

Energy Policy toward a Sustainable Society

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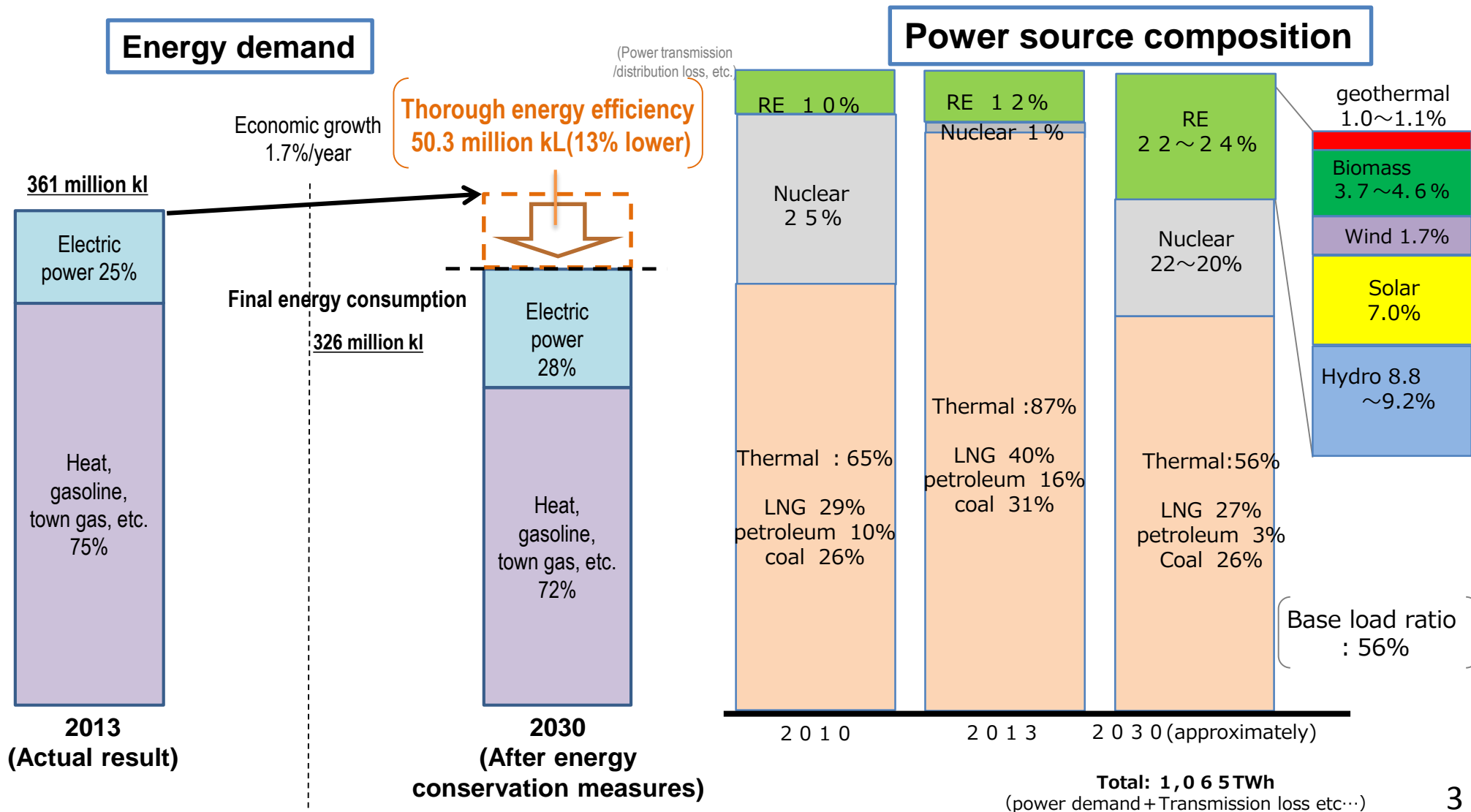
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1 . Trends in Japan

1. Trends in Japan ① Paris Agreement

- Japan committed to a 26% reduction of CO2 in 2013.
- To achieve the Paris agreement, it is important that the energy mixture consists of energy saving and widespread use of renewable energy.



1. Trends in Japan ② Energy Market Reform

- April 2016 - market liberalization for electricity retail
April 2017 - market liberalization for gas retail
- Next step should be unbundling between generators and DSO/TSOs.
- Policies will be discussed, such as activation of the wholesale electricity business market, capacity market, zero-emission value market and so on.

Schedule for market liberalization

April
2015

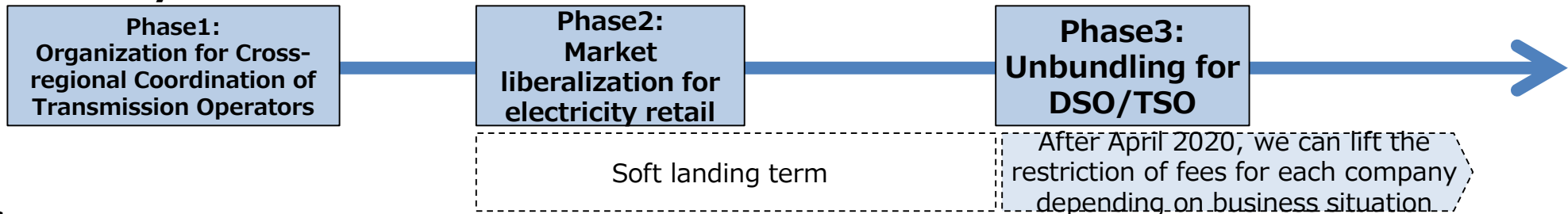
April
2016

April
2017

April
2020

April
2022

Electricity



Gas



Market monitoring Committee



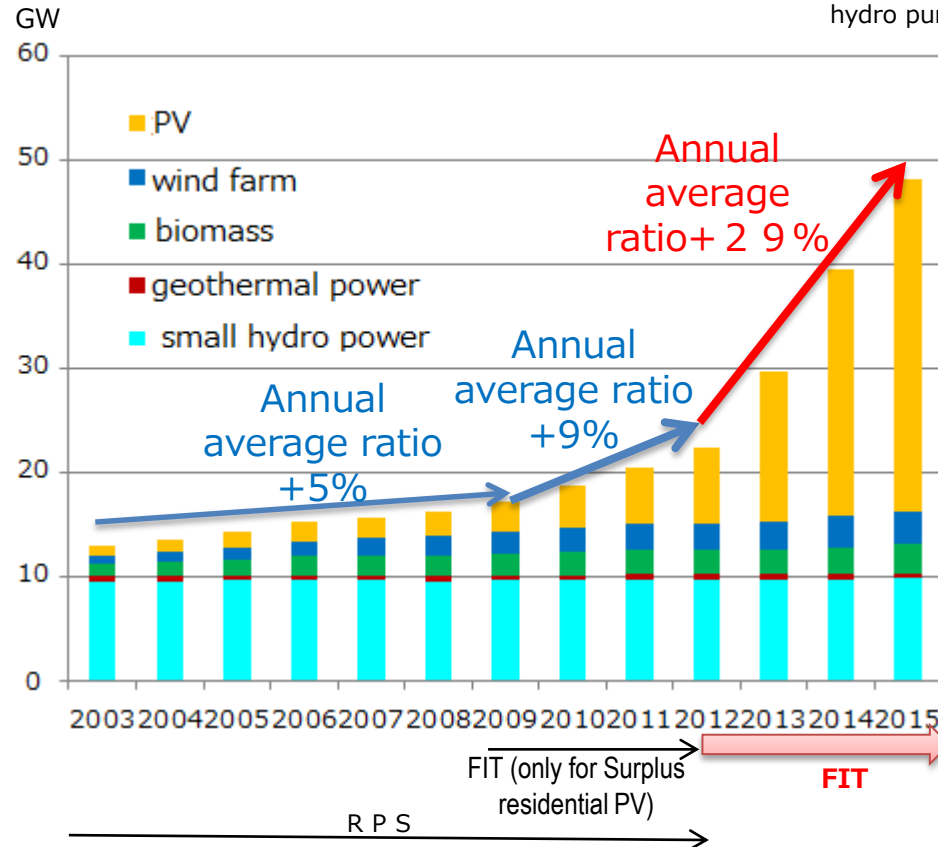
(Sep.2015)

1. Trends in Japan ③ Deployment of RE and Amendment of FIT

- Rapid spread of RE under FIT scheme raises some challenges such as cost effectiveness. Amendment of FIT in place from April 2017 will balance between spread of RE and cost allocation.

Capacity of Renewable Energy

※ without large hydro pump



Amendment of Feed in Tarif(FIT)

July, 2012 FIT starts
(RE capacity increased to 2.5 times in 3.5 years)

Challenges

Partial to PV

- ✓ PV occupied 90% of RE capacity
- ✓ 310 thousand PV cases are authorized, but not operated

Cost Effectiveness

- ✓ Total tariff of 2300 Bill. yen in 2016.
- ✓ In 2030, tariff should be 3700-4000 Bill. yen

Market mechanism

- ✓ Mechanism changing such as liberalization and unbundling

New FIT scheme starts in Apr. 2017

1) Additional Conditions

- Focused on O&M

4) Measures for Industrial sector

2) Cost Effectiveness

- Mega-solar auction
- Mid-term target of purchase price

5) TSO/DSO Purchase

- Flexible wide area power pool increase RE.

3) Wind Farm, Geothermal Power etc...

- The price along several years provided previously.

Spreading RE and cost allocation should be balanced
Energy mixture target : RE 22-24% on 2030

1. Trends in Japan④ Nega-watt Trading and VPP

- Regulations for Nega-watt trading are now ready, starts Apr. 2017.
- 7 VPP demonstration projects (Virtual Power Plant) will start including technologies integrating supplying, storing and efficient use of energy resources.

Activities for Nega-watt trading

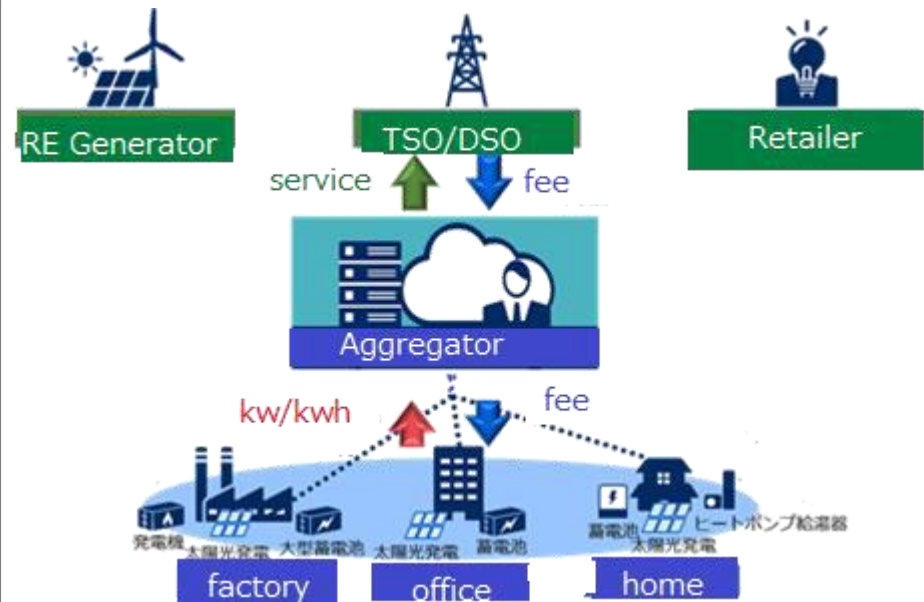
June, 2015 Nega-watt trading positioned clearly in Electricity Business Act

Sep., 2016 "the Guide Line for Nega-watt Trading" revised

Oct., 2016 As providing power for general TSO/DSO, open call starts

Apr., 2017 Trading starts.

Example of Project



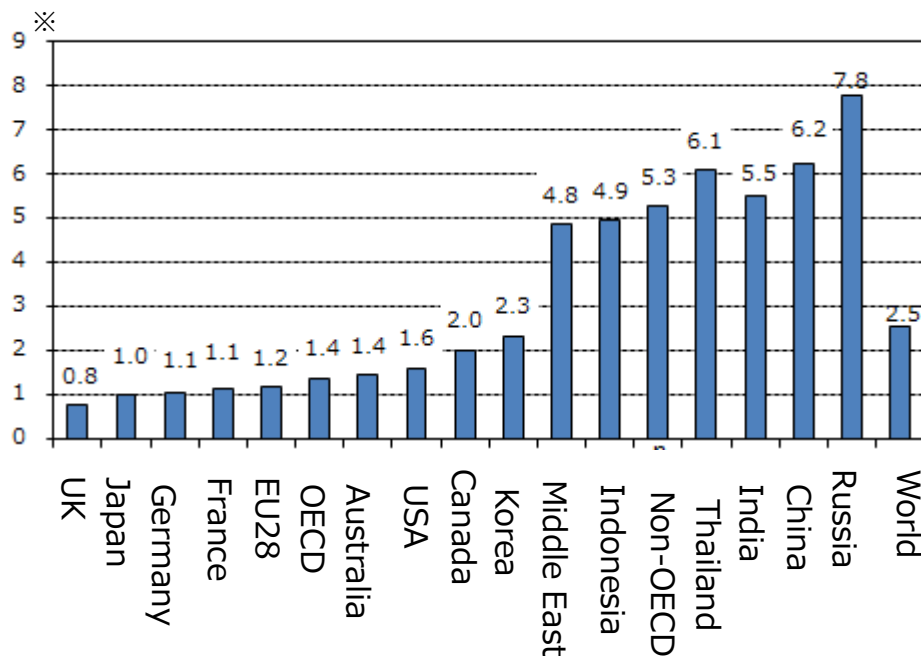
Capacity for control on 2016Fy: **9,800kW**
(8 large battery system and 500 home-use batteries)

2 . Further Steps

2. Further Steps① Enhancement of Energy Efficiency

- Japan has achieved world top-class energy efficiency.
- In each sector such as industrial, commercial, residential and transportation, Japan is pushing forward for greater energy efficiency. The political target is set to decrease to 50.3 million kL crude oil equivalent (=35% energy efficiency ratio by 2013) by 2030.

Energy efficiency by each country (2013)



Reference : IEA/Energy Balances of OECD Countries 2014 Edition, Energy Balances of Non-OECD Countries 2014 Edition, IEEJ/energy economics statistics

(※) Primary energy supply (Toe)/real GDP, and calculated as Japan=1

Industrial Sector <approx. -10.42 million kL>

- Energy efficiency target is set in each industry. SABC evaluation scheme is running
- Multiple players cooperate in energy efficiency action such as common use of facilities.

Commercial Sector <approx. -12.26 million kL>

- Target for each division
⇒ by 2018, 70% of commercial sector will covered.
- Energy efficiency by top-runner scheme
⇒ 31 items such as lighting, air conditioners, cars etc., are now in scope

Residential Sector <approx. -11.60 million kL>

- Energy efficiency of houses and buildings
⇒ zero-emission house/ building, renovation for EE, Mandating EE standards for newly constructed houses
- Energy efficiency by top-runner scheme

Transportation Sector <approx. -16.07 million kL>

- Promotion of next-generation cars
- Traffic flow control, modal shift

2. Further Steps ② Acceleration of Renewable Energy

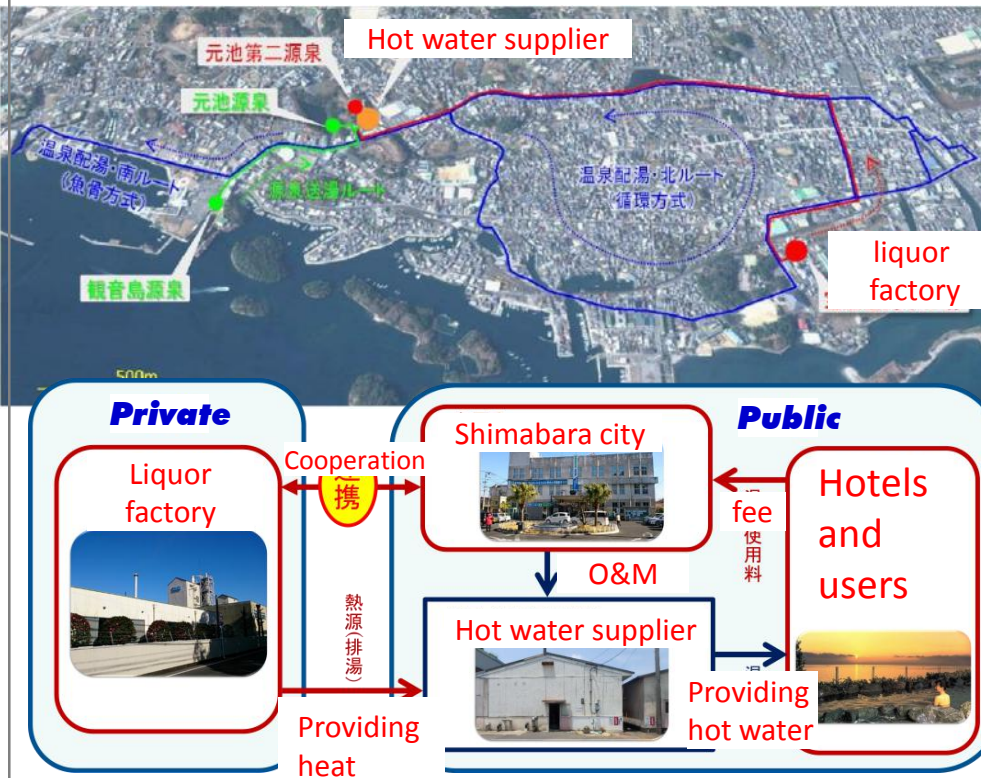
Tasks	Status	Next challenge (as example)
Cost	Cost goes down globally, but in Japan, cost remains high.	<ul style="list-style-type: none"> • New FIT scheme will reduce cost • Effective use of low-cost resources <ul style="list-style-type: none"> – Battery storage and self-use – Utilization for post-FIT power resources (roof top PV etc.)
Grid limitation	Many cases in which cannot connect to grid smoothly.	<ul style="list-style-type: none"> • Overcome grid limitation <ul style="list-style-type: none"> – Regulation for grid connection – Retro-fit for exiting grid – Cost allocation
Regulation and location limitation	Regulation and location limitations delay the introduction of power plants. A long lead time is needed.	<ul style="list-style-type: none"> • Additional promotion for RE <ul style="list-style-type: none"> – Regulation and coordination for public acceptance, environmental assessment

2. Further Steps ③ Distributed Energy System

- Using local energy resources such as Demand Response, waste heat and so on.
- Promote regional activation by combining energy services and local services such as mobility services and medical care.

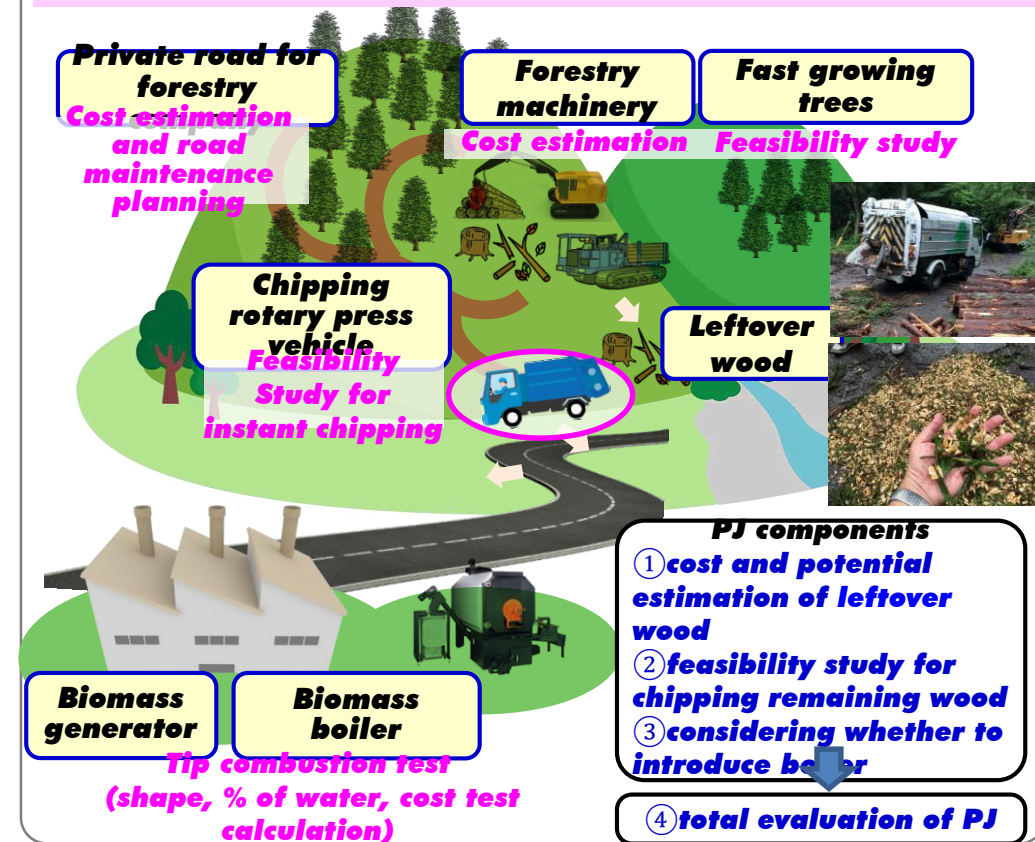
① Shimabara city in Nagasaki pref.

Waste heat from an liquor factory is used in the hot water supply system of a spa town.



② Hita city in Oita pref.

Feasibility study for wood biomass fuel from leftover forest wood



2. Next Challenge④ Hydrogen Society

- Hydrogen is eco-friendly because it doesn't produce CO2 while running. Hydrogen can strengthen energy security because it can be made from several energy resources including un-utilized energy overseas.
- For this target, METI established a roadmap in June 2014 and was revised in March 2016.

Short range activities : expansion of hydrogen



FC co-generation system

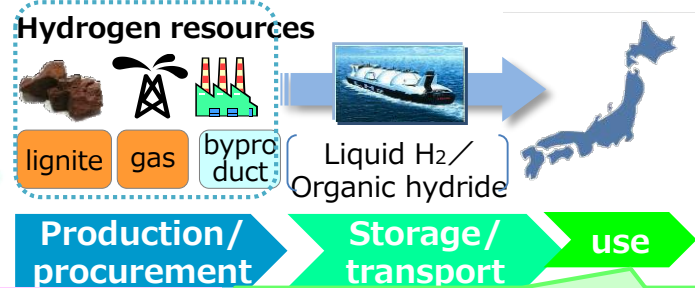


- Target of 1.4mil. by 2020 and 5.3mil. by 2030
- Target price of 800,000 yen/unit by 2020
- ⇒ no subsidy after 2020



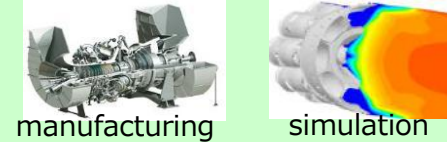
Mid-term activities : supply chain, hydrogen gas turbine/ hydrogen from RE

Global supply chain of Hydrogen, Hydrogen gas turbines



- Utilizing unused overseas energy such as lignite
- Establishment commercial supply chain by 2030,

R&D for H₂ gas turbine



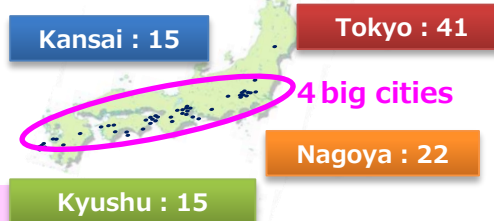
Fuel Cell Vehicle (FCV)

	2020	2025	2030
No. of FCV	40,000	200,000	800,000
No. of stations	160	320	-

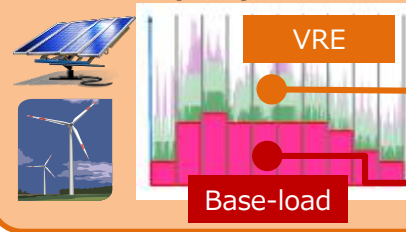
- 18 items for regulation review



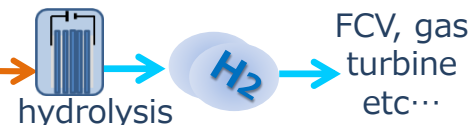
Hydrogen station



Variable Renewable Energy (VRE)



Power-to-gas



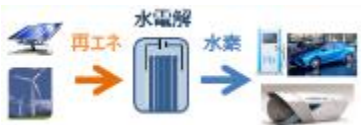
- H₂ made by VRE will be stored, transported and used.

2. Next Challenge ⑤ Fukushima Revitalization

■ To accelerate the energy-related policy measures of the Innovation Coast Initiative and to create a future model for a “New Energy Society”, the Fukushima Plan for a New Energy Society is developed.

Hydrogen by RE

■ Hydrogen produced by VRE will be used in Olympic/ Paralympic Games in Tokyo 2020.



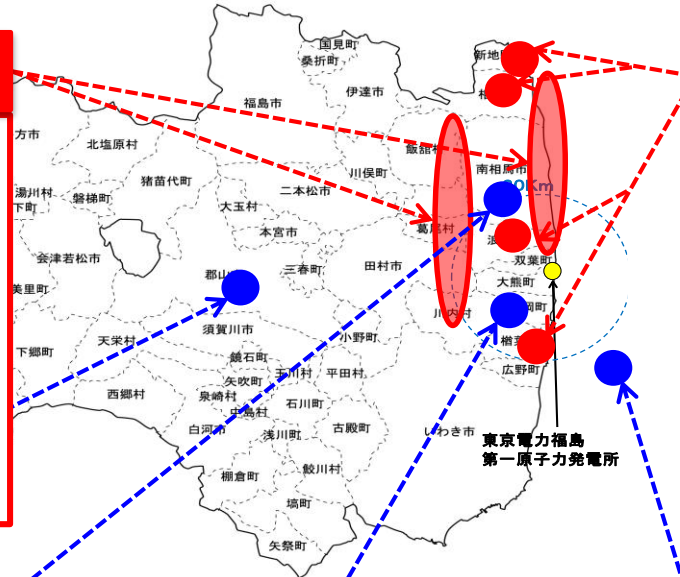
Wind farm

■ Large wind farm including transmission lines in mountain and coastal areas



Smart community

■ Energy supply and demand in the local area are balanced by using battery storage and hydrogen.



R&D center for RE

■ FREA/AIST is the first R&D center focused on RE in Japan.



Battery storage demonstration for substations

■ Battery storage reduces grid instability caused by RE.



Enhancement and revision for substations

■ Enhancement and revision for substations are needed for introducing RE.



Floating wind farm

■ The world's first commercial scale floating wind farm is under construction.

