Strategy for diffusing the next generation vehicles in Japan

Next Generation Vehicle Promotion Center (NeV)

1 Japan Promotes Electrified Vehicle(xEV※) Strategy ahead of 2050

※xEV: HEV(Hybrid Electric Vehicle),BEV(Battery Electric Vehicle), PHEV(Plug-in Hybrid Electric Vehicle), FCEV(Fuel Cell Electric Vehicle)

Following the Paris Agreement signed at COP21 in 2015, countries and industries around the world began developing innovative solutions to tackle global climate change. Improving the environmental performance of automobiles, one of the largest global emitters, is a top priority. xEVs are one of the key technologies making fundamental changes to the automotive industry, in addition to innovations such as connected systems, autonomous driving, and car sharing services. By shifting production to focus exclusively on xEVs, the auto industry can drastically improve environmental performance and help cut global emissions.

In Japan, the market share for xEVs is approximately 30%. This strong presence demonstrates Japan' s high quality in the fields of technology, industry and human resources. Globally, the market share for Japanese xEVs is approximately 30%. Leveraging its strengths, Japan aims to further promote xEVs produced by Japanese automakers to tackle global climate change around the world.

Japan sets long-term goal by the end of 2050, including: advance the shift of vehicles produced by Japanese automakers in global markets to xEVs; bring about environmental performance at the world' s highest level; and contribute to realizing a "Well-to-Wheel Zero Emission" policy (to reduce emissions to zero concerning a vehicle' s overall operation, from fuel and power producing process to running).

Long-Term Goal (by 2050)

Innovation of Vehicle' s Fuel Economy
(80% reduction of GHG※1 emission per vehicle*)
*Vehicles produced by Japanese automakers

×

Innovation of how vehicles are used
・MaaS※2
・Connected
・Services and So Forth

×

Global zero-emission in energy supply
(Power source, hydrogen source, and fuel to be all zero-emission)

➡

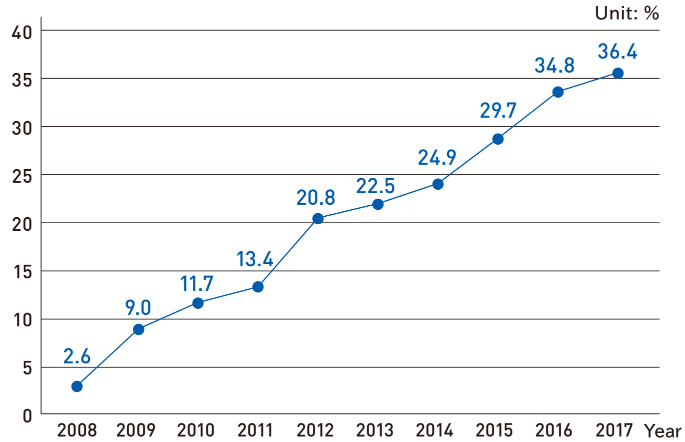
"Well-to-Wheel Zero Emission"

※1: GHG: Greenhouse Gas ※2: MasS: Mobility as a Service (mobility service that creates new value by connecting various transportation services)

Reference: METI 'Strategy Meeting for the New Era of Automobiles'

Adoption rate of next-generation vehicles in Japan

The percentage of next-generation vehicles in new vehicles sold



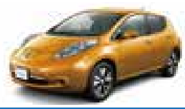
Number of new vehicles sold in 2017 (actual record) 4.386 million cars	
Conventional vehicles	63.6% (2.791 million cars)
Next-generation vehicles	36.4% (1.595 million vehicles)
Hybrid electric vehicle	31.6% (1.385 million vehicles)
Battery electric vehicle Plug-in hybrid electric vehicle	0.41% (18,000 vehicles) 0.82% (36,000 vehicles)
Fuel cell electric vehicle	0.02% (849 vehicles)
Clean diesel vehicles	3.5% (155,000 vehicles)

Reference: Japan Automobile Manufacturers Association, Inc.(JAMA)
'The Motor Industry of Japan 2018'
METI 'Strategy Meeting for the New Era of Automobiles'

2 Recent Trends in Japan

BEVs began entering the market with the introduction of Mitsubishi i-MiEV in 2009. The Nissan Leaf soon followed, currently one of the most prominent BEVs in the world, in 2010.
In 2010 when sales of Nissan Leaf first began, the driving range per charge was at 200km. After 7 years, the range doubled to 400km, after the battery capacity improved.

Performance Improvement of BEV (e.g. Nissan LEAF)

		24kWh (Launched in 2010)	30kWh (Launched in 2015)	40kWh (Launched in 2017)
Photo				
Seating capacity		5	5	5
Dimension (L×W×H)		4480×1790×1540mm	4445×1770×1550mm	4480×1790×1540mm
Curb Weight		1,520kg	1,450kg	1,490kg
Motor:maximum power		80kW	80kW	110kW
Traction Battery	Type	Lithium-ion	Lithium-ion	Lithium-ion
	Capacity	24kWh	30kWh	40kWh
Driving range (JC08)		200km	280km	400km
Charging time	Normal 1φ200V	8 hours (3kW Charge)	8 hours (3kW Charge)	8/16 hours (6kW/3kW Charge)
	Quick (80%)	30 minutes	30 minutes	40 minutes
Price (without tax)		Approx. 3590,000～4220,000 yen	Approx. 2890,000～4070,000 yen	Approx. 2920,000～3700,000 yen

※Specifications/price based on when commercial sales first began

A new vehicle that solves the issue with driving range per charge of BEVs and combines the best features of both BEVs and HEVs entered the market in the 2012 – the PHEV.
During short distance driving, PHEVs use the electric charge taken from an external charger in the same way BEVs do, and during long distance driving, it switches to HEV using gas. The specifications for PHEVs chosen as examples, are shown below.
The battery capacity PHEVs also seems to be on the rise as well. Driving range as a BEV is currently at approximately over 60km, meaning the vehicle can be driven purely as a BEV for daily use.

Representative Commercial PHEV

company		Toyota	Mitsubishi	Honda
Name of vehicle		Prius PHV (Launched in 2012)	Outlander PHEV (Launched in 2013)	CLARITY PHEV (Launched in 2018)
Photo				
Seating capacity		4	5	5
Dimension (L×W×H)		4645×1760×1470mm	4695×1800×1710mm	4915×1875×1480mm
Curb Weight		1,530kg	1,890kg	1,850kg
Engine displacement		1,797cc	2,359cc	1,496cc
Motor:maximum power		53kW	60/70 (2 units) kW	135kW
Traction Battery Capacity		8.8kWh	13.8kWh	17.0kWh
Equivalent EV range (JC08)		68.2km	65.0km	114.6km
Charging time	1φ200V	Approx. 2.3 hours	Approx. 4 hours	Approx. 6 hours
	Quick (80%)	Approx. 20 minutes	Approx. 25 minutes	Approx. 30 minutes

※Specifications as of August 2018

In 2014, Toyota MIRAI was introduced to the market as the first commercial model FCEV. Honda soon followed suit with its very own CLARITY FUEL CELL, made available for leasing in 2016.
Hydrogen, the fuel, is packed into 70MPa pressurized hydrogen tanks. The driving range is over 600km, only requiring 3 min. to fill the tank, making the usability comparable to that of gasoline-powered vehicles.

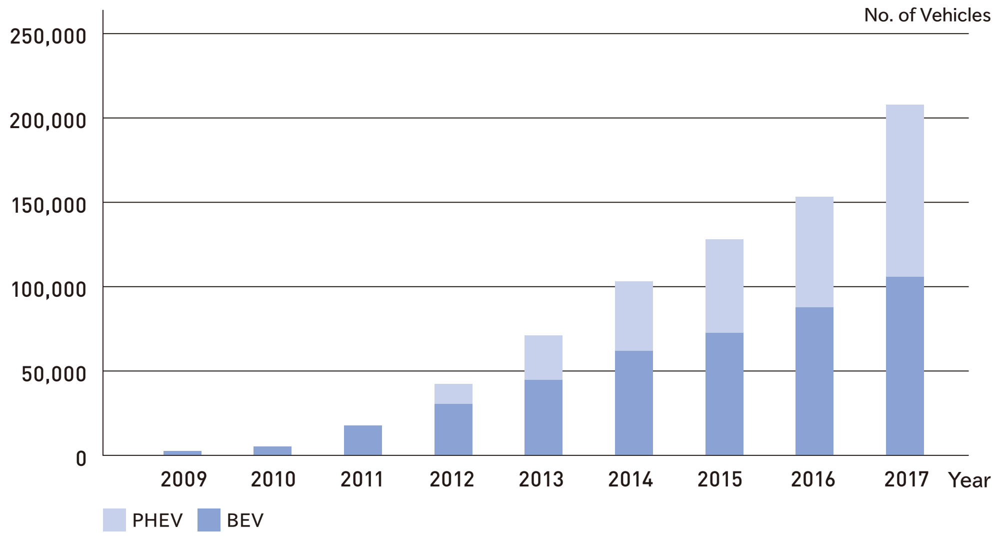
Commercial Model FCEVs

Make		Toyota	Honda
Model		MIRAI (Launched in 2014)	CLARITY FUEL CELL (Launched in 2016※1)
Photo			
Seating capacity		4	5
Dimension(L×W×H)		4890×1815×1535mm	4915×1875×1480mm
Curb Weight		1,850kg	1,890 kg
Fuel cell	type	Polymer electrolyte	Polymer electrolyte
	power	114 kW	103 kW
Motor:maximum power		113 kW	130 kW
Battery type		Nickel-metal hydride	Lithium-ion
Fuel		70MPa compressed hydrogen 2 hydrogen tanks	70MPa compressed hydrogen 2 hydrogen tanks
Driving range (JC08)		Approx. 650 km	Approx. 750 km
Hydrogen refueling time		Approx. 3 minutes	Approx. 3 minutes

Specifications as of August 2018 ※1 Business lease sales, as of August 2018

The graph below shoes the transition in the total number of BEVs and PHEVS sold in Japan after 2009. The number has reached over 200,000 vehicles, and is steadily growing.

Accumulated total no. of BEV/PHEV sold in Japan (since 2009)



Reference: Next Generation Vehicle Promotion Center public data

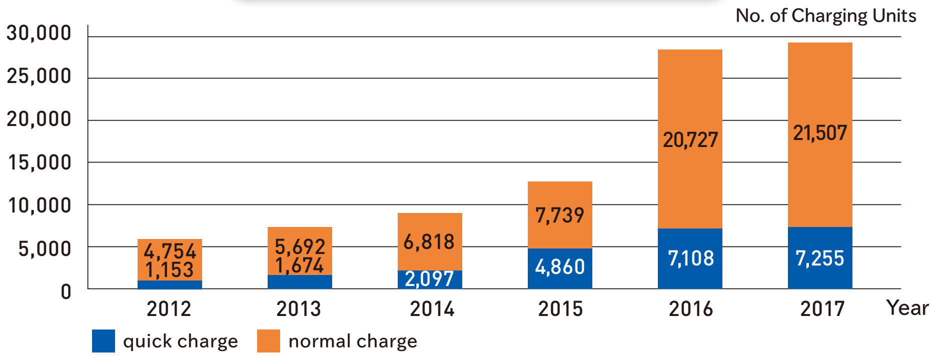
3 Trends in Infrastructure

3-1 ► Charging Infrastructure

The installation of charging stations all over the country is essential for the promotion of BEVs. Currently, there are two ways to charge the major commercial BEVs sold in Japan, normal charging (Alternate Current) and quick charging (Direct Current).
Normal charging stations can be placed in homes; the approximate charging time is 8 hours.※ The cost of installation is much less compared to fast charging stations, making it more suitable for places that allow vehicles to park for a prolonged period of time e.g. homes, hotels, offices.
Electricity at a higher voltage is used for quick charging stations. 30 minutes of charging generally will result in 80% charge, making it suitable for on-the-go charging and emergencies.
The charging stations are rapidly growing in number, as the government subsidizes them.
Driving range per charge has greatly improved and at the same time, BEVs are requiring less time to charge, thus creating the stage for BEVs to be driven all over Japan.

※Charging time may vary based on various conditions such as charger capacity

Installation of Charging Units



Reference: Zenrin (as of December 2017)

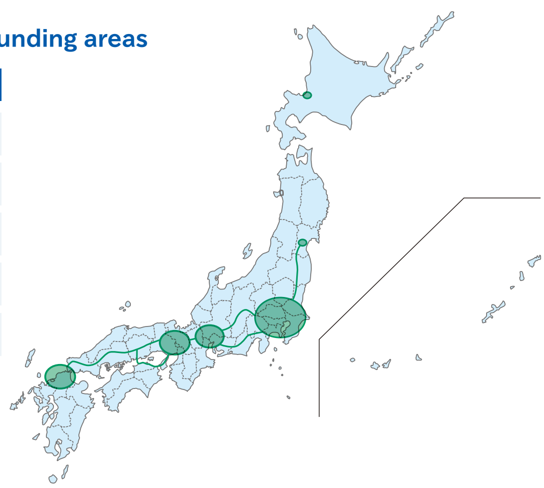
3-2 ► Hydrogen Infrastructure

Installations of hydrogen charging stations for commercial use are currently underway in the four major cities in Japan.
Since 2014, the government subsidy program, The Creation of New Demand for Fuel Cell Vehicles, by METI has been in place since 2014, which has promoted the installation of hydrogen charging stations for commercial use. There are 100 stations in operation as of August 2018.
The installation of hydrogen stations is a must in the promotion of FCEV. In the Basic Strategy of Hydrogen, a government paper, the target number of stations is as follows: 160 stations by fiscal year 2020, 320 by fiscal year 2025. In addition, the target numbers for FCEVs are: approximately 40,000 vehicles by 2020, and approximately, 200,000 vehicles by 2025, reaching approximately 800,000 vehicles by 2030.

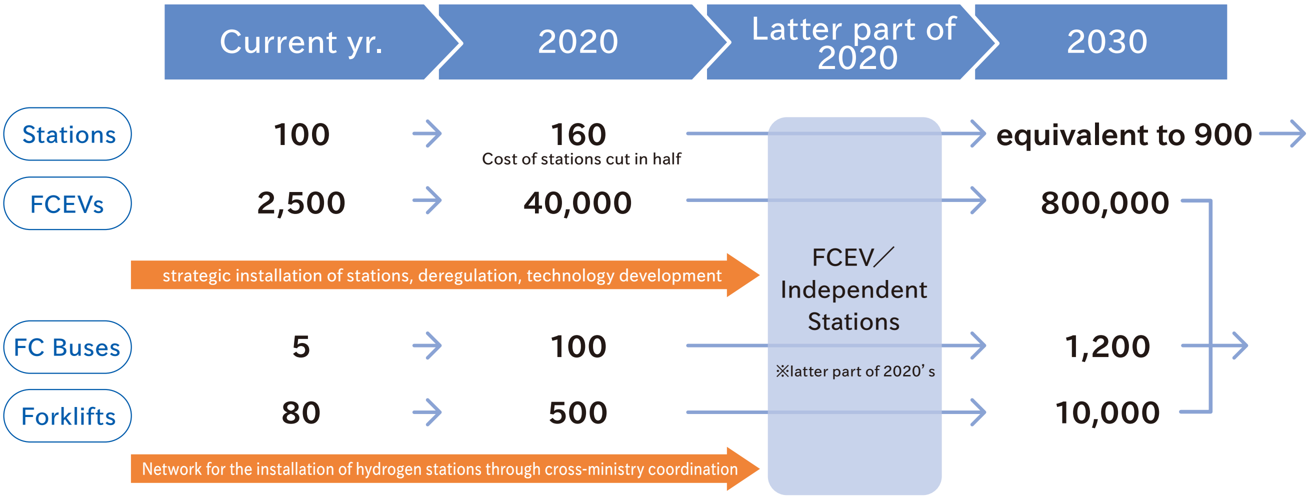
100 Stations in major cities and surrounding areas

Number of Hydrogen Stations installed
Kanto region : 40 stations
Chukyo region : 25 stations
Kansai region : 12 stations
Northern Kyushu region : 11 stations
Other regions : 12 stations

※ as of August 2018
Areas where stations will be installed
as a part of the government subsidy program
for the Creation of New Demand for Fuel Cell Vehicles



Adoption scenario for FCEV and other vehicles etc.



4 New role as a mobile power source

Considerations are currently underway to utilize BEVs, PHEVs and FCEVs as part of the power supply grid. Unlike vehicles of the past, BEVs and PHEVs have large capacity batteries that can electrically connect to the power supply for a prolonged amount of time.
The aim is to use this capability as a power supply system. Shown below is what roles electric vehicles should take as part of the power supply grid.

Roles of EVs as part of the power supply

Name	Flow of Electricity	Expected features
Vehicle to Home (V2H)	From EV to home	Use of electricity of the vehicle as emergency power supply for the home
Vehicle to Grid※ (V2G)	From EV to the grid	Supply electricity from vehicle to the power supply grid to use for adjusting the frequencies/demands to the power supply

※uses power distribution networks owned by electric companies

V2Hs were commercialized at the time of the Great Eastern Japan Earthquake. In many instances, they are used in in combination with BEVs at time of purchase.
The usage of V2Gs will grow in the future, connecting a large number of BEVs and PHEVs to the power supply grid. Field-testing for utilizing them as controllable frequency or as power source to adjust energy demands is currently underway.

Overview of CEV Subsidy※

※CEV: Clean Energy Vehicle

Subsidy To Promote CEV Purchase ≫ Government will use public funds to subsidize part of the cost to purchase clean energy cars such as BEVs, PHEVs, and FCEVs

How to calculate subsidy

The amount of subsidy is calculated based on the grade of the clean energy vehicle. The subsidy is paid within the limits set per vehicle grade and subsidy will not be paid to vehicles if the calculated amount is under 15,000 yen.
Subsidy is given at a standard rate (per 1,000 yen) for each vehicle model/grade.

1 Battery Electric Vehicles (BEV)

Subsidy is calculated based on the driving range per charge.

subsidy amount = (subsidy per driving range per charge (1,000 yen/km) × driving range per charge) × subsidy rate 1/1

※subsidy rate 1/1 means 100% subsidy

2 Plug-in Hybrid Electric Vehicles (PHEV)

Subsidy amount is 200,000 yen for all vehicles. (limited to EVs with calculated driving range over 30km)

3 Fuel Cell Energy Vehicles (FCEV)・Clean Diesel Vehicles (CDV)

Subsidy amount is calculated based on the price (MSRP) difference between the clean energy vehicle and the gasoline-powered vehicles of the same model/grade.

subsidy amount = (A Vehicle Price − B Standard Amount) × C Subsidy Rate

A.Vehicle Price	MSRP (retail price) excluding consumption tax
B.Standard Amount	・Price of the gasoline-powered vehicles (base model) of the same model/grade clean energy vehicle ・For clean diesel vehicles, the reduction in the estimated running cost such as the cost of fuel over a certain number of years is added
C.Subsidy Rate	Subsidy Rate is the rate in which subsidy is provided. The rates for the various grades of clean energy vehicles are shown below. ▶FCEV(2/3) ▶CDV(1/12)

Max. amount per clean energy vehicle type

Clean energy vehicle types	Max. amount of subsidy	Clean energy vehicle types	Max. amount of subsidy
BEV (Battery Electric Vehicles)	400,000 yen	FCEV (Fuel Cell Energy Vehicle)	Unlimited
PHEV (Plug-in Hybrid Vehicles)	200,000 yen	CDV (Clean Diesel Vehicle)	150,000 yen

CEV Subsidized Vehicles

BEV

Make		Tesla	Tesla	Nissan	Nissan
Model		Model S P100D	Model X P100D	e-NV200 van	Leaf
Photo					
Seating capacity		7(max. 5 adults+2 children)	7(max. 7 adults)	5	5
Dimension(L×W×H) (mm)		4970×1950×1440	5037×1990×1680	4560×1755×1855	4480×1790×1540
Curb Weight (kg)		2,290	2,570	1,630	1,490
Motor	maximum power (kW)	262/510	262/510	80	110
	maximum torque (Nm)	713/967	713/967	254	320
Traction Battery	Type	Lithium-ion	Lithium-ion	Lithium-ion	Lithium-ion
	Total Voltage (V)	—	—	350	350
	Capacity (kWh)	100	100	40	40
Driving range (km)		613(NEDC)※1	542(NEDC)※1	300	400
Alternating current energy consumption (Wh/km)		150	179	150	120
Charging time	Normal 1ϕ200V (h)	14.7	14.7	8/16(6kW/3kW Charge)	8/16(6kW/3kW Charge)
	Quick (80%) (min.)	20※2	20※2	40	40

※1 NEDC: New European Driving Cycle ※2: Charged by Tesla Super Charger(50% SOC)

Make		BMW	Volkswagen	Mitsubishi	Mitsubishi
Model		i3	e-Golf	i-MiEV	miniCAB-MiEV
Photo					
Seating capacity		4	5	4	4
Dimension(L×W×H) (mm)		4020×1775×1550	4265×1800×1480	3480×1475×1610	3395×1475×1915
Weight (kg)		1,300	1,590	1,100	1,110
Motor	maximum power (kW)	125	100	47	30
	maximum torque (Nm)	250	290	160	196
Traction Battery	Type	Lithium-ion	Lithium-ion	Lithium-ion	Lithium-ion
	Total Voltage (V)	398.4	323	330	330
	Capacity (kWh)	33.2	35.8	16	16
Driving range (km)		390	301	164	150
Alternating current energy consumption (Wh/km)		98	124	118	127
Charging time	Normal 1ϕ200V (h)	12~13	Approx.6/12 (6kW/3kW Charge)	Approx. 7	Approx. 7
	Quick (80%) (min.)	45	Approx. 35	Approx. 30	Approx. 35

※Examples of CEV subsidized vehicles are shown as of end of August 2018
Vehicle performance was tested by JC08 mode unless noted otherwise
Charging time may vary based on various conditions such as charger capacity

PHEV

Make		Toyota	BMW	BMW	BMW	BMW
Model		PRIUS PHV	225xe iPerformance Active Tourer	330e iPerformance	530e iPerformance	740e iPerformance
Photo						
Seating capacity		4	5	5	5	5
Dimension (L×W×H) (mm)		4645×1760×1470	4375×1800×1550	4645×1800×1440	4945×1870×1485	5110×1900×1480
Curb Weight (kg)		1,530	1,740	1,770	1,910	2,060
Engine displacement (cc)		1,797	1,498	1,998	1,998	1,998
Hybrid fuel economy (km/L)		37.2	17.6	17.7	17.4	15.6
Motor	maximum power (kW)	53	65	65	83	83
	maximum torque (Nm)	163	165	250	250	250
Battery Capacity (kWh)		8.8	7.7	7.7	9.2	9.2
Equivalent EV range (km)		68.2	42.4	36.8	52.5	42.0
Specific power consumption (km/kWh)		10.54	5.8	5.13	5.76	4.99
Charging time	1ϕ200V (h)	Approx. 2.3	Approx. 3	Approx. 3	Approx. 3-5	Approx. 4
	Quick (80%) (min.)	Approx. 20	N/A	N/A	N/A	N/A

Make		BMW	BMW	BMW	BMW	Volkswagen
Model		X5 xDrive40e iPerformance	i3 (Range Extender)	i8 Coupe	MINI Cooper SE Crossover ALL4	Golf GTE
Photo						
Seating capacity		5	4	4	5	5
Dimension (L×W×H) (mm)		4910×1940×1760	4020×1775×1550	4690×1940×1300	4315×1820×1595	4265×1800×1480
Curb Weight (kg)		2,370	1,420	1,590	1,770	1,580
Engine displacement (cc)		1,997	647	1,498	1,499	1,394
Hybrid fuel economy (km/L)		13.8	24.7	15.9	17.3	19.9
Motor	maximum power (kW)	83	125	105	65	80
	maximum torque (Nm)	250	250	250	165	330
Battery Capacity (kWh)		9.2	33.2	11.6	7.6	8.7
Equivalent EV range (km)		30.8	288.9	54.8	42.4	45.0
Specific power consumption (km/kWh)		3.93	9.13	4.86	5.4	5.32
Charging time	1ϕ200V (h)	Approx. 4	12〜13	Approx. 4	Approx. 3	Just over 3
	Quick (80%) (min.)	N/A	Approx. 45	N/A	N/A	N/A

※Examples of CEV subsidized vehicles are shown as of end of August 2018
Vehicle performance was tested by JC08 mode unless noted otherwise
Charging time may vary based on various conditions such as charger capacity

Make		Volkswagen	Porsche	Porsche	Volvo	Volvo
Model		Passat GTE	Panamera4 E-Hybrid	Panamera Turbo S E-Hybrid	V90	XC60
Photo						
Seating capacity		5	4	4	5	5
Dimension (L×W×H)(mm)		4785×1830×1470	5050×1935×1425	5050×1935×1425	4935×1890×1475	4690×1900×1660
Curb Weight (kg)		1,720	2,210	2,360	2,100	2,150
Engine displacement (cc)		1,394	2,893	3,996	1,968	1,968
Hybrid fuel economy (km/L)		20.9	10.8	11.1	15.0	15.7
Motor	maximum power (kW)	85	100	100	34/65 (2 units)	34/65 (2 units)
	maximum torque (Nm)	330	400	400	160/240	160/240
Battery Capacity (kWh)		9.9	14	14	10.4	10.4
Equivalent EV range (km)		53.3	46.4	45.3	45.0	45.4
Specific power consumption (km/kWh)		5.87	3.53	3.42	4.66	4.55
Charging time	1ϕ200V (h)	Approx. 4	Approx. 4.4	Approx. 4.4	2.5~3.5	2.5~3.5
	Quick (80%) (min.)	N/A	N/A	N/A	N/A	N/A

company		Volvo	Honda	Mitsubishi	Mercedes Benz
Name of vehicle		XC90	CLARITY PHEV	OUTLANDER PHEV	GLC 350 e 4MATIC Sports
Photo					
Seating capacity		7	5	5	5
Dimension (L×W×H)(mm)		4950×1960×1760	4915×1875×1480	4695×1800×1710	4670×1900×1640
Curb Weight (kg)		2,340	1,850	1,890	2,110
Engine displacement (cc)		1,968	1,496	2,359	1,991
Hybrid fuel economy (km/L)		13.7	28.0	18.6	13.9
Motor	maximum power (kW)	34/65 (2 units)	135	60/70 (2 units)	85
	maximum torque (Nm)	160/240	315	137/195	340
Battery Capacity (kWh)		10.4	17.0	13.8	8.7
Equivalent EV range (km)		40.4	114.6	65.0	30.1
Specific power consumption (km/kWh)		4.10	7.67	5.55	3.62
Charging time	1ϕ200V (h)	2.5~3.5	Approx. 6	Approx. 4	4
	Quick (80%) (min.)	N/A	Approx. 30	Approx. 25	N/A

※Examples of CEV subsidized vehicles are shown as of end of August 2018
Vehicle performance was tested by JC08 mode unless noted otherwise
Charging time may vary based on various conditions such as charger capacity

FCEV

Make		Toyota	Honda
Model		MIRAI	CLARITY FUEL CELL
Photo			
Seating capacity		4	5
Dimension(L×W×H)(mm)		4890×1815×1535	4915×1875×1480
Curb Weight (kg)		1,850	1,890
Fuel cell	type	Polymer electrolyte	Polymer electrolyte
	Max. power (kW)	114	103
Motor	maximum power	113	130
	maximum torque Nm	335	300
Battery type		Nickel-metal hydride	Lithium-ion
Fuel		70MPa compressed hydrogen 2 hydrogen tanks	70MPa compressed hydrogen 2 hydrogen tanks
Driving range (JC08) (km)		Approx. 650 ※1	Approx. 750 ※1
Hydrogen refueling time (min.)		Approx. 3 ※2	Approx. 3 ※2

※Examples of CEV subsidized vehicles are shown as of end of August 2018
※1 Vehicle performance was tested by JC08 mode
※2 Refueled at 70MPa hydrogen station

Others (motorcycle with sidecar, motorized bicycle)

Make		Mitsuoka	Suzuki	Yamaha	Yamaha
Model		Like-T3	e-Let's	EC-03	E-Vino
Photo					
Seating capacity		2	1	1	1
Dimension(L×W×H)(mm)		2485×1075×1170	1665×600×985	1565×600×990	1675×660×1005
Curb Weight (kg)		326	72	56	68
Motor	Rated power (kW)	3	0.58	0.58	0.58
	maximum power	5.6	1.7	1.4	1.2
	maximum torque (Nm)	36	15	—	7.8
Battery	Type	Lithium-ion	Lithium-ion	Lithium-ion	Lithium-ion
	Total Voltage (V)	72	50.4	—	50
	Capacity (kWh)	4.32	0.715	—	—
Driving range (km)		Approx. 60 (at 40km/h road load)	30 (at 30km/h road load)	43 (at 30km/h road load)	29 (at 30km/h road load)
Charging time (h)		Approx. 6 (100V)	Approx. 4 (100V)	Approx. 6 (100V)	Approx. 3 (100V)

※Examples of CEV subsidized vehicles are shown as of end of August 2018

Company Profile

Name Next Generation Vehicle Promotion Center : NeV

Location Nihonbashi Kimura Building,1-16-3 Nihonbashi, Chuo-ku, Tokyo, 103-0027, Japan

History Established February 19, 2007.
Separate from the Japan Automobile Research Institute; named the Electric Vehicle Promotion Center.
Changed name April 1, 2009.
Obtained corporate status as a general incorporated association and changed name to what it is today.

Objective Contribute to the implementation of Japan's energy and environmental policies by promoting vehicles with superior energy and environmental performance.

Abbreviation

Abbreviations used in this pamphlet will be as follows.
Excludes proper nouns.

- BEV → Battery Electric Vehicle
- HEV → Hybrid Electric Vehicle
- PHEV → Plug-in Hybrid Electric Vehicle
- FCEV → Fuel Cell Electric Vehicle

http://www.cev-pc.or.jp

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