Honda Fuel Cell Electric Vehicle Development and Introduction

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Fuel cell technology

Running on naturally generated hydrogen

FCEV (Zero CO₂ emissions)

Severity of Issue

Energy and Environmental Issues

Reducing emissions

Reducing CO₂

Renewable fuels

Energy (Sustainability)

Global warming (CO₂, GHG)

Emissions (VOC, NOₓ, CO)

2000 Present
**Specification**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Maximum motor output</th>
<th>100 kW (136ps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>4,845x1,845x1,470 mm</td>
<td>Maximum motor torque</td>
<td>256 Nm (26.1kg·m)</td>
</tr>
<tr>
<td>Vehicle weight</td>
<td>1630 kg</td>
<td>Energy storage</td>
<td>Li-ion battery 288 (V)</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>100 mph</td>
<td>Hydrogen tank</td>
<td>171 L/ 35Mpa</td>
</tr>
<tr>
<td>Driving range</td>
<td>240 mile</td>
<td>capacity/pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hydrogen charging time</td>
<td>3 - 4min</td>
</tr>
<tr>
<td>Fuel-cell stack power</td>
<td>100 kW</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FCEV CONCEPT
- Range: >300 miles
- H₂ Tank Pressure: 70 MPa
- Refuel Time: approx. 3 minutes
- Seating: 5

New Fuel Cell Stack
- Output: >100 kW
- Power Density: > 3 kW/L
- Layout: in the engine room
Driving range improved Gen. by Gen. >>> Competitive to ICE
<table>
<thead>
<tr>
<th></th>
<th>Clarity</th>
<th>FCEV Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>FC Stack Power Density</td>
<td>2 kW/L</td>
<td>3 kW/L</td>
</tr>
<tr>
<td>FC Stack Location</td>
<td>Center tunnel</td>
<td>Under Hood</td>
</tr>
<tr>
<td>Seating</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Tank Pressure</td>
<td>35MPa</td>
<td>70MPa</td>
</tr>
<tr>
<td>Range</td>
<td>240mile</td>
<td>&gt; 300mile</td>
</tr>
<tr>
<td>Refuel time</td>
<td>3min</td>
<td>3min</td>
</tr>
</tbody>
</table>

More seating, better packaging, increased range.
Fuel Cell electric Vehicle: Issues Lying Ahead

- Hydrogen infrastructure
- Fuel cost

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

<table>
<thead>
<tr>
<th>Japan</th>
<th>US</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 HRSs deployment plan in 4 Big cities</td>
<td>68 HRSs deployment plan in LA State</td>
<td>50 HRSs deployment plan in Germany</td>
</tr>
</tbody>
</table>
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)

Necessary for cooperation of Hydrogen Refueling Station toward the FCEV expansion

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

**Solar Energy**
- **High-pressure water electrolysis system**
- **Electrolysis of water**
- **Hydrogen production**

**Solar Panel**
- **Electricity generation**

**Grid**

**Electrolysis of water**
- **Water**
- **Hydrogen**

**Fuel Cell**
- **Running on electricity generated by fuel cells**

**Solar Hydrogen Station**
- **Refueling nozzle**

**Return to nature**

**Electricity**
- **Solar Hydrogen Station**

**Low-carbon hydrogen can be produced from solar energy**

**H2**

**Refueling nozzle**

**Grid**

**Solar Energy**
**Solar Hydrogen Station (SHS2)**

**Hydrogen Production**
- Flow Rate: 0.7 Nm³/h (1.5 kg/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

100V Mobile Inverter Box (V2L)
- DC
- Max 9kVA
- Single phase three-wire 100V

100V Mobile Inverter Box (V2L)
- AC 100V
- Used in Emergency Case

200V Mobile Inverter Box (V2H)
- DC
- Max 9kVA
- Single phase three-wire 200V

200V Mobile Inverter Box (V2L)
- DC
- Max 9kVA
- Single phase three-wire 200V 6kAV

Public Space (Museum)
Vehicle electrification is the main pathway toward greenhouse gas reduction and a shift to alternative, renewable energy sources.

For low CO₂ 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