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Renewable Energy Update: Japan

Institute of Energy Economics Japan (IEEJ)

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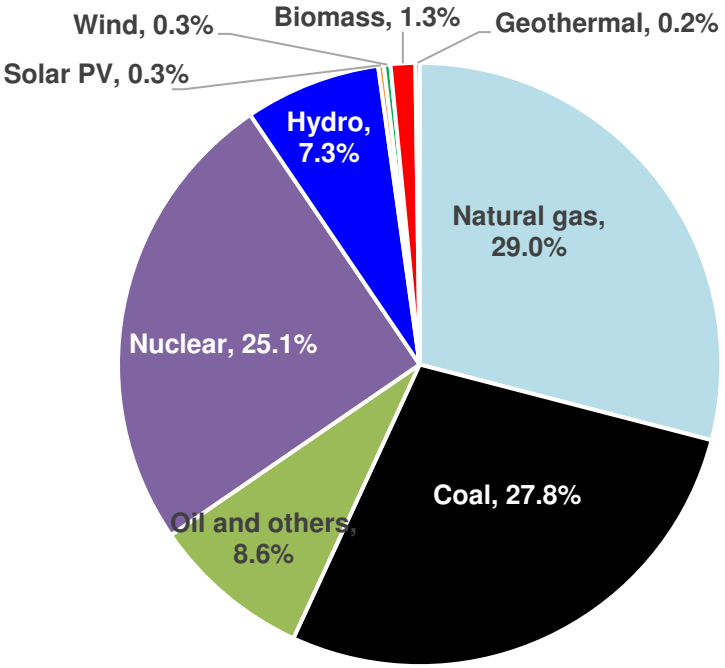
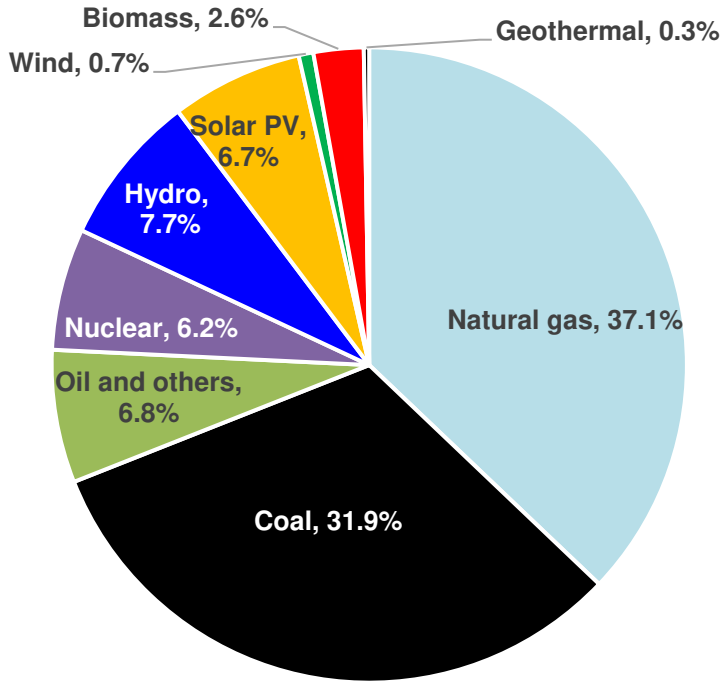
Renewable energy accounted for 18.0% of total power generation in Japan in FY 2019: Almost doubled compared to FY 2010

- Renewable energy accounted for 18.0% of total power generation of 1,028 TWh in Japan in FY 2019: Almost doubuled compared to the 9.5% of FY 2010 of 1,151 TWh
  - Solar massively increased by 6.4%points, while others far less growth or flat: Biomass 1.3%, wind 0.4%, hydro 0.4%, geothermal 0.1%points
  - The share of renewabls is expected to be around 20% in FY 2020, more than doubled compared to FY 2010

FY 2010 power generation in Japan (1,150 TWh)
(Renewables share 9.5%)



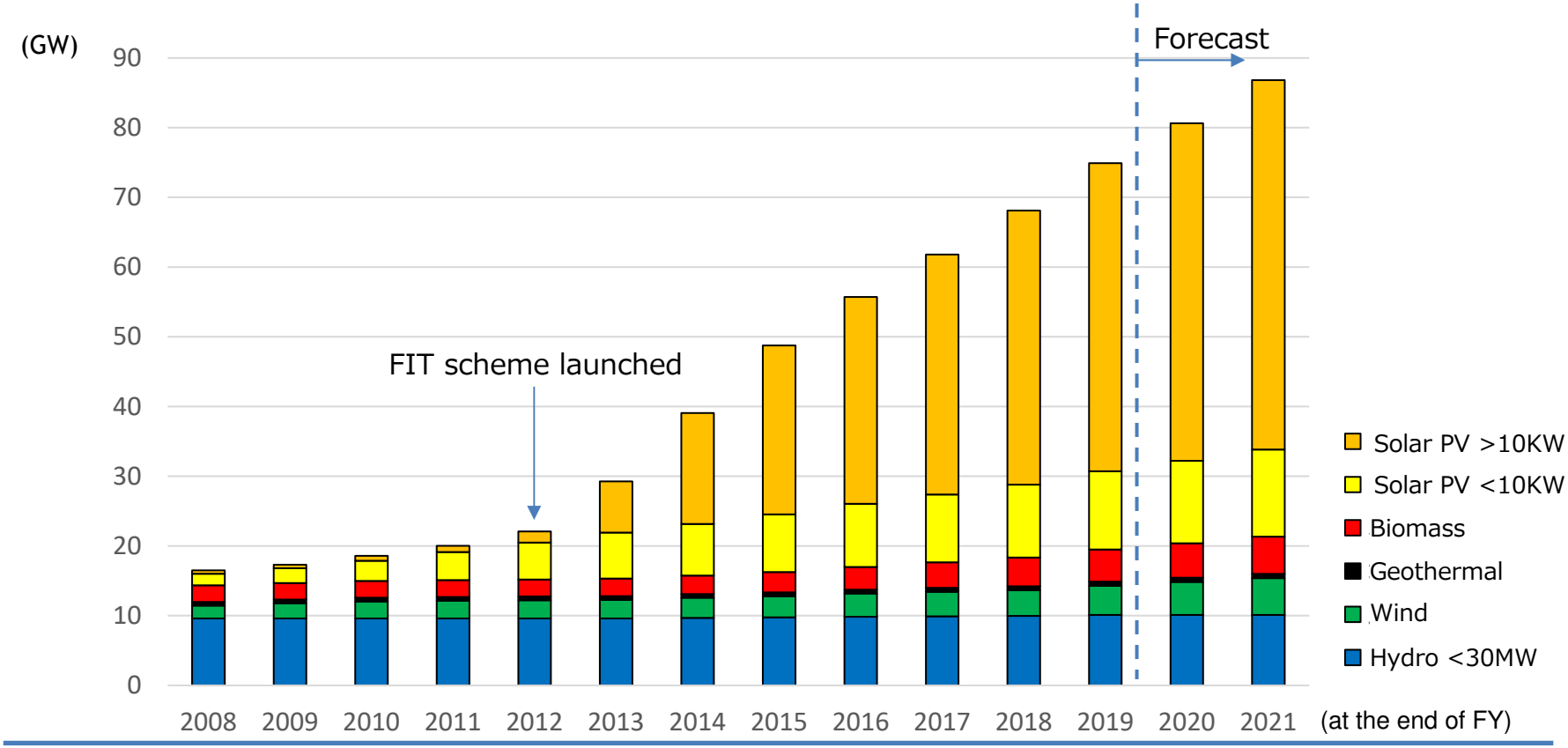
FY 2019 power generation in Japan (1,028 TWh)
(Renewables share 18.0%)



Source: Prepared based on data from the *General Energy Statistics of Japan 2020*

Cumulative renewable power generation capacity in Japan (2008-2021): A massive increase in solar PV, but others far less…

- Renewable capacity (excl. large hydro > 30 MW) increased from 19GW in 2010 to 76GW in 2019 by more than 4-fold with an average growth rate of 16% p.a.
  - More than 90% of the growth was dominated by solar PV increasing from 3.6GW in 2010 to 57GW in 2019 by 15-fold
  - In contrast to solar PV, other renewables, namely wind, biomass, geothermal and hydro increased by very little fraction

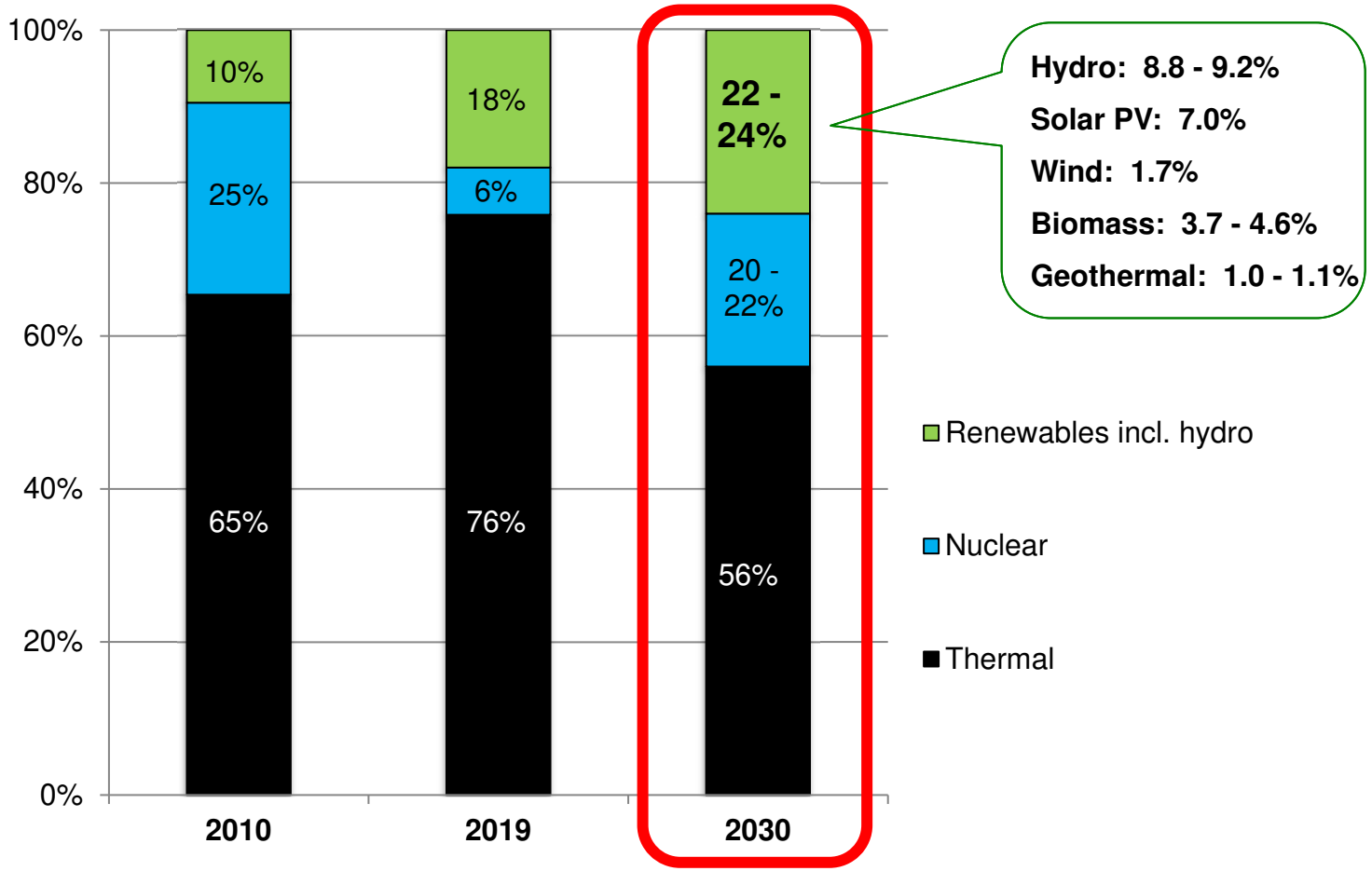


*Solar PV is measured in AC capacity

Source: Estimates from Institute of Energy Economics Japan

Current target of renewables by 2030: 22-24% of power generation

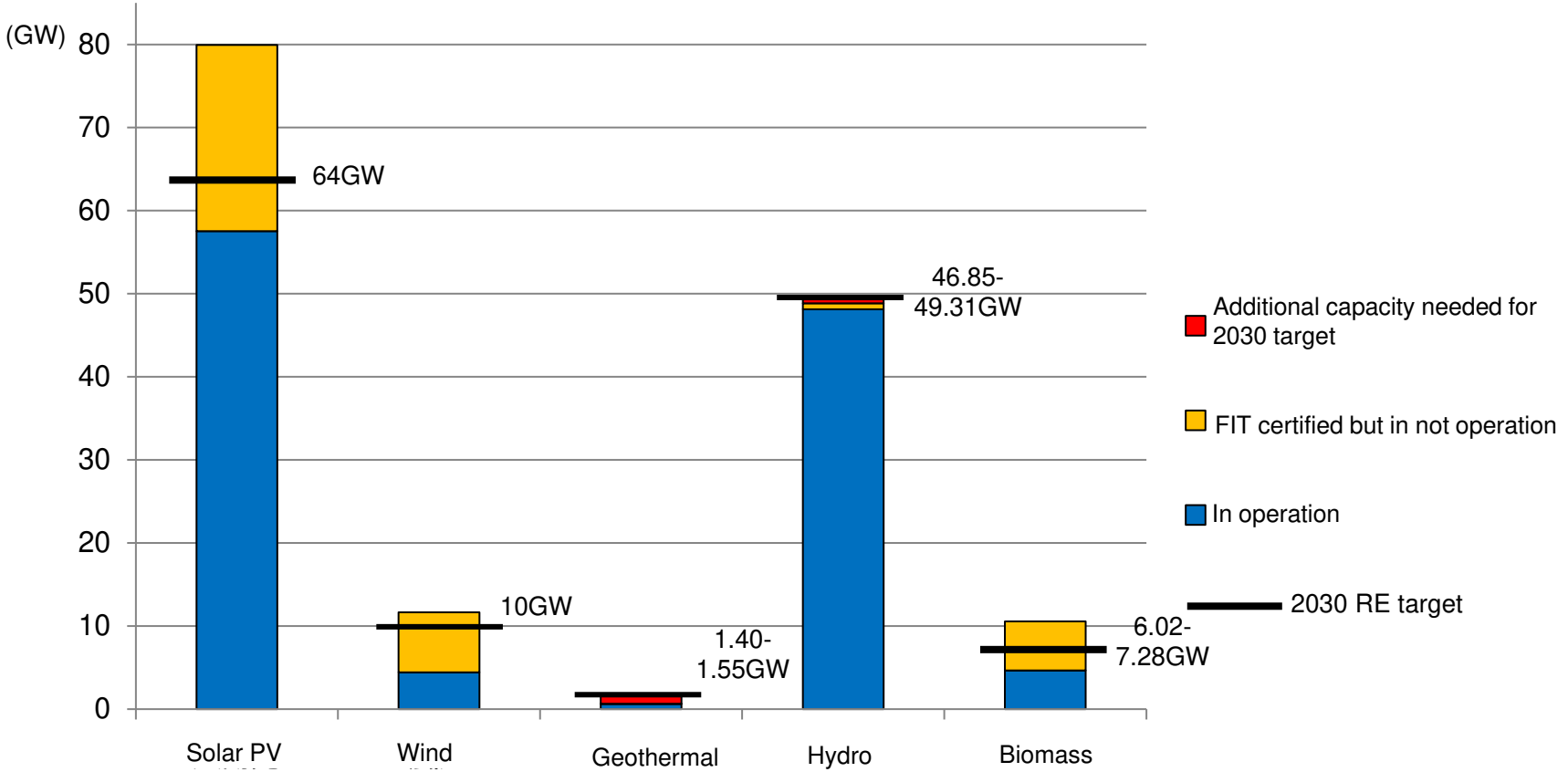
- The curent target of renewables is set at 22-24% of total power generation in 2030
  - This 2030 RE target is likely to be revised upward substantially corresponding to the newly declared 46% GHG reduction target by 2030



Present status of renewable capacity against the current 2030 target

(as of June 2020, incl. large hydro > 30 MW)

- Overall, the renewable capacity has steadily increased toward the 2030 target though the progress varies between individual RE resource
  - Solar PV is expected to reach the 2030 target within a few years time
  - When including the capacity of FIT certified projects, wind and biomass are well over the 2030 target; Only geothermal is falling short of the 2030 target.



*Solar PV is measured in AC capacity

Source:Estimates from Institute of Energy Economics Japan

The 2050 Carbon Neutral declaration in October 2020

- Prime Minister Suga declared Japan's intention to aim for net-zero GHG emissions by 2050

"We hereby declare that by 2050 Japan will aim to reduce greenhouse gas emissions to net-zero, that is, to realize a carbon-neutral, decarbonized society"

- In order to bring about a transformation of industrial structures toward net-zero GHG emissions, Japanese government formulated "Green Growth strategy" indicating specific 14 growth sectors in December 2020

Green Growth Strategy: 14 Growth Sectors to realise 2050 carbon neutral

Energy

Offshore wind power
Wind turbines, parts,
floating wind turbines

Fuel ammonia
Combustion burner
(as fuel in transition period
to hydrogen-powered society)

Hydrogen
Turbines for power generation,
hydrogen reduction steel-making, carrier ships,
water electrolyzers

Nuclear power
SMR (Small Modular Reactor),
nuclear power for hydrogen production

Transport/Manufacturing

Mobility and battery
EV (electric vehicle),
FCV (fuel cell vehicle),
next generation batteries

Semiconductor and ICT
Data centers,
energy-saving semiconductors
(demand-side efficiency)

Maritime
Fuel-cell ships, electric propulsion ships,
gas-fueled ships

Logistics, people flow and infrastructure
Smart transportation, drones for logistics,
fuel-cell construction machinery

Foods, agriculture, forestry and fisheries
Smart-agriculture, wooden skyscrapers,
blue carbon

Aviation
Hybrid electric, Hydrogen-powered
Aircraft

Carbon Recycling
Concrete, biofuel, plastic materials

Home/ Office

**Housing and building,
Next generation PV**
(perovskite solar cell)

Resource circulation
Biomaterials,
recycled materials,
waste power generation

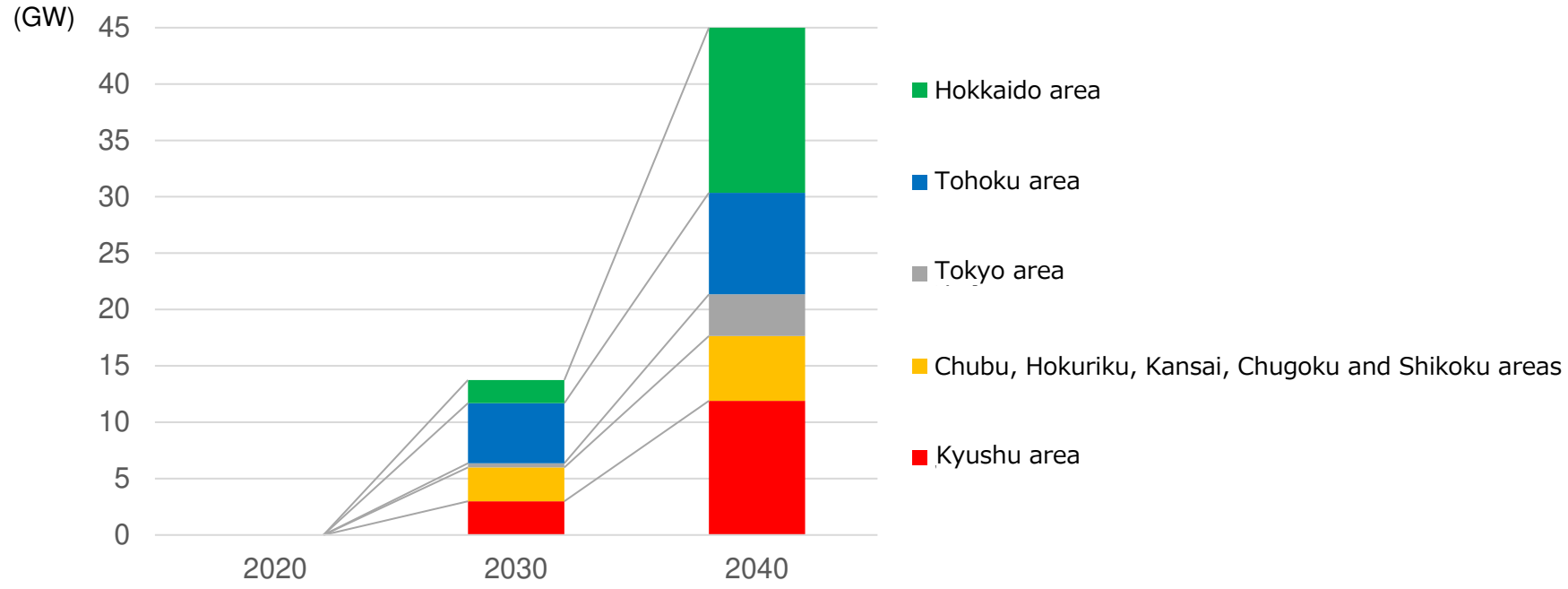
Lifestyle-related industry
Local decarbonization business

Sectors directly related to renewables

Offshore wind capacity target: 30–45 GW by 2040

- Offshore wind capacity targets are set at 10GW by 2030, 30–45 GW by 2040: A massive increase
- Main challenges: costs, create domestic supply chains and expansion/strengthen of power grid
  - Targeted cost is JPY 8–9 (appx. 9-10 US cent) /kWh for fixed-foundation type by 2030-35
  - Japan needs a competitive domestic supply chain as it currently relies on other countries for almost all materials and equipment needed to build offshore wind facilities
  - Transmission lines must be expanded/strengthened that connect the remote areas such as Hokkaido, Tohoku and others favourable for wind power to Tokyo and other higher demand areas (also considering HVDC power transmission)

Offshore wind capacity developemnt by local areas in Japan (max. capacity with permits granted by 2030 and 2040)



Source: Prepared based on the Offshore Wind Industry Vision (first draft) (15 December 2020)

Basic Hydrogen Strategy

- Basic Hydrogen Strategy (2017) : World's first national strategy as of 2017
  - 2050 Vision: position Hydrogen as a new energy option following renewables
  - Target: making Hydrogen affordable ($3/kg by 2030 → $2/kg by 2050)

- Conditions for realising affordable hydrogen
  - Supply side: lower cost production utilising renewables and unused resources, forming large scale hydrogen supply chain
  - Demand side: Mass usage, beginning with mobility sector then expanding to power generation and finally industrial sector

- Key technologies to be developed
  - Production: Electrolysis, gasification + CCS
  - Transportation: Energy carrier such as LH2, MCH, NH3 and others
  - Usage: Fuel cells in mobility and power generation, hydrogen-fired Generation

- The Strategy is also likely to be revised corresponding to the 2050 carbon neutral target