



Mitsubishi Motors Next-generation Environmental Technology

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Mitsubishi Motors Corporation

Next-generation Environmental Technology

Environmental Regulation and EV/PHEV

Mitsubishi Motors EV/PHEV Overview

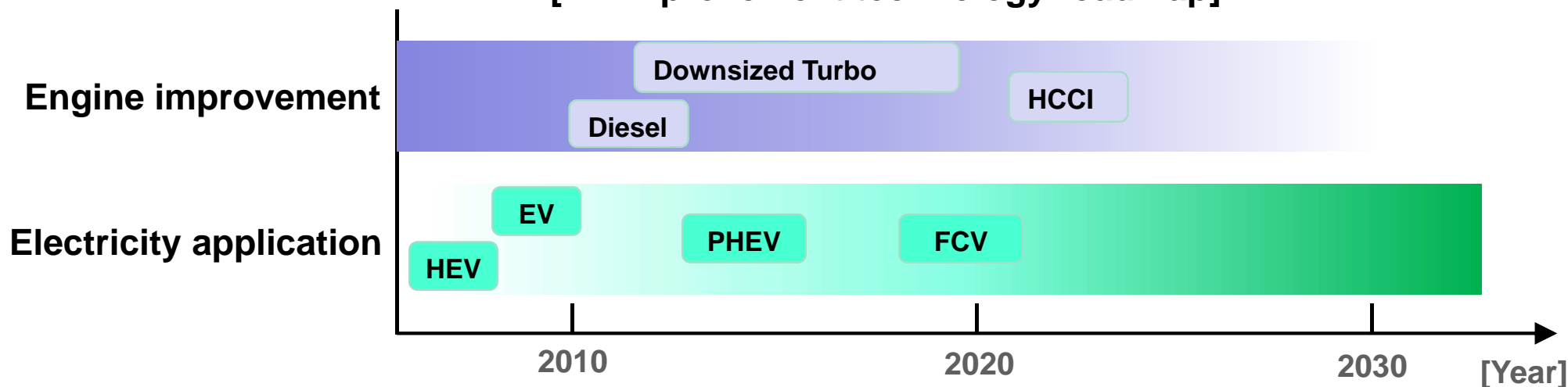
EV/PHEV Promotion Strategy

Infrastructure Deployment Plan

FE/CO₂ Improving Technology Trend

Recent fuel economy (FE) and CO₂-reducing technologies tend to use electric motor technologies on top of conventional engine improvements.

[FE improvement technology roadmap]



[Engine improvement]

Diesel : 15-20%

- Apply diesel cycle which has good FE.
- Improve emission with injection system and catalyst.

Downsized Turbo : 15-25%

- FE improved by downsizing and direct injection.
- Turbocharger compensate power.



HCCI : 20-30%

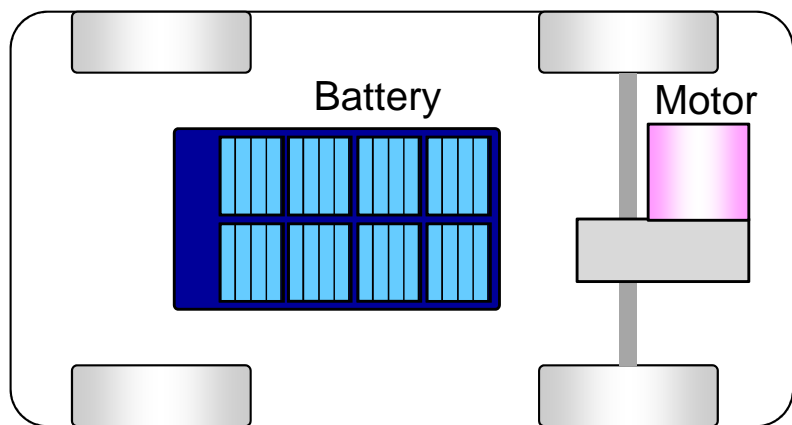
(Homogeneous Charge
Compression Ignition)

- Intake pre-mixed vaporized gasoline and burn with autogenous ignition.
- Improve FE and emission with high compression and lean-burn.

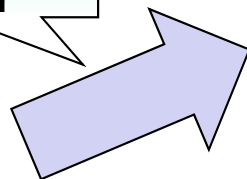
Improving Fuel Economy/CO₂ through Electric Systems

- Focus on CO₂ reduction with on-board recharging and energy regeneration capability to improve FE/CO₂ utilizing electric propulsion systems.
- Based on each EV system, each PHEV and FCV utilizes its unique electricity supply system.

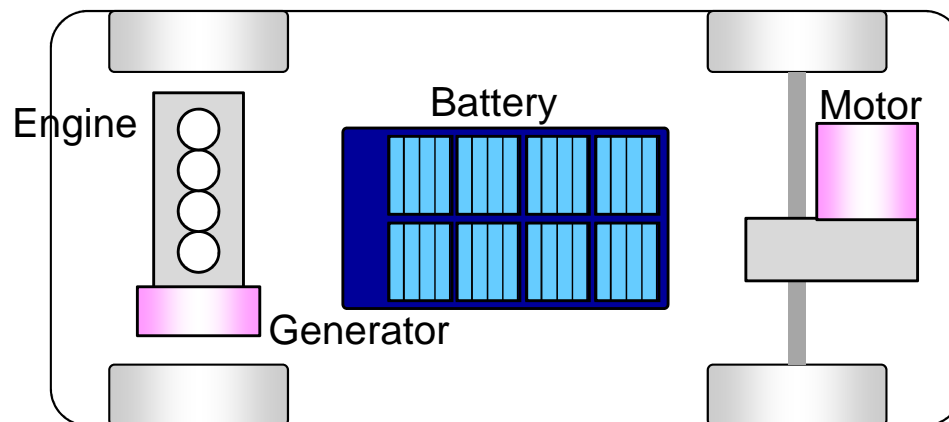
【EV】



Add
Engine and
Generator

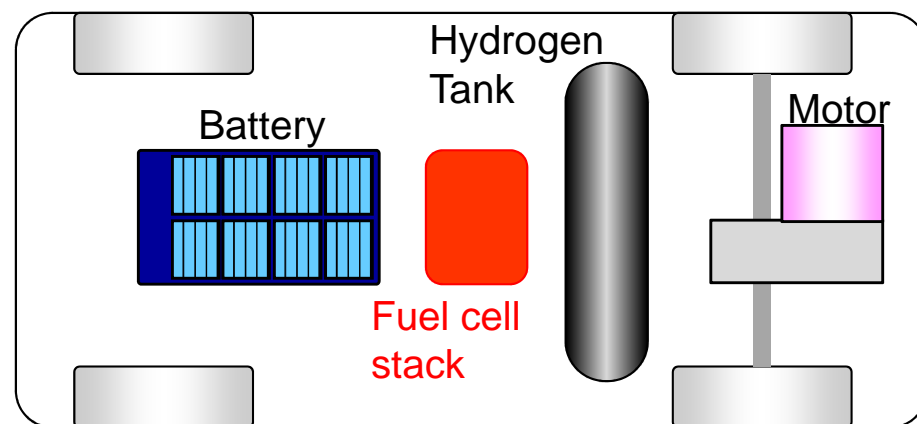
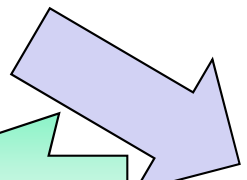


【PHEV】



【FCV】

Add
Hydrogen tank and
Fuel cell stack



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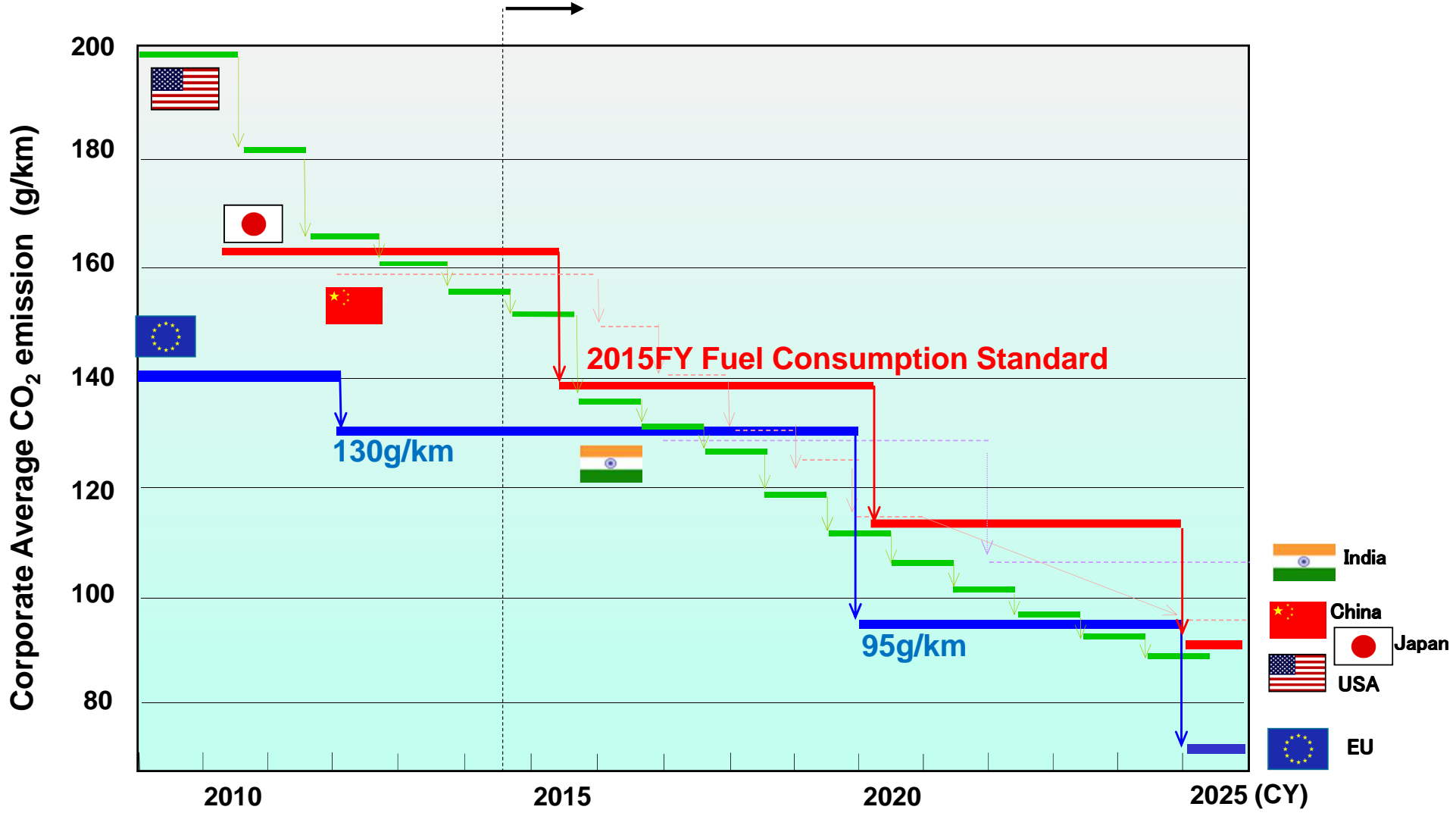
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Environmental Regulation Tightening (-2025)

Environmental awareness has influenced stricter CO₂ emission regulations in the United States and Europe. This trend has picked up in emerging countries as well.



Stricter Environmental Regulations (-2025)

Automobile manufacturers have resorted to selling EVs / PHEVs due to upcoming stricter CO₂ regulations after 2020.

Region	Regulation (Fuel Economy :FE)
Europe	<ul style="list-style-type: none"> • 27% improvement (car) is expected in 2020 from in 2014. • In addition, about 25% improvement in 2025.
US	<ul style="list-style-type: none"> • 26% improvement (car) is expected in 2020 from in 2014. • In addition, about 22% improvement in 2025. • ZEV regulation requires EV & PHEV sale for Large Manufacturer, and requires EV or PHEV for Intermediate Manufacturer as for MMC.
China	<ul style="list-style-type: none"> • 28% improvement (car) is expected in 2020 from in 2014. • Local EV/PHEV manufactures need to hold patent rights to sell the vehicles and technical know-hows.
Brazil	<ul style="list-style-type: none"> • Corporate Ave. FE regulation is enforced in 2016. • Regulation scheme is similar to US. • Large vehicle difficult to conform the law. • Diesel engine is out of the regulation.

EV/PHEV Incentives

Monetary incentives to accelerate EV/PHEV deployment has started from Japan. After tightening environmental regulation, this policy has expanded to US and Europe. In addition some emerging countries has adopted some as well.

Region	Monetary benefit	Other country
Japan	<ul style="list-style-type: none"> • Government subsidy (Max. 850,000 yen) • Autonomy subsidy (Max. 400,000 yen) • Auto tax and weight tax exemption (approx. 100,000 yen) 	
Europe	<ul style="list-style-type: none"> • [Netherlands] : BIK(benefit in kind) tax merit in 5 years(Max.€16,000) CO2 tax (€7,300) exemption • [UK] : Subsidy Max. £5,000, BIK tax exemption in 5years (£14,000) • [France] : Subsidy Max. €6,300(EV) , €4,000(PHEV) BIK tax merit in 3 years(€5,000) • [Sweden] : Subsidy SEK 40,000, Road tax exemption BIK tax merit in 3 years(SEK 36,000) • [Norway] : VAT 25% exemption(EV), Registration tax exemption 	Ireland Spain Italy Belgium Portugal Finland Denmark
U.S.A	<ul style="list-style-type: none"> • Subsidy Max. \$7,500, Monetary benefit in each state (Max.\$7,500) 	
Canada	<ul style="list-style-type: none"> • Subsidy Max. C\$8,500 	
Asia	<ul style="list-style-type: none"> • [China] : Consumer tax exemption • [Thailand] : Commodity tax (17-50%==>10%) • [Malaysia] : Import tax, Commodity tax exemption 	Hong Kong Singapore Sri Lanka
Middle & South America	<ul style="list-style-type: none"> • [Colombia, Aruba] : Import tax exemption 	

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Mitsubishi Motors EVs : *MiEV* Series

MMC launched the world's first mass produced EV i-MiEV in 2009 and expanded the EV lineup in minicar models.

i-MiEV: Launched in Jul. 2009



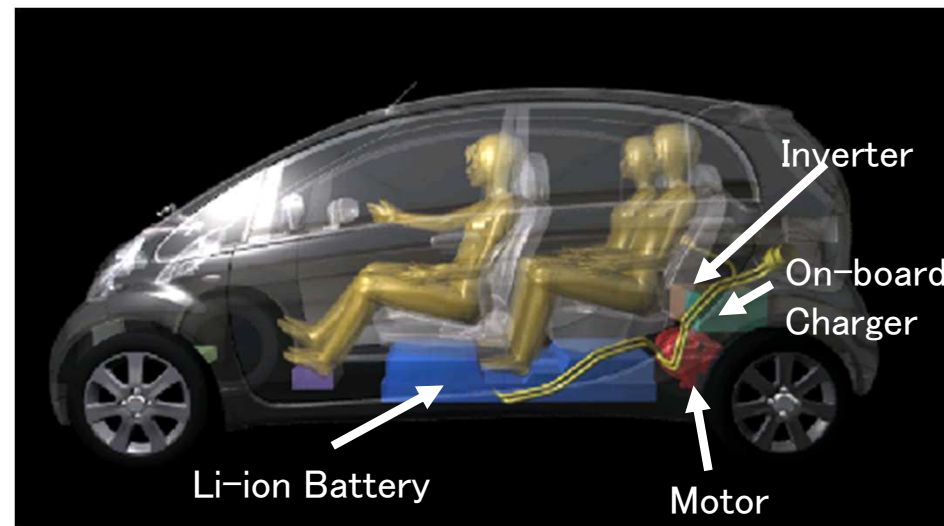
MINICAB MiEV VAN: Launched in Dec 2011



MINICAB MiEV Truck: Launched in Jan.2013

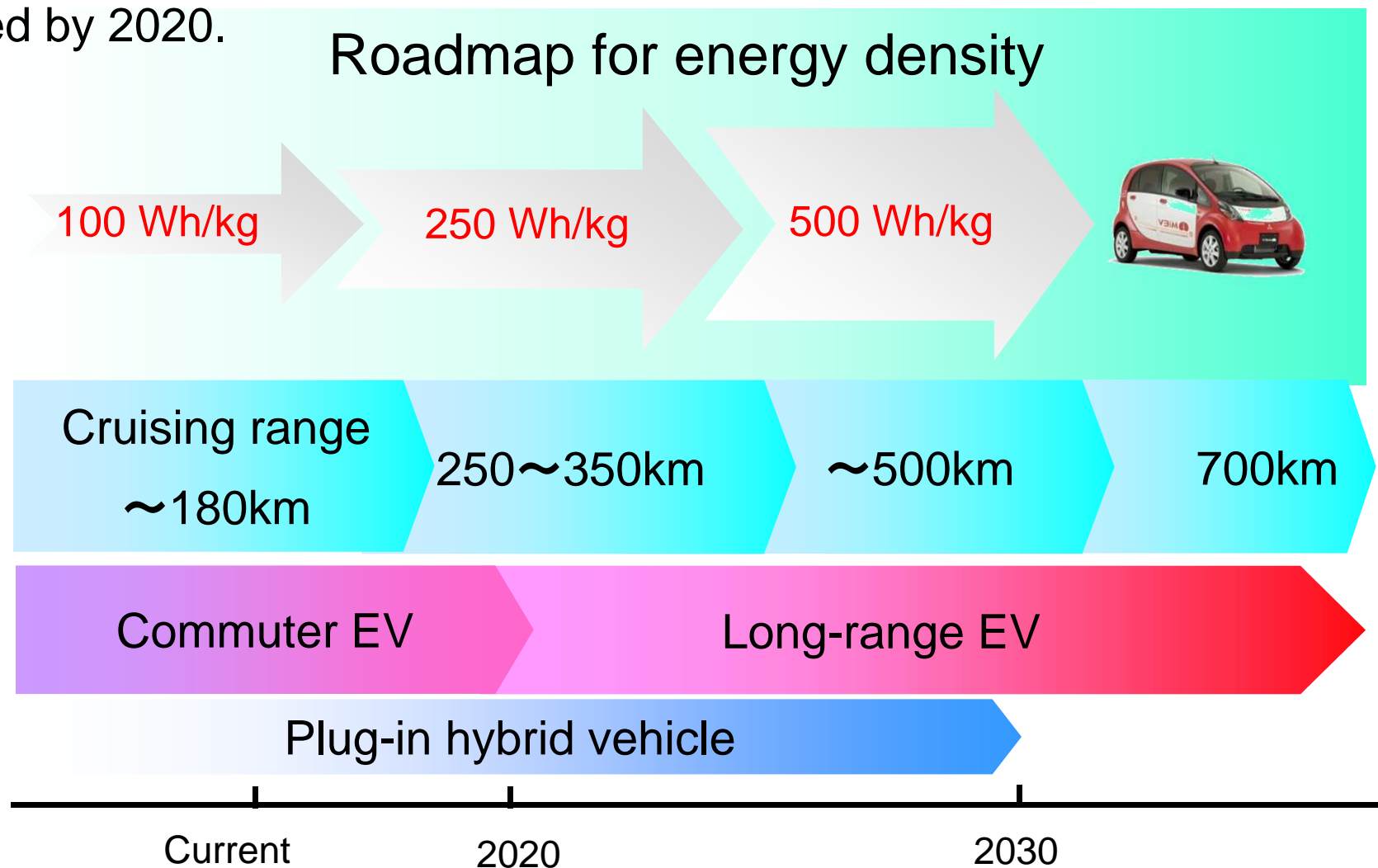


No change in interior or luggage space from conventional model



Challenge for EV batteries – Cruising Range

Cruising range of an EV depends on battery energy density. Battery manufacturers have been developing high-density batteries with the support from the Japanese government (METI). New batteries which provide up to 300km EV range should be developed by 2020.



Source : 「NEDO Battery Roadmap 2013」(modified)

EV and PHEV Intended Usage

EV : Small class which is used as city commuter.

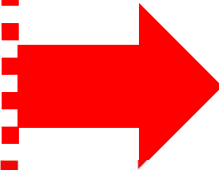
PHEV : Mid-size or above with a mandatory long cruising range.

→ Battery improvements expand EV territory.

EV



Battery Improvements
expand EV territory



PHEV



Mitsubishi PHEV : New-generation SUV

The 4x4 SUV PHEV provides both zero CO₂ emission driving and high performance driving pleasure.

**OUTLANDER
PHEV**



**New generation SUV
with clean EV technology**



EV technology : i-MiEV

- Clean Energy
- Smooth and powerful
- Low running cost



SUV technology : Pajero

- Wide visibility
- Roomy cabin
- Useful luggage space



4WD technology : EVO

- Powerful 4WD
- Stable driving on icy road
- S-AWC high cornering performance

Outlander PHEV Concept



OUTLANDER PHEV

New generation SUV with clean EV technology

- Smooth motor driving without shift shock.
- Silent cabin without Engine noise.



- Low CO₂ emission vehicle with EV technology
- Maximize EV range for CO₂ reduction

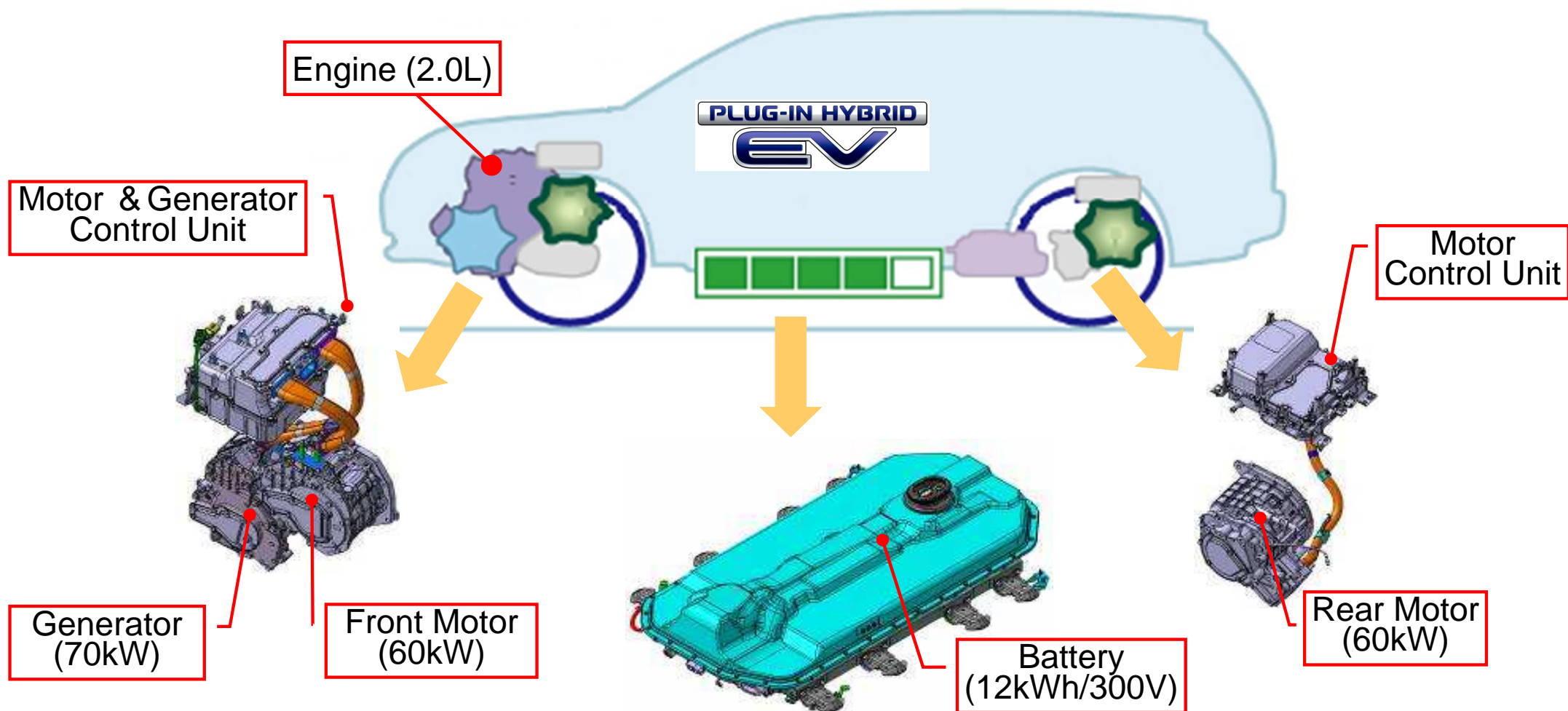
- World first 4WD system with twin drive motor.
- Yaw control system with brake integrated control system.



- High-torque acceleration via electric motor.
- Quick pedal response.

PHEV System Overview

- Keep enough EV cruising range with large- capacity battery.
- Achieve long cruising range by gasoline-engine generated electricity.
- Gasoline-engine power used during high speed cruising, and electric motor assist when accelerating.



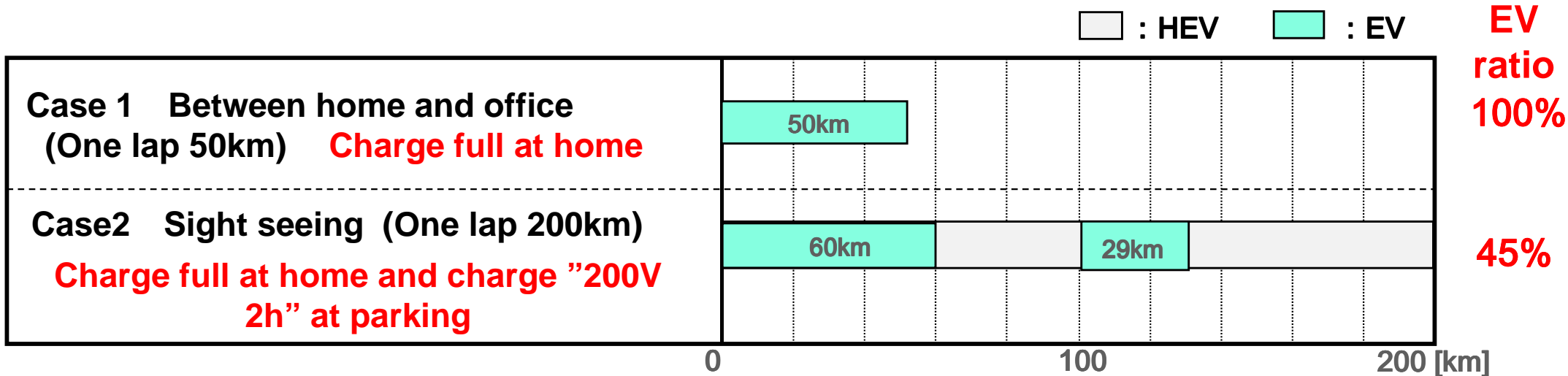
PHEV Performance : 4WD Technology and Durability



PHEV Performance : Economy and Ecology

Weekday : 100% EV driving between home and office.

Weekend : Effectively charge at parking areas and minimize CO₂ emissions.



Successful long-distance test Switzerland – the Netherlands



- From Härkingen (CH importer) to Amsterdam (NL importer)
- 830 km with one full battery/tank
- Average consumption
1 kWh + 5.44 L/100 km

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Leading Company in EV/PHEV Technology

Environmental
Responsibility

Development of next-generation EV technology

- Extend cruising range per single charge
- Affordable price
- Expansion of charge infrastructure

Development of next-generation PHEV technology : SUV PHEV

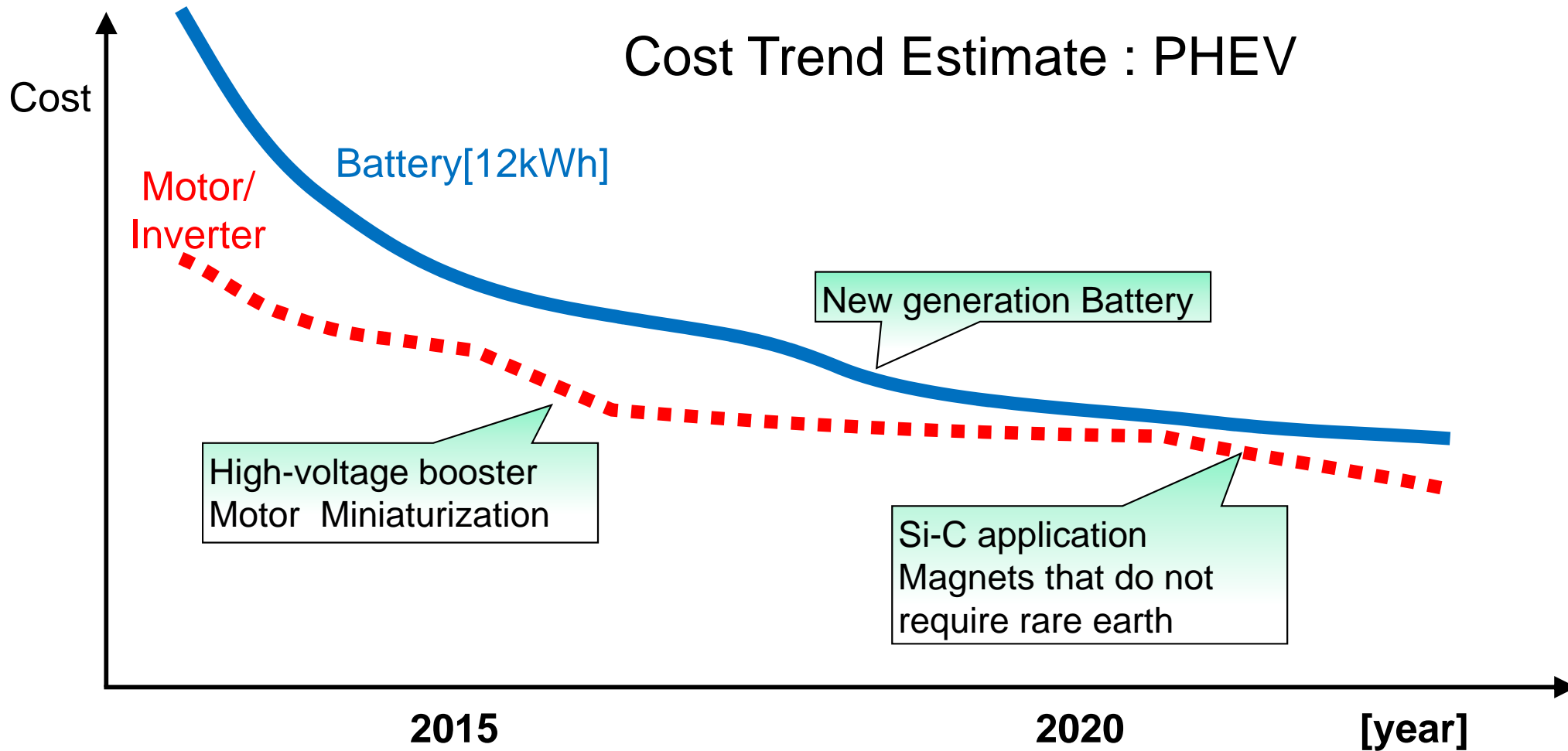
- Sophisticated integration of driving pleasure and PHEV : e-EVOLUTION
- Development of high-efficiency system
- Increase PHEV application to SUVs



How we achieve lower price?

Battery : Lower price will be available as EV/PHEV becomes popular. Next-generation battery with high energy density and low cost will be launched around 2018.

Motor/Inverter: High-voltage booster system enables motor miniaturization. Si-C (Silicon-carbide) will be available around 2020.

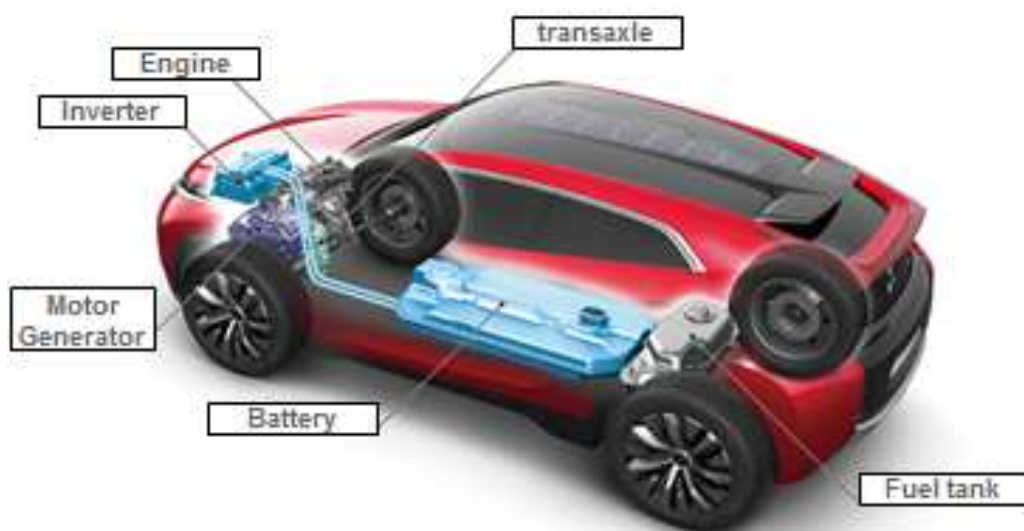


Next Mitsubishi EV/PHEV

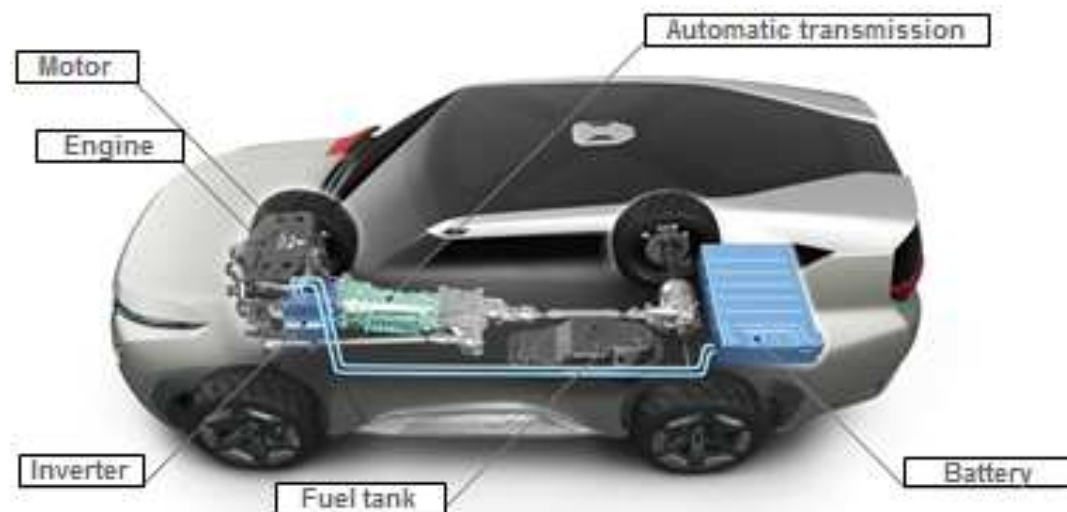
EV : Adopt next-generation battery and motor/inverter.

PHEV : Expand “Clean, Smooth, Powerful ” PHEV into different SUV size.

Compact size SUV (XR-PHEV)

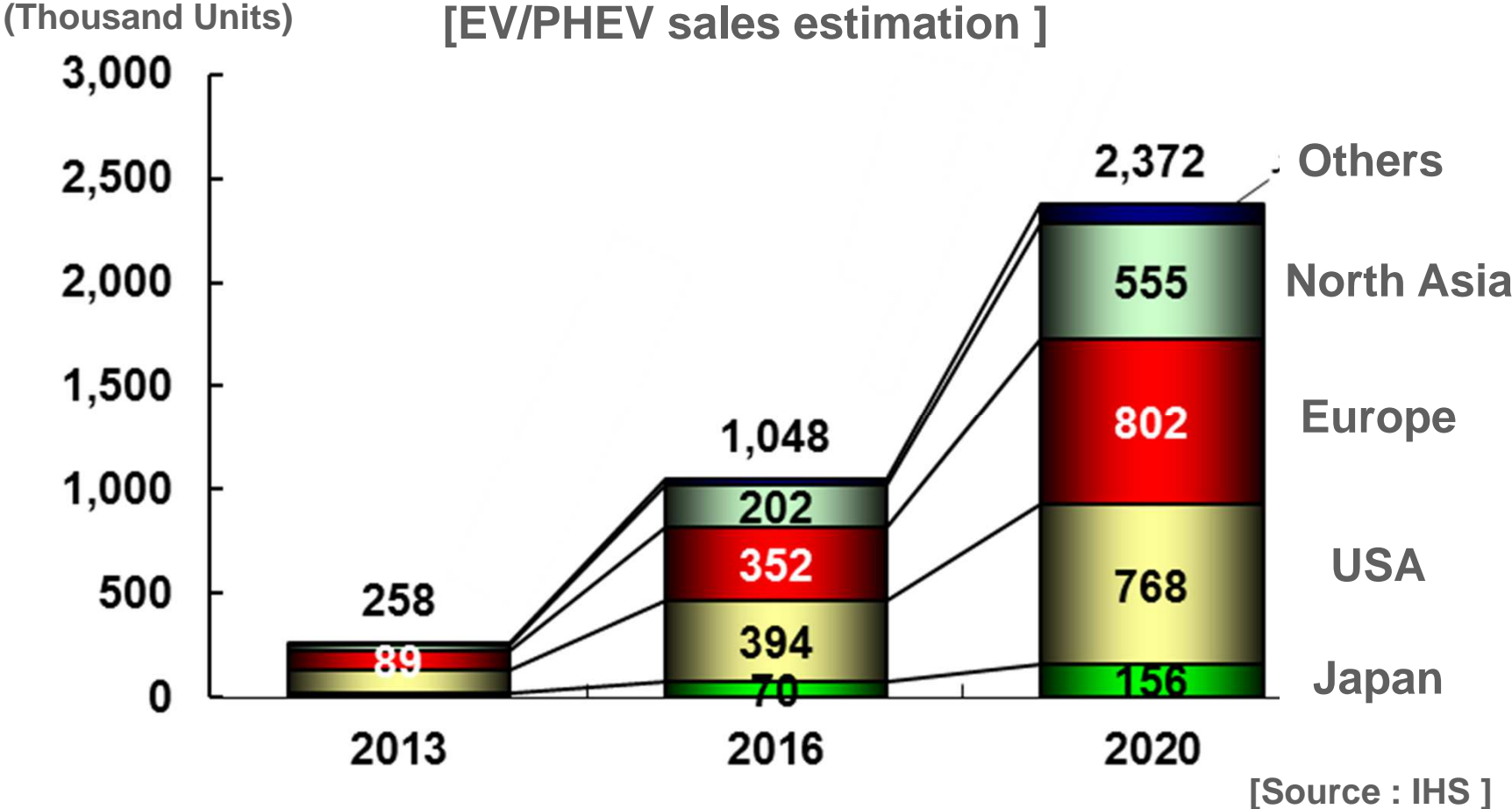


Full-size SUV (GC-PHEV)



EV/PHEV Market Forecast

Analysts have estimated future EV/PHEV market volume in Europe and United States around 800k vehicles respectively by 2020. MMC believes this estimation seems too small and believes market volume should triple by 2020 when referring to U.S. and Europe FE regulations.



New Market for EVs/PHEVs: Battery Application

To study new usage for EVs/PHEVs, MMC developed the V2H (vehicle-to-home) prototype. The V2H pilot project started on April 2012 and the V2H mass production model was launched in July 2014 by Mitsubishi Electric.



“M-tech Labo”, Smart grid experimental plant



Charging/discharging station



Recycled battery

New Market for EV/PHEV: Power Demand Control



Smart community pilot project in Málaga, Spain.
 Realize collaboration between grid and EV infrastructure.



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Infrastructure Expansion

Country	EV/PHEV total volume*	Charger [Unit]		Country area [km ²]
		Target (2020)** (include Quick Charger)	Quick Charger*** (CHAdeMO)	
Japan	93,000	2,005,000	1,978	377,915
USA	215,000	Set in each state	686	9,826,675
Germany	19,000	150,000	53	357,022
Italy	3,000	125,000	6	301,340
France	30,000	97,000	114	551,500
Spain	2,500	82,000	105	505,370
Netherlands	37,000	32,000	81	41,543

*As of July, 2014(MMC)

**Source Japan METI,
Europe: Delegation of the Europe Union to Japan

***As of August, 2014(CHAdeMO)



Activity for Infrastructure Expansion in Japan

Four manufactures have started collaboration in promoting charger installation and establishing charging network service (July, 2013)

Not enough chargers at present

Quick charger : about 2,000

Normal charger : about 3,000 and more

Charging network service has several issues

**Subsidy for charger installation
100.5 billion yen**

Object : 2/3 of the charger and installation expense

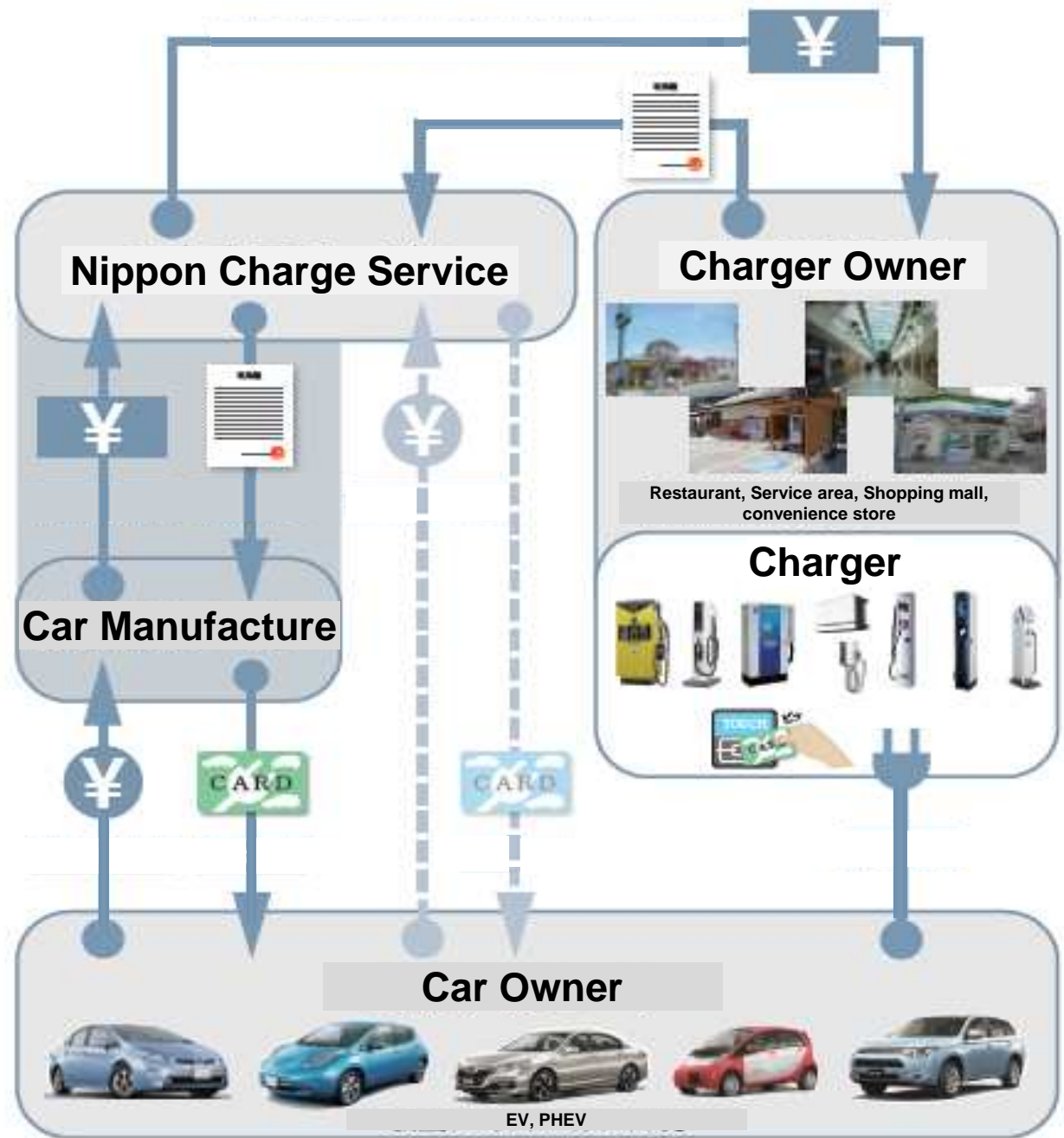


1. Activity for charger installing promotion in Japan
2. Support installation expense and maintenance expense.
3. Establish convenient charging network service for EV/PHEV user.

Establishment of Nippon Charge Service (NCS)

Business outline

- ① Support user's expense for newly installed quick-charger. (application deadline 2014/9)
- ② Provide a charging network where rights to use quick-chargers can be sold to automobile makers and users can be billed for quick-charger usage
- ③ Sell rights to use supported chargers to car manufacturers. Provide the charging network service.



Drive@earth



MITSUBISHI MOTORS