Honda Fuel Cell Electric Vehicle Development and Introduction

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Environment and Energy Issue

- Recognition of Issue
- Toward Next Generation Technology

（Concept of sustainable society）

Fuel Cell Electric Vehicles as a Viable Alternative

- Honda Development Status
- Honda New FCEV Concept
- Recent Trends toward Introduction

Summary

Energy and Environmental Issues

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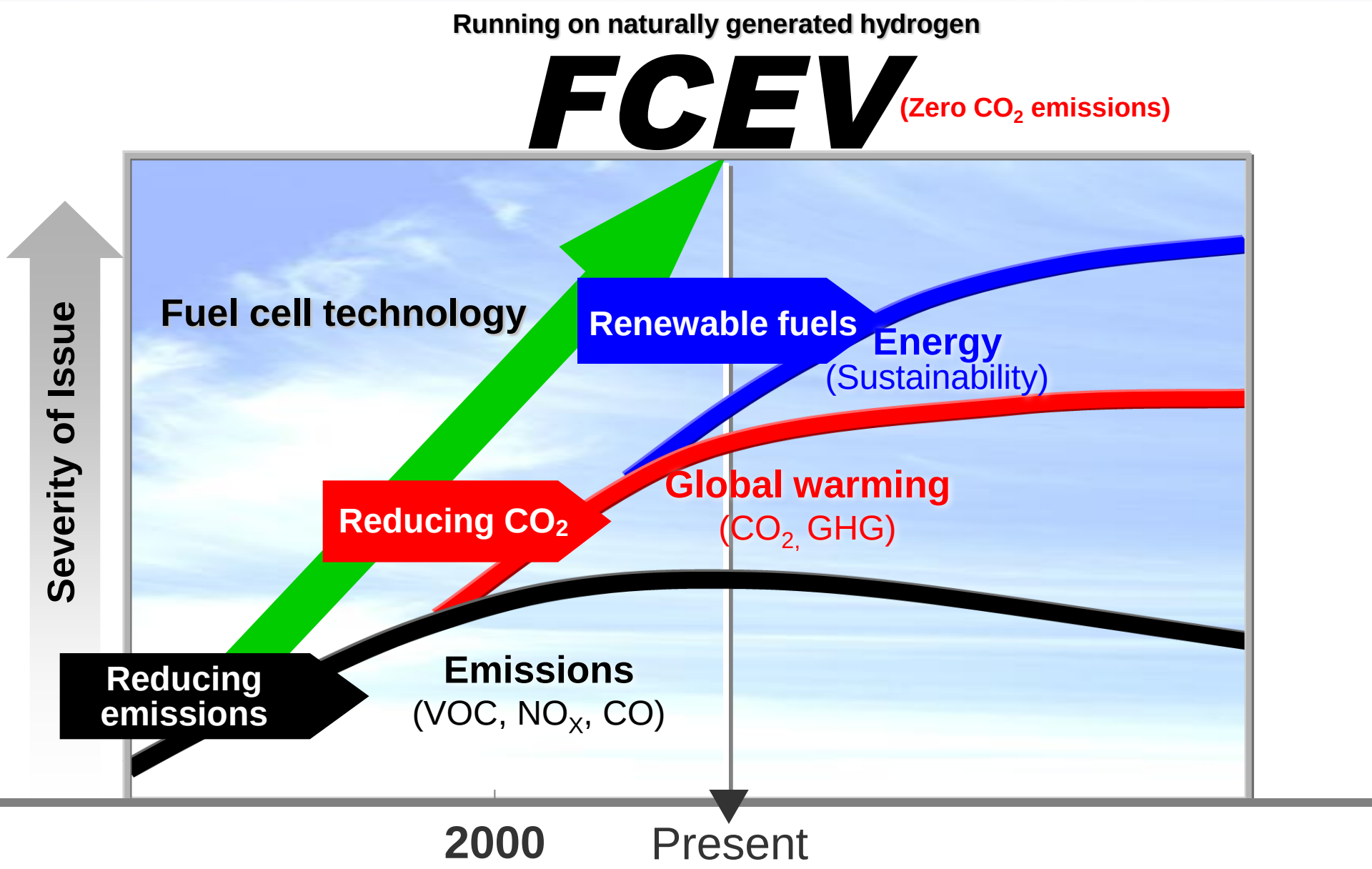

History of Honda FCEV Development

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1980s | 1995 | 2000 | 2002 | 2004 | 2006 | 2008

Fundamental research

FCX- V1,V2 V3 V4 FCX FCX CLARITY

Hydrogen-powered **FCEV** (Hydrogen absorbing alloys)

Hydrogen-powered FCEV (High-pressure tank of hydrogen)

FCX Clarity

FCEV
(Fuel Cell Electric Vehicle)

Methanol reforming FCEV

Applied Technologies

Public road test → Lease sale

- Motor

EV-PLUS (Electric vehicle)

- High-pressure tank of hydrogen

CIVIC-GX (CNG vehicle)

- Energy management

Hybrid vehicle

INSIGHT | 02 CIVIC Hybrid | 06 CIVIC Hybrid | INSIGHT

FCX Clarity outline

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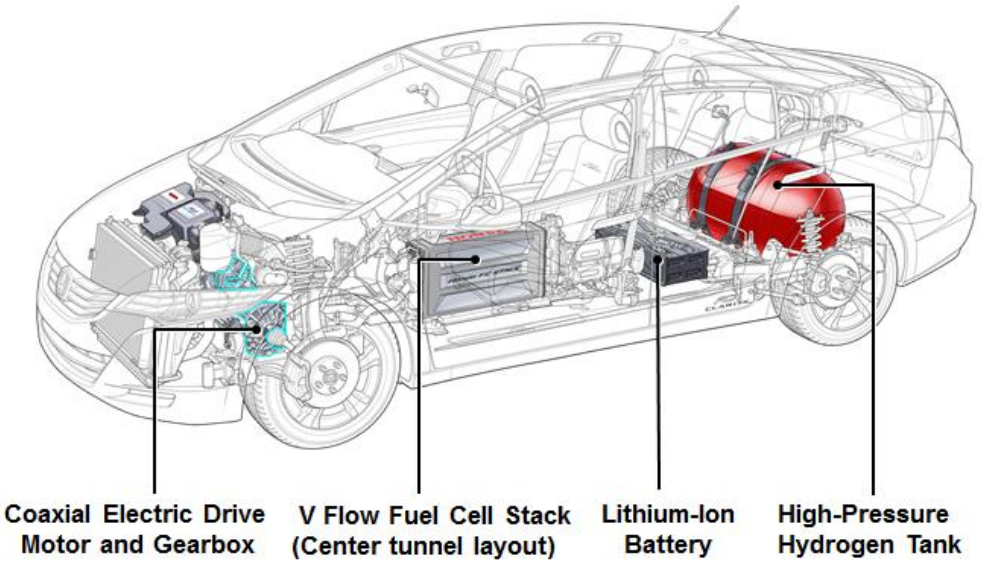
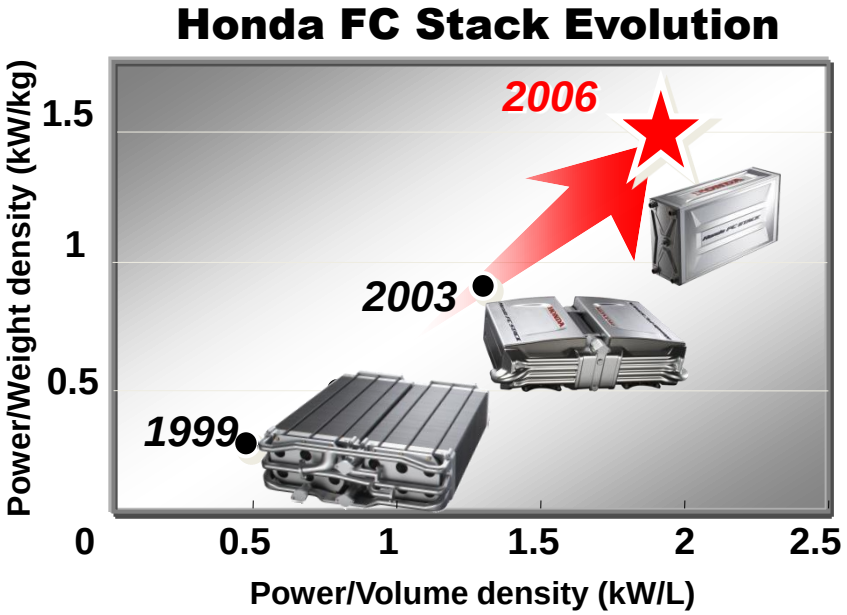
FCX CLARITY





■ Specification

Size	**4,845x1,845x1,470 mm**	Maximum motor output	**100 kW (136ps)**
Vehicle weight	**1630 kg**	Maximum motor torque	**256 Nm (26.1kg･m)**
Maximum speed	**100 mph**	Energy storage	**Li-ion battery 288 (V)**
Driving range	**240 mile**	Hydrogen tank capacity/pressure	**171 L/ 35Mpa**
Fuel-cell stack power	**100 kW**	Hydrogen charging time	**3 - 4min**

FCEV CONCEPT / New FC STACK

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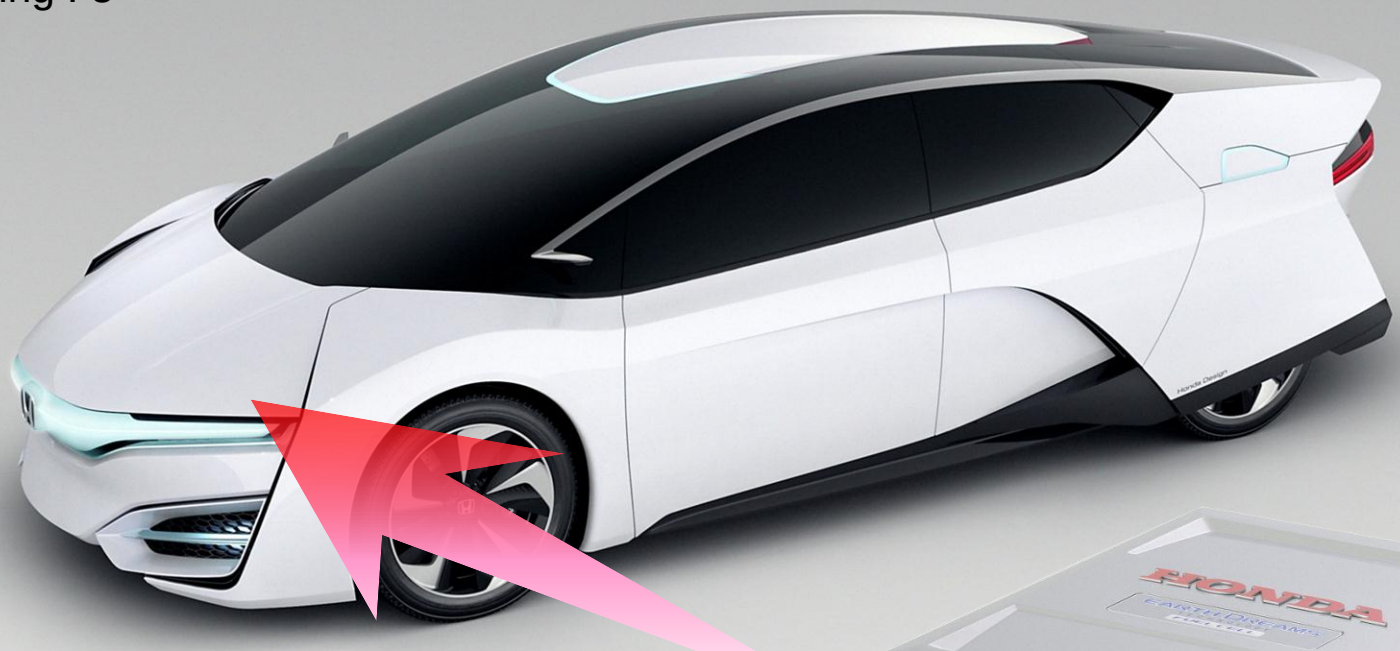
FCEV CONCEPT

- Range : > 300miles
- H2 Tank Pressure : 70MPa
- Refuel Time : approx. 3minutes
- Seating : 5



New Fuel Cell Stack

- Output : >100kW
- Power Density : > 3kW/L
- Layout : in the engine room

Driving Range Extension

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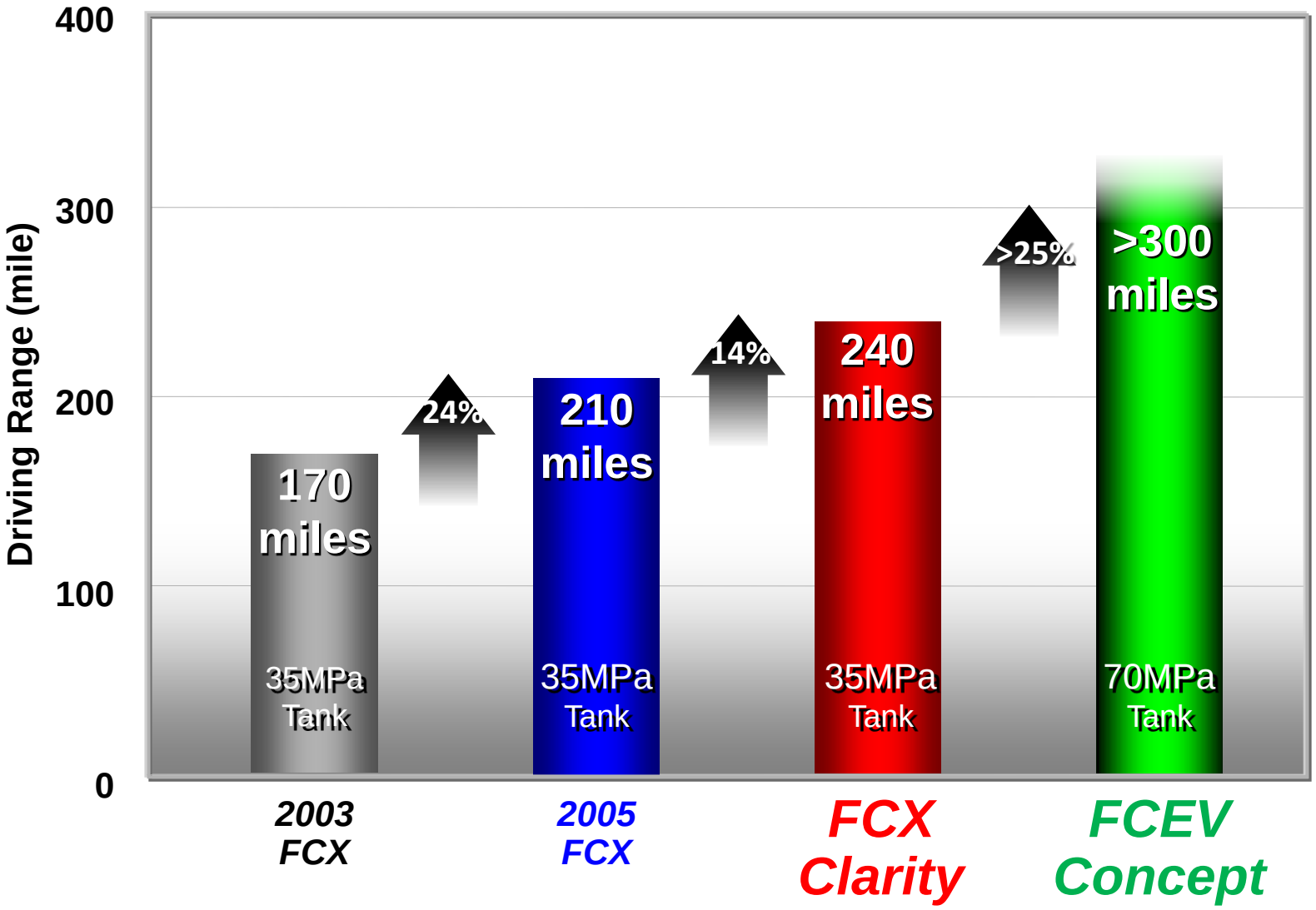

Driving range improved Gen. by Gen. >>> Competitive to ICE

Evolution toward FCEV Commercialization

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	Clarity	FCEV Concept
FC Stack Power Density	2 kW/L	3 kW/L
FC Stack Location	Center tunnel	Under Hood
Seating	4	5
Tank Pressure	35MPa	70MPa
Range	240mile	> 300mile
Refuel time	3min	3min

Not FCEV exclusive chassis

Cost down

FCEV Sales Increase

Same usability as ICE vehicle

More seating, better packaging, increased range.

Fuel Cell electric Vehicle: Issues Lying Ahead

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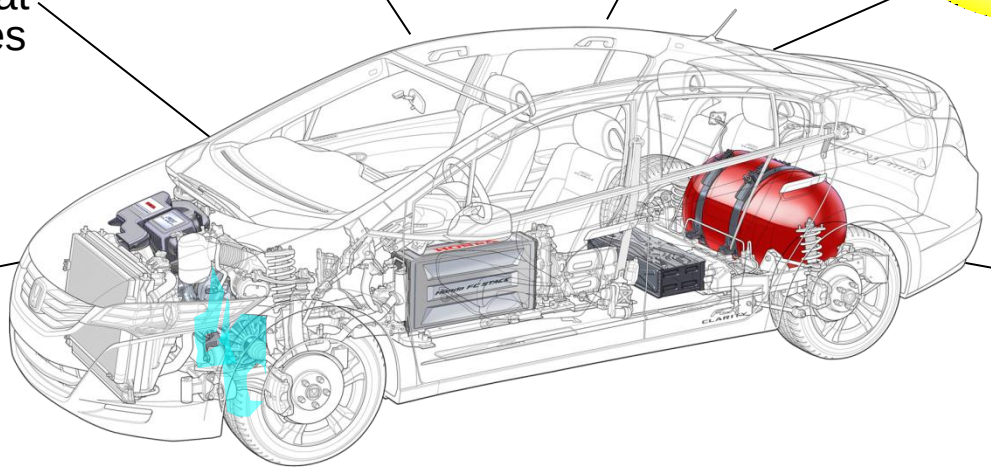
Performance
Size/weight reduction

Durability
Reliability
Thousands of hours

Environment adaptability
Sub-zero startup
Heat dissipation at high temperatures

Quality control
Cell uniformity



Driving Range
Hydrogen storage

Cost
Reduce platinum use
Mass production technology

- Hydrogen infrastructure
- Fuel cost

- Related regulations still in preparation
- Need for common international standard

Infrastructure preparation plan

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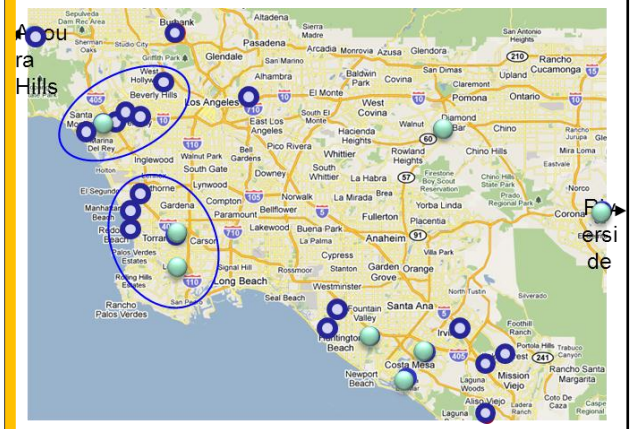
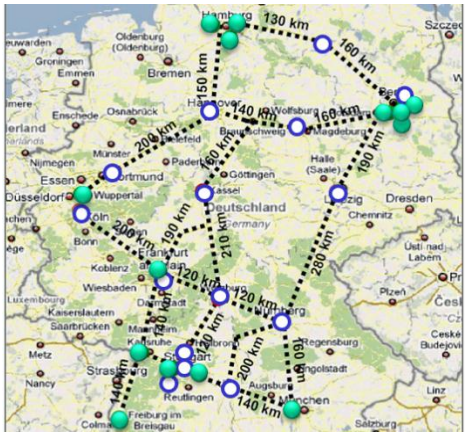
■Governmental Strategic Energy Plan of Japan, April, 2014

- Stationery Fuel Cells (Ene-Farm　etc)
- Fuel Cell Vehicle introduction (preparation of Hydrogen refueling stations)
- Hydrogen Power generation
- Hydrogen production, storage, transportation for stable supply

Government : Making a road map toward establishment of a “Hydrogen Society”

Japan	US	EU
100 HRSs deployment plan in 4 Big cities	68 HRSs deployment plan in LA State	50 HRSs deployment plan in Germany
		

Roadmap to FCEV Commercialization

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Technology Demonstration 2002～

Technology and Market Demonstration 2008～

2015

Commercialization 2020 2025～

Honda will launch an all-new fuel cell electric model sequentially in Japan, the U.S. and Europe starting in 2015. This new fuel cell vehicle will showcase further technological advancement and significant cost reduction that Honda has accomplished. (September 21, 2012)

Collaboration with GM toward 2020 (July 2, 2013)

■Sales expansion
・Affordable price

■Expansion
・Cost down

FCX Clarity

■Sales to general public
・Cost
・Production quality
・More driving range

'05M FCX

'03M FCX

■Technology improved
・Cold start up

■Expanding of a Lease
・Performance
・Durability
・Driving range

■World's first FCEV

The image of hydrogen infrastructure deployment

Delivery the FCEV improved Quality Management and Cost reduction in 2015
Expansion the FCEV collaborated with GM (technology and scale merit) in 2020
Necessary for cooperation of Hydrogen Refueling Station toward the FCEV expansion

Hydrogen-Based Renewable Energy

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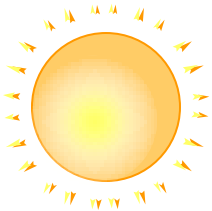
Low-carbon hydrogen can be produced from solar energy

Solar Energy



Solar Panel

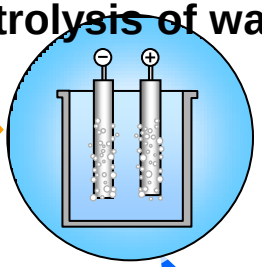
Electricity generation

Hydrogen

Hydrogen production

Running on electricity generated by fuel cells

Electrolysis of water



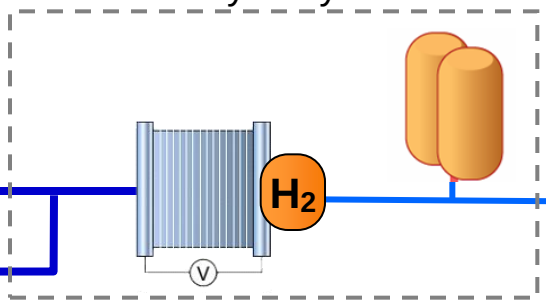
Fuel Cell

Electricity

Water

Return to nature

High-pressure water electrolysis system



Refueling nozzle

Grid

Solar Hydrogen Station

Solar Hydrogen Station(SHS2)

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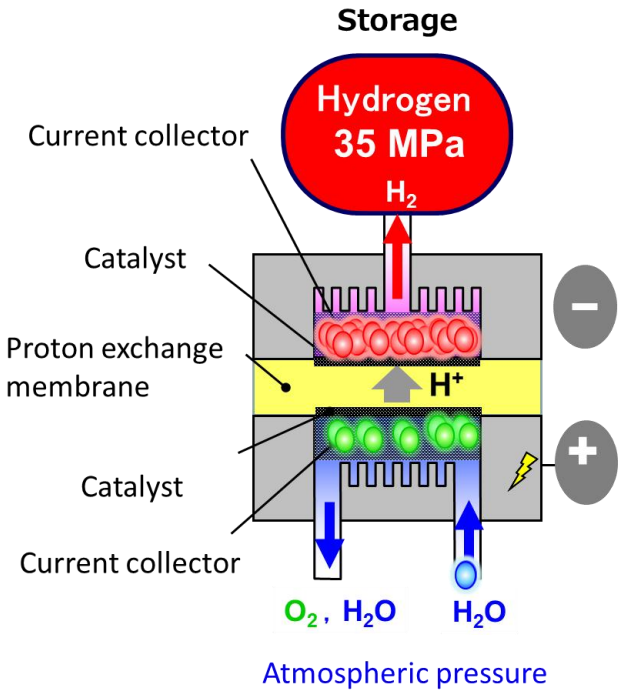

Hydrogen Production	Flow Rate	0.7 Nm^3/h (1.5kg/Day)
	Filling Pressure	35 MPa (Max)
	Purity	> 99.99%
Components	Solar cell	6 kW
	Electrolysis	High differential pressure electrolyzer
Utility	Electricity	240 VAC
	Water	Tap Water
Unit Size		Approx. 0.33 m3

◆Fleet test started in LA from 2010.

◆SHS was installed in Saitama pref. office in 2012.
FCX Clarity is operated using the hydrogen generated from SHS.
FCX Clarity has a function of Power supply from vehicle.

Picture of SHS installed in Saitama Prefectural Office

FCX Clarity with external power supply system

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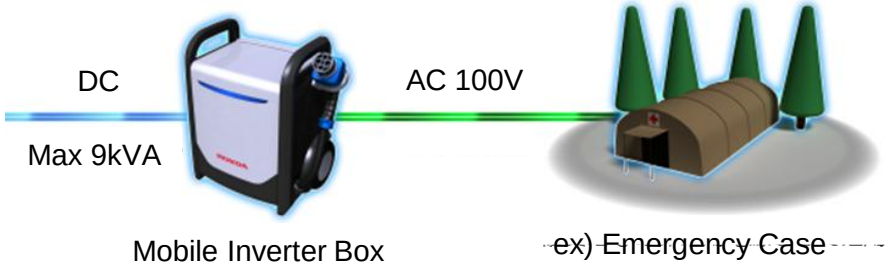
100V Mobile Inverter Box(V2L)

FCX Clarity with external power supply system

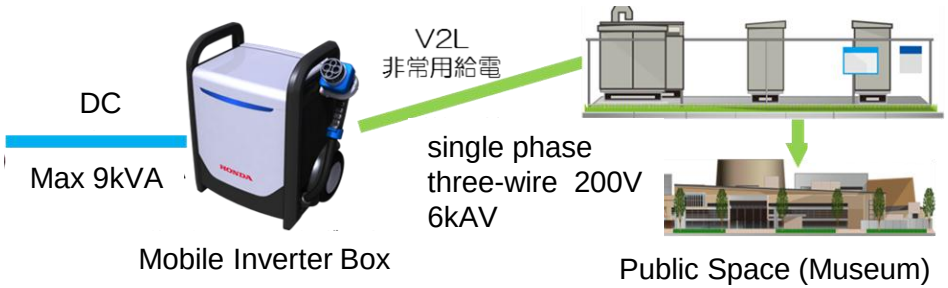
200V Mobile Inverter Box(V2H/V2L)

100V Mobile Inverter Box（V2L）



200V Mobile Inverter Box（V2H）

200V Mobile Inverter Box（V2L Emergency Case）



Conclusion

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- ✓ **Vehicle electrification is the main pathway toward greenhouse gas reduction and a shift to alternative, renewable energy sources.**
- ✓ **For low CO_2 emission community, Hydrogen is very promising energy buffer easily converting to electricity.**
- ✓ **Technological breakthroughs helping reduce cost and cooperation from academia, industry and government are needed for the popularization of FCEVs.**
- ✓ **A concerted effort among related industries/companies, the establishment of global standards and the creation of a hydrogen refueling infrastructure are also required if FCEVs are to be marketed as scheduled starting in 2015.**

BLUE SKIES FOR
OUR CHILDREN


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