Overview of NEDO Green Innovation Fund Projects toward achieving the 2050 Carbon Neutrality

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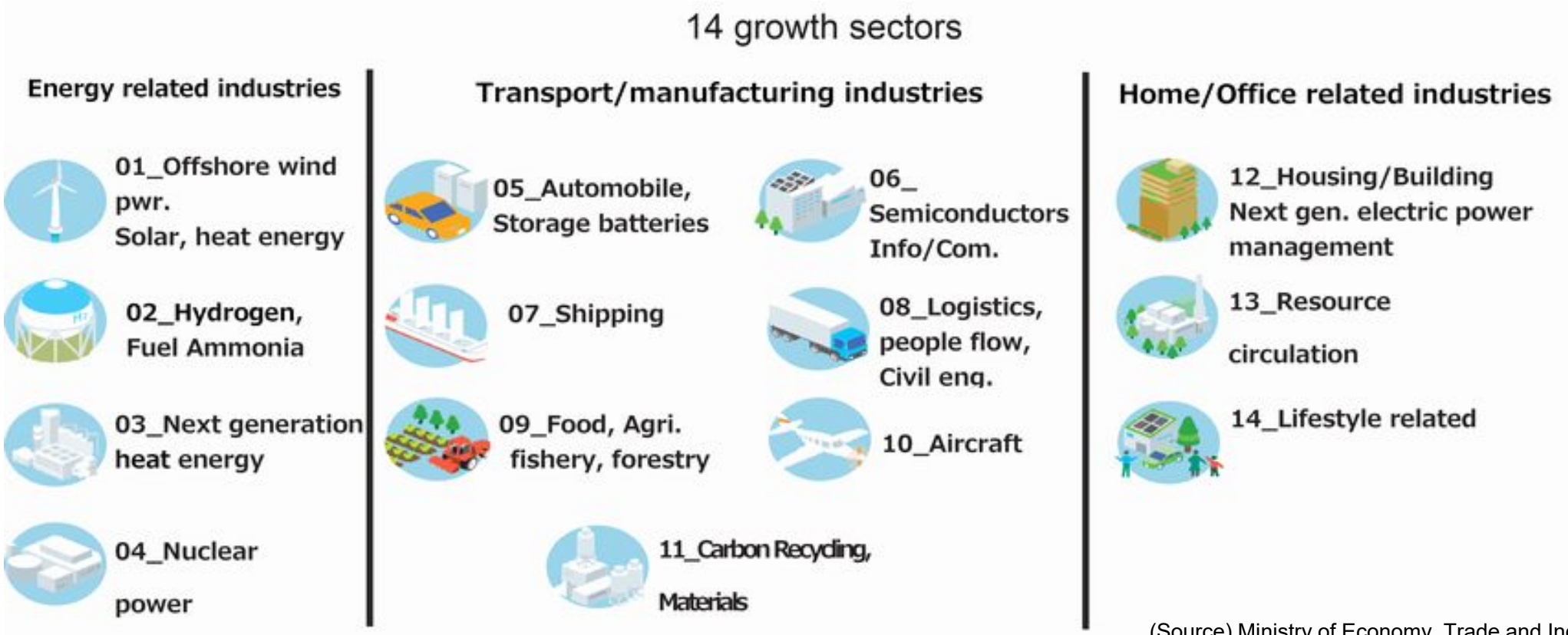
Japan's policies for carbon neutrality in 2050

- **In October 2020**, Japan declared that it aims to **achieve carbon neutrality by 2050**.
- The Ministry of Economy, Trade and Industry in collaboration with other ministries and agencies, **formulated the "Green Growth Strategy through Achieving Carbon Neutrality in 2050"**.
- This strategy specifies 14 promising fields that are expected to grow and provides action plans for them from the viewpoints of both industrial and energy policies.



(Source) Ministry of Economy, Trade and Industry, Japan

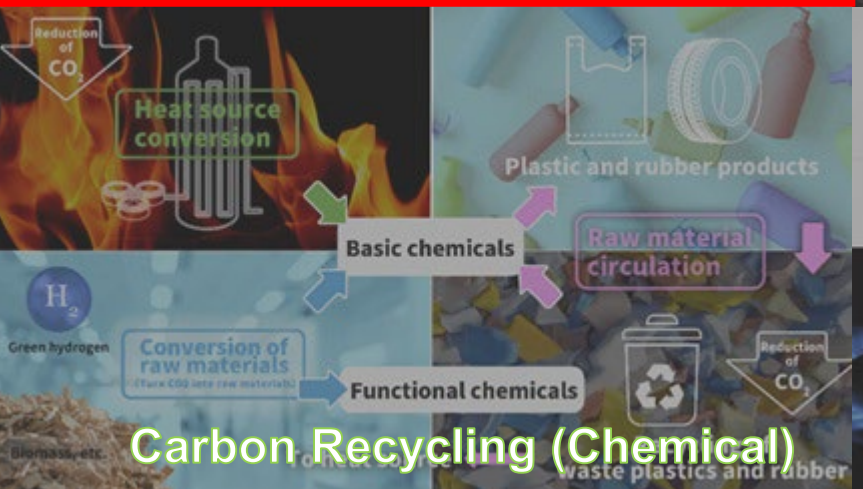
Creation of 2 trillion yen “the Green Innovation Fund” for NEDO

Continuous support for up to 10 years

From ambitious R&D to social implementation

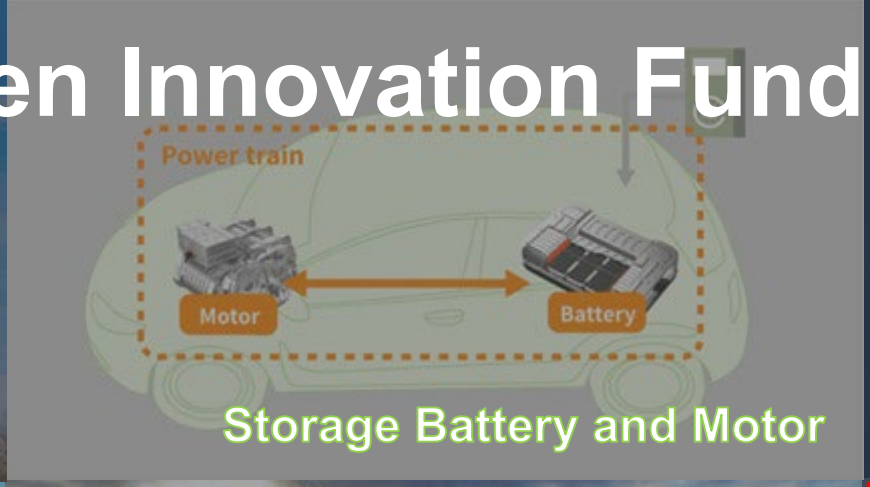
Management commitment

The Green Innovation Fund Projects



The Green Innovation Fund Projects

CO_2 Separation and Capture

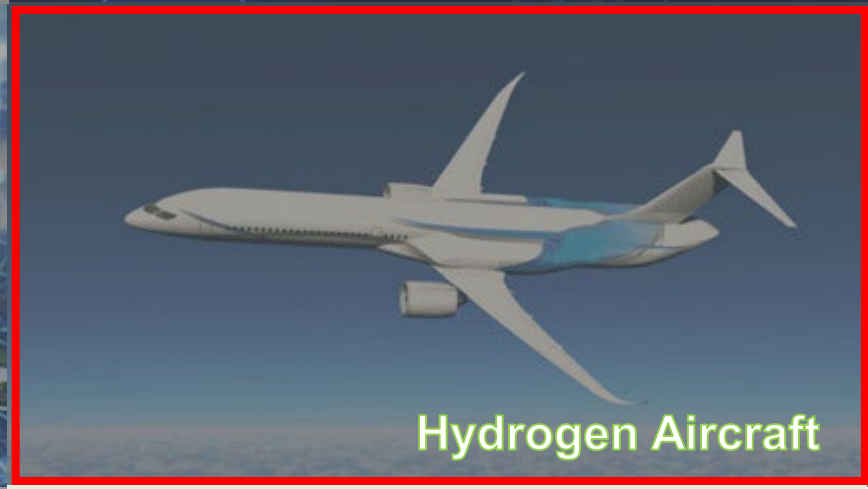


Storage Battery and Motor

In-vehicle Computing

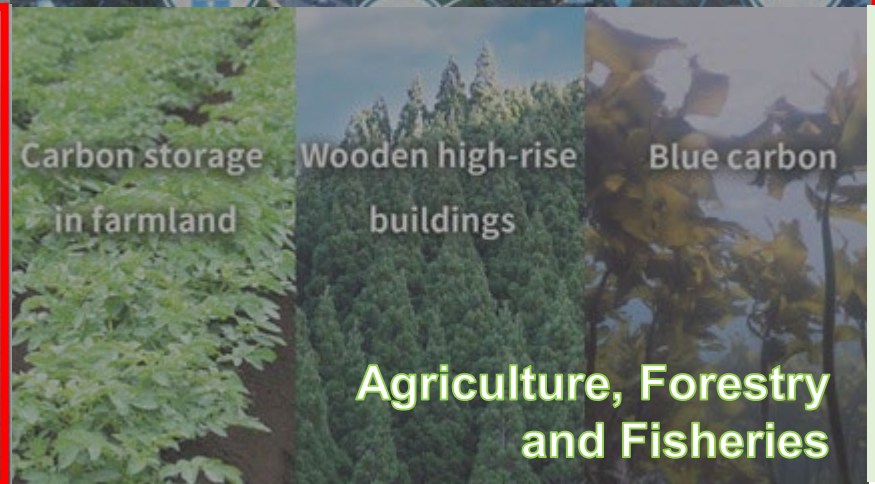
Smart Mobility

Digital Infrastructure



Hydrogen Aircraft

Zero-emission Ship



Agriculture, Forestry and Fisheries

Already formulated **17** projects,

allocated over **1.6** trillion yen

and more coming soon...

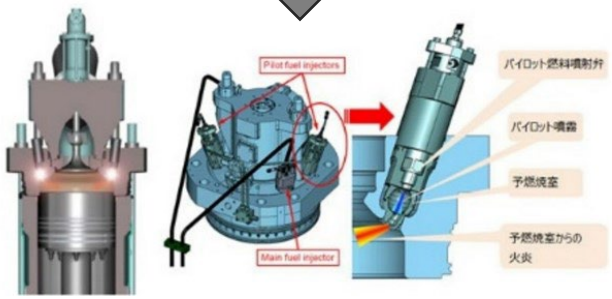
Next-generation Ship Development

- In the shipping sector, **hydrogen, ammonia, and carbon-recycled methane are expected to be used as zero-emission ship fuels**; however, their adoption will depend considerably on the fuel prices and the development of the fuel supply infrastructure.
- In this project, we will **develop and demonstrate the engine, fuel tank, fuel supply system**, and other components for next-generation ships and develop the infrastructure for ammonia fuel supply to ships, including the developing of an ammonia bunkering ship.

Hydrogen/ammonia-fueled engine

・Hydrogen: extremely flammable
・Ammonia: fire retardants, generates N_2O

Requires advanced combustion control and fuel injection technology



LNG fuel injection technology

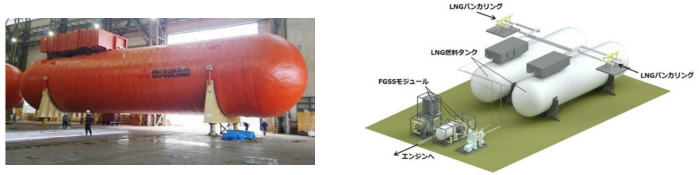
(Source) IHI Power Systems Co.,Ltd.

Fuel tank/fuel supply system

	Hydrogen	Ammonia
Volume	4.5 times	2.7 times
Boiling point	−253 °C	−33 °C
Issues	leakage, brittleness	corrosive, toxic

※Volume comparison with C heavy oil

Requires space saving, structural optimization, and material optimization



Current LNG fuel tank and fuel supply system

(Source) Mitsubishi Heavy Industries

Measures against methane slip

- Development of technology to reduce the unburned methane contained in the exhaust gas from an LNG-fueled ship.

Ship ammonia fuel supply

- Developed an ammonia bunkering ship that supplies fuel to ammonia-fueled ships.

Current LNG bunkering ship

(Source) Central LNG Marine Fuel Japan Corporation

Next-generation Aircraft Development

- To realize carbon neutrality in the aviation field, realizing sustainable aviation fuels (SAFs) and innovations such as **aircraft weight reduction, engine efficiency improvement and electrification, hydrogen aircraft development**, etc. are necessary.
- Entire aircraft is developed by European and American OEM manufacturers (Boeing, Airbus). Japan will develop **core technologies for hydrogen aircraft** and technologies for **lightweight primary structural components with complex shapes for them**.

Next-generation aircraft (image)

(Source) Airbus SE, The Boeing Company

Technical issues

＜Engine combustor＞

⇒To develop a hydrogen combustion method, combustor material, cooling technology, etc.

＜Hydrogen fuel storage tank＞

⇒To develop lightweight and safe tank materials that can store the required amount of liquid hydrogen.

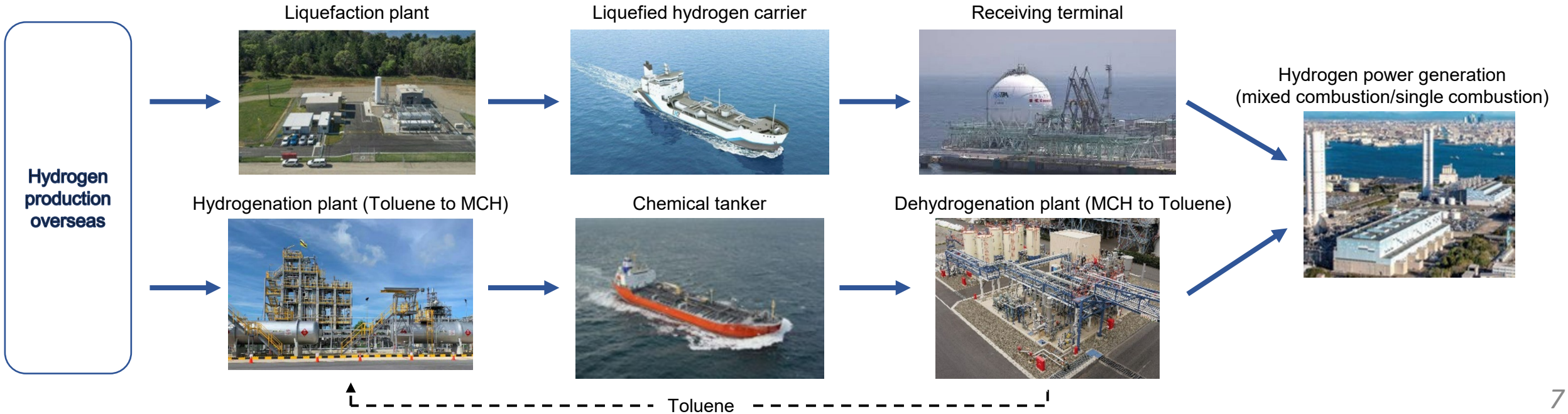
＜Airframe design concept and responses to complex shape of aircraft structure＞

⇒To develop composite materials that have the strength and lightness necessary for realizing hydrogen aircraft.

Large-scale Hydrogen Supply Chain Establishment

- Toward the realization of a hydrogen society, the project will promote **the construction of a large-scale hydrogen supply chain as well as demand creation**.
- Using multiple hydrogen carriers (liquefied hydrogen, methylcyclohexane (MCH)), the project aims to **reducing supply costs to 30 yen/Nm³ in 2030 and 20 yen/Nm³ or lesser in 2050** (equivalent to fossil fuels) **by the development and demonstration of large-scale transportation equipment and hydrogen combustion stability in actual hydrogen power generation equipment**.

Large-scale hydrogen supply chain using a hydrogen carrier (image)



Hydrogen Production through Water Electrolysis Using Power from Renewables

- To establish domestic hydrogen production bases that utilize surplus renewables, etc. and to acquire the overseas market, this project **aims to further reduce the equipment cost (up to approximately 1/6 of the current cost) by increasing the size and modularizing multiple types of water electrolyzers (alkaline and polymer electrolyte membrane (PEM) types), implementing membranes, and demonstrating power-to-X systems**.

Power-to-X system configuration

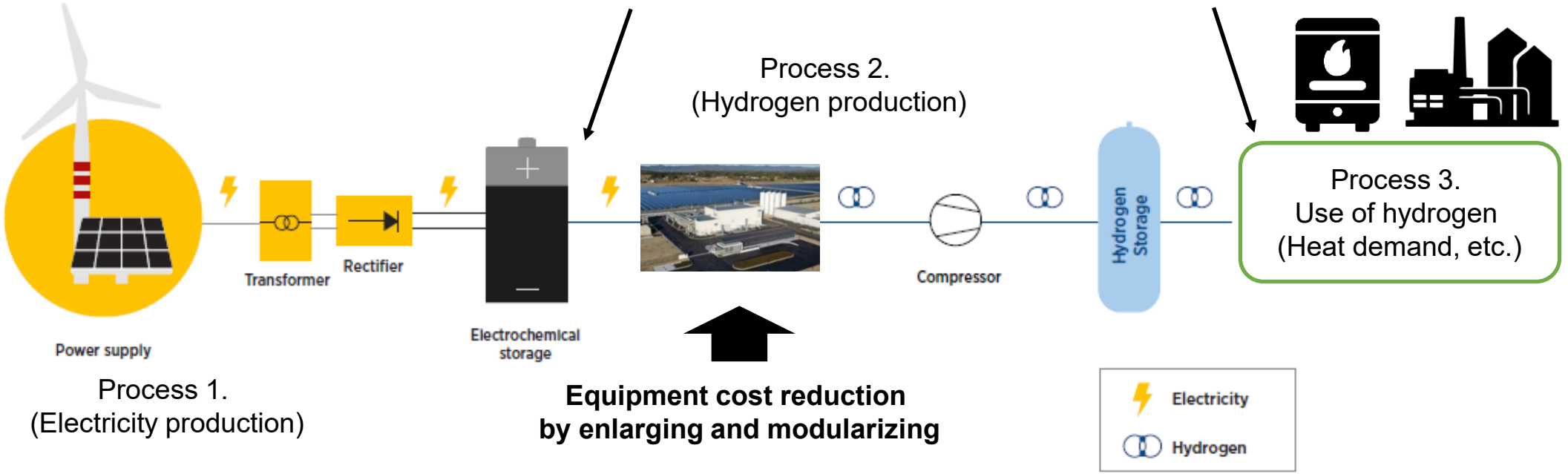


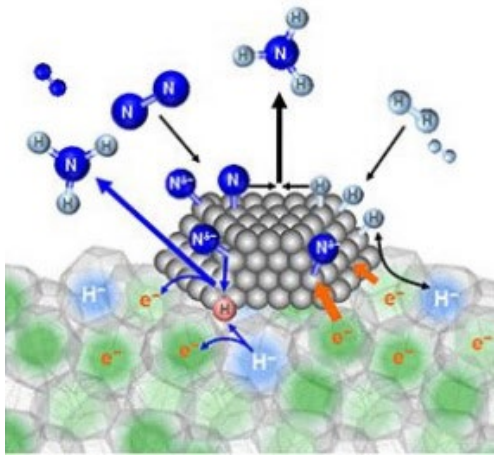
Image (Fukushima Hydrogen Energy Research Field)

Fuel Ammonia Supply Chain Establishment

- Ammonia supply is limited to raw materials such as fertilizers; therefore, **building a large-scale fuel ammonia supply chain integrating use and supply sides** is necessary.
- We will **develop and demonstrate a manufacturing method for fuel ammonia with large-scale production, cost reduction, and reduction in CO_2 emissions**, as well as **develop technologies for high-mixed and single firing**.

Ammonia synthesis technology

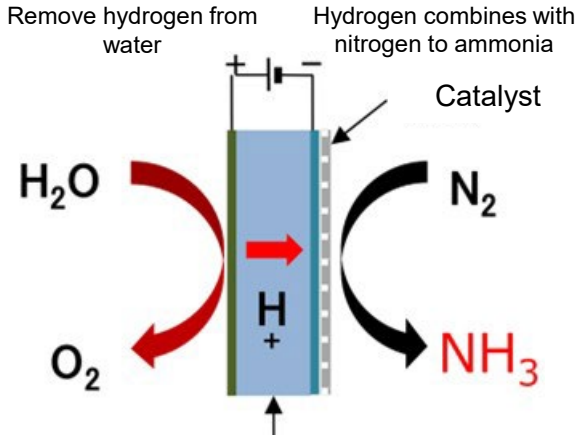
- Developed a synthetic method superior to the Haber–Bosch method to reduce the synthesis cost of blue ammonia (at least 15%).



Catalyst separates nitrogen and hydrogen molecules and combines them to form ammonia..

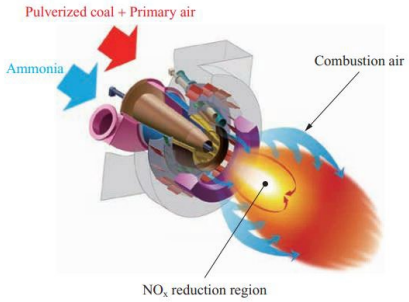
Green ammonia synthesis

- By the development of catalysts and electrolytes, we will develop a new production method without using hydrogen to realize cost reductions for green ammonia.



Manufacture of burners

- Aiming for high-mixed and single firing in boilers and gas turbines, we will develop high-mixed and single firing burners (50% or more in actual equipment).



(Source) IHI

NEDO Green Japan, Green Innovation

Green Innovation Fund Projects

https://green-innovation.nedo.go.jp/en/