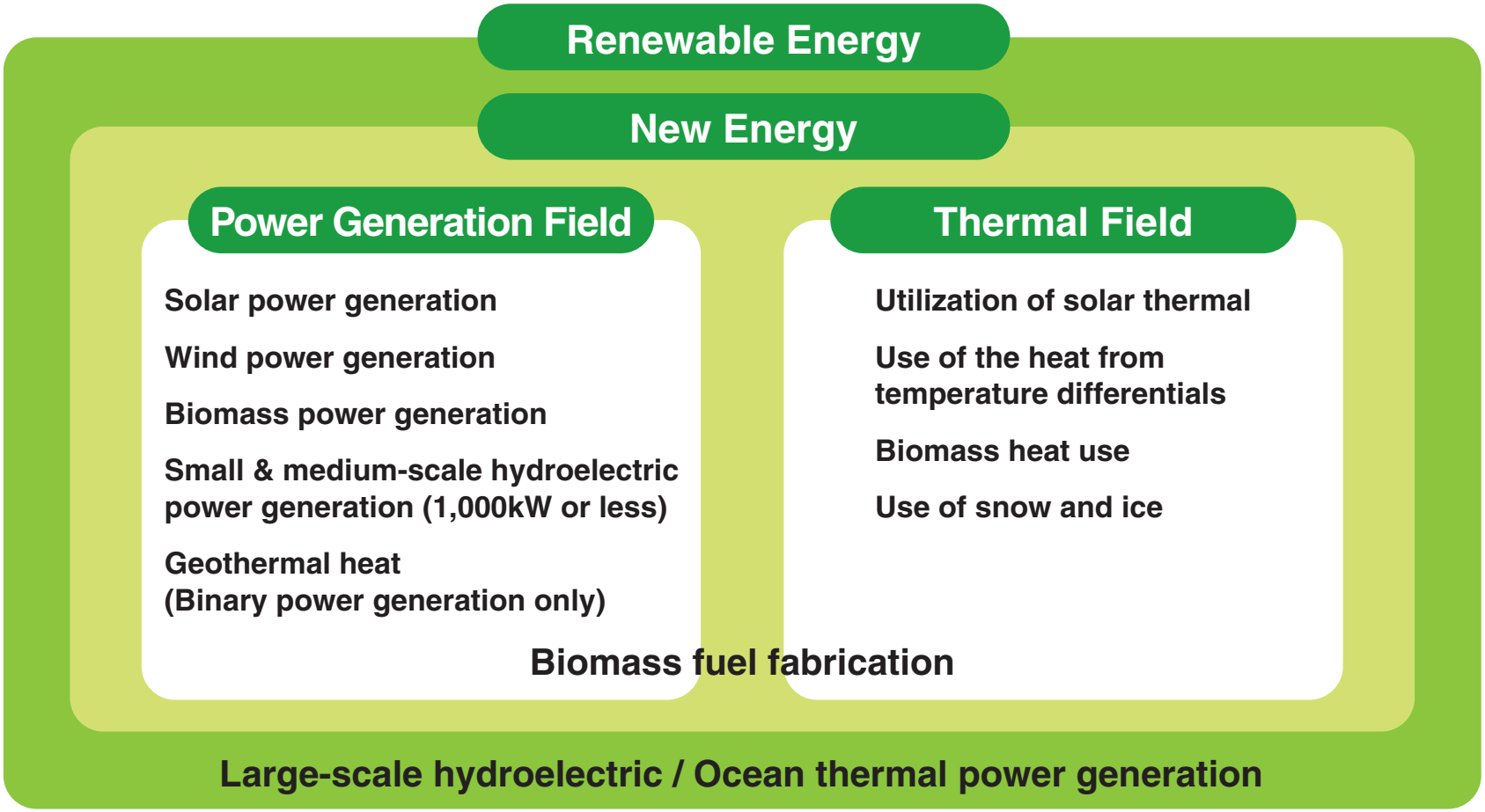
What is New Energy?

"New Energy" is defined under Japanese law* as "something that has reached the stage of being capable of implementation on a technical level, but has not been deployed fully due to economic restraints, and something that is particularly required to introduce a form of energy to replace oil. Currently, 10 types have been specified, including solar and wind power generation, bio-mass, and more.



*Act on Special Measures for the Promotion of New Energy Use, abbreviated as New Energy Act

Source: Agency for Natural Resources and Energy website

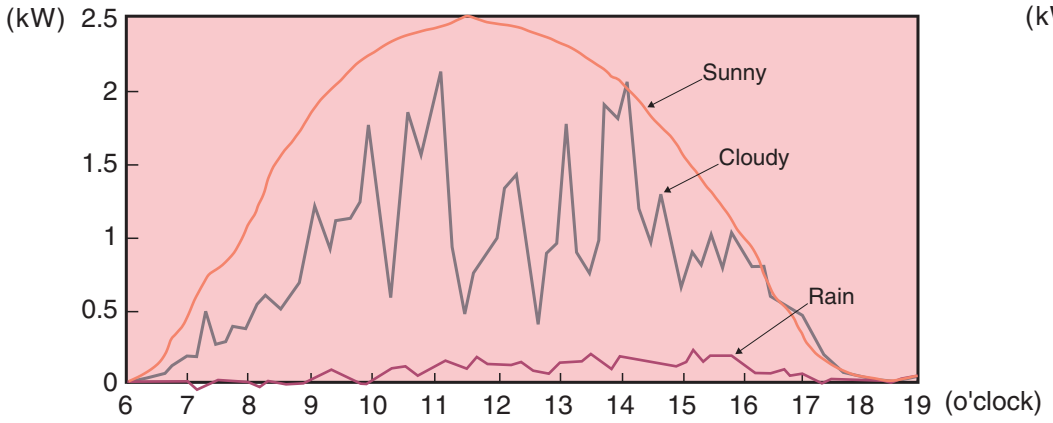
Evaluation & Problems of New Energy

	Solar Power	Wind Power	Waste Power (Biomass Power)
Merits	○No fear of exhaustion ○Emits no CO_2 or other gases in the process of power generation ○Due to neighboring the demand area, there is no transmission loss ○Generate at daytime when the demand rises	○No fear of exhaustion ○Emits no CO_2 or other gases in the process of power generation	○No additional CO_2 emission by power generation ○Continuously supplied stable power source among new energies
Demerits	○Due to low energy density※1, it needs much larger area than thermal and nuclear power generation for the same amount of power generation ○Unstable due to no generation at night and low power output in rainy or cloudy days ○High costs on facilities	○Due to low energy density, it needs much larger area than thermal and nuclear power generation for the same amount of power generation ○Unstable due to occasional and seasonal volatility in wind directions and speed ○Makes noises when windmills rotate ○Locations where the wind situation is good are unevenly distributed ○High costs on facilities	○Low generation efficiency ○Needs further environmental burden reduction measures such as dioxin emission control measures and ash reduction
Necessary Site Area※2	To substitute for a 1,000MW-class nuclear power plant		
	Approx. 58 km^2, almost the same as the area inside the Yamanote Line (Tokyo Loop Line)	Approx. 214 km^2, approx. 3.4 times larger than the area inside the Yamanote Line	
Load Factor	12%	20%	

※1 Energy density: the amount of power generation possible per the size of the space (area) used to generate it, expressed as a number.
※2 Figures from the Study Group on Low Carbon Power Supply System (July 2008)

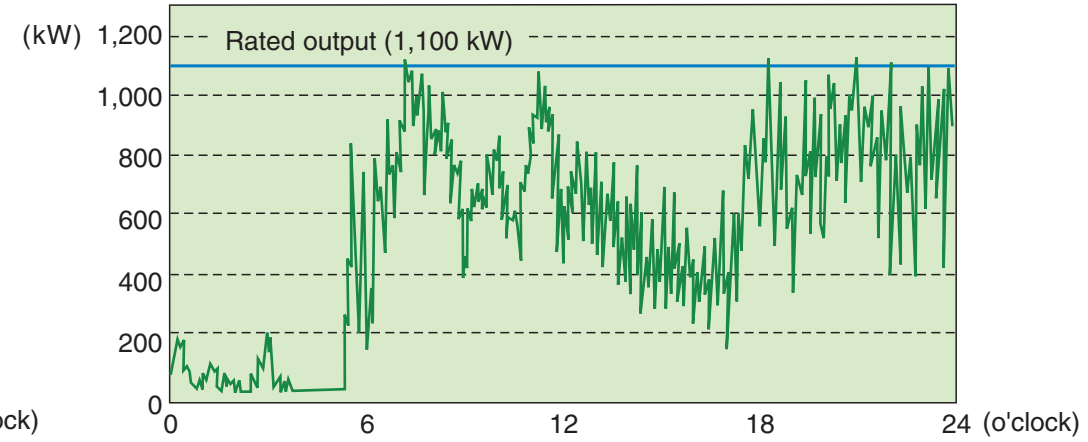
Fluctuations in the Outputs of Solar and Wind Power

Fluctuations in the Output of Solar Power (Spring)



Capacity 3.2kW, latitude 34.4°N, longtitude 132.4°E azimuth angle 0°(due south), tilt angle 30°

Fluctuations in the Output of Wind Power (Winter)

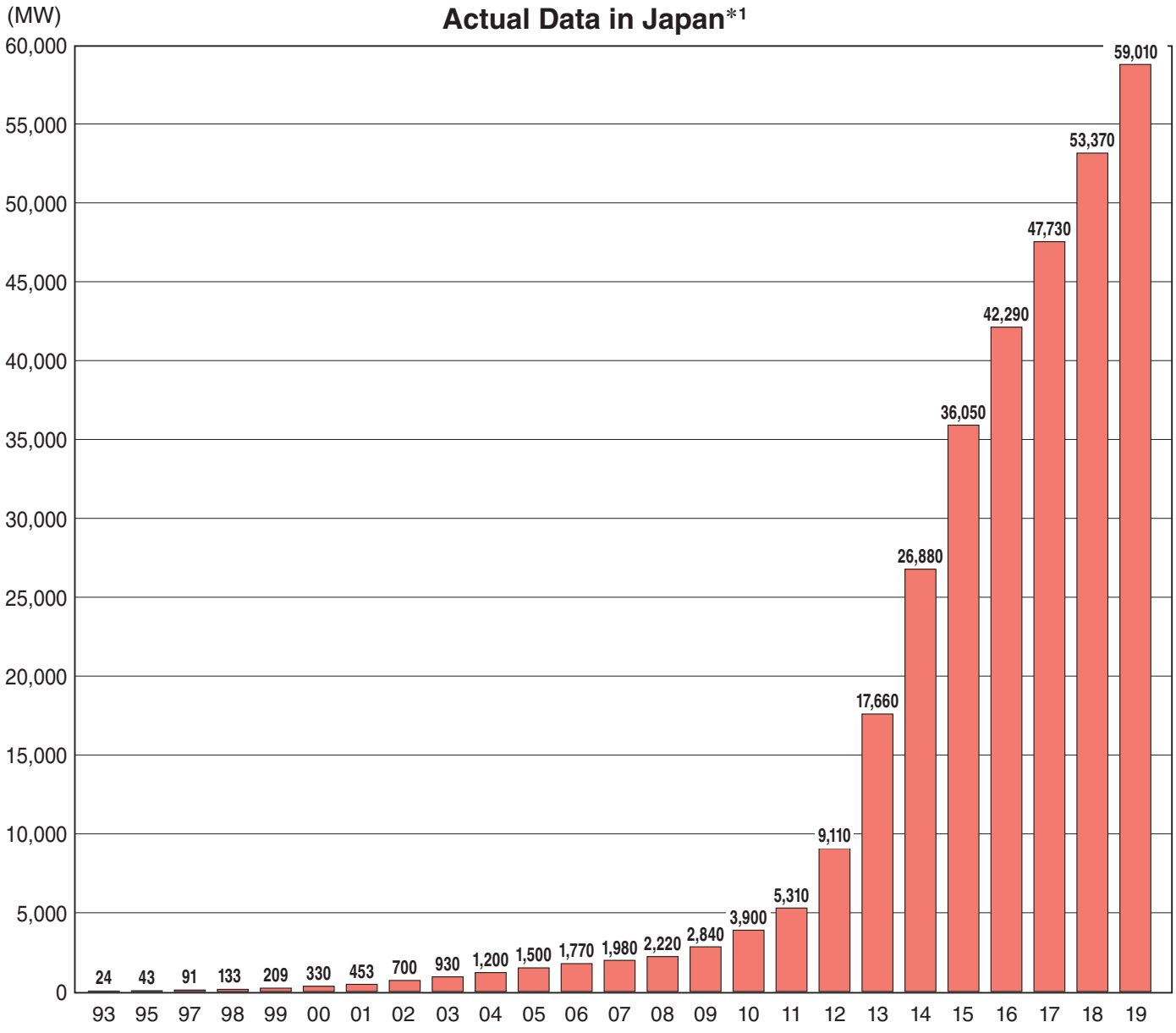


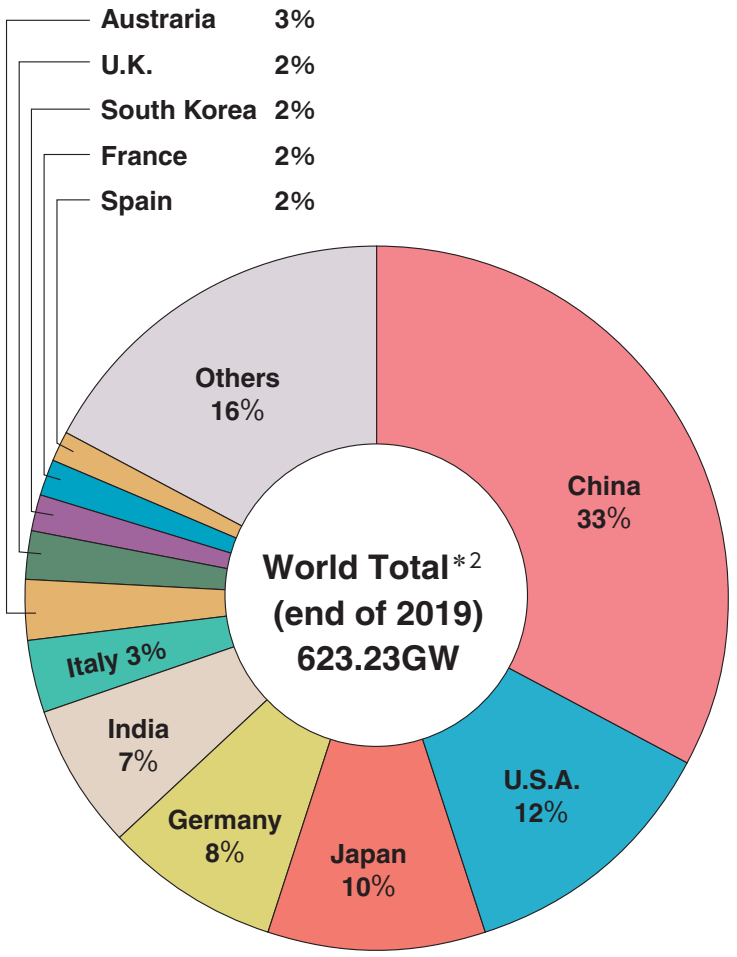
Solar power generated varies with the weather and time of day.

Wind power generated varies with the strength of the wind.

Source: The Federation of Electric Power Companies of Japan materials, Hokkaido Electric Power Co., Inc., Horikappu Power Plant

Solar Power Generation Capacity in Japan and the World

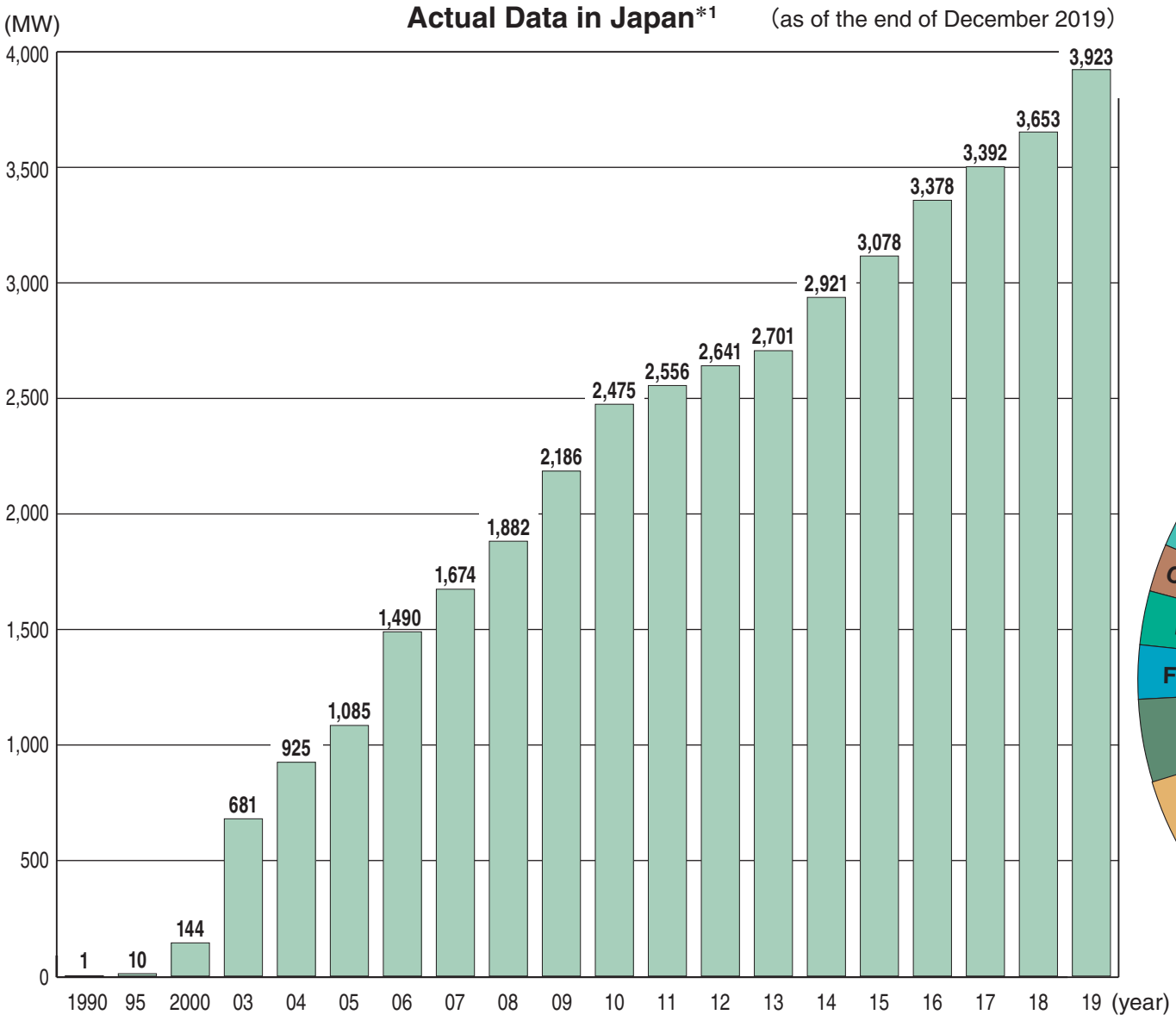


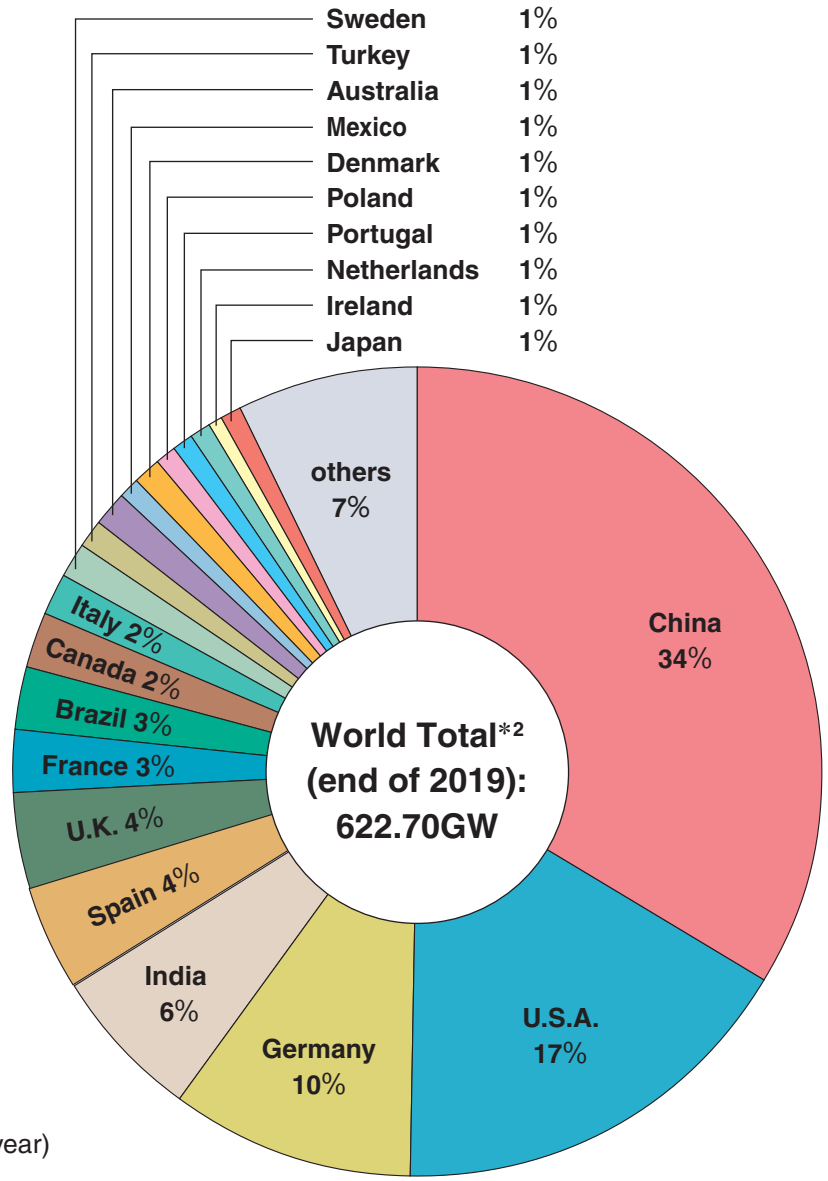


(Note) Figures may not add up to the totals due to rounding.

Source: *1 Agency for Natural Resources and Energy, Energy White Paper 2021, and *2 IEA, TRENDS 2020 IN PHOTOVOLTAIC APPLICATION・Photovoltaic Power Systems Programme(PVPS)」「2020 Snapshoto of Global PV Markets」

Wind Power Generation Capacity in Japan and the World





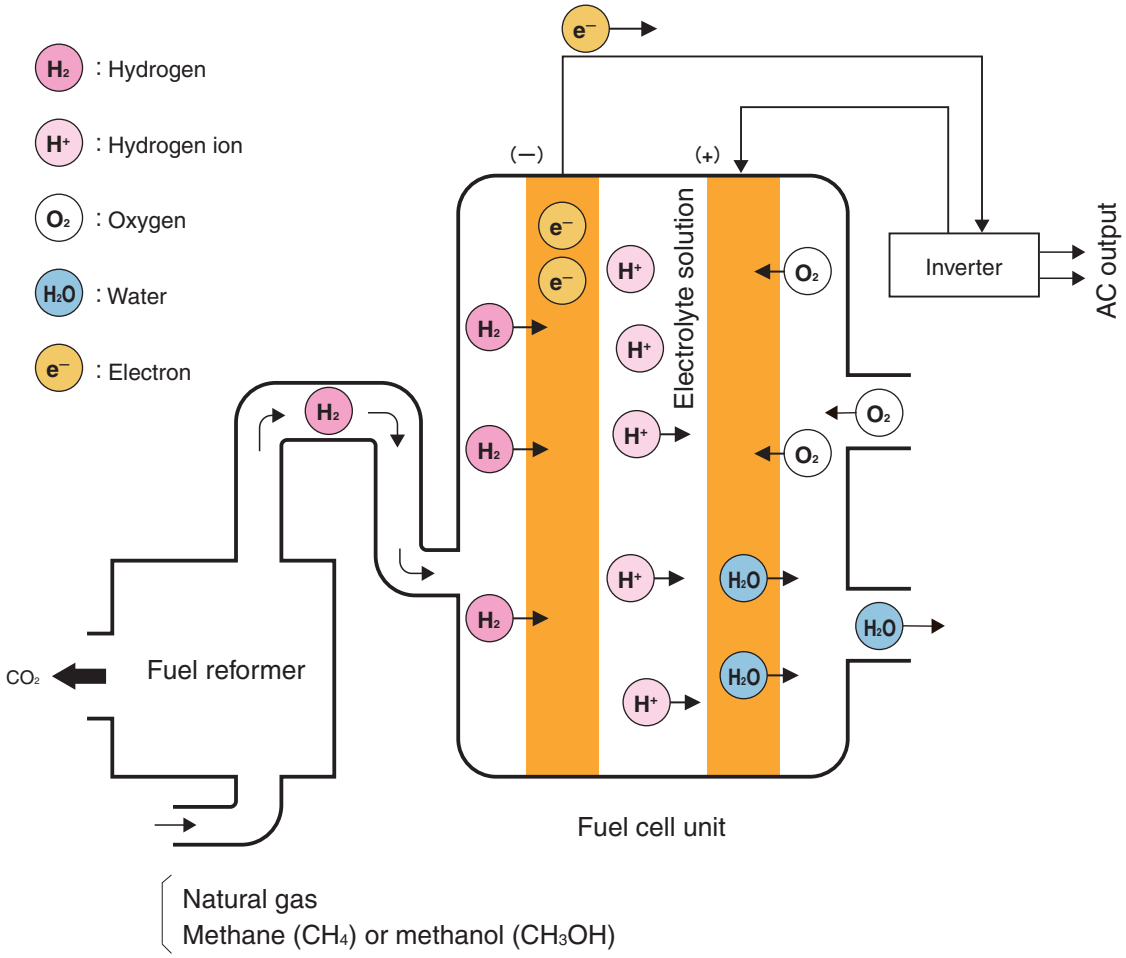
(Note) Figures may not add up to the totals due to rounding.

Source: *1 Agency for Natural Resources and Energy, Energy White Paper 2021 (Made with data of NEDO before 2003 and JWPA after 2004),
*2 IRENA (2020), Renewable Capacity Statistics 2020

How Fuel Cells Work

Mechanism: Electricity produced by a chemical reaction between hydrogen and oxygen

Conceptual diagram of phosphoric acid fuel cell power generation



<Merits>

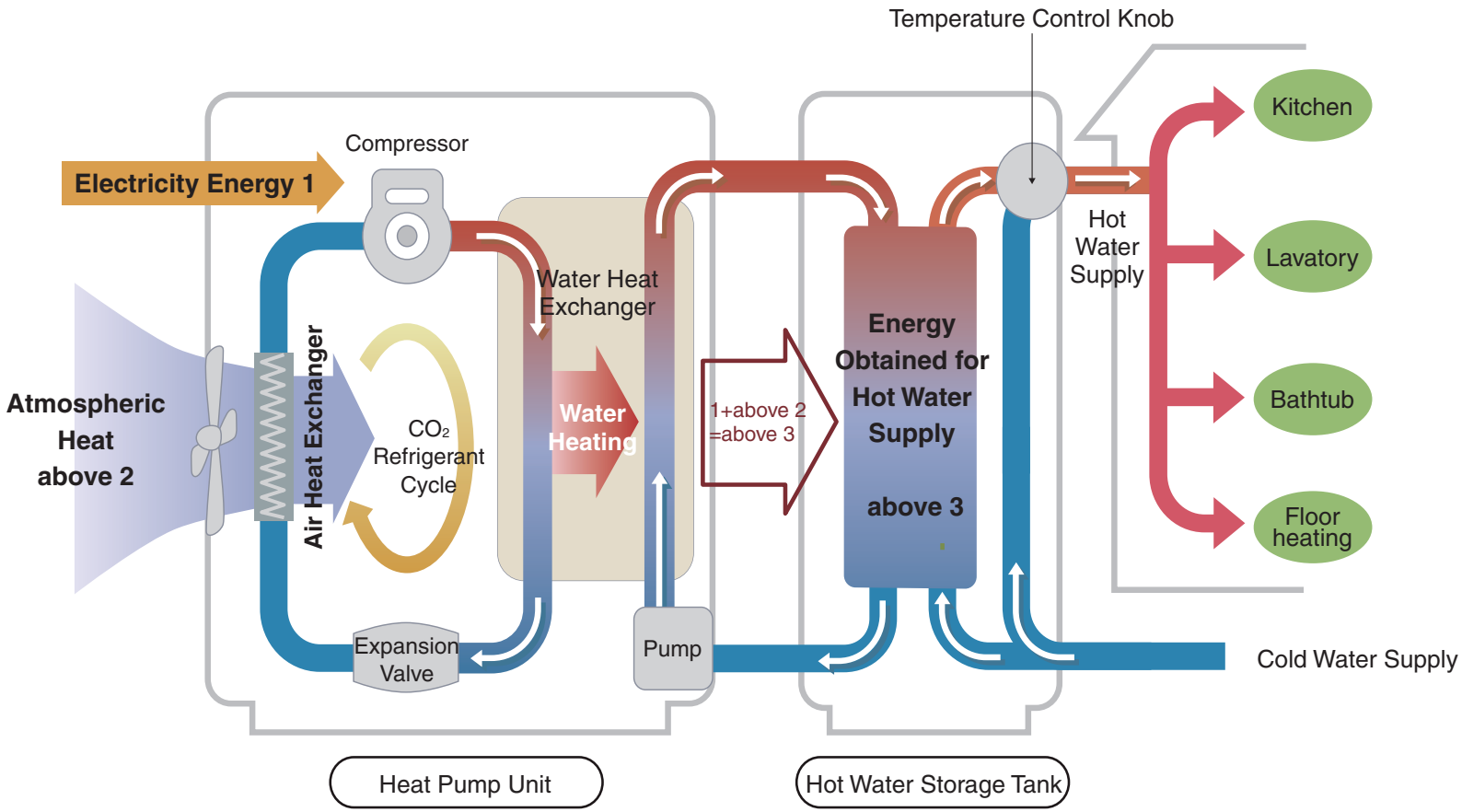
- ○Total thermal efficiency is higher when combined with utilization of waste heat
- ○Absolutely no sulfur oxides (SOx) and almost no nitrogen oxides (NOx) generated
- ○Little noise
- ○Can readily be installed where demand exists

<Demerits>

- ○Hydrogen supply system is not yet properly established
- ○CO_2 generated when hydrogen produced using fossil fuels
- ○Low battery durability and low reliability as a system
- ○High equipment costs

How a Heat Pump Hot Water Supply System Utilizing CO_2 Refrigerant Works

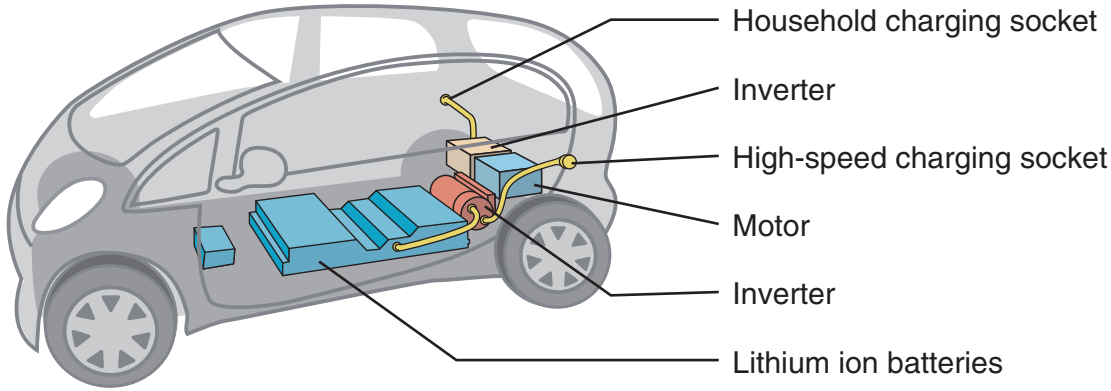
EcoCute



1 Electricity Energy + above 2 Atomospheric Heat = above 3 Energy Obtained for Hot Water Supply

Source: The Federation of Electric Power Companies of Japan, Environmental Action Plan by the Japanese Electric Utility Industry, with others

How Electric Vehicles Work



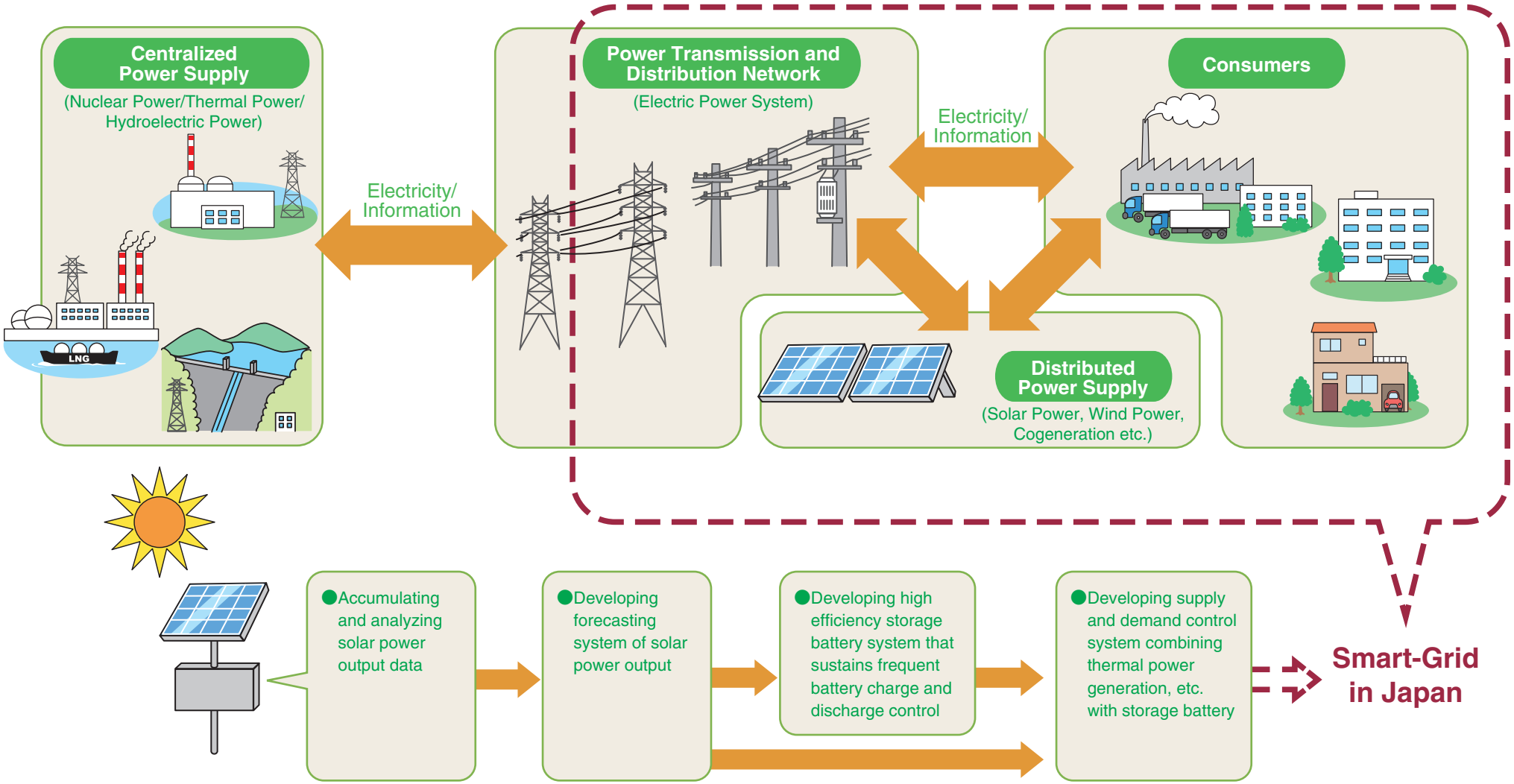
Features
・Low CO_2 emissions* →30% of gasoline vehicles
・High overall efficiency* →Primary energy input per 1km of driving is approximately 30% that of gasoline vehicles
・Fuel cost is low →Less than 30% of gasoline vehicles
・Improvement of city environment →No gas emission, less noise, etc.

Issues
・Batteries are expensive →Prices expected to drop as technology evolves and more are mass produced
・Batteries are large (heavy) →Expected to become smaller and lighter as technology advances
・Limited number of recharging stations →Will spread as electric vehicles become more common

*CO_2 emissions and overall efficiency are assessed in their entirety, from the production, supply and consumption of the energy.

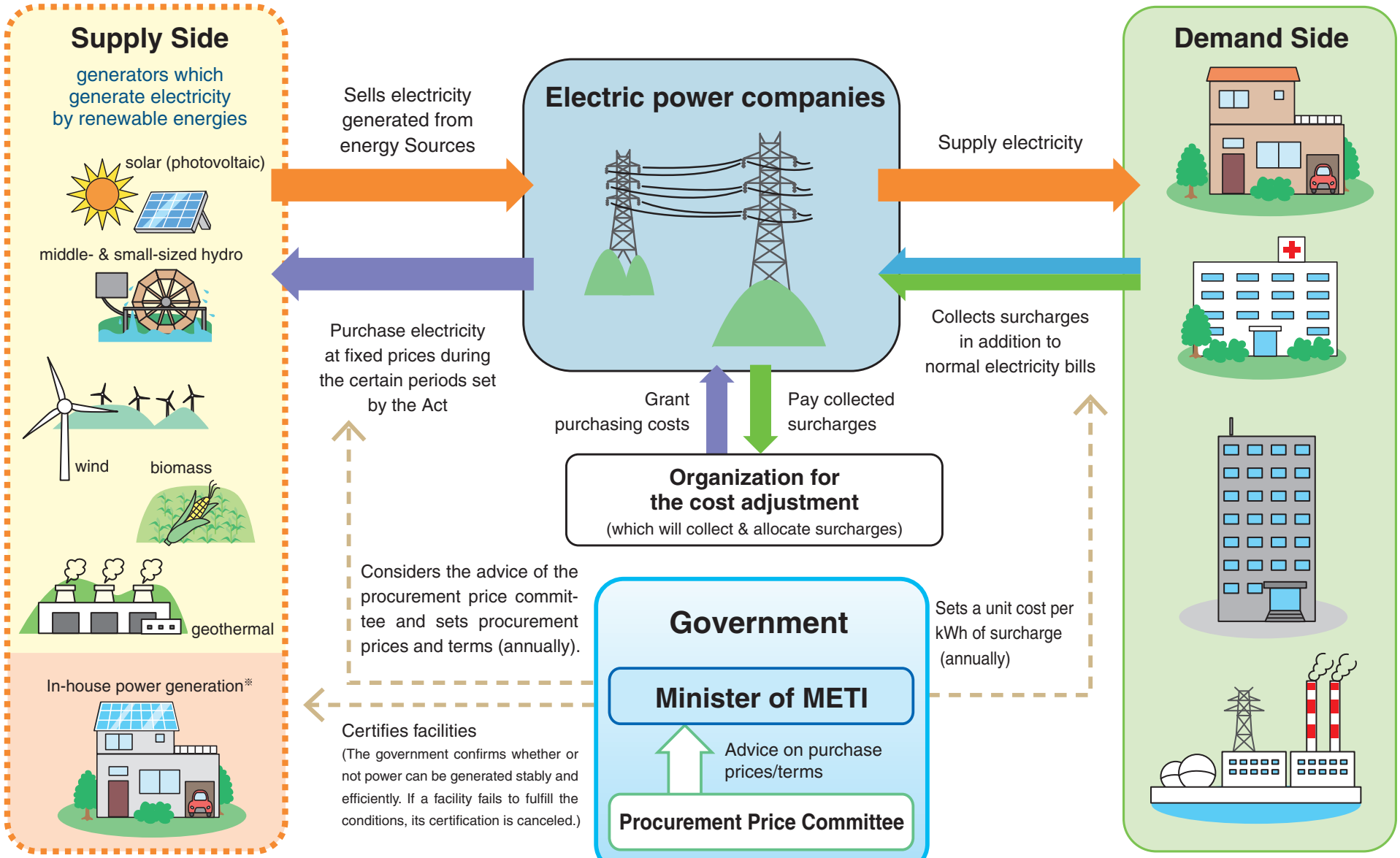
Source: The Federation of Electric Power Companies of Japan, Environmental Action Plan by the Japanese Electric Utility Industry, with others

The Basic Concept of a Smart-Grid in Japan



Source: The Federation of Electric Power Companies of Japan, Environmental Action Plan by the Japanese Electric Utility Industry, with others

Outline of Feed-in Tariff Scheme for Renewable Energies



※The sunlight below 10 kW is considered surplus acquisition.

Source: Agency for Natural Resources and Energy website, with others