HONDA
The Power of Dreams

Honda's Vision for Carbon Neutrality in 2050

President and Representative Director
Honda R&D
Keiji OHTSU

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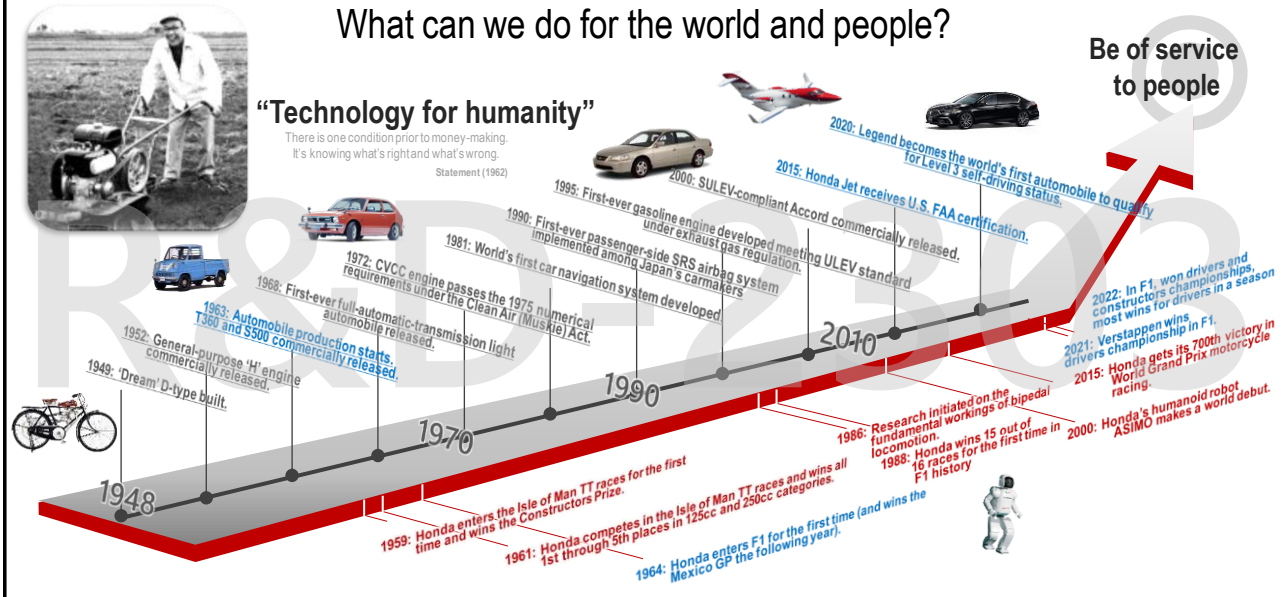
History of Honda



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F1 Challenge

Entry into automobile business and F1

■ In 1963, Honda entered the automobile business with its pickup truck and sports car

T360

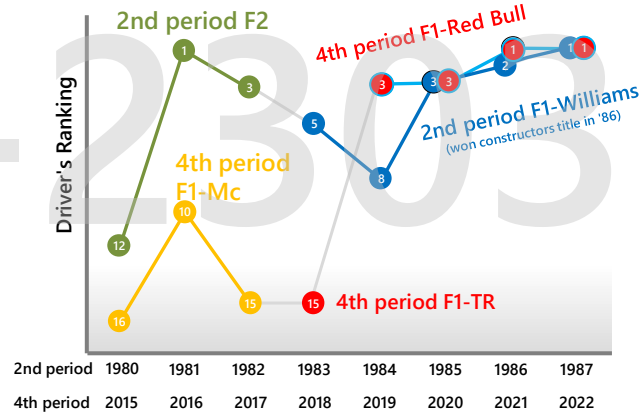
S500

■ Entered F1 in 1964, won the following year

First entry in 1964

First victory in 1965

■ Highest drivers ranks reached in 2nd and 4th periods



Winning the F1 Championship in 2022

- Drivers championship for two years in a row
- Constructors championship
- Most wins for drivers in a season (15 wins)

Honda's DNA

What I research in Honda is "What do people like?"

(Founder Soichiro Honda)

In other others,

we research "people"

We take on challenges to serve each person
and realize their dreams

30 million units per year

Joy of serving

1 customer / 1 second

Challenges in the Automobile and Mobility Industry

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Create a new value in an increasingly complex society

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Challenges in New Areas

8

Evolve the value on mobility and make positive changes to society

Expand time and space where people can take active roles

Create more free time for people

Maximize the value of time

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Honda's New Environmental and Safety Targets

Carbon neutrality for all products and corporate activities

2050

Zero traffic collision fatalities involving Honda motorcycles and automobiles

Mobility

Power unit

Energy

Robotics

Honda's Direction and Vision

Honda environmental and safety vision

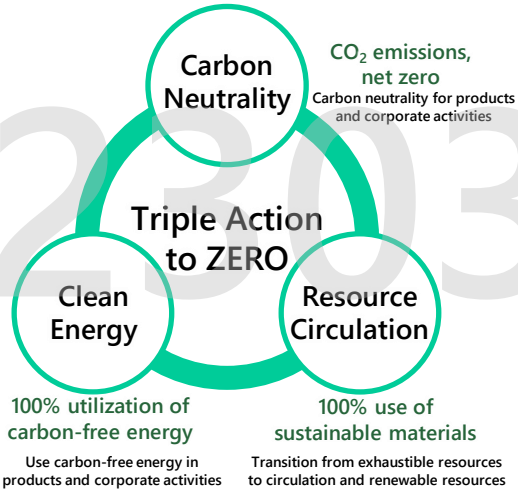
Realizing the joy and freedom of mobility and a sustainable society where people can enjoy life

We aim for a

circular/resource-recycling society having zero environmental impact

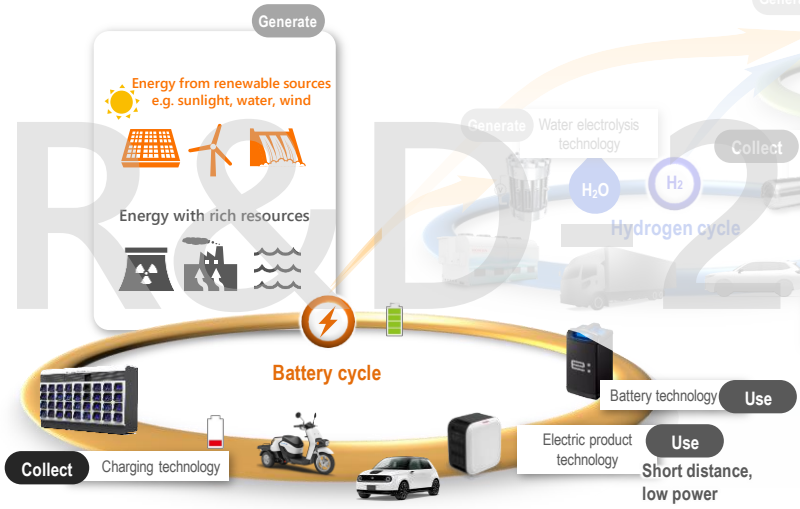
We want to keep providing the "joy of mobility"

We want to realize a "sustainable society"



Multifaceted Approach to Realize Carbon Neutrality

In addition to electricity from renewable sources, cyclical use of hydrogen and carbon as energy carriers



Utilize appropriate energy depending on regions and applications.

Provide the right energy and power unit technologies at the right place.

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Battery EV that Honda Aims for

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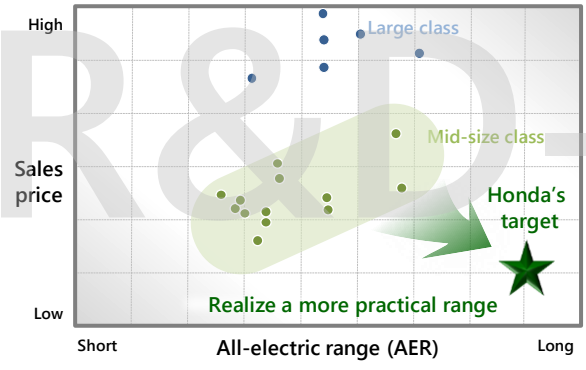
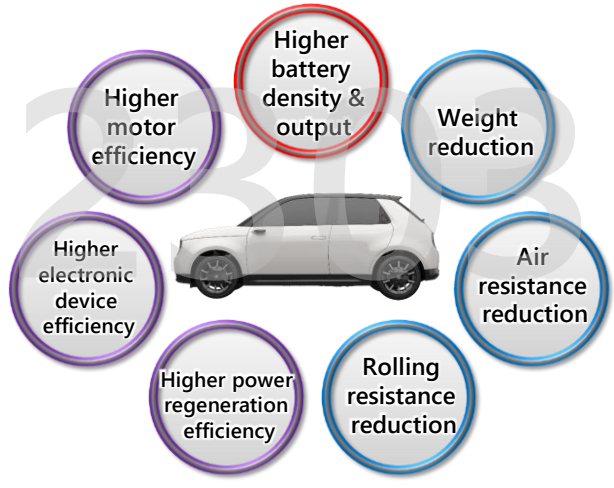
To spread EVs without a burden on customers, we aim for products that surpasses ICE from AER and sales price perspectives

■ Honda's targets for EV



■ Technological challenges of EV



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Increase the Energy for Battery EVs

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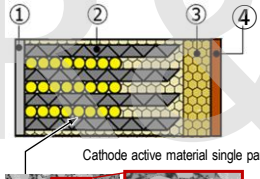
Development of an innovative battery with high energy density

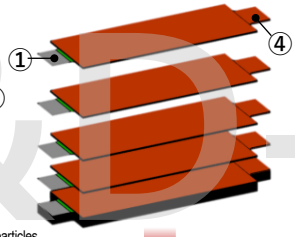
Cell specification development

■ Electrode structure

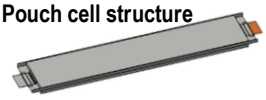
① Cathode current collecting foil
② Cathode composite
③ Solid electrolyte layer
④ Anode



■ Electrode laminated structure



■ Pouch cell structure



Energy density likely to exceed that of conventional liquid LIB

Production process development

Prototype cell

Mixing

High-speed roll pressing

Establish production technology for the prototype cell on a pilot line

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"Honda eMaaS" Concept

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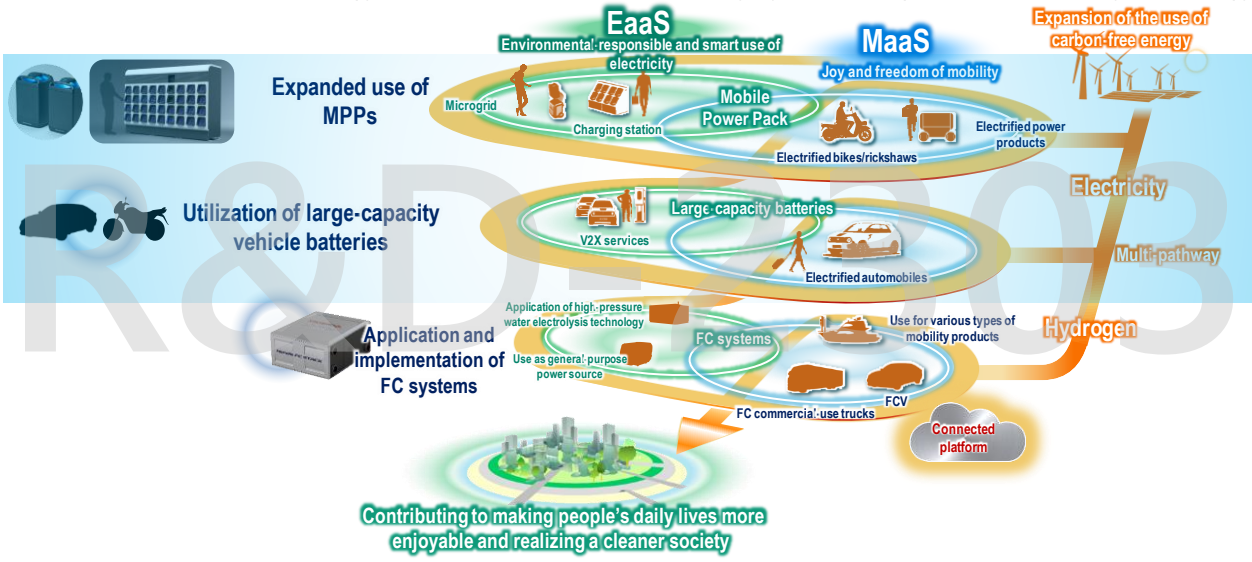
With the use of renewable energy at the core, realize a clean society by connecting electrified mobility and energy



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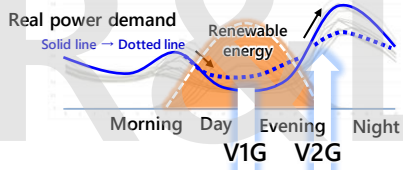
Demonstration Test of the Usefulness of Smart Grid for Renewable Energy Expansion – Europe 15

Control recharging management in a smart way aiming to cut the peak power consumption

■ Power sources become more unstable, requiring adjustment capability

■ Duck curve effect



BEV utilization

Utilize battery EVs to adjust the grid

■ Demonstration tests in EU

e:PROGRESS

Islington, UK

Offenbach, Germany

Honda e

moixa EVTEC ubitricity

Two-way charging & simple socket

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Demonstration Test of the Usefulness of Smart Grid for Renewable Energy Expansion – Japan 16

Currently demonstrating the system and technology for making the most of electric mobility batteries

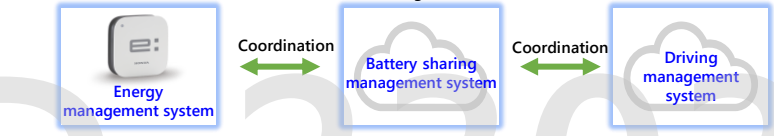
Demonstration partner
Suzuhiro Kamaboko
From February 2022

Strike a balance between energy management of the office building and the demand for the use of company cars to reduce business expenses and CO_2 emissions

Predict and control power supply & demand at office building

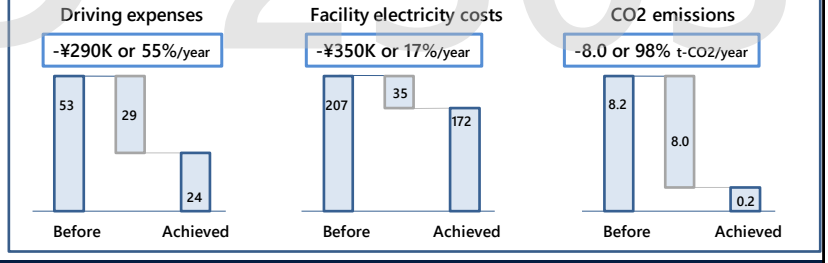
Strike a balance btw EV-using operations and energy management

Calculate the shortest driving route while saving energy



Honda Power Controller e Concept

Economic benefits and CO_2 emissions reduction (Actual results for FY2022)



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Honda Mobile Power Pack

Honda Mobile Power Pack e:

Sturdy, easy-to-handle intelligent battery pack

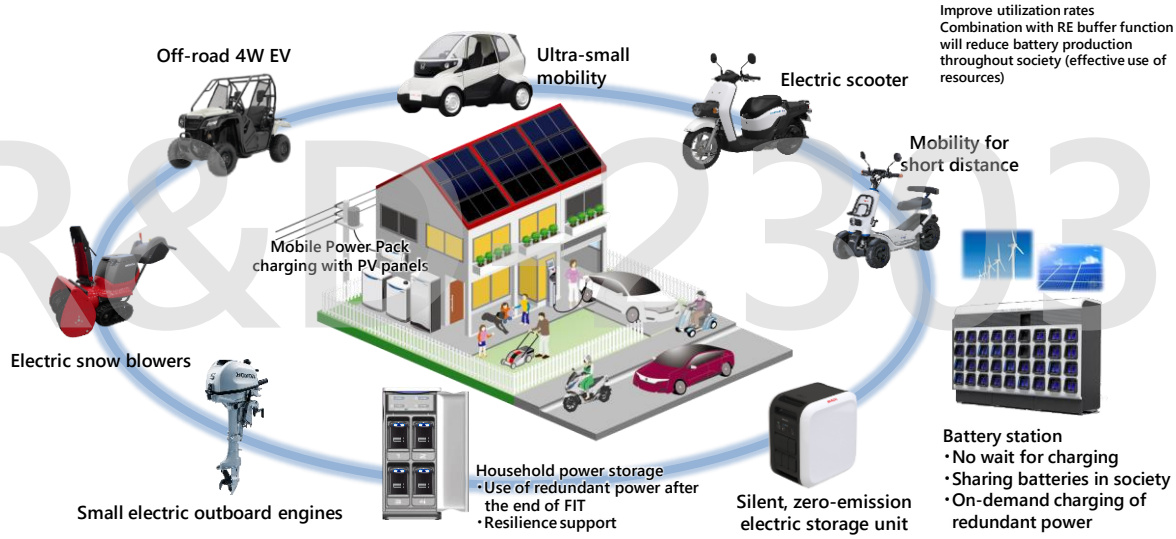
- Safe and highly reliable
- High power and high capacity for expanded use
- Small and lightweight for easy use
- High durability for long-term use
- Low cost for market penetration

48V
(compliant with UN R136)

The 2nd generation was announced in autumn 2021

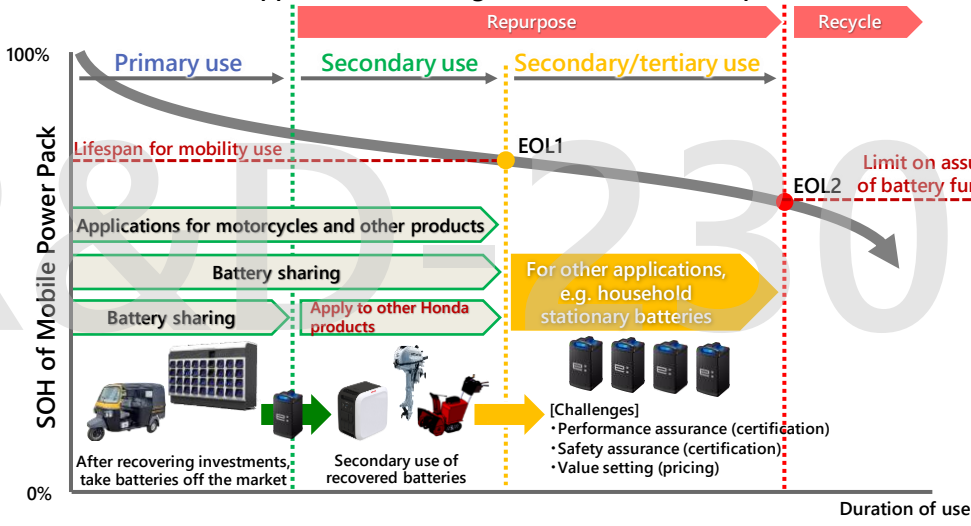
Honda Mobile Power Pack World

Enable commonality of batteries between various Honda products



Secondary Use of Mobile Power Packs ("Repurpose")

Utilizing the detachability, we are considering secondhand use
for several applications, starting with Honda's various products.



Multifaceted Approach to Realize Carbon Neutrality

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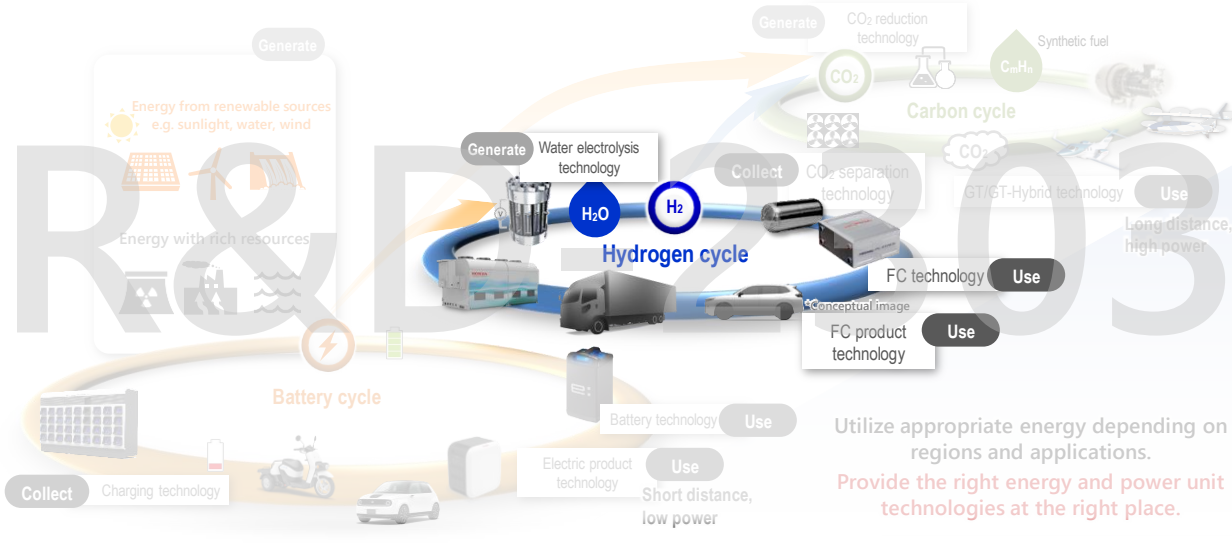
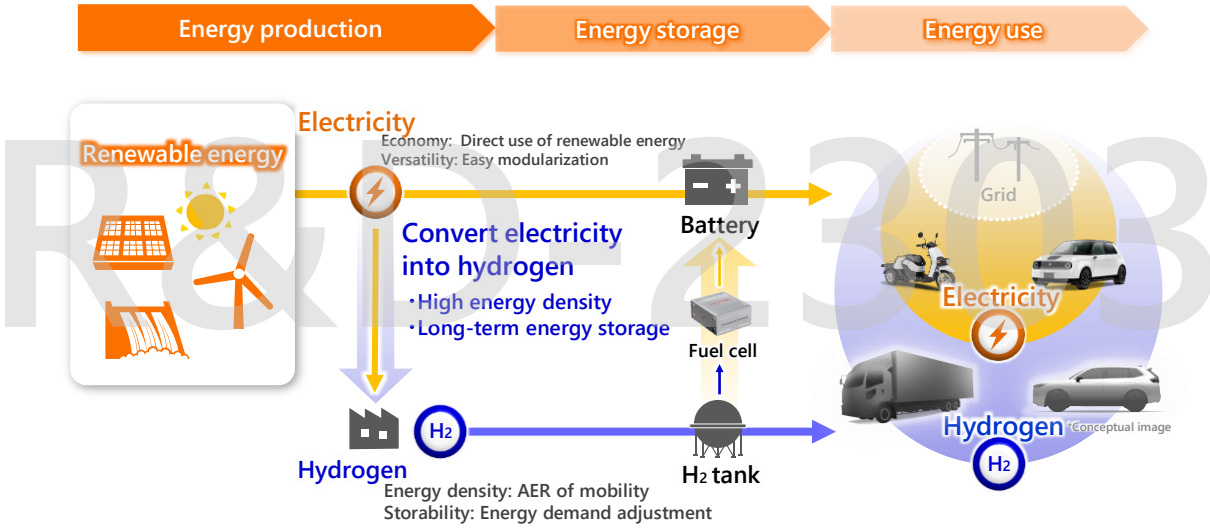


Roles of Electricity and Hydrogen

Wisely utilize hydrogen energy as well as electricity to accelerate electrification of the whole society



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Challenges for Implementing Hydrogen in Society

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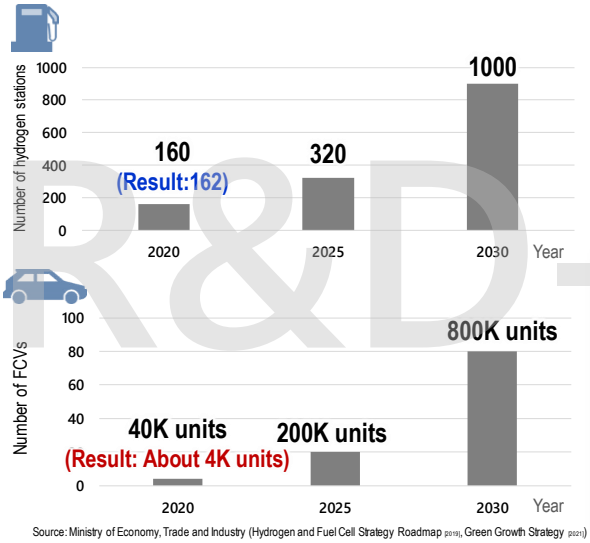
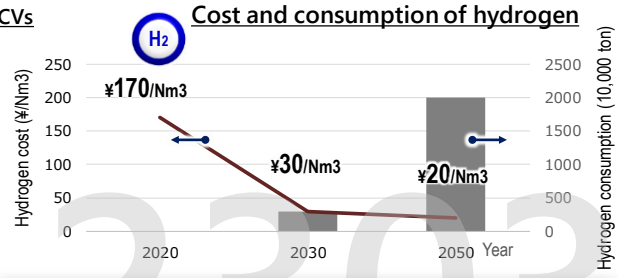
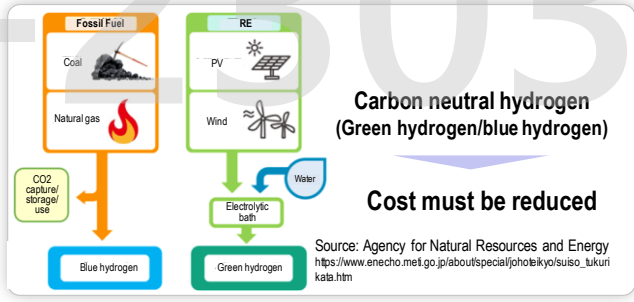
Roadmap for widespread adoption of hydrogen stations and FCVs



Source: Ministry of Economy, Trade and Industry (Hydrogen and Fuel Cell Strategy Roadmap 2019), Green Growth Strategy 2021)

Cost and consumption of hydrogen





Source: Agency for Natural Resources and Energy https://www.enecho.meti.go.jp/about/special/johoteikyo/suiso_tukurikata.htm

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Next-generation Fuel Cell System

Produce a next-generation fuel cell system at our joint venture in Michigan, the U.S.

Joint development & manufacture with GM

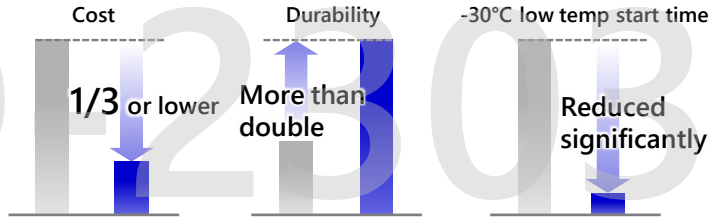
gm HONDA

Next-generation fuel cell system*

*The system based on a fuel cell developed jointly by General Motors (GM) and Honda

■ Evolution from CLARITY FUEL CELL

– CLARITY FUEL CELL – Next Generation



Lower cost

Innovative materials for electrode
Advanced cell seal structure
Simplified auxiliaries
Higher stack productivity, etc.

Higher durability

Use of corrosion-resistant materials
Deterioration control, etc.

Higher resistance against low temp

Warming control

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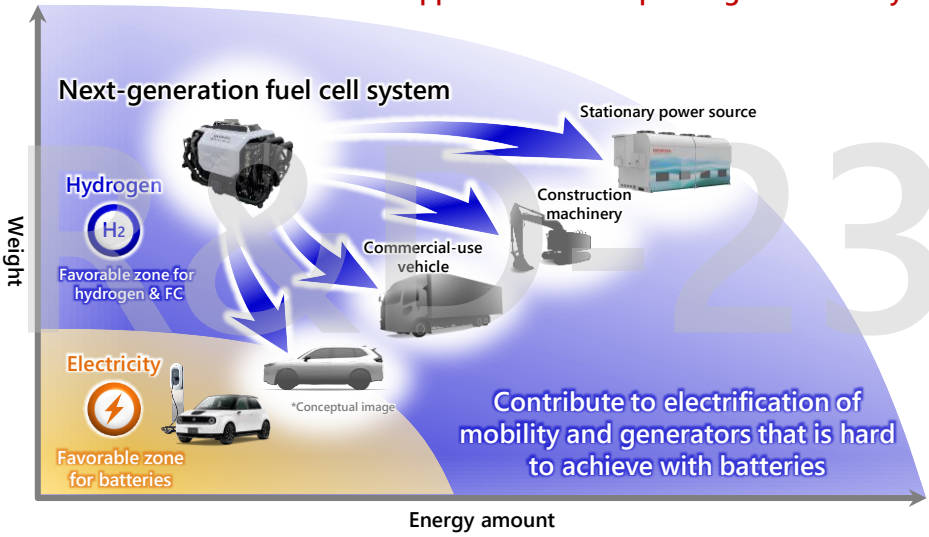
Expansion of Applications of FC Technology and Use of Hydrogen

Provide clean mobility and reliable power by using FC core technology for various applications and expanding the use of hydrogen



Consider use of FC systems for various applications

Commercial-use truck

Joint research with Isuzu Motors; Tests on public roads will start in FY2024

Explore and research the possibility of FC utilization

Power source

Ship

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6th Strategic Energy Plan Approved by the Cabinet on October 22, 2021

Source: "Outline of Strategic Energy Plan" by Agency for Natural Resources and Energy

In FY2030, 41% of the power generation is expected to be from fossil fuel

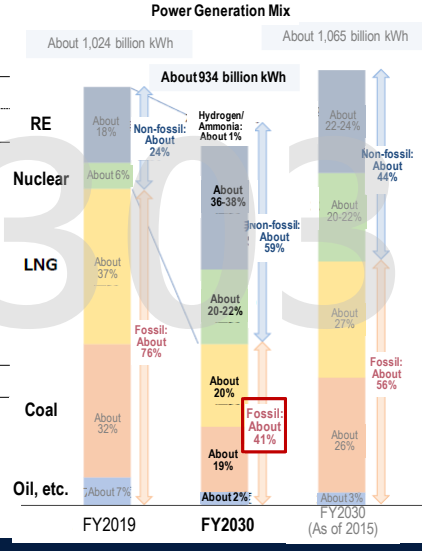
■ FY2030 Power generation mix (ambitious outlook)

Energy efficiency improvement		62 million kl
Final energy consumption (without energy conservation)		350 million kl
Power generation mix	Renewable energy	36-38%*
	Hydrogen/Ammonia	1%
	Nuclear	20-22%
	LNG	20%
	Coal	19%
	Oil, etc.	2%
(+ non-energy related gases/sinks)		
GHG reduction rate		46% Continuing strenuous efforts to cut its emissions by 50%

*If progress is made in utilization and implementation of R&D of renewable energy currently underway, 38% or higher will be aimed at.

(Details of renewables)

solar	14-16%
wind	5%
geothermal	1%
hydropower	11%
biomass	5%



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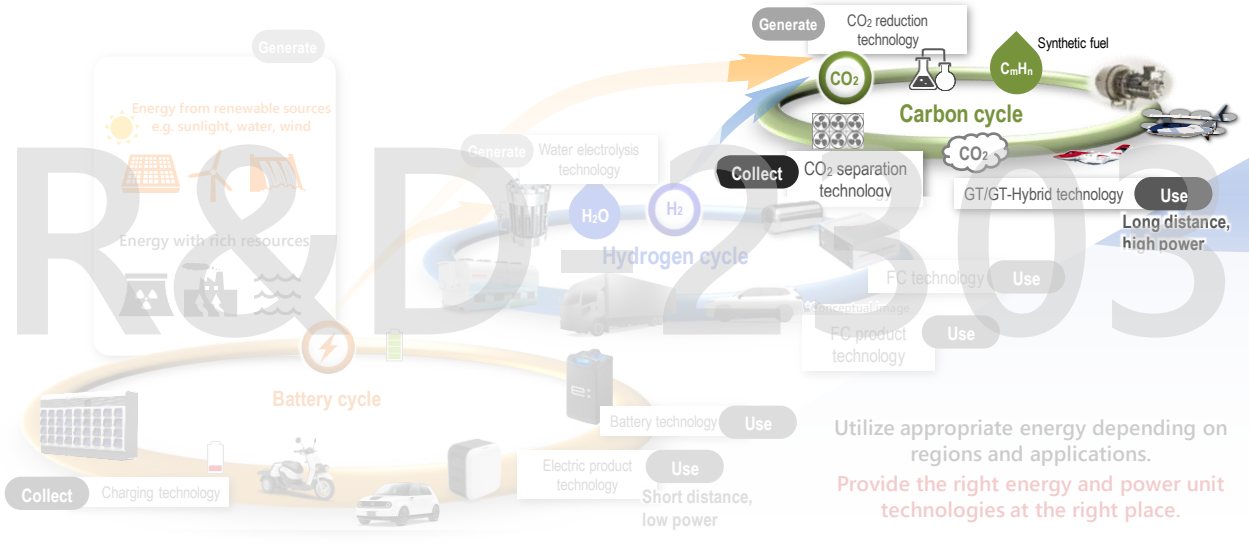

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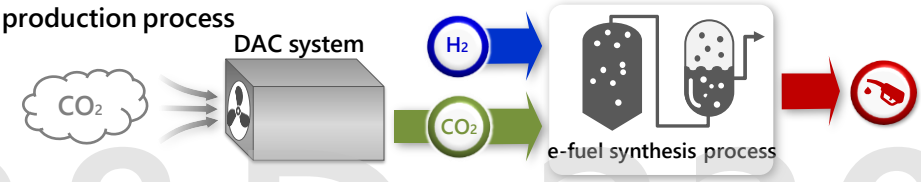
Direct Air Capture (DAC) + e-fuel technology

Research and pursue technology for capturing CO2 from the air and synthesizing carbon-neutral fuel

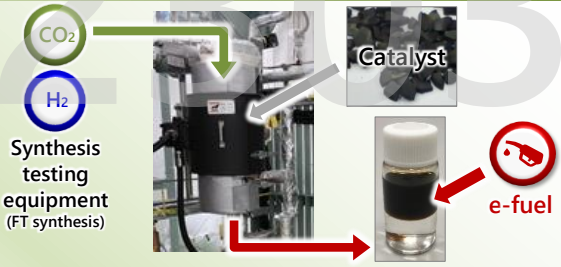
■e-fuel production process



DAC test module

Enable enrichment of CO_2 by specifically absorbing/desorbing it

e-fuel synthesis testing equipment

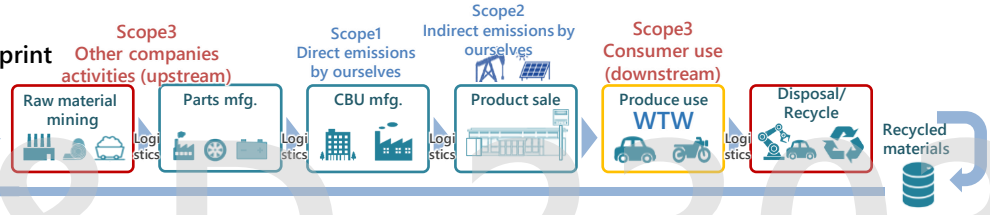


Use catalysts to produce e-fuel out of hydrogen and CO_2

Resource Circulation – GHG emissions

Electrification alone cannot achieve carbon neutrality

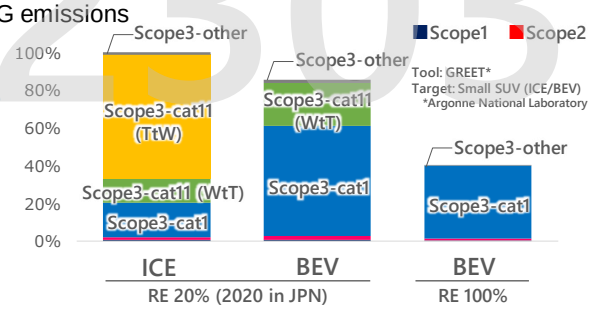
■ Corporate environment footprint



■ GHG emissions

Corporate GHG are emitted from products and corporate activities.
Emissions from products must be reduced throughout their life cycle

Σ Life cycle GHG emissions
= Raw material + Mfg. + WtT + TtW + Transport + Disposal



Resource Circulation – Honda's goal

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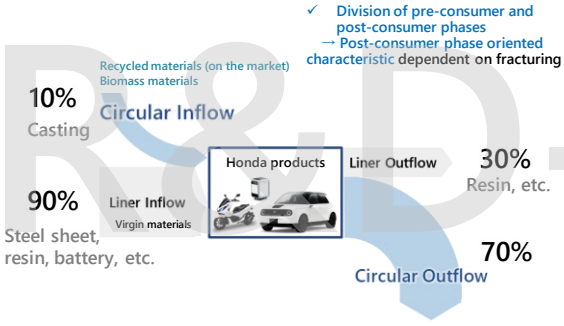
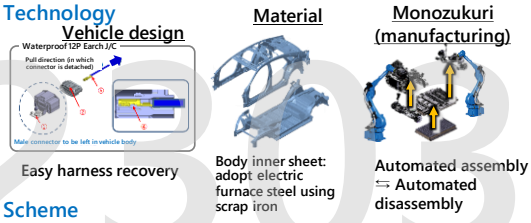
Recycle high-grade resources from end-of-life vehicles (ELV) horizontally to strike a balance with economic rationality

Current: Resource value is not recovered to vehicles, flowing out to other industries

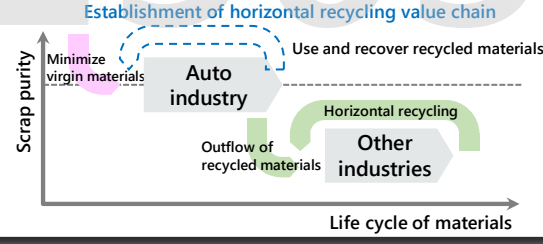


Establish technology and scheme to realize horizontal recycling

■ Technology



■ Scheme



Honda R&D

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New Areas: 3 Core Technologies

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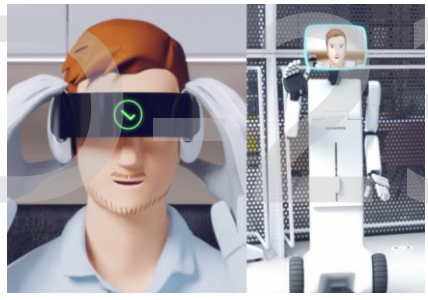
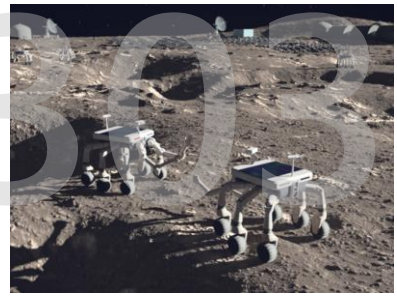
Honda eVTOL
(electric vertical take-off and landing aircraft)

Honda Avatar Robot
(avatar robot)



Challenges in the field of space technology



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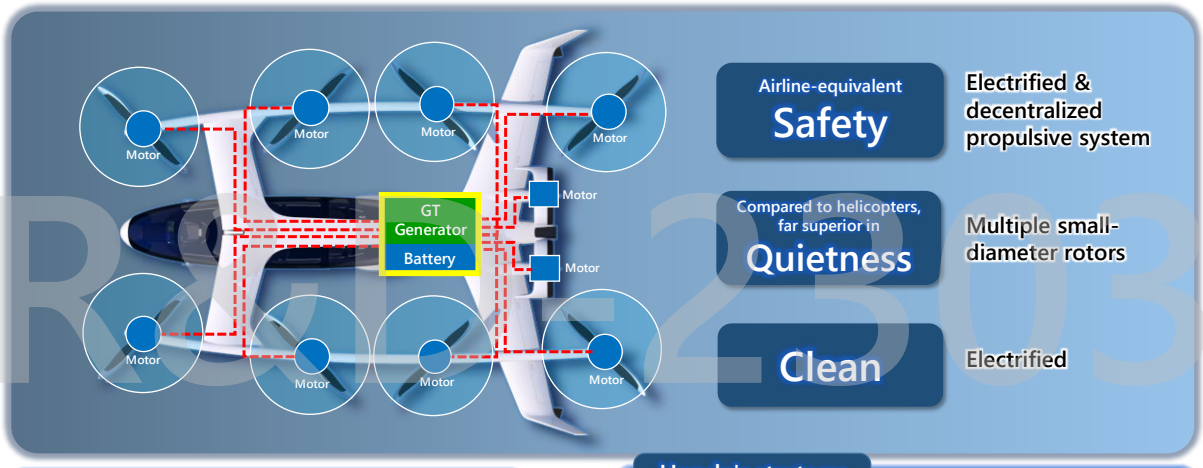
eVTOL electric Vertical Take Off and Landing



All Electric eVTOL — Short flight range: Low energy density of current batteries

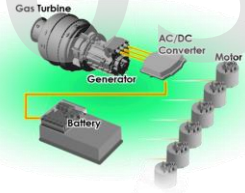
Honda's strategy — Honda e:TECHNOLOGY

Hybrid eVTOL

Realistic approach that can adapt to the evolution of batteries

Hybrid eVTOL that Leverages Honda Core Technologies

eVTOL Airframe



Gas turbine hybrid power unit

Honda is accelerating research and development in the field of **space technologies,** viewing it as a place to take on challenges while leveraging its core technologies

R&D-2303

Circulative renewable energy system

Development robots on the lunar surface

Reusable rockets

Circulative Renewable Energy System (Hydrogen Technologies)

We're developing this **small-sized, lightweight and high-efficiency energy system** which will work on the lunar surface

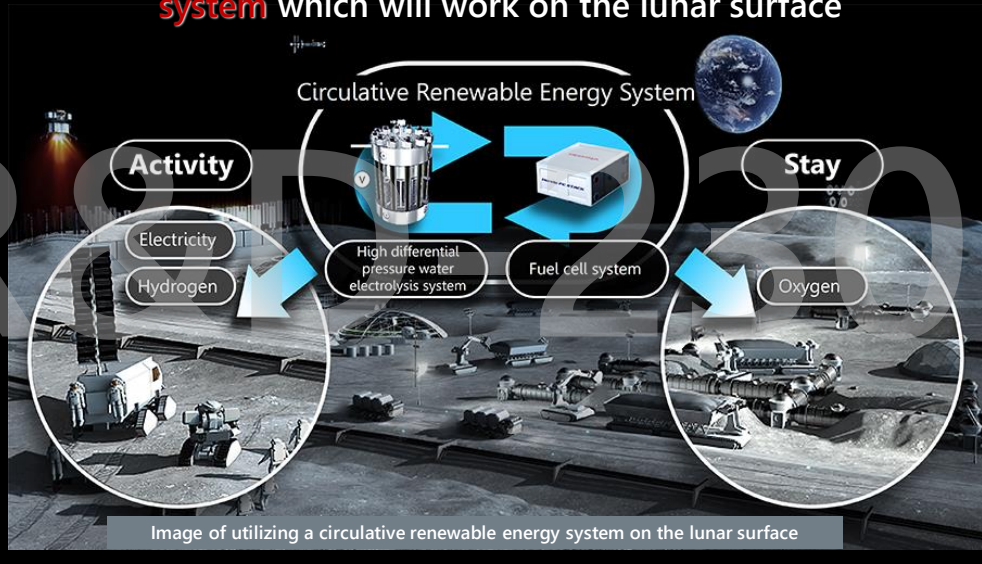


Image of utilizing a circulative renewable energy system on the lunar surface

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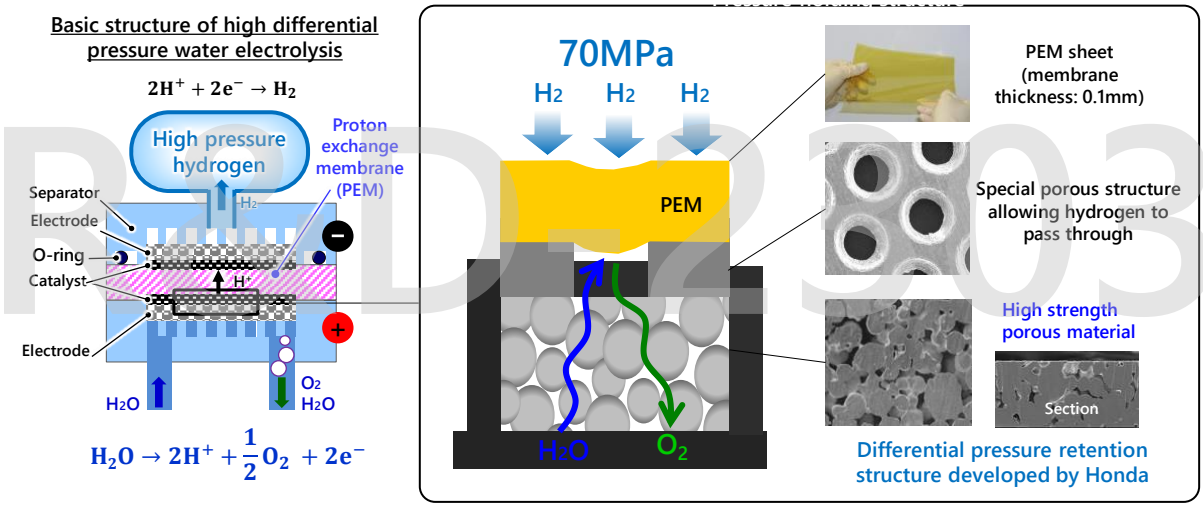
High Differential Pressure Water Electrolysis

Honda's differential pressure retention structure enables water electrolysis of 70MPa



Conclusion



Take on challenges to be of service to people