Hydrogen as part of TOYOTA‘s mobility strategy

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Development of Mobility
## German Climate Protection Plan

### CO₂-Einsparungen in einzelnen Bereichen

<table>
<thead>
<tr>
<th>Handlungsfeld</th>
<th>1990 (in Mio. t CO₂-Aq.)</th>
<th>2014 (in Mio. t CO₂-Aq.)</th>
<th>2030 (in Mio. t CO₂-Aq.)</th>
<th>2030 (Minderung in % gtl. 1990)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energie-Wirtschaft</td>
<td>466</td>
<td>358</td>
<td>175 – 183</td>
<td>62 – 61 %</td>
</tr>
<tr>
<td>Gebäude</td>
<td>209</td>
<td>119</td>
<td>70 – 72</td>
<td>67 – 66 %</td>
</tr>
<tr>
<td>Verkehr</td>
<td>163</td>
<td>150</td>
<td>95 – 98</td>
<td>42 – 40 %</td>
</tr>
<tr>
<td>Industrie</td>
<td>283</td>
<td>191</td>
<td>140 – 143</td>
<td>51 – 49 %</td>
</tr>
<tr>
<td>Land-Wirtschaft</td>
<td>88</td>
<td>72</td>
<td>58 – 61</td>
<td>34 – 31 %</td>
</tr>
<tr>
<td>Teilsumme</td>
<td>1209</td>
<td>890</td>
<td>538 – 557</td>
<td>58 – 54 %</td>
</tr>
<tr>
<td>Sonstige</td>
<td>38</td>
<td>12</td>
<td>5</td>
<td>87 %</td>
</tr>
<tr>
<td><strong>Gesamtsumme</strong></td>
<td><strong>1248</strong></td>
<td><strong>902</strong></td>
<td><strong>543 – 562</strong></td>
<td><strong>56 – 55 %</strong></td>
</tr>
</tbody>
</table>
Toyota Earth Charta issued in 1992

toyota global vision

Toyota will lead the way to the future of mobility, enriching lives around the world with the safest and most responsible ways of moving people.

Through our commitment to quality, constant innovation and respect for the planet, we aim to exceed expectations and be rewarded with a smile.

We will meet our challenging goals by engaging the talent and passion of people, who believe there is always a better way.
Environmental Challenge 2050

- New Vehicle Zero CO₂
- Life Cycle Zero CO₂
- Plant Zero CO₂
- Minimized Water Usage
- Recycling based Society
- Harmony with the Nature
Environmental Challenge 2050

1992
Toyota Earth Charter

New Vehicle Zero CO₂ Emission

CHALLENGE 1
New Vehicle Zero CO₂ Emission's Challenge

Lifecycle Zero CO₂ Emission

CHALLENGE 2
Life Cycle Zero CO₂ Emission's Challenge

Plant Zero CO₂ Emission

CHALLENGE 3
Plant Zero CO₂ Emission's Challenge

Minimized and optimized Water usage

CHALLENGE 4
Challenge of Minimizing and Optimizing Water Usage

Recycling Based Society

CHALLENGE 5
Challenge of Esta blishing a Recycling-based Society and Systems

Society in Harmony with Nature

CHALLENGE 6
Challenge of Esta blishing a Future Society in Harmony with Nature

Toyota
Reduction of new vehicle CO₂ Emissions by 90% compared with 2010
Toyota’s sustainable mobility strategy

- **EVs**: short-range
- **HVs & PHVs**: general use
- **FCVs**: medium-to long-range

**Fuel**
- Electricity
- Gasoline, diesel, biofuels, CNG, synthetic fuels, etc.
- Hydrogen

**Vehicle size**
- Personal mobility
- Short-distance commuter vehicles
- Home delivery vehicles

**Travel distance**
- Full-size trucks
- Home delivery trucks

**Home delivery vehicles**
- **EVs**

**Personal mobility**
- **EVs**

**Short-distance commuter vehicles**
- **EVs**

**Route buses**
- **HVs**

**Passenger cars**
- **PHVs**

**FC buses**
- **FCV passenger vehicles**

**Full-size trucks**
- **FCVs**

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**EVs**: short-range; **HVs & PHVs**: general use; **FCVs**: medium-to long-range
HYDROGEN
H₂ has been used for over a century...
Every year, millions of tons are generated, stored and transported safely.
H₂ helps addressing key problems
FC development since 1996

- **FCEV Fuel**
  - H₂ Stored in adsorbing alloy
  - 1996

- **FCHV-3 Fuel**
  - Hydrogen (adsorbing alloy)
  - 1999

- **FCHV-4 Fuel**
  - Hydrogen stored in high-pressure tanks
  - 2001

- **FCHV**
  - Toyota-made tanks, 1st FCV homologated
  - 2002

- **FCHV-5 Fuel**
  - Hydrogen generated on-board by reforming on gasoline
  - 2005

- **FCHV-adv Fuel**
  - New stack, stainless steel cells
  - 2009

- **Mirai**
  - Revolutionary Titanium stack, 3.1 kW/L world record
  - 2011

- **FCV-R Fuel**
  - Mirai precursor
  - 2015
Mirai – as easy as a conventional car

0 emission
except water

550 km*
range

3-5 min
to refuel

*: According to NEDC
• Increase of Mirai Production up to 30,000/pa (2020)
• Broad usage of Hydrogen Technology within Toyota Group
Collaboration needed to create $\text{H}_2\text{ }\text{Society}$

Politics & Economy
Member Companies of the Hydrogen Council:

- Turnover of more than 2,0 trillion Euro
- More than 2,5 million employees
- More than 2,1 billion Euro annual investment for Fuel Cell Technology
Governmental Support

Initiatives

Mobilité Hydrogène France

H₂ MOBILITY

UK H₂ Mobility

Hydrogen Mobility Europe

Japan’s Road Map toward Hydrogen Society

California Fuel Cell Partnership

TOYOTA
But Collaboration needed to create H₂ Society

Small steps → big step

- Vehicle manufacturers
- Energy and infrastructure providers
- Public authorities / governments
- Customers
Thank you very much for your attention!

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