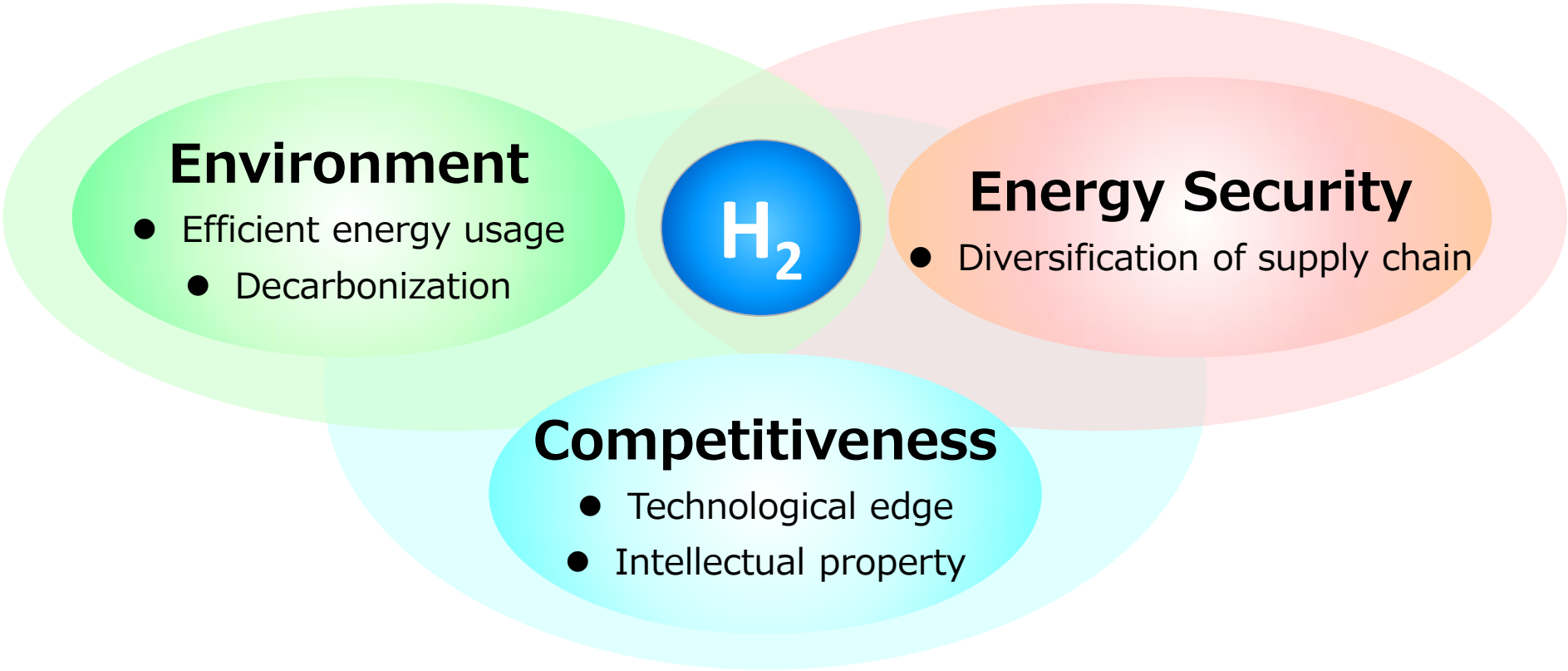
Session-II:
Hydrogen Storage & Transportation

2017/12

Ministry of Economy, Trade and Industry (METI)
Automobile Division
Batteries and Next-Generation Technologies Office

Why Hydrogen?

- Potential to be ultimate energy for Japan satisfying both **environmental** and **energy security requirements**
  - ✓ Origin of the start of developing hydrogen & fuel cells technologies in Japan: **Oil Crisis of the 1970's (= Energy Security)**
  - ✓ Recent expectation for hydrogen: **Paris Agreement (= Environment)**



Strategic Roadmap to realize a “Hydrogen Society"

Phase:1
A dramatic increase of Fuel Cells Installation

2009:
Residential FC

2014: FCV

2014:HRS

Introduction support and R&D

2020
Tokyo Olympic /Paralympics

2030

2040

Phase:2
H2 Power Generation/ Mass Supply Chain

- Accelerate RD&D

2nd half of 2020’s:
-Enhance Supply Chain in Japan

Around 2030:
-Hydrogen Power Plant

Phase:3
CO_2-free Hydrogen

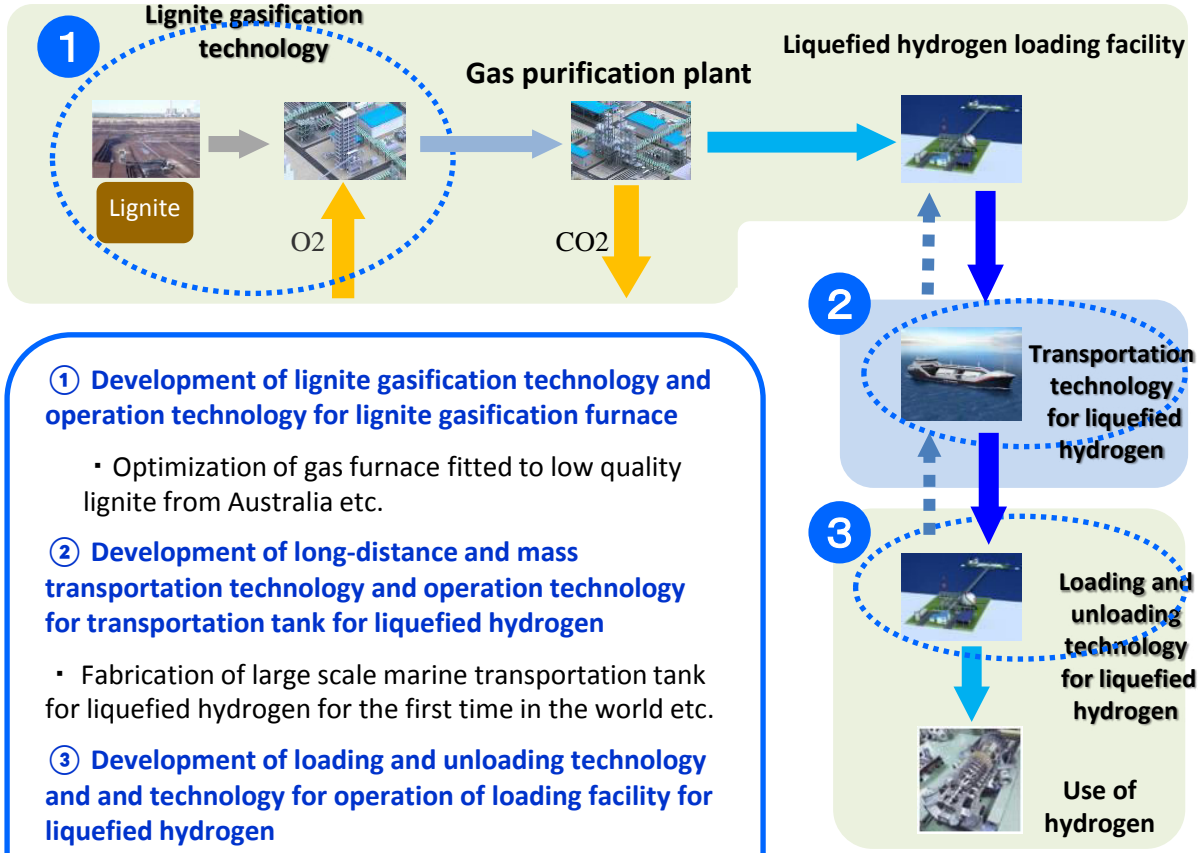
Around 2040:
-Full Scale CO_2-free Hydrogen

FCV : Fuel Cell Vehicle
HRS : Hydrogen Refueling Station

[Hydrogen Supply Chain] ① Lignite × Liquefied Hydrogen

- Aiming at establishing supply chains of liquefied hydrogen, in which production, storage, transportation and utilization are integrated. Hydrogen production, liquefaction of hydrogen, and loading of liquefied hydrogen are conducted in Australia and shipped on the sea, and then the process from unloading to supply are conducted in Japan.

Outline of chains and validation terms



① Development of lignite gasification technology and operation technology for lignite gasification furnace

・Optimization of gas furnace fitted to low quality lignite from Australia etc.

② Development of long-distance and mass transportation technology and operation technology for transportation tank for liquefied hydrogen

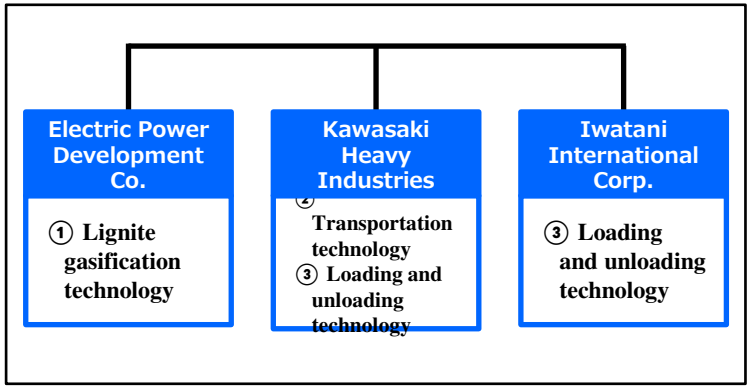
・Fabrication of large scale marine transportation tank for liquefied hydrogen for the first time in the world etc.

③ Development of loading and unloading technology and and technology for operation of loading facility for liquefied hydrogen

・Validation of liquefied hydrogen loading system etc.

Implementation system, schedule

<Implementation system>



<Assumed schedule>

FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Component tests, specification design	Design, production, test operation etc.				Validation operation

Draft Budget for Hydrogen and Fuel Cells in FY 2018

Phase 1 — **Installation Fuel Cell** — Focus on implementation from the present

Phase 2 — **H2 Power Plant/ Mass Supply Chain** — Realized in the late 2020s

Phase 3 — **CO2-free Hydrogen** — Realized in around 2040

Disseminate stationary FCs

Subsidies for Stationary FCs [8.9 billion yen]

Promote the accelerated introduction and cost reduction of Ene-farm. From FY 2017, support for stationary FC for business and industrial use is added .

Disseminate FCVs

Subsidies for HRSs [5.7 billion yen]

Support HRS installations and promote creating new FCV demand.

Support for FCVs [Included in 15 billion yen]

Build a H2 supply chain

Demonstrations for global H2 supply chain 9.4 billion yen]

Demonstrate how hydrogen can be produced from untapped overseas energy resources, transported in the form of liquefied hydrogen or organic hydride, and used to generate power. Implement P2G field tests, etc.

R&D of FC, etc.

R&D of FCs [2.9 billion yen]

Conduct R&D for better performance and lower costs of FCs, and demonstrate stationary FCs for business use

Stationary FC for business use

R&D of HRSs [2.4 billion yen]

Develop technologies for lower costs and safety of HRSs, and collect data for reviewing regulations.

R&D of H2 production, transport and storage

R&D for producing, transporting and storing H2 derived from renewable energy [0.9 billion yen]

Develop technologies of high efficiency water electrolysis units, tanks for storing liquefied hydrogen, etc. with the use of renewable energy sources.