

EV Development status of HMG

Powertrain Performance Development Center, R&D Division
Hyundai Motor Group

- I. Global Green car(EV) Market Trend**
- II. HMG's Green car(EV) Status and Strategy**
- III. Concluding Remarks**

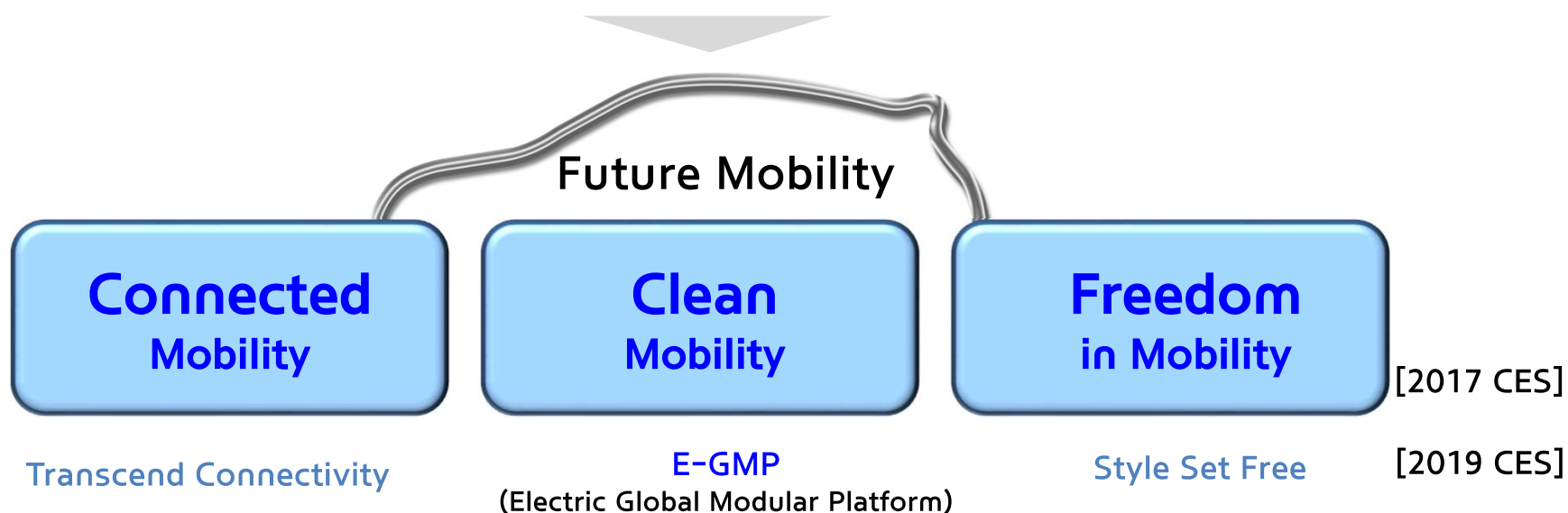
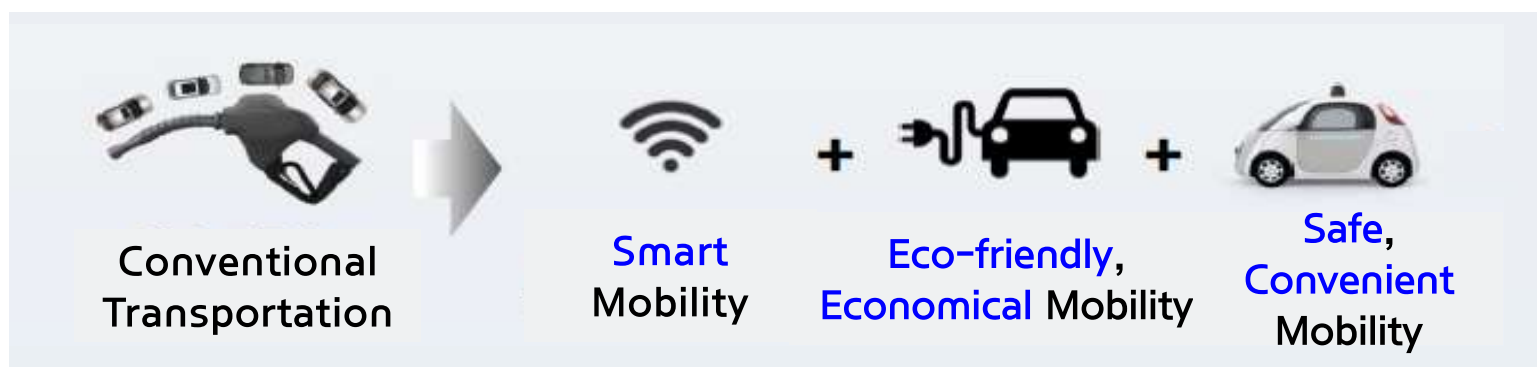
I . Global Green car(EV) Market Trend

HMG's way to future mobility

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Paradigm Shift in automotive industry has brought a “New Concept of Mobility”



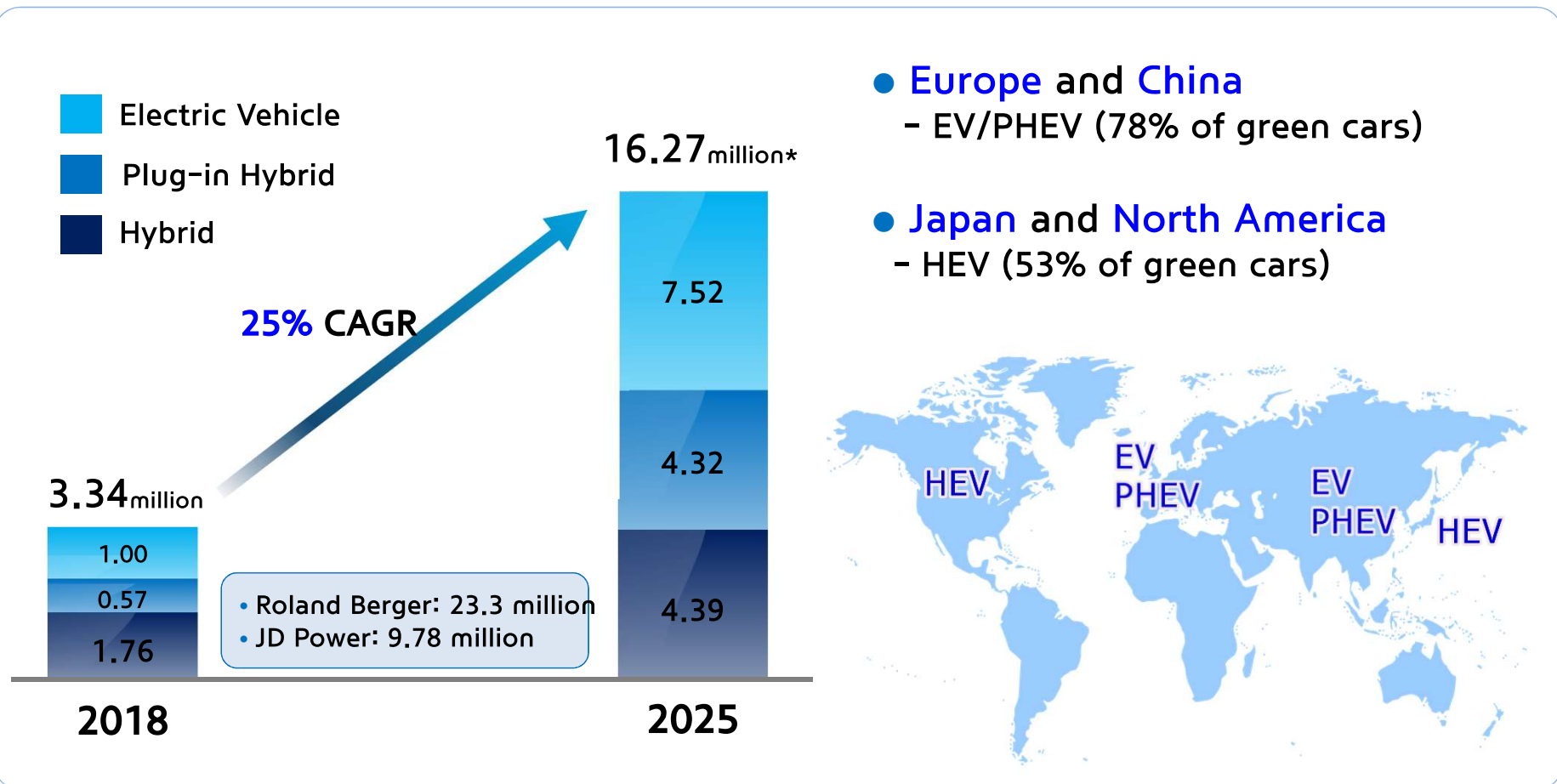
Green Car Market Forecast

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By **2025**, global green car market will expand to **16M. Units**

* about 15% of global vehicle market (110M.)



* Estimation based on external research institutes and HMC internal data

- CAGR : Compound Annual Growth Rate

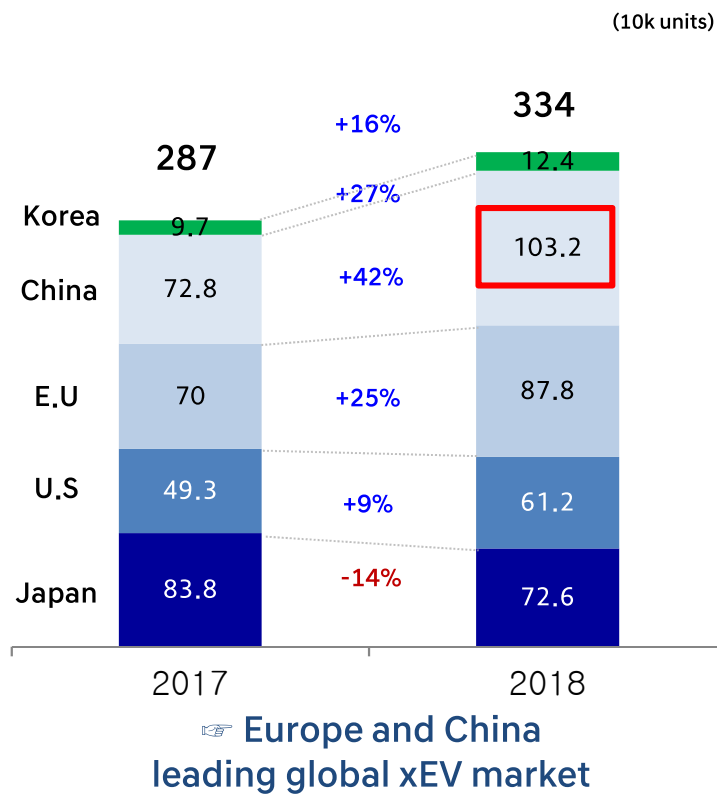
Green Car Market Forecast

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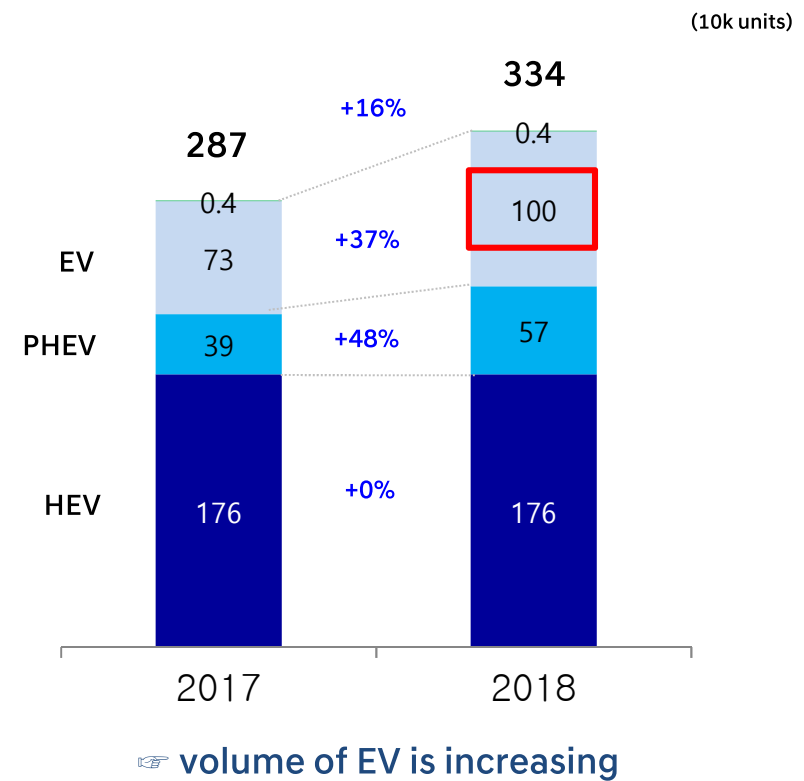


Global sales of 2018 have reached **3.34 Million** units

Global



Vehicle types



II . HMG's Green car(EV) Status and Strategy

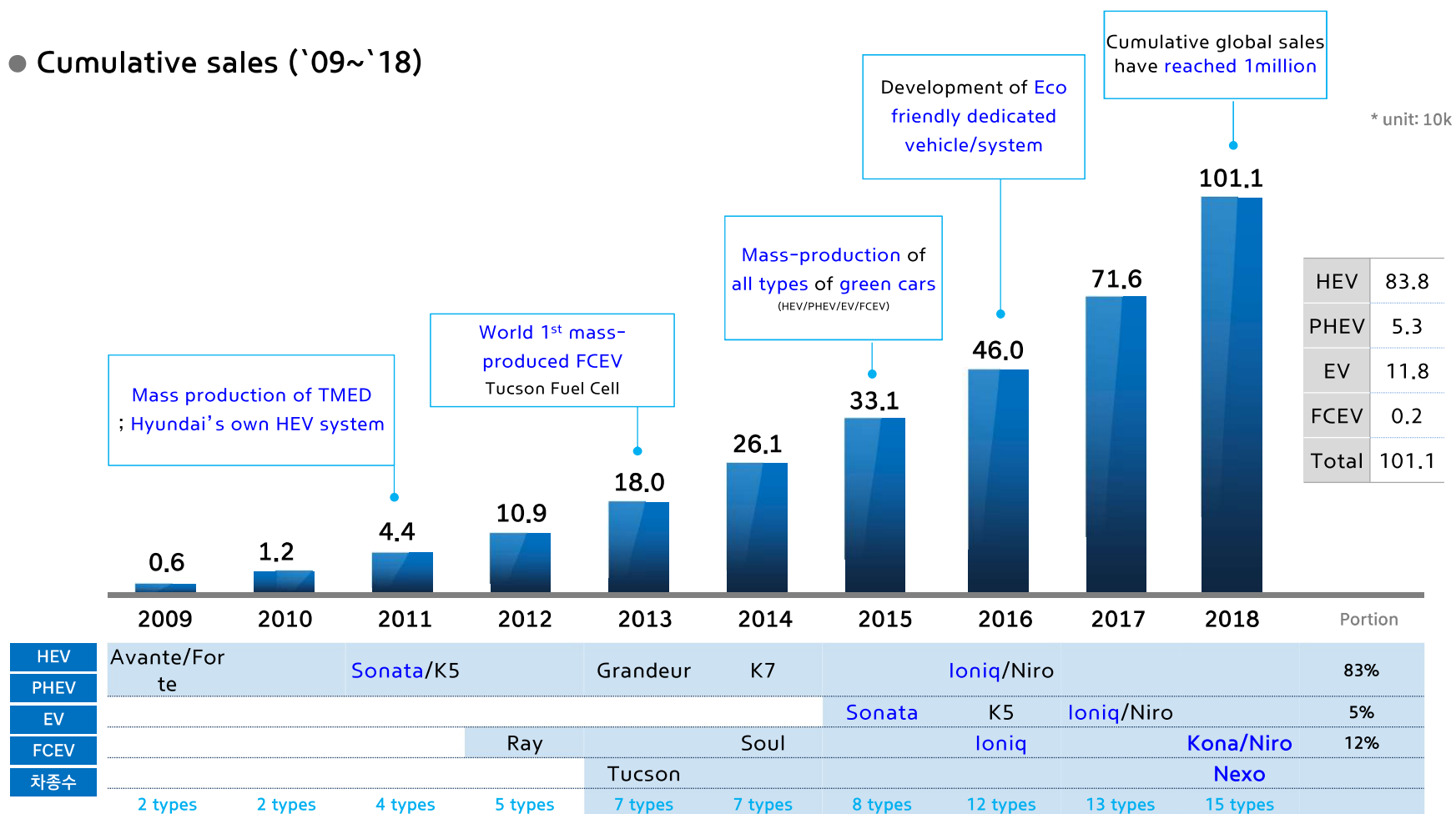
HMG's Green Cars sales

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Cumulative HMG Global Sales Hit 1 Million (July '09 ~ Dec '18)

● Cumulative sales ('09~'18)



HMG EV global sales jump to **rank 7 in 2018**(4 folds increase since 2016)

■ HMG Green Car Sales continuously growing

Source: IHS Markit

2016		
Rank	Brand	Sales
1	Renault-Nissan_MITSUBISHI	77,316
2	Tesla Motors	56,913
3	Zotye	52,410
4	BAIC	43,762
5	BYD	35,212
6	Geely	23,608
7	Changan	21,142
8	Jianghuai	18,188
9	Chery	16,806
10	Volkswagen	13,023
11	Hyundai	12,992

(2 types)
- IONIQ EV 5k
- Soul EV 8k

2017		
Rank	Brand	Sales
1	BAIC	102,567
2	Renault-Nissan_MITSUBISHI	85,996
3	Zotye	72,276
4	Tesla Motors	70,992
5	Changan	63,581
6	BYD	37,729
7	Chery	29,024
8	Jianghuai	27,995
9	Hyundai	26,684
10	GM	24,777

(4 types)
- IONIQ EV 16k
- SOUL EV 11k
- [CHINA] Cerato EV /Elantra EV 0.3k

2018			
Rank	Brand	Sales	Growth rate
1	Renault-Nissan_MITSUBISHI	138,590	+61%
2	Tesla Motors	137,348	+93%
3	BYD	90,669	+140%
4	BAIC	86,502	-16%
5	Chery	51,208	+76%
6	SAIC	50,928	+132%
7	Hyundai	49,389	+85%
8	Changan	46,287	-27%
9	Jianghuai	44,893	+60%
10	Geely	43,724	+106%

(7 types)
- IONIQ EV 18k
- SOUL EV 10k
- KONA EV 15k
- NIRO EV 4k
- [CHINA] Cerato EV /Elantra EV /KX3 EV 2k

HMG's Green Cars : Past, Present, and Future

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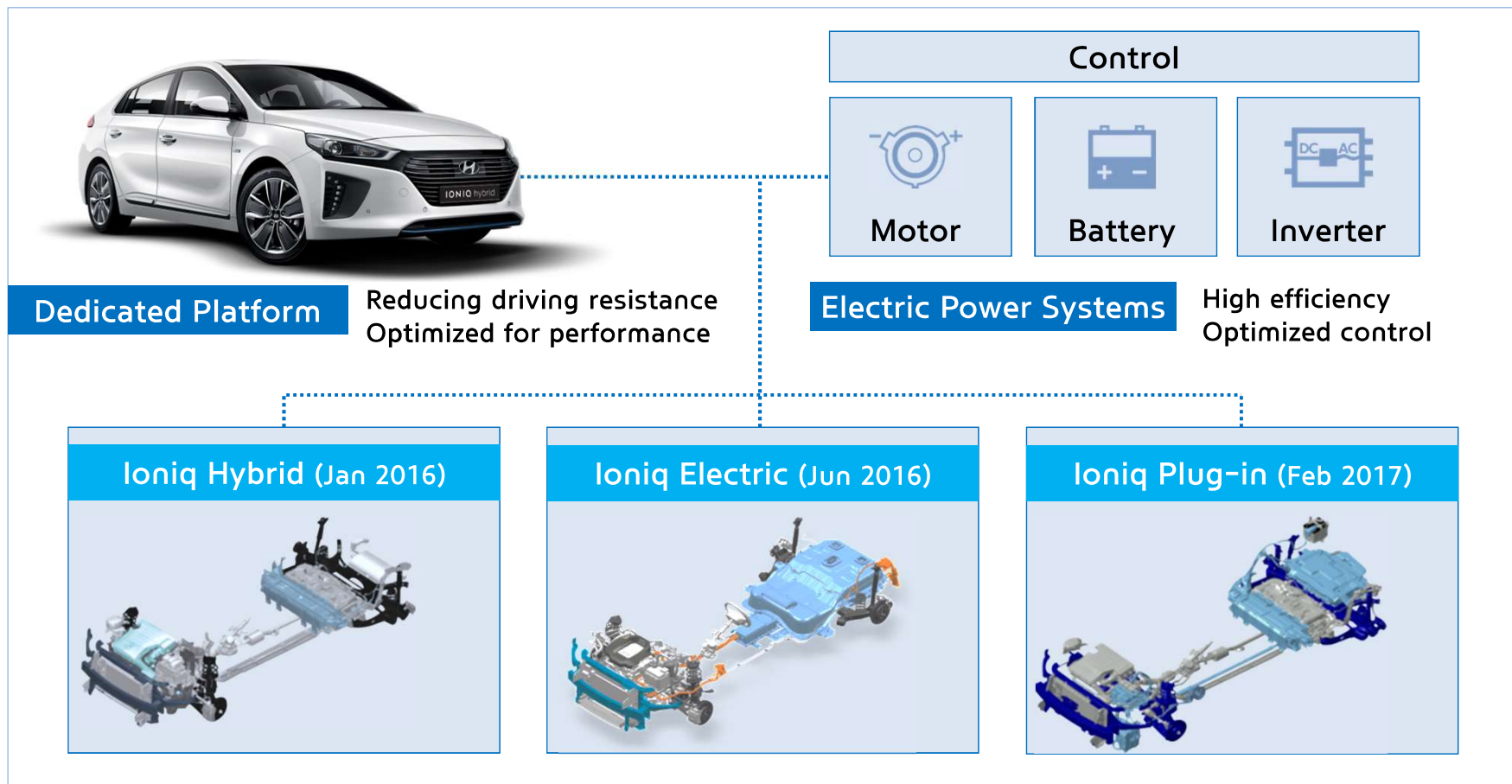


Expanding to **44 models by 2025** (15 models in 2018)



World's the first vehicle to offer 3 electrified powertrains in a single platform

- Based on a **dedicated platform**, **highly efficient** electric power system provides **the best performance**.

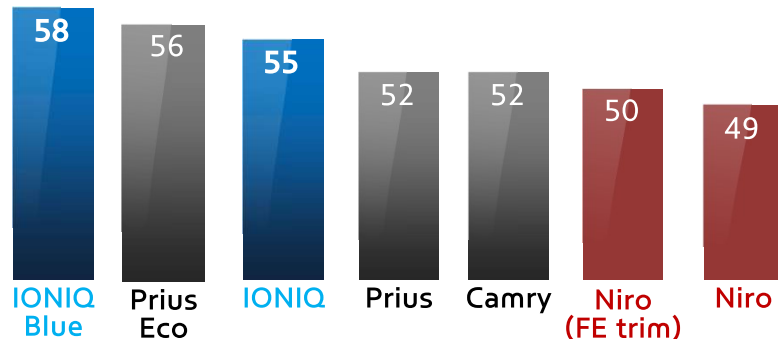


The Most Fuel-Efficient Car (among IC engine and HEV) by EPA

* EPA : Environmental Protection Agency in USA

IONIQ hybrid

2016, released in global market



DCT - TMED

(TMED: Transmission Mounted Electric Device)



© Hyundai's TMED system + DCT for HEV

→ World's best fuel efficiency and powerful performance

© Dedicated high efficient P/T system

→ Dedicated hybrid engine (40% efficiency)

→ Highly efficient motor drive system

→ Dedicated hybrid DCT 1

The most energy-efficient vehicle in the world

IONIQ electric



136
IONIQ
Electric

130
Tesla
Model 3
Long range

123
Tesla
Model 3
Mid Range

120
KONA
Electric

119
GM
Bolt/
VW e-Golf

116
Tesla
Model 3
AWD

114
Honda
Clarity EV



Energy Efficiency &
Renewable Energy

└ DOE : Department of Energy

(EPA Ratings, 2018 MY)

Unit : MPGe

Miles Per Gallon gasoline equivalent ┘



Selected as “the Greenest Vehicle” by ACEEE*

* ACEEE : the American Council for an Energy-Efficient Economy

SUV_{type} Long-Range EV : KONA Electric ('18.4), NIRO EV ('18.7), Soul Booster EV ('19.2)



KONAElectric



NIROEV



- ★ the Next Green Car Awards in U.K.
- ★ Car of the Year 2019 in North America

● Electric driving range (Korea)

Type (Range)	KONA Electric	NIRO EV	Soul Booster EV
Long	406 km	385 km	386 km
Standard	254 km	246 km	250 km

* NIRO: Cd better, ETW worse

● Specifications

Type (Range)	Motor	Battery
Long	150 kW	64 kWh
Standard	100 kW	39.2 kWh

● Advanced Power Electric devices

- Liquid-cooled 64kWh Li-ion Battery
- Integrated type motor and inverter
- PE components : 160,000km or 10 years warranty

● Segment-leading Driving Range

● Cutting-edge ADAS Systems



Forward Collision-Avoidance Assist



Lane keeping assist

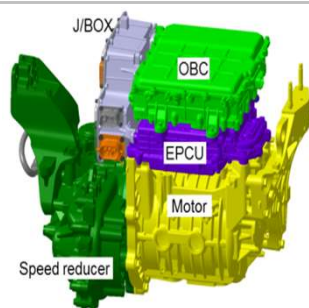


Highway driving assist

Integrated Motor Systems with High efficient EPCU High energy density battery system

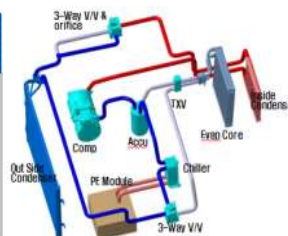
Integrated Motor with Electric Power Control Unit

- EPCU (Inverter+LDC+VCU) Integrated & high power density
- On Board Charger with higher power output
- High powered Motor & dynamic performance



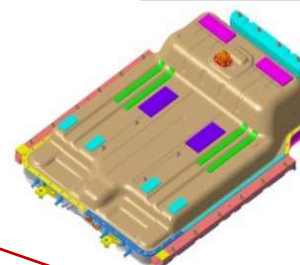
Heat Pump (optional)

- High efficient heating
- Utilizing waste heat from drivetrain



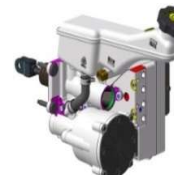
High-Volt. Battery Pack

- High energy density Lithium-Ion Polymer Battery (LiPB)
- HV shut off device under the hood in addition to a safety plug
- Liquid Cooled System/ Battery Heater



Integrated Electric Booster

- Integrated motor-driven Booster Pressure build-up (motor) + Controller (ECU/Valve)
- Decrease of the operating noise/ cost and weight
- Maximizing Regen Braking



KONA Electric, Winner in EV Real Range Test by 『WHATCAR?』 ('18.10)
NIRO EV, 『Car of the Year 2019 : Overall Winner』 by 『WHATCAR?』 ('19.1)

*WHATCAR? : authoritative automobile magazine of UK.

『True MPG Test』 by WHATCAR!



Winner in Range

417
(6.5)

407
(6.4)

407
(4.5)

328
(4.4)

254
(6.5)

235
(5.7)

206
(5.2)

188
(6.7)

KONA
Electric
(64kWh)

NIRO
EV
(64kWh)

Jaguar
I-PACE
(90kWh)

Tesla
S 75D
(75kWh)

KONA
Electric
(39kWh)

Renault
Zoe
(41kWh)

Nissan
Leaf
(40kWh)

IONIQ
Electric
(28kWh)

449
(WLTP)

470
(WLTP)

Winner in Efficiency



Range, km
(Efficiency, km/kWh)

HMG's EV- Development strategy

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Goal : Economic + Long Range + High Performance EV
(Fun-to-Drive)

'14 ~

Standard Range EV (~300 km)

2016
IONIQ Electric



'18 ~

Long Range EV (500 km~)

2018
KONA Electric



'20 ~

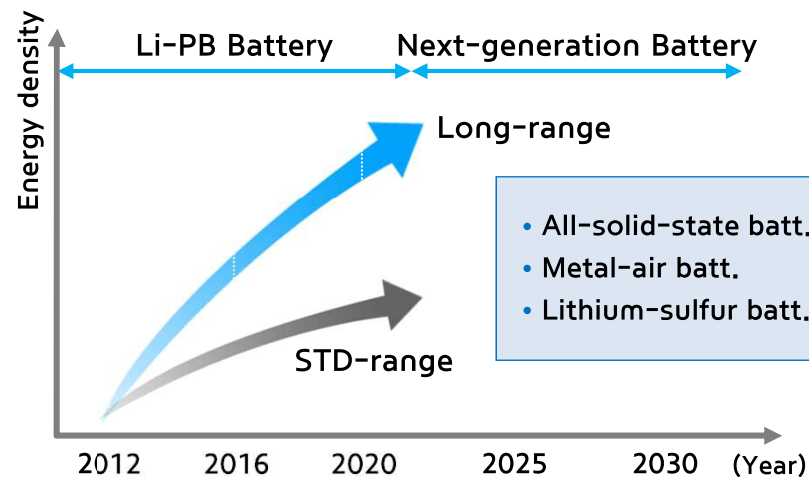
High-performance Long Range (500 km~)

2021
GENESIS Electric
(EV dedicated Platform)



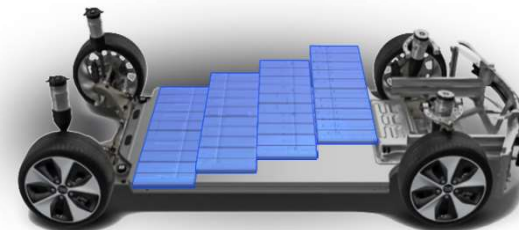
※ range : EU,
NEDC

< Next-Gen. Battery for Long Range EVs >



< Dedicated EV Platform ; E-GMP** >

- Flexible battery capacity for all segments
- High voltage system to reduce charging time
- High power charger : 400kW global standard



* concept image

**Electric-Global Modular Platform (released in CES 2019)

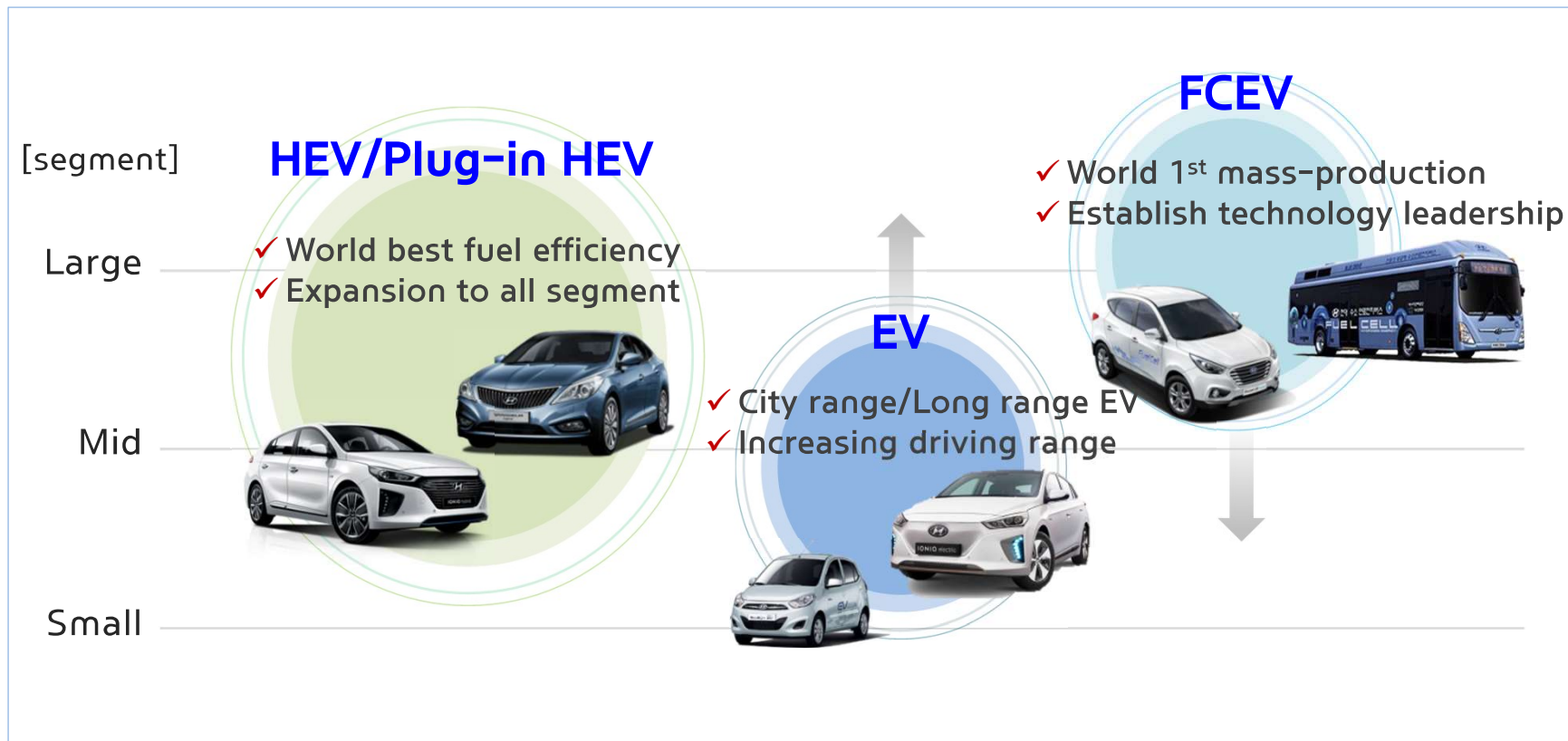
III. Concluding Remarks

HMG's Green Car – R&D Direction

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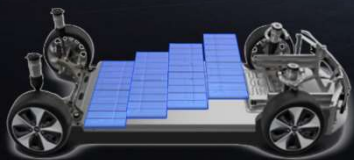
Development of **all three types of xEVs** to respond **global market needs** and to lead **future mobility market**



*“Lifetime partner in
automobiles and beyond”*



Thank You



HYUNDAI
MOTOR GROUP

NEW THINKING.
NEW POSSIBILITIES.