

Gaikindo 2019 Daily Seminar

Alternative Power Train Technology in the World and Development Strategy for the Southeast Asian Market

25/Jul/2019
PT . Honda R&D Indonesia

Contents

1, Alternative Power train technology in the world

- **Honda Hybrid information**
- **Honda Battery EV information**
- **Honda FCV information**
- **Honda's ideal future mobility**

2, Development strategy for the southeast Asian Market

- **Investigation for the environment**
- **Battery EV concern in southeast Asian**
- **Considering the southeast Asian Market**

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Alternative Power train technology in the world

2030 vision

Serve people world wide with the “joy of expanding their life’s potential”

- Lead the advancement of mobility and enable people everywhere in the world to improve their daily lives -

Honda products line up

The Power of Dreams

Motor cycle



Automobile



Marine



Power products



Honda jet/Aircraft engine

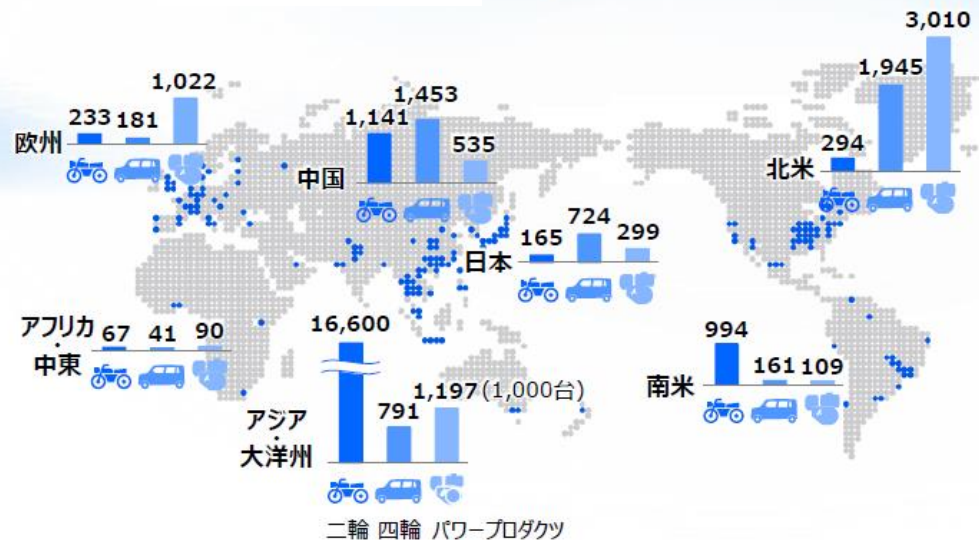


Robotics



Product volume
in the world

32mil. units



Honda Meeting 2019

Honda 2030vision provides joy of expanding their life’s potential

Alternative Power train technology in the world

Honda's Never-changing Wellsprings

Honda enriches **peoples'** lives through technology



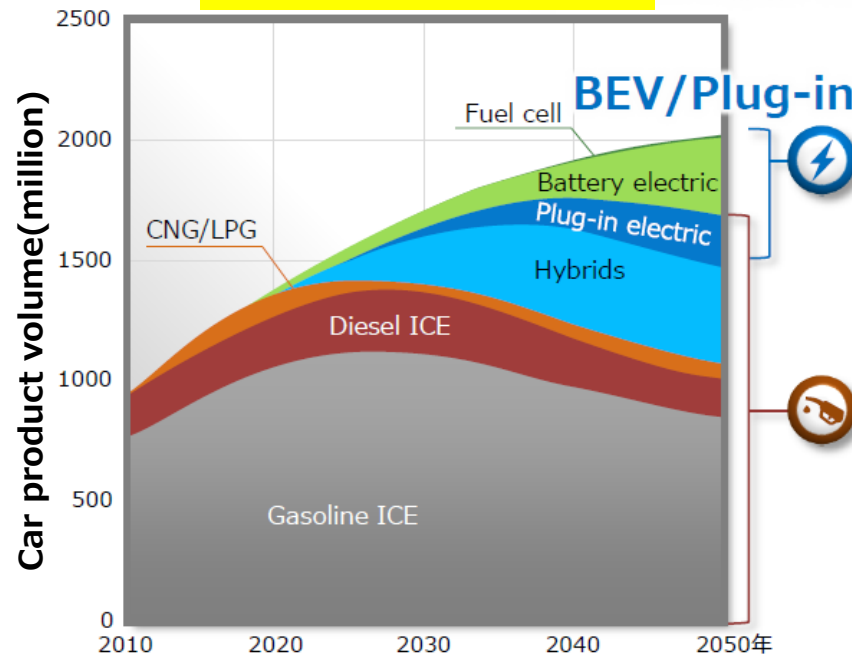
Honda enriches Peoples' lives through technology continuously

Alternative Power train technology in the world

To Hold Increase in Global Temperature to Well Below 2°C

Unfortunately between ideal and reality has big gap

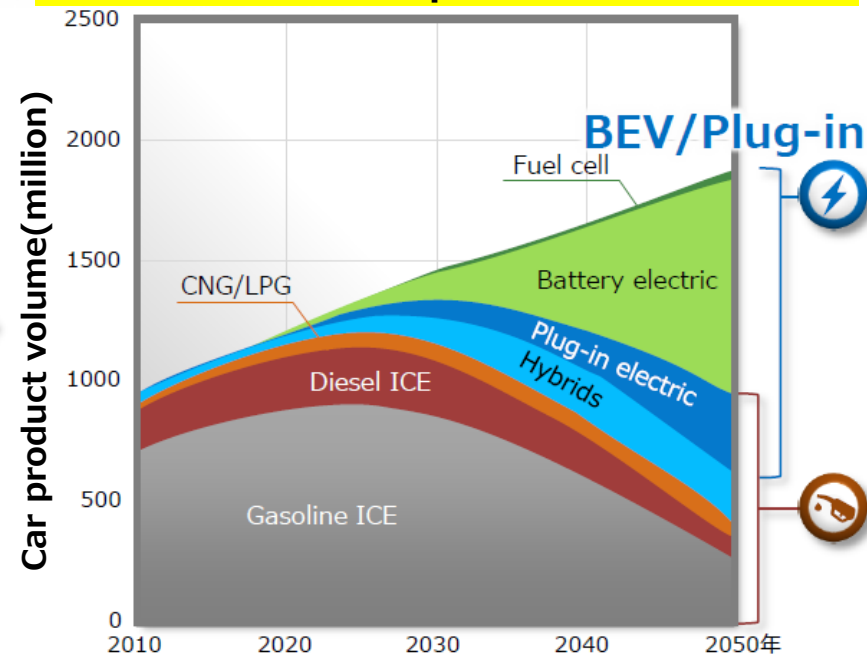
Standard scenario



Technological progress and social change
(IHS Markit Rivalry Scenario)

*Source: Drawn by IHS Markit 2018 Rivalry Scenario

Environmental requirements scenario



Environment requirements by BEV/PHEV
(IEA : WB2DS)

*Source: IEA Energy Technology Perspectives 2017, (WB2DS LDVs)

※WB2DS=Well Below 2 Degree Scenario (世界の気温上昇を2℃より十分に低く抑えるシナリオ)

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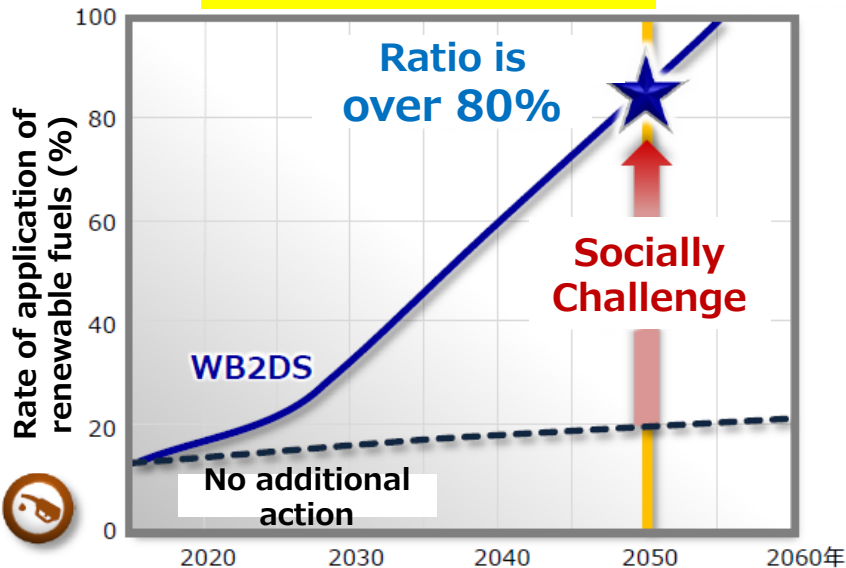
For WB2DS, both prediction have big gap

Alternative Power train technology in the world

Well below 2 degree C for global temperature rise

It is very hard for each scenarios to achieve WB2DS

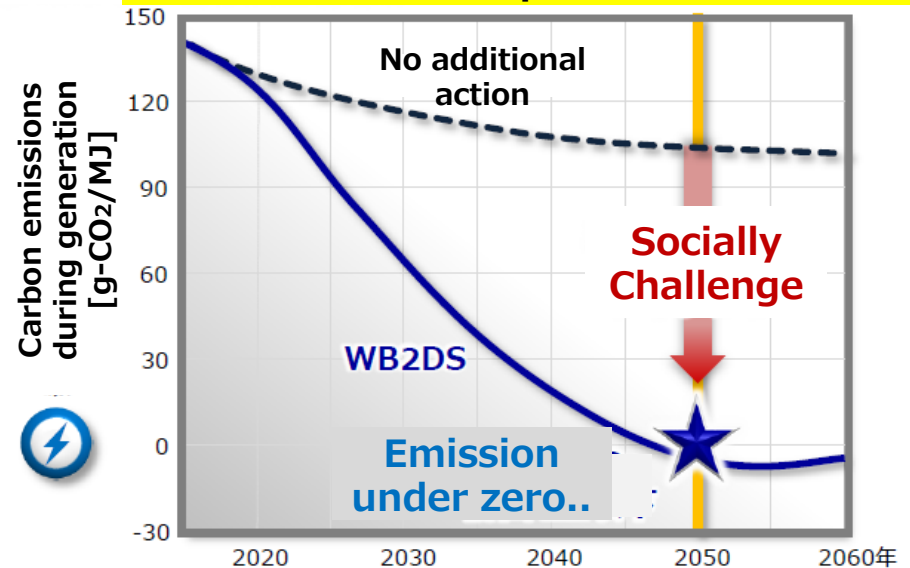
Standard scenario



Ratio for recyclable fuel for achievement WB2DS

*Source: This analysis is based on the Mobility model developed by the International Energy Agency, ©OECA/IEA2017, but the resulting analysis has been prepared by Honda and does not necessarily reflect the views of the International Energy Agency

Environmental requirement scenario



Reduction power generation CO2 for achievement WB2DS

*Source: This analysis is based on the Mobility model developed by the International Energy Agency, ©OECA/IEA2017, but the resulting analysis has been prepared by Honda and does not necessarily reflect the views of the International Energy Agency

It is very hard to achieve for WB2DS

Alternative Power train technology in the world

Scenario 1

Electrified mobility society

→ Users' convenience (locality, infrastructure, and usage) should be more enhanced

Scenario 2

Mobility society by utilizing renewable energy (biofuel, e-fuel, hydrogen, and others)

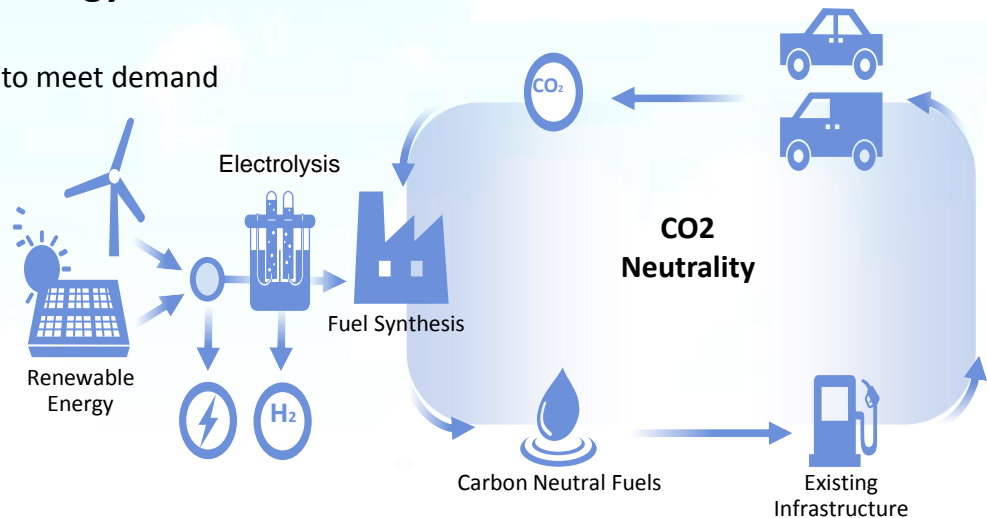
→ The issue is to secure enough production amount to meet demand

Scenario 3

Mixed scenario of "1" and "2"

"Multi-Pathways"

Honda draws a scenario to provide carbon-free mobility to all customers for sustainable society



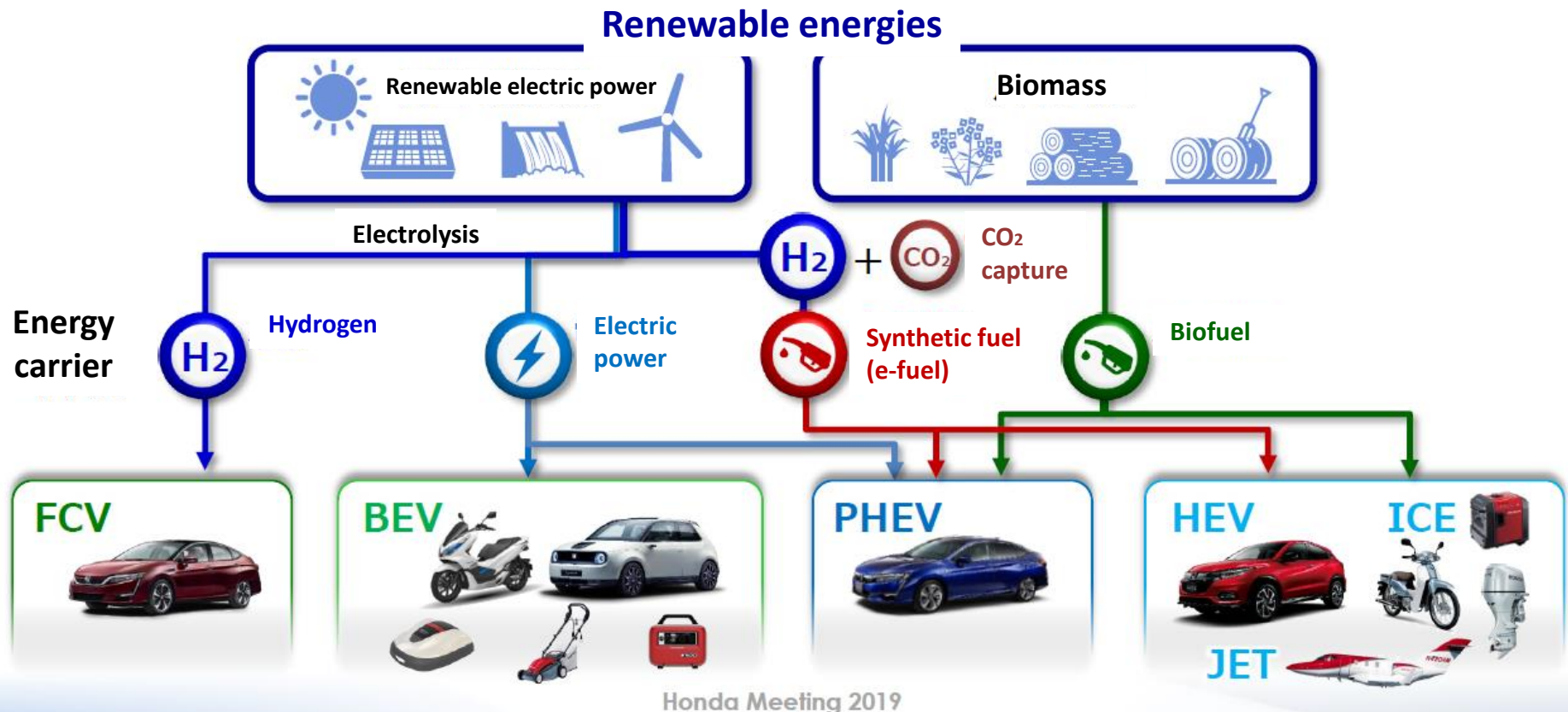
※ Multi-pathways : a concept to maximize the usage of renewable energy not only by direct use of electricity, but also by conversion use to fuels such as hydrogen or e-fuel

Honda's scenario is Multi-Pathways

Alternative Power train technology in the world

Maximizing Use of Renewable Energy

Honda is seeking to regain the joy and freedom of mobility by making multi-pathway.
It possible to use the **optimal** product (power unit) in the optimal place
for the optimal application by providing the optimal energy carrier

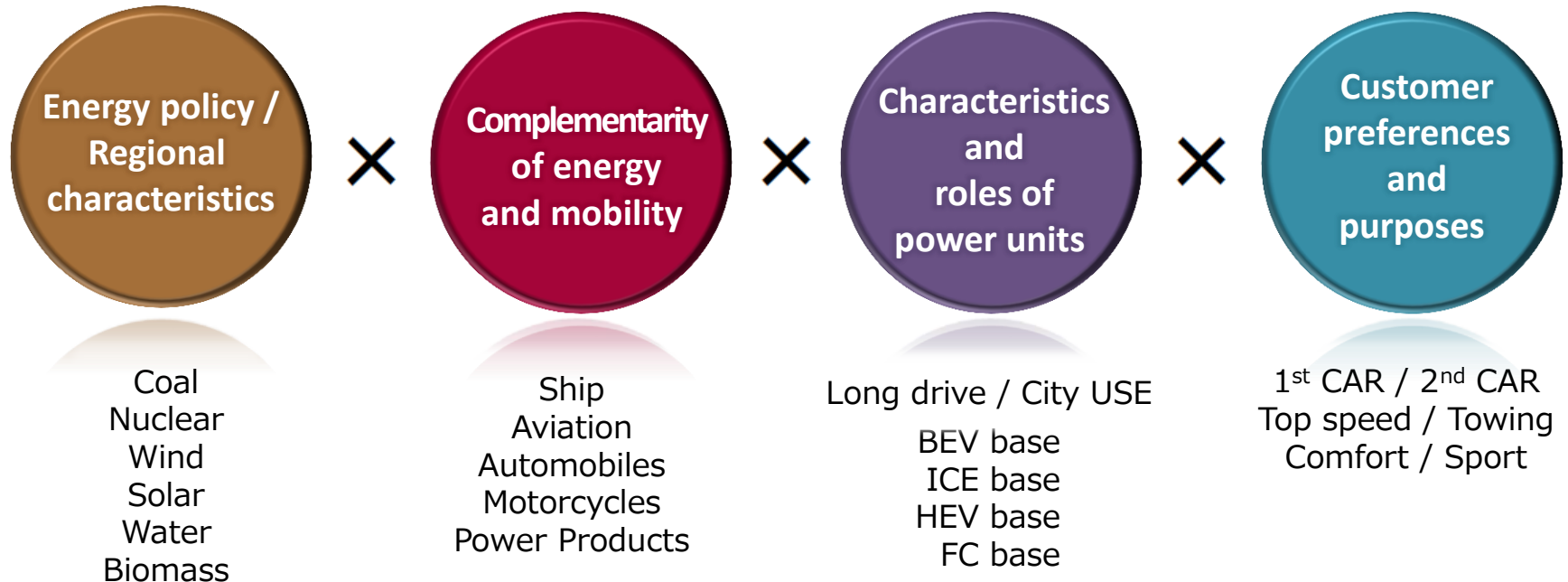


Key word is “Optimal” and “Multi-pathways”

Alternative Power train technology in the world

Key Points for the Creation of Multi-pathways[※]

It will be essential to organize key points from the perspectives of the different people, societies and energy in each region, and to prepare the right power units for each application



※ Multi-pathways = a concept to maximize the usage of renewable energy not only by direct use of electricity, but also by conversion use to fuels such as hydrogen or e-fuel

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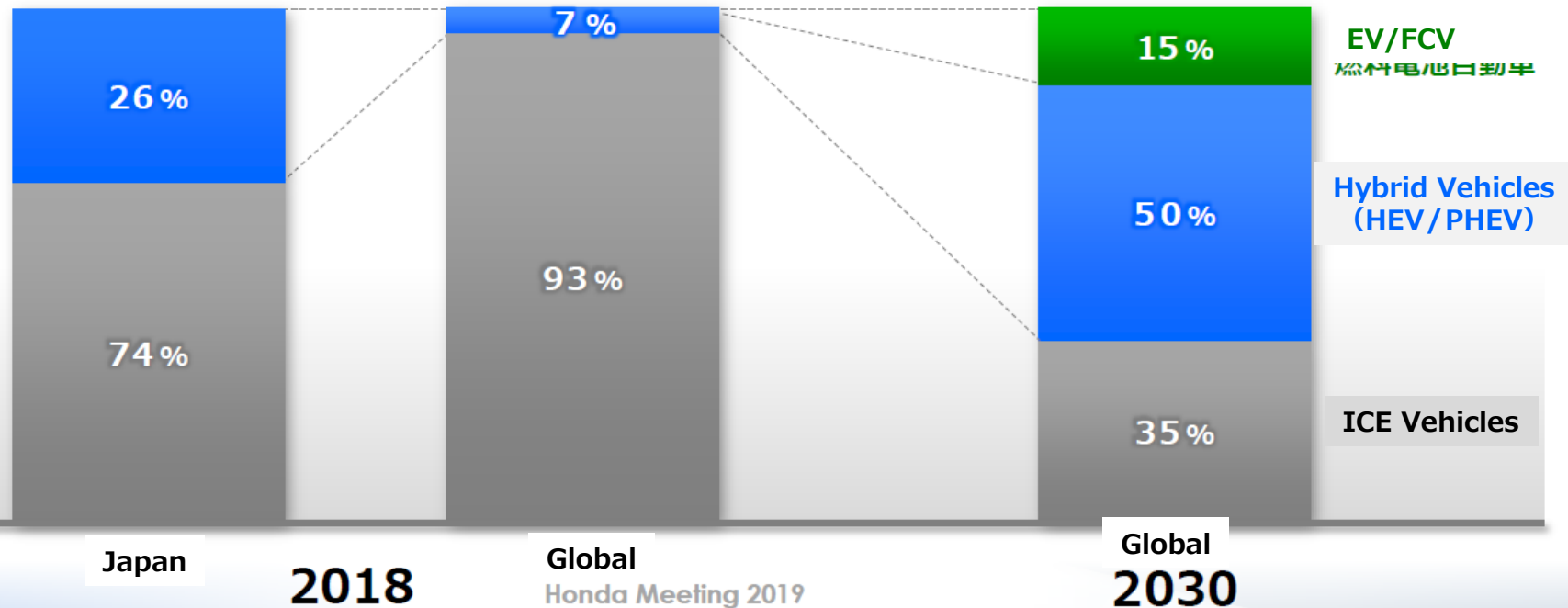
We need to adjust for each countries , societies and peoples

Alternative Power train technology in the world

Honda's Electrification Initiatives of Automobile

Moving towards electrification rate of **two-thirds or greater** in 2030

- Battery electric vehicle (BEV) and fuel cell vehicle (FCV) make up: **15%**
- HEV and PHEV are main factors: **50%**

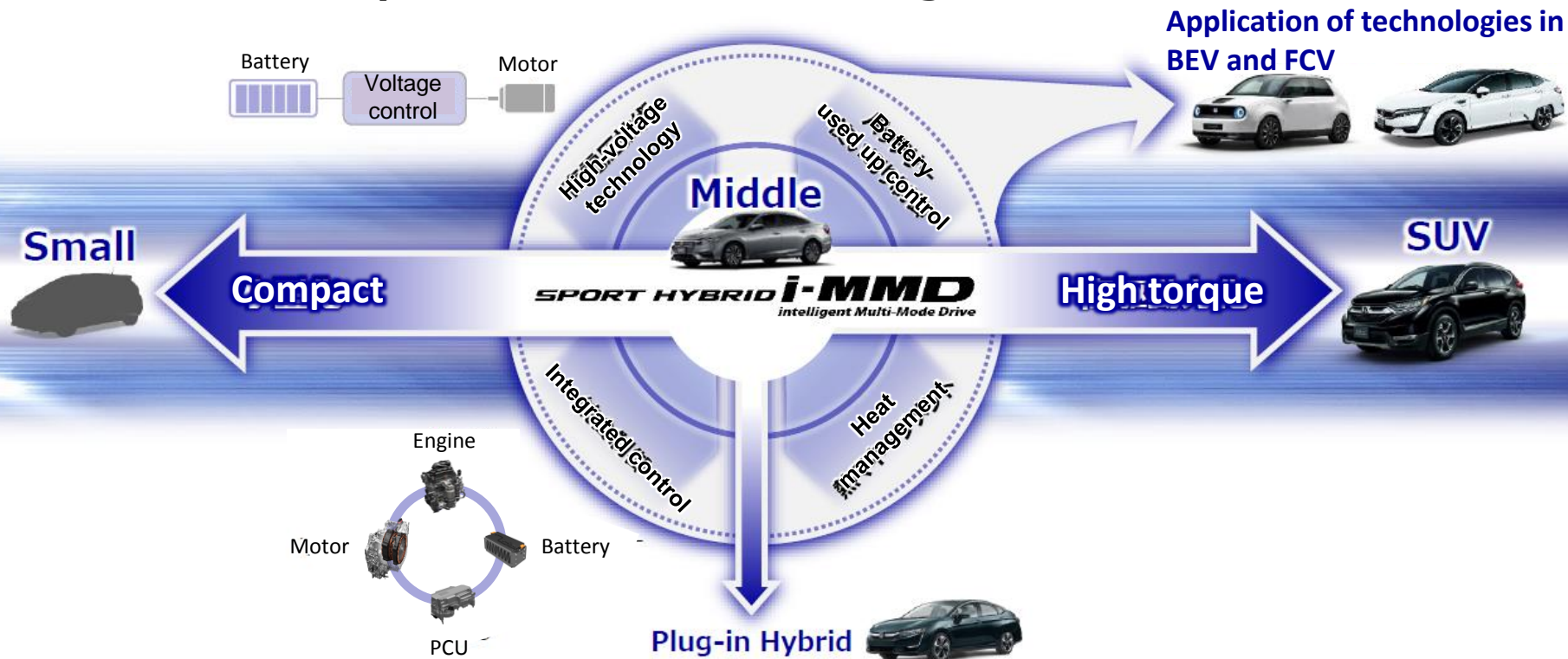


Target ; electrification rate of two-thirds in 2030

Alternative Power train technology in the world

Expanded Deployment of the i-MMD System

Expansion of scope of i-MMD Deployment
of key electrification technologies in BEV/FCV



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i-MMD system will be key electrification technologies

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Honda Hybrid information

SPORT HYBRID i-MMD
intelligent Multi-Mode Drive

i-MMD Overall system configuration

Front Unit

Power Control Unit (PCU)

2.0L Atkinson cycle DOHC
i-VTEC engine

Twin motors (Electric CVT)

Under-floor Unit

Intelligent Power Unit (IPU)

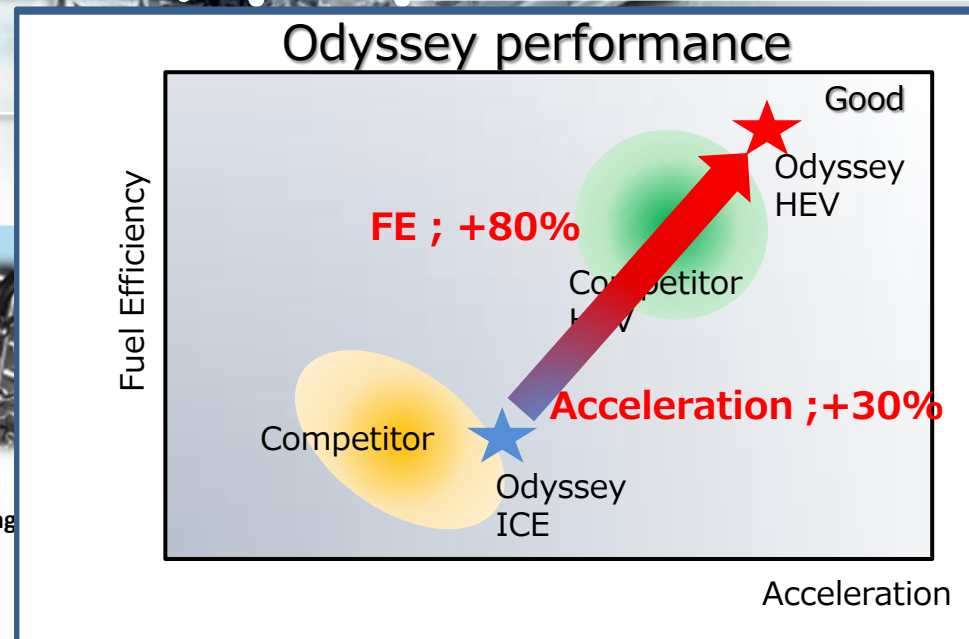
er lithium-ion battery
verter

2.0L Atkinson cycle
DOHC i-VTEC engine

Eng



Lithium-ion battery



Achieving both world's highest efficiency and smooth and sporty performance

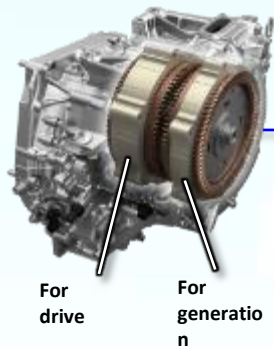
Honda Hybrid information

SPORT HYBRID i-MMD
intelligent Multi-Mode Drive

High-performance Motor

A unique manufacturing method and technologies to increase density have realized size and weight reductions

Newly developed high-performance motor

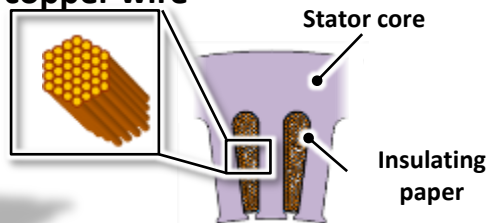


- High-density coils
- Reduction of magnet size
- Optimized electromagnetic circuits

■ Reduced size and weight	-23%
■ Torque	+8Nm
■ Power	+11kW



Circular
copper wire

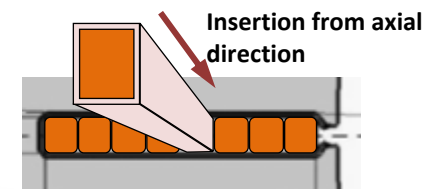


Coil space factor: 47%

High coil density



Rectangular copper wire



Coil space factor: 60%

Newly motor has unique manufacturing method and technologies

Honda Hybrid information

SPORT HYBRID i-MMD
intelligent Multi-Mode Drive

Power Control Unit

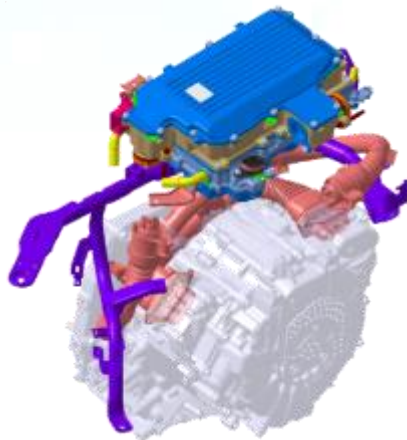
A unique manufacturing method and technologies to increase density have realized size and weight reductions



Power Control Unit (PCU)

- Low-loss power semiconductors
- Concentration of ECU functions
- Transmission-mounted

- Reduced size **-23%**
- Reduced weight **-23%**



Newly PCU has unique manufacturing method and technologies

Honda Hybrid information

SPORT HYBRID i-MMD
intelligent Multi-Mode Drive

Intelligent Power Unit

Positioning the battery under the front passenger seat has contributed to maintaining utility performance



IPU (Intelligent Power Unit)

- Reduction of size of lithium-ion battery
- Integration of battery ECU with unit
- Reduction of size through increased battery cooling efficiency
- Reduction of size and weight of DC-DC converter
- 100V, 1500W power source inverter built in

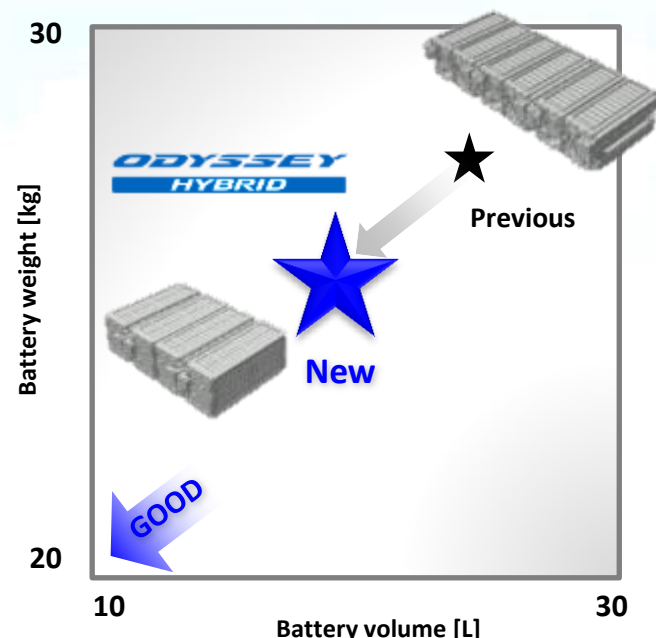


Positioned under front passenger seat

■ Size reduction **-11%**

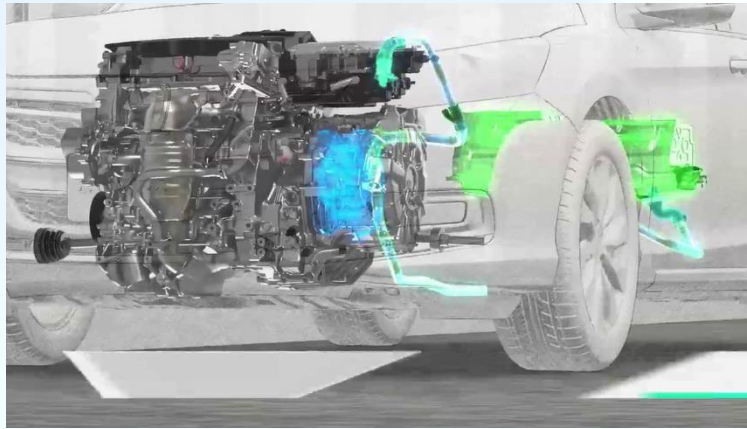
■ Weight reduction **-6%**

Reduction of size and weight of battery module



Newly IPU is needed to reduce size and weight for utility performance

Honda Hybrid information

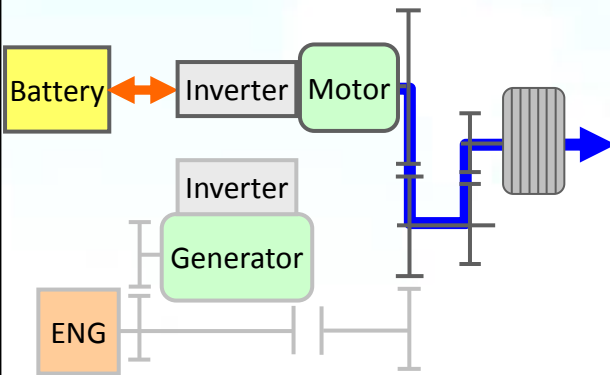


i-MMD Operation modes

— Electrical Transmission

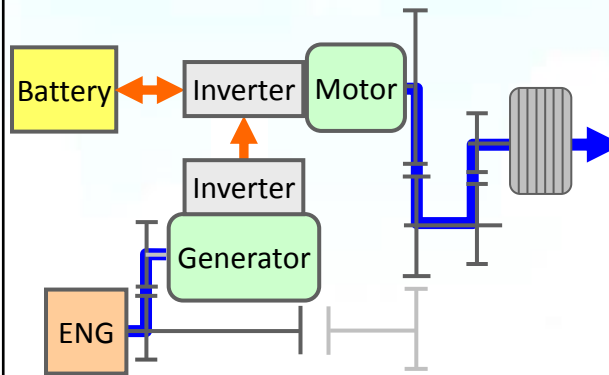
— Mechanical Transmission

EV Drive



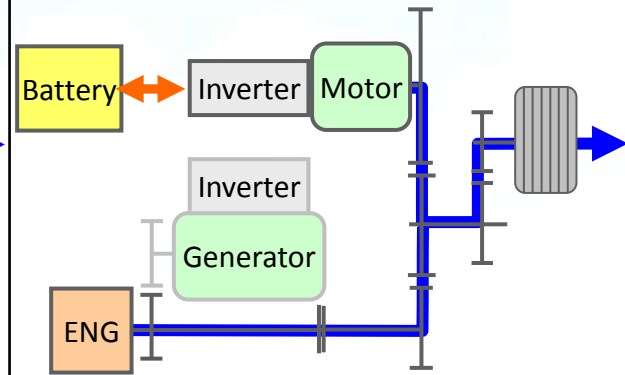
Use electric energy stored in the battery to drive the motor

Hybrid Drive



Use electric energy generated by the engine to drive the motor, with assistance or charging of the battery

Engine Drive



Use engine output to directly drive the wheels, with assistance or charging of the battery

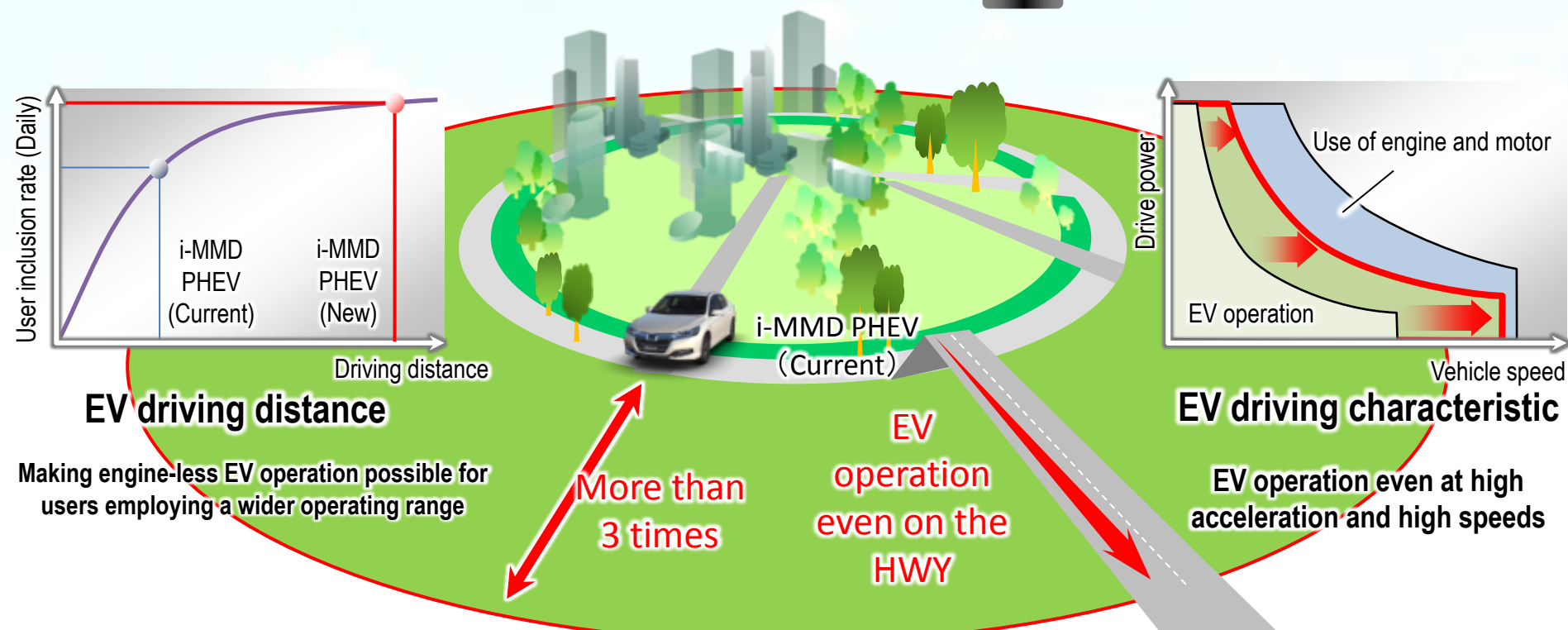
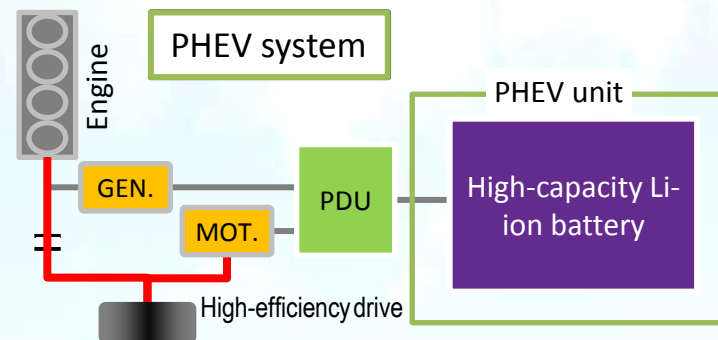
i-MMD has 3 modes, which are selected each situations

Honda Hybrid information

Innovation of SPORT HYBRID i-MMD PHEV

High-efficiency electrical system (i-MMD)

From the current i-MMD PHEV to more advanced electric technologies that are even more user-friendly



Honda's latest PHEV technology realizes a wider range of operation

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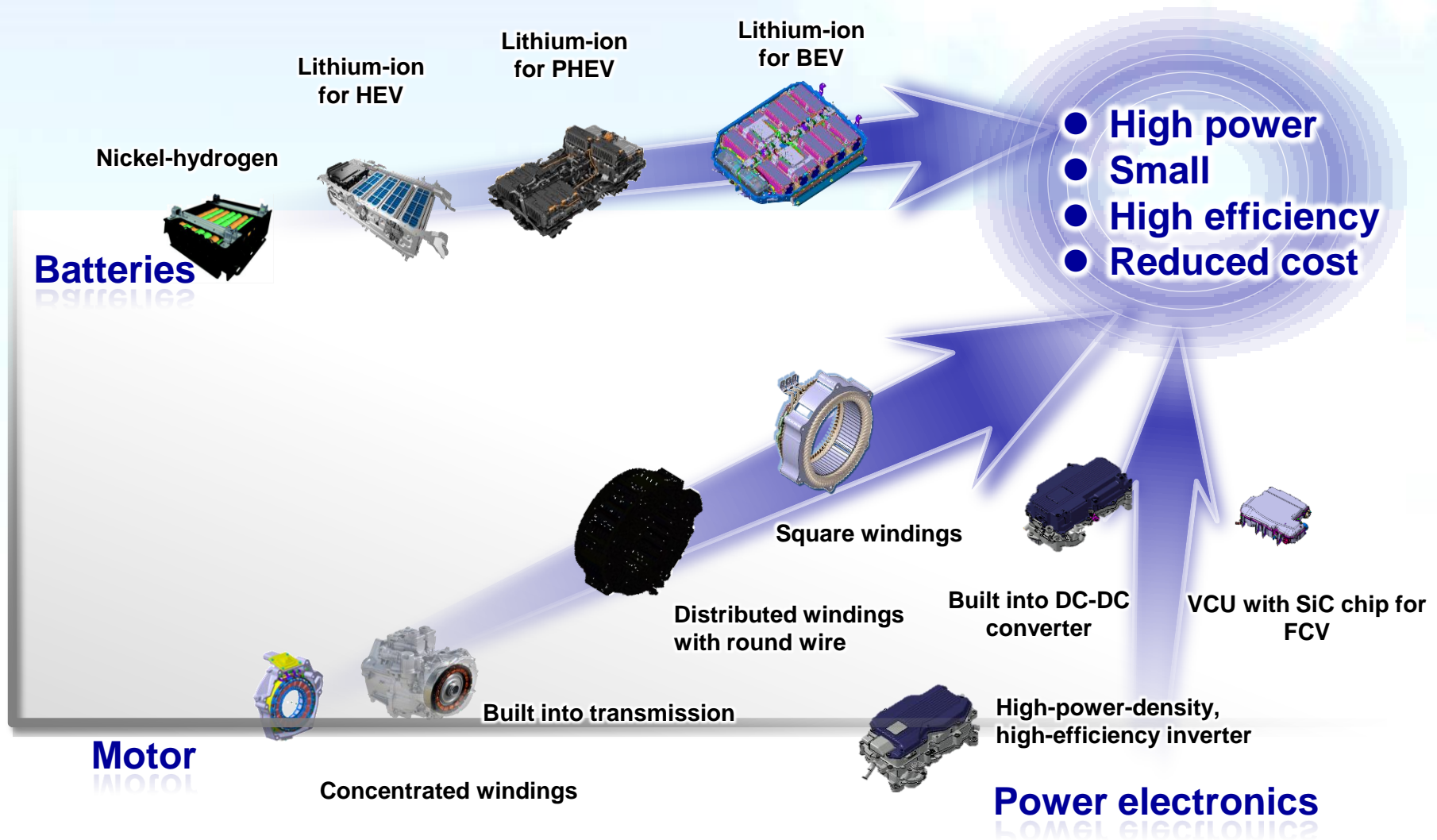
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Honda Battery EV information

Evolution of Electrified Components



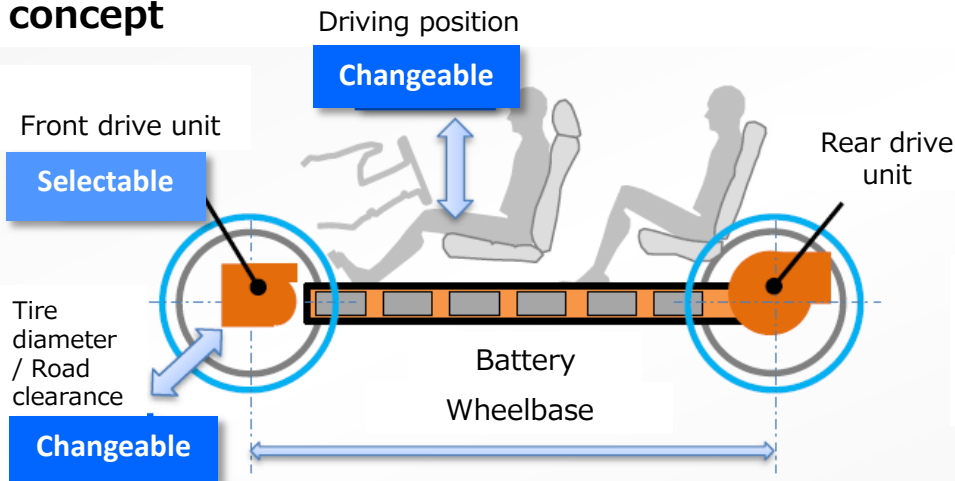
i-MMD electrical technologies expands to PHEV/BEV progress

Honda Battery EV information

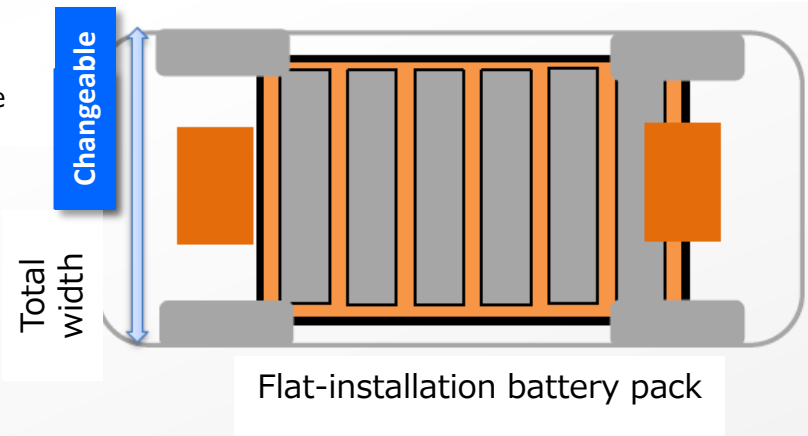
<BEV architecture>

Provide BEVs with exhilarating drive and
“human”-centered comfortable space

- 50/50 weight distribution, low center of gravity, and rear main drive (2WD/4WD) for exhilarating drive
- High efficient package by Honda's MM concept



- Integrated development of common-adaptable battery pack by using optimum locally-procurable batteries in each region



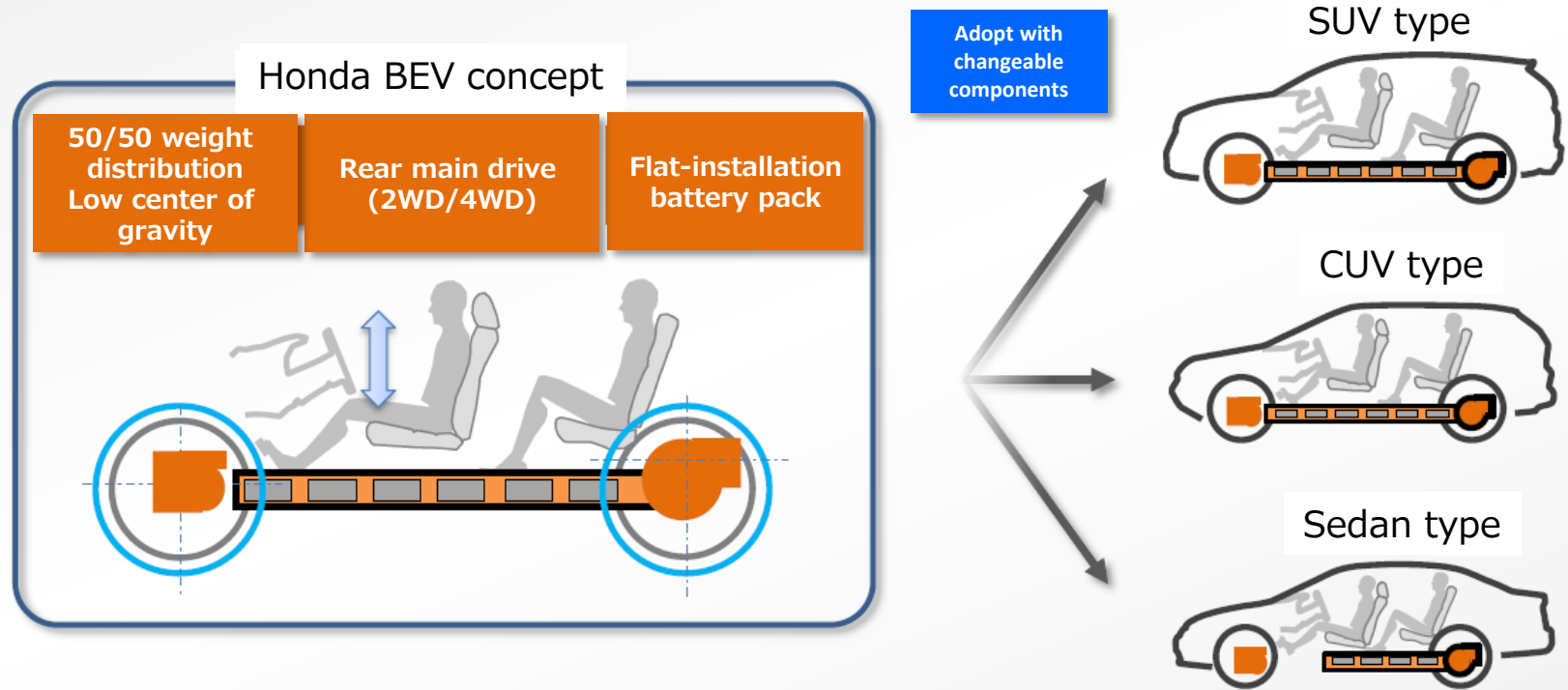
Honda Meeting 2019

As BEV power train is simple , architecture will be important

Honda Battery EV information

<Deployment Image of Honda Architecture (BEV)>

Respond to various customer's needs
based on Honda BEV concept



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BEV architecture can provide many type chassis

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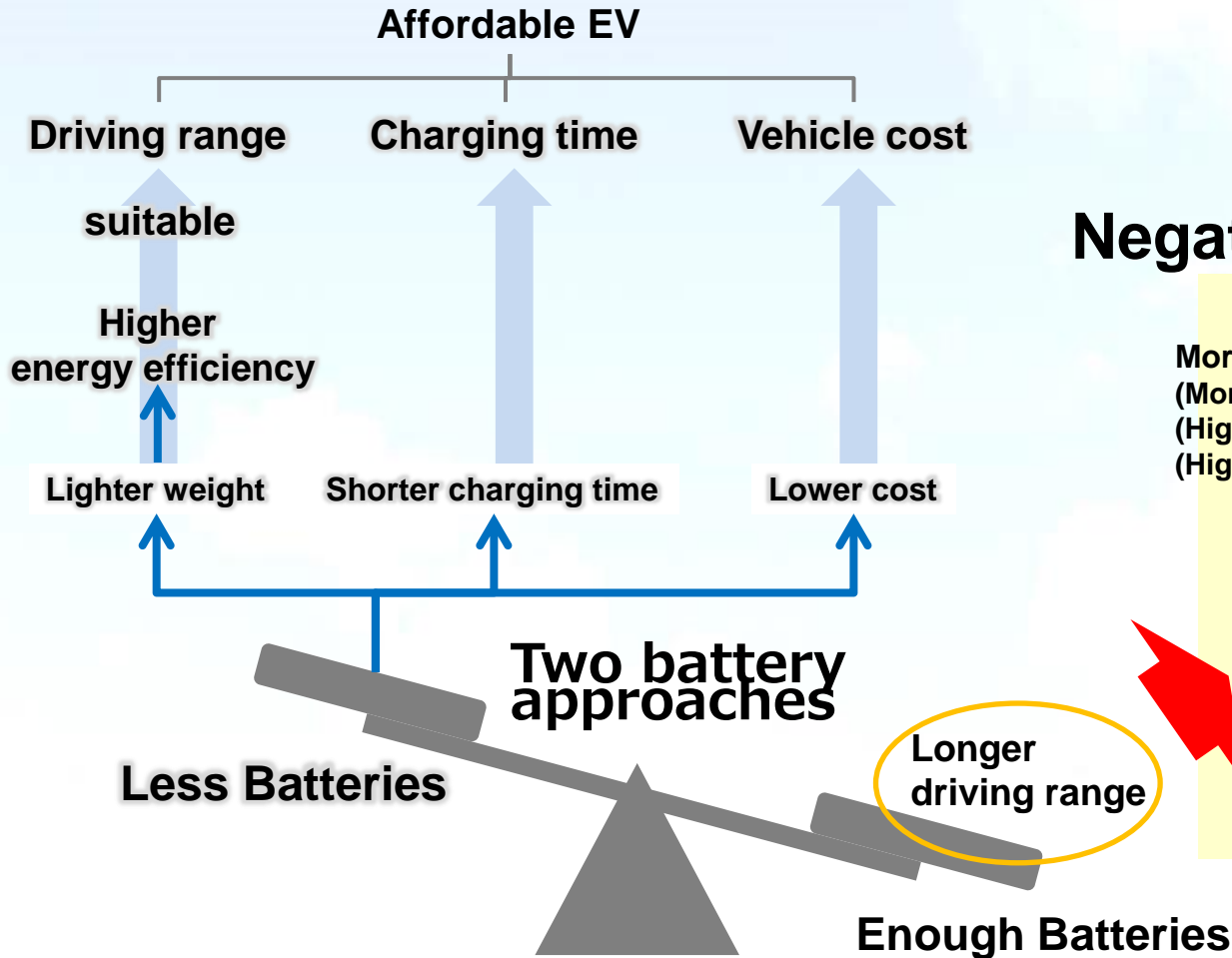
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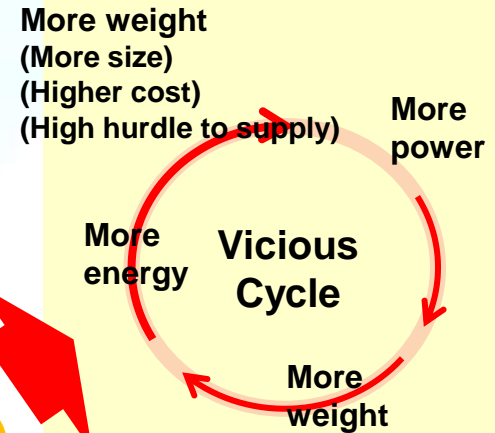
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Honda FCV information

Battery approach on Electric Vehicle



Negative spiral for BEV

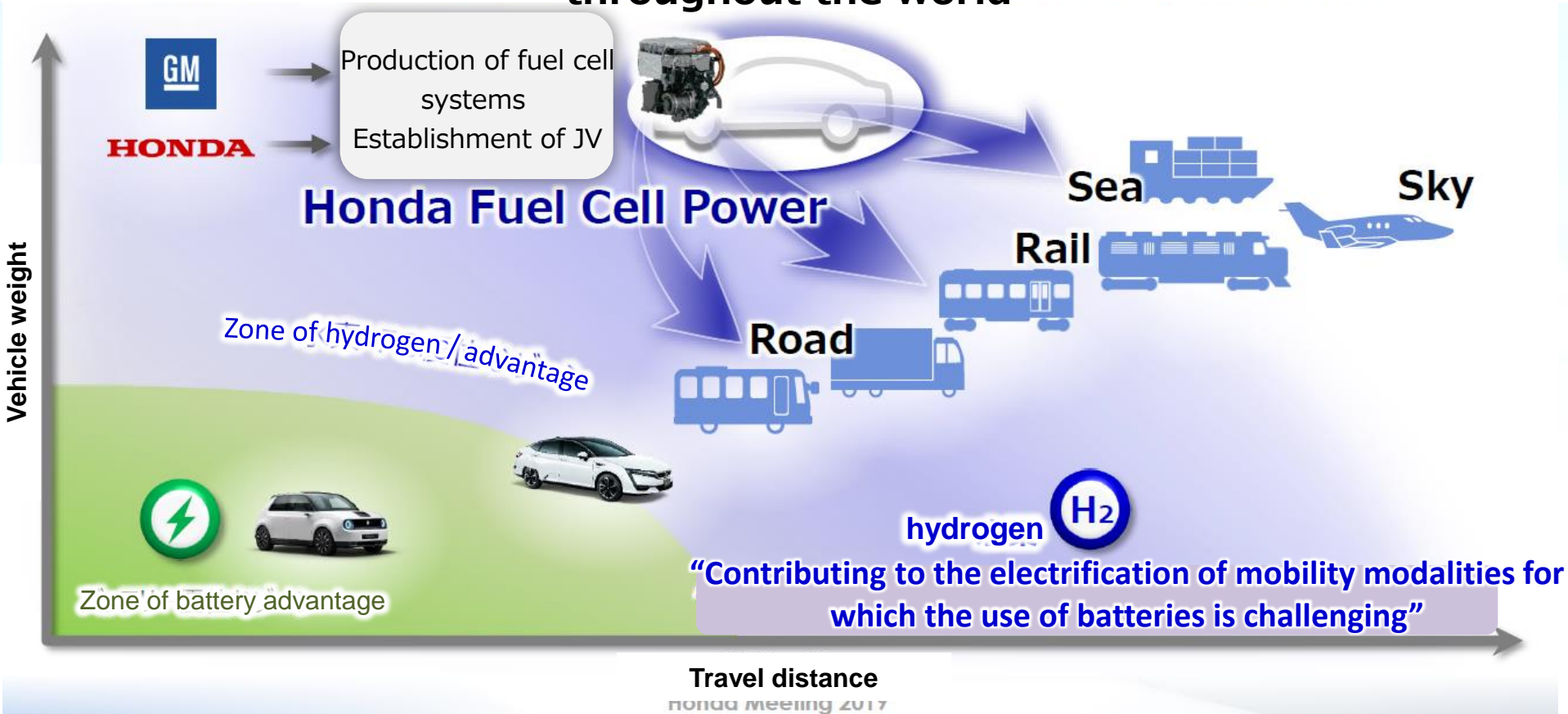


Battery performance is under development , performance is not perfect.
If we need more driving distance , it goes into a negative spiral for BEV.

Honda FCV information

FCV Road map

Building a new ecosystem together and delivering joy to customers throughout the world



Regarding BEV concern for long distance, FCV is one of answer.

Honda FCV information

1980s 1995 2000 2002 2004 2006 2008 2015

Fundamental
research

FCX- V1, V2 V3 V4

FCX

**FCX
CLARITY**

**Next
Gen.**

Hydrogen-powered FCEV
(Hydrogen absorbing alloys)

Hydrogen-powered FCEV (High-pressure
tank of hydrogen)

FCX Clarity

FCX-V0

FCEV

(Fuel Cell Electric Vehicle)

Applied

Technologies

Methanol reforming
FCEV

Public road test

Lease sale

Motor



EV-Plus

Electric vehicle



FIT-EV

High-pressure
tank



Civic GX

CNG vehicle



CIVIC Hybrid



INSIGHT / CR-Z



Accord Hybrid

Energy
management



INSIGHT

Hybrid vehicle

Honda started Fuel Cell fundamental research in 1980's

Honda FCV information

■ Performance

	Clarity	Clarity Fuel Cell
FC Stack Power Density	2 kW/L	3 kW/L
FC Stack Location	Center tunnel	Under Floor
Seating	4	5
Tank Pressure	35MPa	70MPa
Range	240mile	>300mile ※1
Refuel time	3min	3min ※2

※1 Internal test result

※2 Filling time based on condition

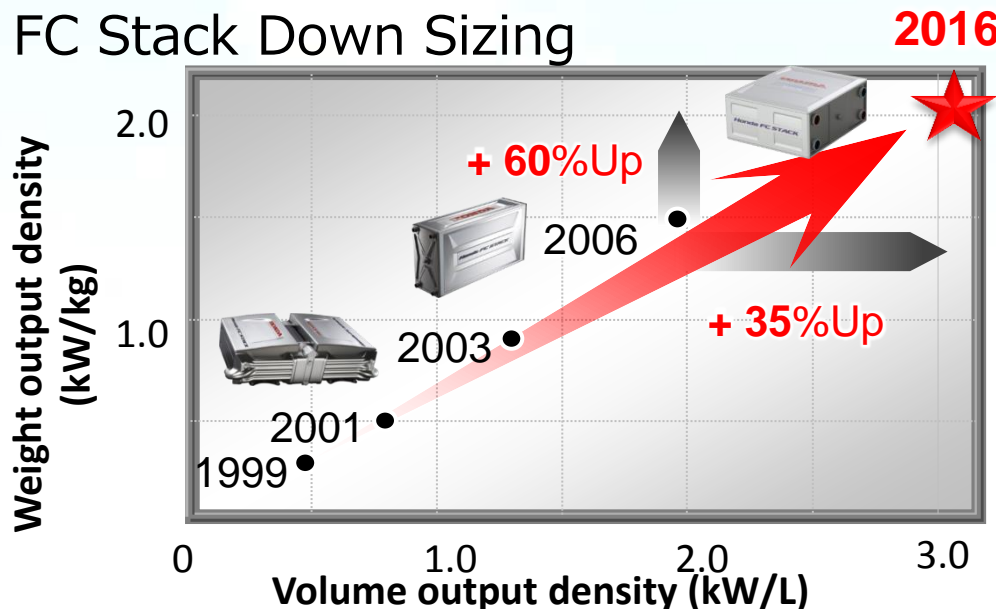
**Non FCEV
dedicated
chassis**

**FCEV
Spreading**

2016

Same usability as ICE vehicle

■ FC Stack Down Sizing



New Fuel Cell Stack

- Output : 130kW
- Power Density : > 3kW/L
- Layout : in the engine room

FCV driving distance achieves 750km(J mode) over with 3min refuel time

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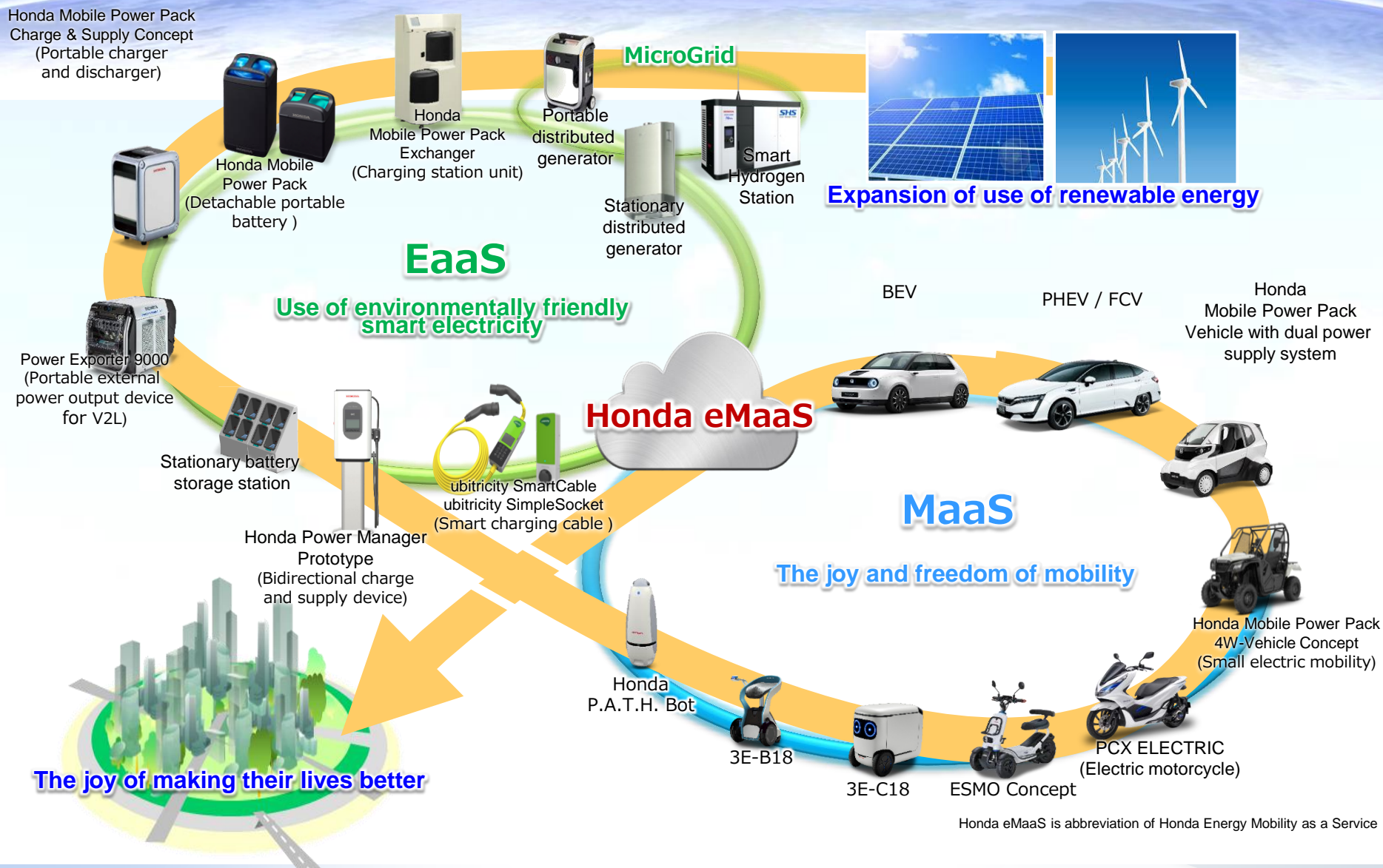
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Honda's ideal future mobility

HONDA
The Power of Dreams

Serve the joy and freedom of mobility via our carbon-free initiatives



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Investigation for the environment

Welcome to the United Nations



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Media registration for IPCC Special Report on Climate Change and Land

2019/17/MA

IPCC MEDIA ADVISORY 20 June 2019

GENEVA, June 20 – The Intergovernmental Panel on Climate Change (IPCC) will consider the Special Report *Climate Change and Land* on 2 – 6 August 2019 during its 50th Session to be held in Geneva, Switzerland.

The full title of the report is *Climate Change and Land, an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems (SRCL)*.

Formally, the draft Summary for Policymakers (SPM) will be considered by the Second Joint Session of IPCC Working Groups I, II and III. The work of the Working Group Session is then submitted to the 50th Session of the IPCC for acceptance.

Press conference

A press conference to present the Summary for Policymakers of *Climate Change and Land* will be held after subject to approval of the Summary for Policymakers.

WHEN: 10:00 a.m. CEST (Geneva) on Thursday, 8 August 2019

(04:00 EDT (New York) , 08:00 GMT, 09:00 BST (London), 11:00 EAT (Nairobi), 15:00 ICT (Bangkok))

113 degrees in France: why Europe is so vulnerable to extreme heat

All-time temperature records have been broken in the heat wave sweeping the continent.

By Umair Irfan | Updated Jun 28, 2019, 11:53am EDT

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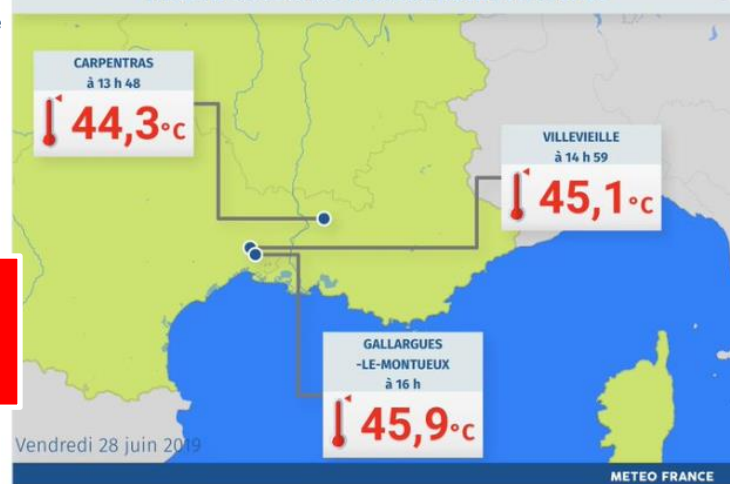


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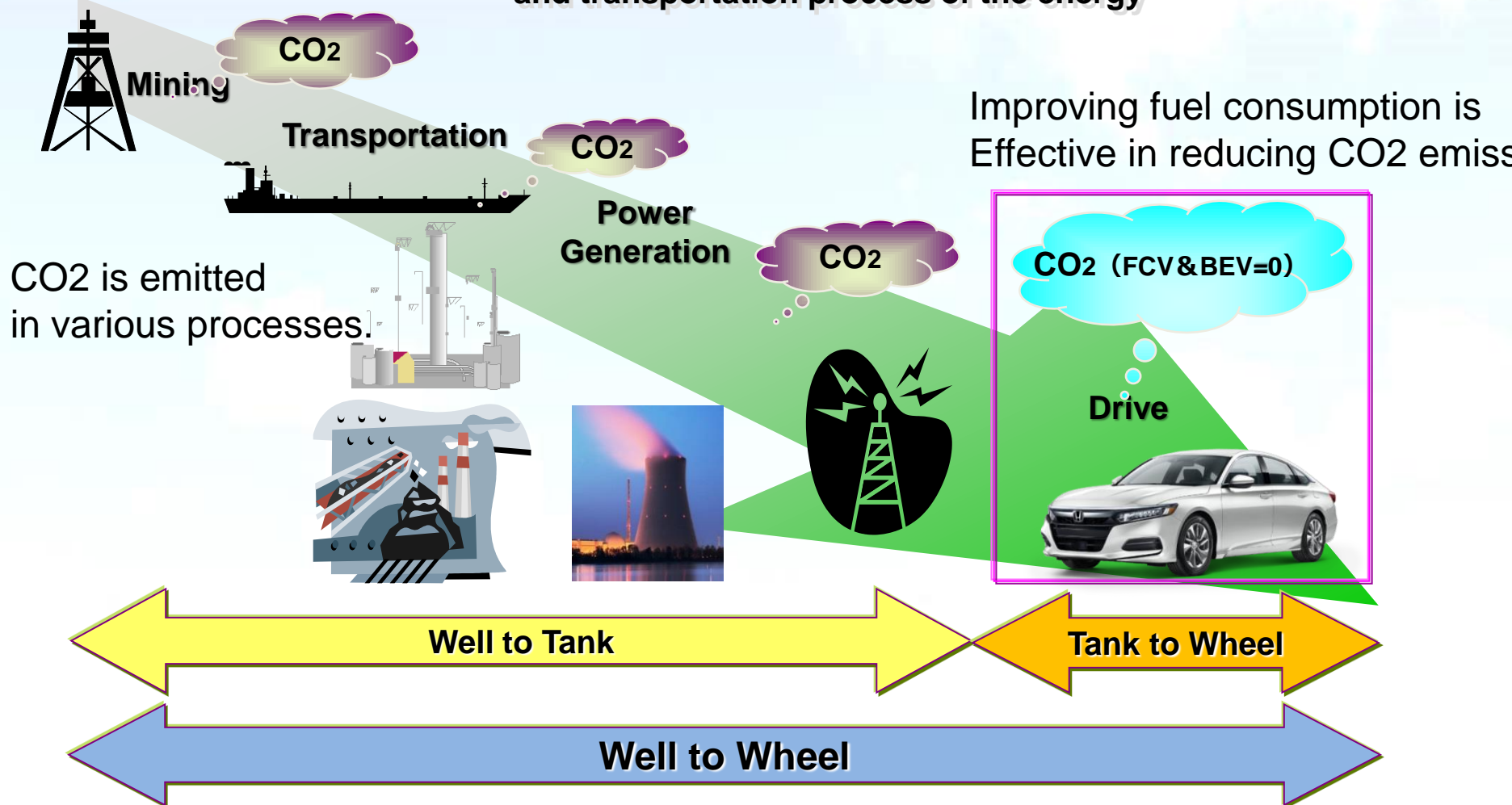


We have to consider CO2 reduction immediately

In 2019 Jun, EU average temp rose up 10 degree C for an average year. IPCC implemented special report. The world weather becomes warmer actually.

Investigation for the environment

Consider influence on environment including production,
and transportation process of the energy



Well to wheel CO₂ emissions depends on the upstream situation
and driving situation

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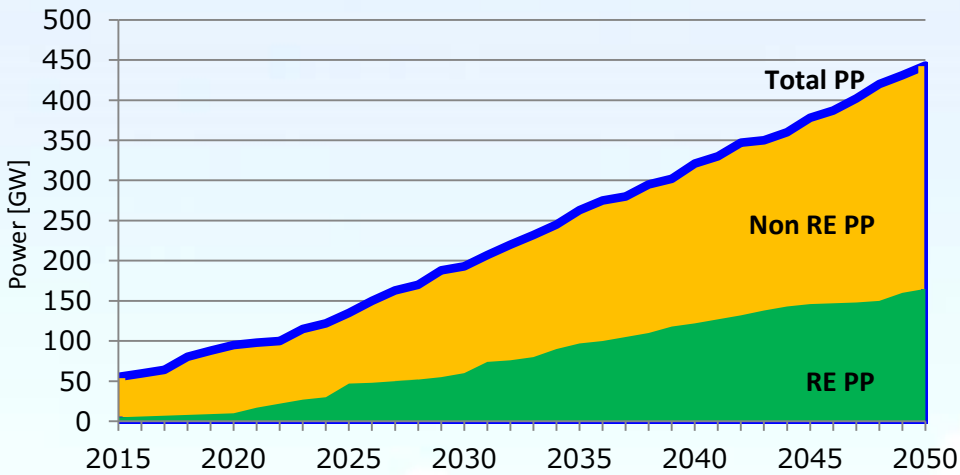
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Battery EV concern in southeast Asian

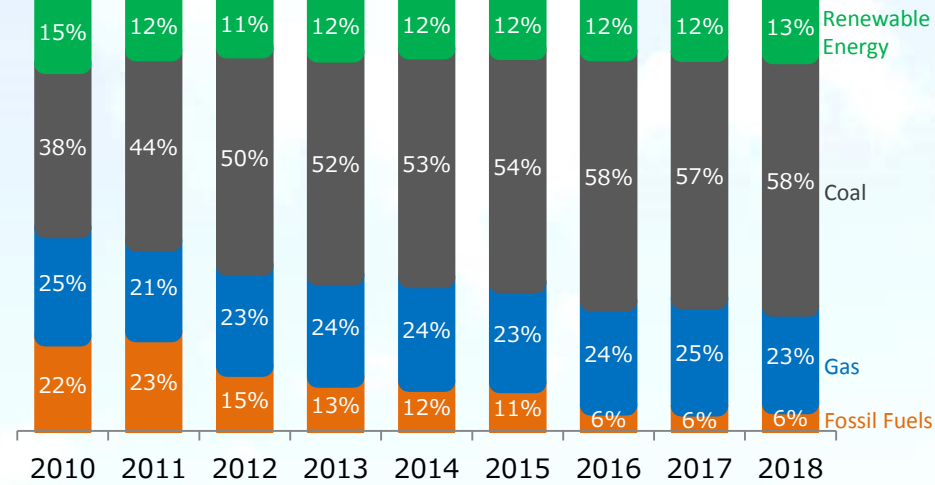
Power Plants Capacity Roadmap



Source: RUEN, 2016

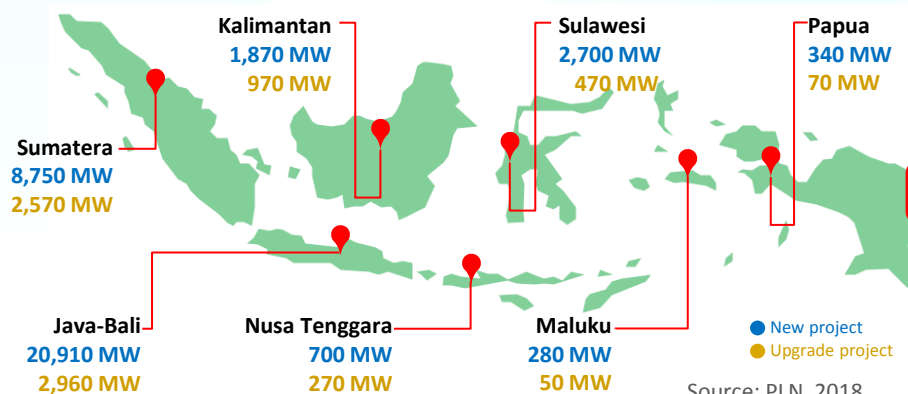
Indonesia

Current Power Plant Composition



Source: MEMR, 2018

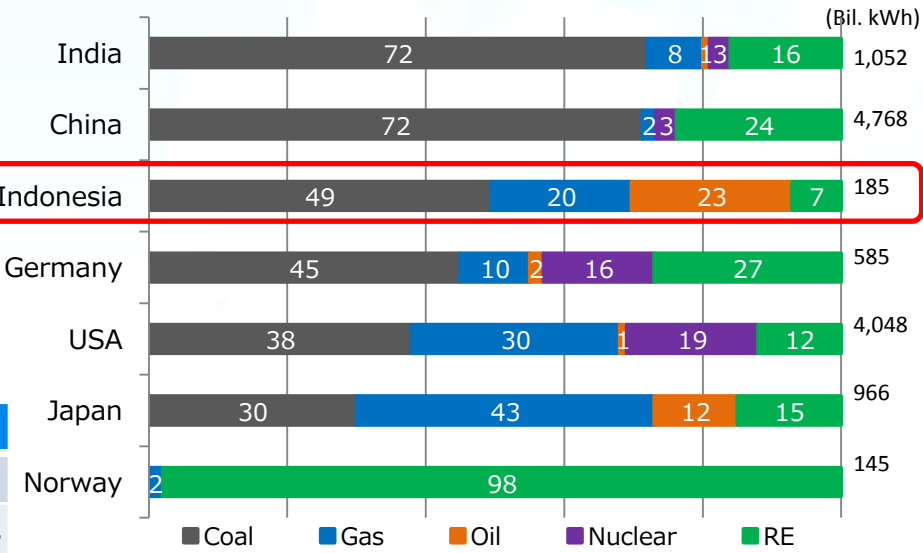
35,000 MW + 7,000 MW Power Plant Project



Source: PLN, 2018

Development Plan	2015	2016	2017	2018	2019
New Development (MW)	3,782	4,212	6,389	9,237	19,319
Installed Capacity (MW)	57,367	61,579	67,968	77,205	96,524

Electricity Generation Mix Comparison in 2014*



*data in %

Source: IEA, 2015, World Bank 2016

The plan to increase power plant capacity is dominated by non-renewable energy (coal). In contrast, the utilization of renewable energy sources is very minimum, far lower than most countries.

Battery EV concern in southeast Asian

Source : CO2EmissionsReduction in Japan's Road Transport Sector 2018

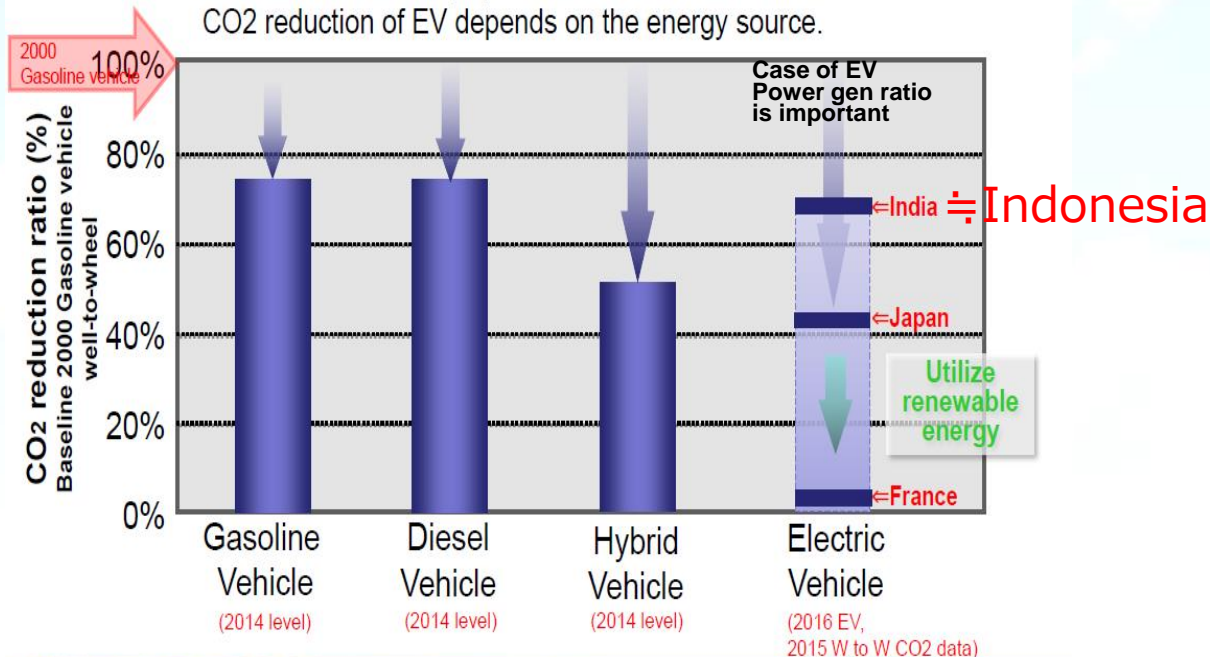


Next-generation vehicles

In 2014 when compared to 2000

Well-to-wheel CO2 emissions by vehicle type

HEV and EV have high potential to reduce CO2 emissions.
CO2 reduction of EV depends on the energy source.



"MoRTH-JAMA meeting for Global warming countermeasures in Transport"

43

5 March 2018

CO2 of ICE & HEV are reduced by improving vehicle efficiency.
CO2 reduction of EV`s depends on the power generation.

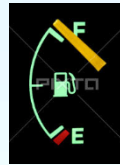
Battery EV concern in southeast Asian



Under Indonesia traffic jam



A/C On



Petrol car
No problem

Petrol car

Petrol car

BEV

Normally, Battery Electric Vehicle(BEV)'s Driving distance is from 200km to 300km * for a full charge.(Automobile)

* Depending on driving mode



Motorcycle EV is no problem due to possible to pass through and without A/C.



While A/C On under traffic jam,
Battery charging level will be down excessively

Traffic Jam affects to Automobile BEV driving distance (unstable)
→ Customer always have to worry about Battery empty

Battery EV concern in Indonesia

If BEV penetrate drastically...

Current Industry



New Industry

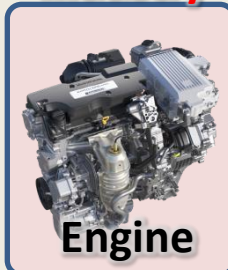


If drastically change ,BEV changes current Industry with big impact
(Almost supplier has impact)

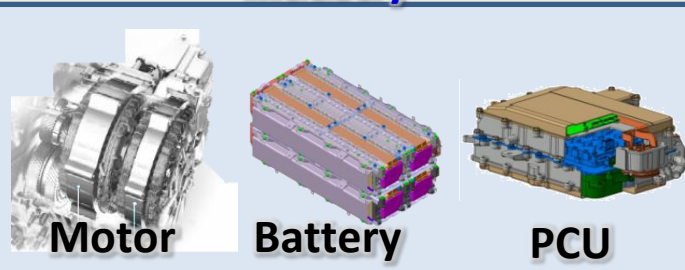
How can we develop Indonesia industry ?
Keeping current industry /Considering long term strategy

Hybrid Technology

Current Industry



New Industry



Hybrid Technology can support and develop Indonesia Industry

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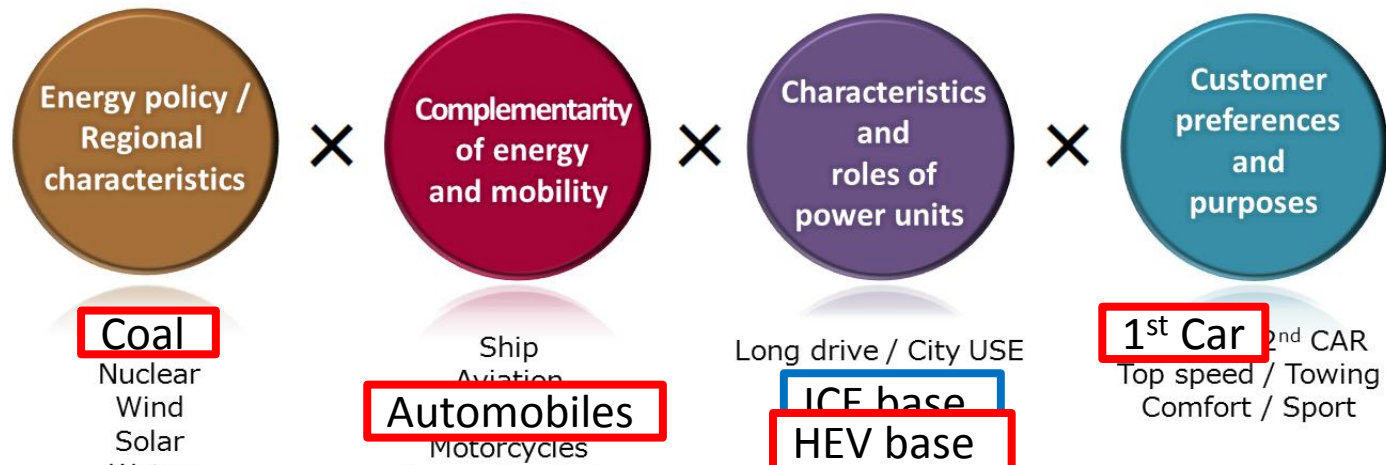
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Alternative Power train technology in the world

Key Points for the Creation of Multi-pathways[※]

It will be essential to organize key points from the perspectives of the different people, societies and energy in each region, and to prepare the right power units for each application



The most suitable power train of Southeast Asian is HEV in the future.

For fun to drive and environment

We need to expand HEV for environment

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Summary

1. Alternative Power train technology in the world.

Honda will expand i-MMD for fun to drive and CO2 reduction.

i-MMD technology can use PHEV , BEV and FCV.

2. Investigation for the environment.

Recently strange weather occur all of the world.

We need to consider CO2 reduction immediately.

3. Development strategy for the southeast Asian Market

**Southeast Asian electric power plants use non-renewable energy,
so BEV can not reduce CO2 now.**

**Until electric power plants use renewable energy mainly,
and dissolve heavy traffic jam,**

HEV expansion is best answer for fun to drive and CO2 reduction.