Toyota’s Challenge

Aiming to Popularize BEVs

June 7, 2019

Shigeki Terashi
Executive Vice President
Toyota Motor Corporation
Initiatives for vehicle electrification
Core technology for the electrification of Toyota vehicles and CASE technology

**Core technology for electrification**

- Motor
- Battery
- Power Control Unit

Automated driving technology

Connected technology

- FC stack
- High-pressure hydrogen tank
- Charger
- Engine

**Categories**

- FCEVs
- BEVs
- PHEVs
- HEVs
- MaaS
Milestones in popularizing electrified vehicles (announced in Dec. 2017)

- 1997: World’s first mass-produced HEV
- 2014: FCEVs
- From 2020: BEVs actively rolled out
- From around 2025: Electrified version available for all vehicle models
- 2030: HEVs • PHEVs: 4.5 million units or more
- BEVs • FCEVs: 1 million units or more
- 2040:
- 2050: Zero CO₂ challenge

Engine-powered vehicles

- HEVs
- PHEVs
- FCEVs
- BEVs
Rate of popularization of Toyota’s electrified vehicles

**Current rate of popularization**

- **Engine-powered vehicles**
- **Electrified vehicles**

**Rate of popularization in 2017**

- **2017 result**
- **2018 result**

**2025 (as of 2019)**

**2030 (as of 2017)**

**2030 HEVs/PHEVs**: 4.5 million units or more

**BEVs/FCEVs**: 1 million units or more

**Approx. 5 years ahead**

Sudden surge in electrification at a pace exceeding initial challenge declared in 2017.
Main zero-emission vehicles
(Including development concept, driving demonstrations, and system provision)

- Passenger vehicles
- Commercial vehicles

FCEVs

BEVs

Walking area

Ultra-compact

Compact and midsize

MaaS

Lunar Rover
In 2020, commence mass production of proprietary BEVs starting in China

Increase Toyota and Lexus BEV models worldwide (gradual introduction in Japan, India, U.S., and Europe)

10 BEV models to be available worldwide by the early 2020s
From 2020, introduce proprietary BEVs starting in China

C-HR/IZOA

*World premier at Shanghai Motor Show in April 2019
Initiatives Toyota will engage in to popularize BEVs

Toyota will take a cooperative stance and work together with many parties to promote initiatives for the construction of new business models.

1) Commence initiatives that aim to create new business models leveraging ultra-compact BEVs, starting in Japan

2) For areas in which the BEV market is already growing, efficiently develop various types of BEVs adapted to market needs at a low cost

3) Develop high-performance batteries, which are the key to improved performance, and prepare a system for supplying batteries to respond to the rapidly expanding needs for electrified vehicles
1) To popularize BEVs
-Development of business model-
Major BEV markets and main policies worldwide

Graph showing major BEV markets and main policies worldwide:

- **France:** 1.5% 32,200 units
  - BEV purchase grant: Max. 820,000 yen

- **Germany:** 1.1% 37,300 units
  - BEV purchase grant: Max. 520,000 yen

- **Norway:** 31.2% 46,000 units
  - BEV acquisition tax exemption: 1.38 million yen
  - Import tax exemption, added-value tax (25%) exemption

- **US:** 1.3% 228,600 units
  - Max. 800,000 yen tax exemption from federal government
  - Also tax exemptions by state

- **China:** 3.3% 707,800 units
  - BEV purchase grant: Max. 1 million yen

**BEV market formation supported by incentives such as tax benefits and grants**

(According to Toyota Motor Corporation)
Shift focus from the conventional idea of “manufacturing BEVs and having customers buy them,” to the idea of...

Searching for partners openly and extensively, striving toward contributing to a better society and engaging in initiatives to construct new business models
Promote initiatives for the maximum utilization of added value for BEVs and batteries, from sales to disposal including improving product appeal such as battery performance, in collaboration with partners in various fields.
1) To popularize BEVs: Deploy ultra-compact BEVs in Japan
Customer opinions & concerns regarding BEVs

- Unwilling to drive long distances daily; need free mobility for local errands such as shopping or going to hospitals
- Concerned about being able to drive a standard car
- Usually drive alone or with one passenger
- Only need to drive at certain times; car not needed at home
- Prefer similar cruising range as new cars regardless of how many years the car has been used
- Suitable car size for ease of parking
- Safe & free mobility for all in both urban & rural environments

Emergence of new business opportunities for BEVs, including for compact vehicles, short distance use, and corporate use
Ultra-compact BEVs

Concept-i RIDE model
(Exhibited at Tokyo Motor Show 2017)

Expected users
- Younger people and the elderly individuals who prefer smaller vehicles
- Corporations and local municipal bodies that want to respond to environmental issues and make economical choices
Ultra-compact BEVs

Commercially planned vehicles

[Planned for release in 2020]

Main uses & features

Mobility for daily errands such as shopping

Business use for short-distance trips or visits

Overview

Occupancy: 2 people
Size (mm): Length Approx. 2,500
          Width Approx. 1,300
          Height Approx. 1,500

Maximum speed: 60 km/h
Cruising range on a single charge: Approx. 100 km
Ultra-compact BEVs

i-ROAD

Main uses & features

Unlikely to topple over, despite being the size of a motorcycle  Short-distance mobility
• Serves as the last-mile in urban areas
• Mobility for tourist outings and resort stays

Overview

Occupancy: 1 or 2 people
Size (mm): Length 2,345
Width 870
Height 1,455
Maximum speed: 60 km/h
Cruising range on a single charge: Approx. 50 km
Walking area BEVs

Concept-i WALK
Concept model
(Exhibited at Tokyo Motor Show 2017)

Standing type
[Planned for release in 2020]

Main uses & features
Patrolling and security checks at large facilities such as airports or plants
Mobility for luggage transport/handling

Overview
Size (mm):
- Length 700
- Width 450
- Height 1,200

Maximum speed: 2, 4, 6, 10 km/h (variable speed)

Cruising range on a single charge: Approx. 14 km
Charging time: 2.5 hours (battery is replaceable)
## Walking area BEVs

<table>
<thead>
<tr>
<th>Seated type</th>
<th>Wheelchair-linked type</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Planned for release in 2021]</td>
<td>[Planned for release in 2021]</td>
</tr>
</tbody>
</table>

### Main uses & features
- Mobility when handling luggage
- Mobility when walking is difficult
- Rental at large facilities and tourism spots for manual wheelchair users

### Overview
- **Seated type**
  - Size (mm): Length 1,180 \ Width 630 \ Height 1,090
  - Maximum speed: 2, 4, 6 km/h (variable speed)
  - Cruising range on a single charge: Approx. 10 km
  - Charging time: 2 hours (battery is replaceable)

- **Wheelchair-linked type**
  - Size (mm): Length 540 \ Width 630 \ Height 1,090
  - Maximum speed: 2, 4, 6 km/h (variable speed)
  - Cruising range on a single charge: Approx. 20 km
  - Charging time: 2.5 hours (battery is replaceable)
Collaborate with partners in various fields and also engage in dialogue with customers to establish business models while fulfilling various roles. (Companies or local governments currently sharing ideas: 40 entities)
Roles fulfilled by ultra-compact BEVs and walking area

To achieve “Mobility for All,” offer safe and secure mobility that responds in detail to various customer needs.
2) BEVs for global deployment
BEVs for global deployment

Aiming for popularization in major markets with strong demand such as China, the U.S., and Europe

To encourage various customers with different needs to choose this product:

1) Prepare enough variations
   (At least 10 models globally from 2020 onward)

2) Implement efficient and smart development to offer vehicles at reasonable prices
Efficient planning and development

Deploy six variations jointly with partners in their respective fields of expertise
Dedicated platform collaborative planning ( ): e-TNGA

Determine fixed points and points of change, and respond fluidly to multiple variations
Dedicated platform collaborative planning (e-TNGA): BEV unit that enables multiple variations through motor combinations.
### Module development: e-TNGA

<table>
<thead>
<tr>
<th>Front module</th>
<th>Center module</th>
<th>Rear module</th>
<th>Battery</th>
<th>Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Front module" /></td>
<td><img src="image2" alt="Center module" /></td>
<td><img src="image3" alt="Rear module" /></td>
<td><img src="image4" alt="Battery" /></td>
<td><img src="image5" alt="Motor" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overhang</th>
<th>Wheel base</th>
<th>Overhang</th>
<th>Capacity</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short</td>
<td>Short</td>
<td>Short</td>
<td>Small</td>
<td>Small</td>
</tr>
<tr>
<td>Long</td>
<td>Middle</td>
<td>Long</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Large</td>
<td>Large</td>
</tr>
</tbody>
</table>

Deploy multiple variations efficiently
BEVs for global deployment
System for BEV popularization

**EV C.A. Spirit Corporation** (From Oct. 2017)

Employ full-time engineers from each company for collaborative development of common architecture

**Supply basic technology to accelerate product development**

**Toyota ZEV Factory** (from Nov. 2018)

Promoting BEV product development and related business planning

**EV Business Planning Dept.**
(From Oct. 2016)
Toyota ZEV factory roles

Achieve “Mobility for All” with the compact mobility lineup

Globally deployed BEVs
Contribute to reducing CO₂ emissions through the global popularization of BEVs

Ultra-compact

Pursuing mobility that is loved by people and society

Battery development
Automated driving
Mobility-related business

Passenger vehicles and commercial vehicles

Vehicle size
Traveling distance
Main duties

- BEV and FCEV business strategy planning
  → Product planning, collaboration

- BEV development planning
  → Platform development, production technology etc.

- BEV product development to address walking area, ultra-compact design, full-scale deployment

Framework

Add logos for Hayashi Telempu and Toyota Personnel as of June 2019: Approx. 290

Employees on loan from related companies and organizations to promote BEV product development and related company plans

- AISIN
- FTS
- SUMITOMO ELECTRIC
- DAIHATSU
- SUBARU
- TOYOTA
- MITSUI & CO.
- YAZAKI
Aiming for the popularization of globally deployed BEVs

Promote the construction of new business models for globally deployed BEVs

Peripheral services

Development and manufacturing

Leases

Assessment

Sales

Used vehicle sales

Reuse of batteries

Recycling
3) Battery development and supply
Core technology for Toyota vehicle electrification and CASE technology

Core technology for electrification:
- Motor
- Battery
- Power Control Unit

Automated driving technology

Connected technology

FC stack + High-pressure hydrogen tank → FCEVs
Charger + Engine → BEVs

Motor Battery Power Control Unit

Connected technology

MaaS

HEVs

PHEVs

FCEVs

BEVs

PHEVs

HEVs
HEVs: Achieve fuel efficiency even with low battery capacity due to highly efficient system. Utilize in BEVs.
PHEVs: Realize long BEV cruising range by means of a highly efficient system

Utilize in BEVs

BEV cruising range per battery capacity (New European Driving Cycle)

Approx. 10%
Battery durability (battery remaining capacity after long-term use)

Aim for world-class durability to control degradation in various aspects including battery materials, pack structure, and the steering system.

World-class durability targets

- C-HR/IZOA
- Second-generation Prius PHV (Approx. 75%)
- First-generation Prius PHV

(BEV cruising range)

(Battery capacity maintenance rate)

Years passed

10 years
Increasing battery durability not only improves product appeal, but is effective for used vehicle sales and the battery reuse business.
Need to develop partnerships in development and supply

Batteries are needed at a rate significantly exceeding previous expectations

Battery capacity needed for all Toyota electrified vehicles

- Current rate of popularization
- Previous rate of popularization

Approx. 20-fold
Coordinate with global battery manufacturers in addition to conventional partners, Panasonic and PEVE, to respond to the rapid popularization of electrified vehicles.
Message from Toyota
Aiming to popularize BEVs

• Much work lies ahead to achieve the popularization of BEVs. Specifically, we will be focusing on vehicle development and the stable supply, improved durability, and reuse of batteries.

• Toyota is steadily preparing a framework to respond thoroughly to the challenge, putting all the pieces in place, including the construction of new business models.

• We are searching for partners in a more extensive and open manner as we strive to contribute to a better society. Please join us in promoting our initiatives.
Transitioning from an automobile company to a mobility company

Mobility for All

Our home planet

Popularization of electrified vehicles on a global scale