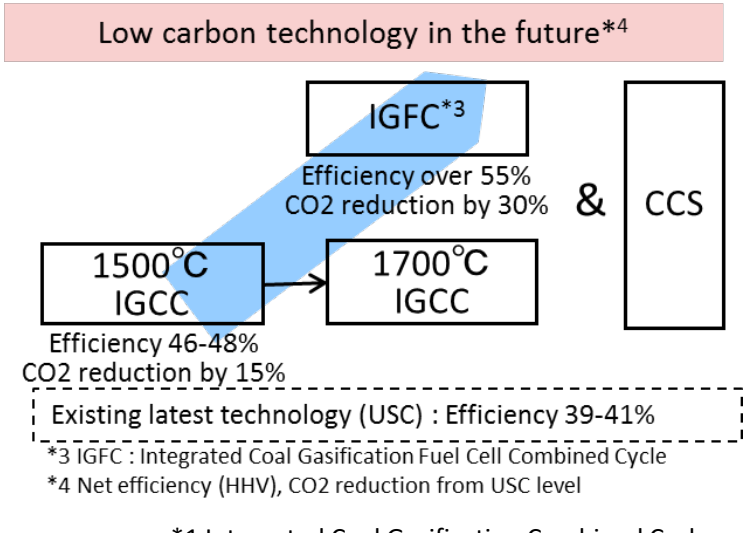
Geo-thermal

Project	Capacity	Equity ratio	Owned capacity	Start of operation
Wasabizawa	46.2MW	50%	23.1MW	Started operation in May 2019
Onikobe Replacement	14.9MW	100%	14.9MW	April 2023 (planned)
Appi	14.9MW	15%	2.2MW	April 2024 (planned)

Challenge for carbon reduction and decarbonization in coal use

- ✓ Contribute to realizing a balanced energy mix through use of coal, a stable energy source that is widely available around the world, while contributing to achieving a low-carbon society through challenges for decarbonization of fossil energy power sources
  - ◆ Develop technologies aiming for zero emissions in the 2050s
    - ➢ Commercialization of oxygen-blown IGCC*1
    - ➢ R&D of CCS*2 (Osaki CoolGen), hydrogen (Brown coal hydrogen demonstration project)
  - ◆ Promote development of high-efficiency coal-fired thermal power
  - ◆ Take steps toward biomass mixed combustion, focusing on wood-based biomass fuel
    - ➢ Continue combustion at existing coal-fired power plants
    - ➢ Aim for a maximum of 10% mixed combustion in Takehara Thermal Power Plant New Unit No.1 (start of operations planned for 2020)





*1 Integrated Coal Gasification Combined Cycle
*2 CO2 Capture and Storage

Ohma Nuclear Power Plant Project

- ✓ Through the use of MOX fuel, play a central role in the nuclear fuel cycle and contribute to energy security
- ✓ Contribute to realizing a low-carbon society as a CO2-free energy source

Overview of the Ohma Nuclear Power Project	
Location	Ohma-machi, Shimokita-gun, Aomori Prefecture
Capacity	1,383MW
Type of nuclear reactor	Advanced Boiling Water Reactor (ABWR)
Fuel	Enriched uranium and uranium-plutonium mixed oxide (MOX)
Start of construction	May, 2008
Start of operation	To be determined
Status	In December 2014, J-POWER submitted to NRA an application for permission for alteration of reactor installment license and an application for construction plan approval in order to undertake review of compliance with the new safety standards

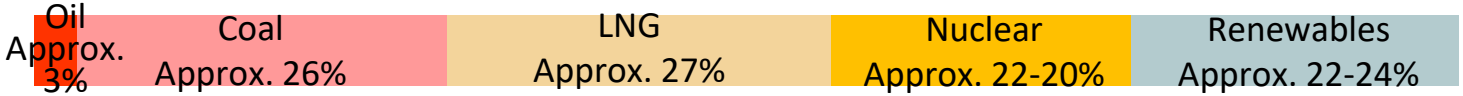
(Reference) Initiatives for CO2 Reduction in Japan

GHG reduction target

- Reducing GHG by 26% in 2030 from 2013 level

Energy mix (Generation type in FY2030)

- Estimating share for each generation type in FY2030 in line with GHG reduction target
- Total thermal efficiency is estimated to be at the same level as high-efficiency generation (coal : USC, LNG : combined cycle)
- Renewables are mainstreamed



	Generators	Grid operators	Retailors
Voluntary initiative	Commitment to a low carbon society on electricity business (J-POWER is joining) ➢ Electricity business companies as a whole* aim for the carbon intensity in line with the energy mix (0.37kg-CO2/kWh at user's end in FY2030) *Covering over 99% of total electricity sales in Japan when this commitment was drew up in 2015		
Policy measures	Energy conservation act ➢ Newly built thermal power must employ highest efficiency technology that is already in commercial operation ➢ Each generator must aim for achieving high efficiency premised in the energy mix		Energy supply structure enhancement act ➢ Each retailor must aim for over 44% in terms of non-fossil power ratio in FY2030, the same level estimated in the energy mix