Future Powertrain

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Toyota Motor Corporation
Hiroyuki Fukui
Toyota Environmental Challenge 2050

1. Challenge of Achieving Zero
   - New Vehicle Zero CO₂ Emissions Challenge

2. Challenge of Establishing a Recycling-based Society and Systems
   - Life Cycle Zero CO₂ Emissions Challenge

3. Challenge of Minimizing and Optimizing Water Usage
   - Plant Zero CO₂ Emissions Challenge

4. Challenge of Minimizing and Optimizing Water Usage
   - Net Positive Impact Challenge

5. Challenge of Establishing a Recycling-based Society and Systems
   - Challenge of Establishing a Recycling-based Society and Systems

6. Challenge of Establishing a Future Society in Harmony with Nature
   - Zero Environmental Impact Challenge

Contributing to a Better Society through Net Positive Impact
Challenge 1: New Vehicle Zero CO\textsubscript{2} Emission Challenge

New vehicle CO\textsubscript{2} (average)

Powertrain mix

- Conventional ICE
- HV
- PHV
- EV

90% reduction
Toyota “PRIUS”

Fuel efficiency (km/L):
- 1st Gen. Prius: 28.0
- 2nd Gen. Prius: 29.6
- 3rd Gen. Prius: 32.6
- New Prius: 38.0
- NPEF: 40.8

HV system cost:
- 1st Gen. Prius
- 2nd Gen. Prius
- 3rd Gen. Prius
- New Prius

Rewarded with a smile
Toyota HV sales

Accumulated HV Sales (mil. unit)

Accumulated CO2 Reduction (mil. ton)

Annual HV Sales (mil. unit)

Annual CO2 Reduction (mil. ton)

1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2016 (Jan-Apr)

9 Mil. unit

1 Mil.

10

5

0

0

10

50

67 Mil. ton

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TOYOTA
Challenge 1: New Vehicle Zero CO₂ Emission Challenge

New vehicle CO₂ (average)

Powertrain mix

90% reduction

Conventional ICE

HV

PHV

EV
Driving trip and electric drive coverage

Japanese driving statistics
Electric drive cover ratio

**EV cover ratio**

- **83% PHV**
- **66% EV**

**EV drive range (km)**

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### Plug-in Hybrid Prius

<table>
<thead>
<tr>
<th></th>
<th>New Gen. model</th>
<th>Current model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EV mode range (JC08 test cycle)</strong> (km)</td>
<td>At least 60</td>
<td>26.4</td>
</tr>
<tr>
<td><strong>HV mode fuel efficiency</strong> (km/L)</td>
<td>37</td>
<td>31.6</td>
</tr>
<tr>
<td><strong>EV mode top speed</strong> (km/h)</td>
<td>135</td>
<td>100</td>
</tr>
<tr>
<td><strong>Lithium-ion battery capacity</strong> (kWh)</td>
<td>8.8</td>
<td>4.4</td>
</tr>
</tbody>
</table>
Challenge 1: New Vehicle Zero CO₂ Emission Challenge

New vehicle CO₂ (average)

- **2010**: Blue bar
- **2050**: Red bar with 90% reduction

Powertrain mix:
- **Conventional ICE**
- **HV**
- **PHV**
- **EV**

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Future low carbon society

- EV/PHV
- Electricity storage facilities
- Thermal power generation
- Power generation units
- Automotive fuel
- Hydrogen-Electricity Conversion
- High-volume, long-term storage
- Photovoltaic generation
- Wind power
- Biomass
- Wastewater
- Renewable Energy
- Electricity Grid
- Hydrogen Grid
- Fossil Fuels
- HyGrid Study Group

Hydrogen tanks

Energy Flow:
- Electricity
- Hydrogen
- Fossil fuels

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