
# Proposal for an eco-friendly electric vehicles conversion

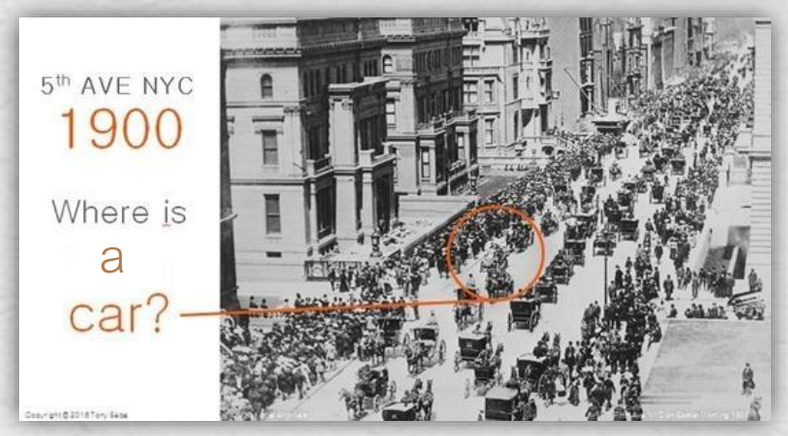
2019. 05. 07.

eFIBIRD

# 1. 2030 Clean Disruption of Energy and Transportation by Tony Seba

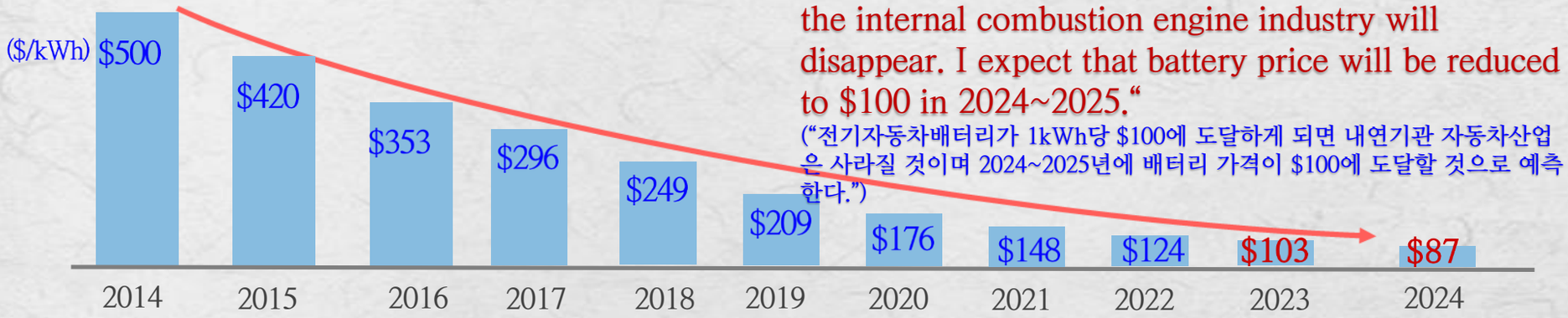
## Paradigm Shift to EV

"In 1900, someone took a picture of New York's Fifth Avenue, there were full of carriages on the street. There was only one car. In 1913, the same street was covered with cars."("2030년이 되면 새로 출시되는 자동차는 모두 전기 자동차가 될 것입니다…1900년에 찍은 뉴욕 5번가 사진을 보면 거리에 마차가 가득 차 있습니다. 자동차는 딱 한 대 뿐이죠. 1913년 사진엔 자동차로 뒤덮였습니다.")





## Price Trend of Lithium Ion Battery for EV




"If battery cost of electric car reaches to $100/kWh, the internal combustion engine industry will disappear. I expect that battery price will be reduced to $100 in 2024~2025."
("전기자동차배터리가 1kWh당 $100에 도달하게 되면 내연기관 자동차산업은 사라질 것이며 2024~2025년에 배터리 가격이 $100에 도달할 것으로 예측한다.")

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# 2. EV Buses reduce co2 Emissions

1,000 buses emit 13.797 million tons of carbon dioxide each year. Therefore, the supply of 1,000 electric buses would reduce carbon emissions by 13.797 million tons. This is equal to the effect of planting 3.78 million trees. It can also have the effect of creating a forest park of 6,667,000㎡ in the city.

1,000대의 버스가 매년 배출하는 이산화탄소는 13.797백만 톤에 달함, 그러므로 전기버스 1,000대를 보급하면 탄소배출량 13.797백만 톤을 감축하게 되며, 378만 그루의 나무를 심은 효과에 해당하므로 도시에 6,667,000㎡의 삼림공원을 조성하는 효과를 얻을 수 있음


The annual carbon emissions of 7,482 buses in the seoul city are 103,229 tons.

Change to EV Bus

The Effect of Planting 28,281,960 trees

The Effect of Forest Park on 49,882,494㎡

The Effect of 103.229 tons CO2 Reduction

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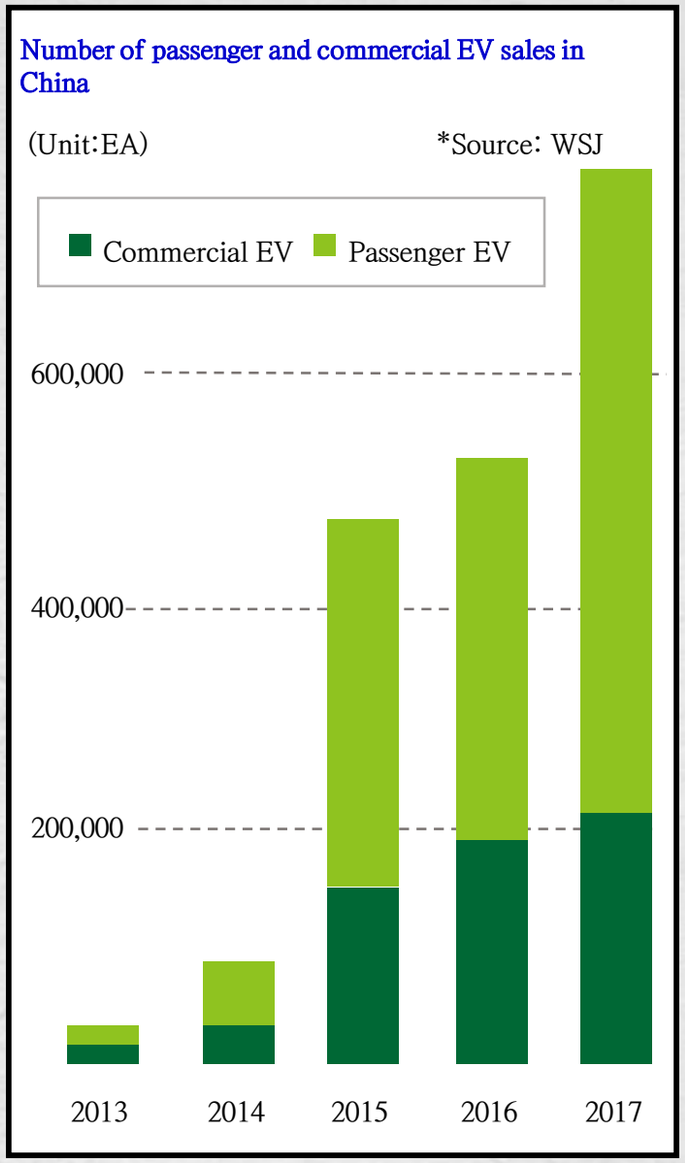
# 3. NEV are the core of China's 'Manufacturing 2025' project




"EV are the core of China's 'Manufacturing 2025' project. The Chinese government is encouraging electric car manufacturers to gain an upper hand in domestic demand and succeed overseas, especially on commercial electric vehicles such as buses."

"전기차는 중국의 '제조 2025' 프로젝트의 핵심이다. 중국 정부는 전기차 제조업체들이 국내에서 우위를 확보한 뒤 해외에서도 성공할 수 있도록 독려하고 있으며 특히 버스 등 상업용 전기차에 초점을 맞추고 있다" (2018. 12. 2. WSJ)

As of 2016, 115,000 EV buses were sold in China, while only 100 were sold in South Korea. Unlike the Chinese government, which subsidizes 45 percent of the sales price, the Korean government only subsidized 100 buses. Even if the government reduces the amount of subsidies per unit, it will have to subsidize 3,000 to 5,000 EV buses every year.

2016년 전기버스 판매가격의 45%를 보조금을 지급한 중국에서 전기버스만 11.5만대가 판매되었으며, 반면에 2016년 한국은 100대에 한해 보조금이 지급되었으며 판매 대수는 100대 이하임. 우리 정부는 대당 지원액을 줄이더라도 매년 3,000~5,000대 정도 보조금을 지원해야 전기버스산업이 활성화될 것임

❖ China provided about 23 trillion won in subsidies for eco-friendly vehicles between 2015~2018(중국은 2015~2018년 친환경차 보조금 약 23조 원 지원)

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# 4. China's eco-friendly vehicles obligatory sale Start-up

Starting this year, carmakers selling vehicles in China will be required to fill 10 percent of their each vehicle type sales with eco-friendly vehicles(electric vehicles, hybrids and hydrogen cars). Otherwise, you must purchase credit from another company. In fact, they are fined.
올해부터 중국에서 자동차를 파는 완성차 업체는 차종별 판매량의 약 10%(크레디트)를 친환경차(전기차, 하이브리드, 수소차 등)로 채우지 못하면 다른 회사로부터 크레디트를 사야 한다. 사실상 벌금을 무는 셈이다.

Considering the EU's strong carbon dioxide emission regulations in 2021, following China, the fines Hyundai and Kia have to pay are estimated to reach 1 trillion won in 2022, Lee Hang-gu Industrial Research Institute claimed.
이항구 산업연구원 선임연구위원 "중국에 이어 2021년 유럽연합(EU)의 강력한 이산화탄소 배출 규제까지 감안하면 2022년 현대·기아차가 물어야 할 벌금은 1조 원에 이를 것으로 추산된다"고 주장

# 5. China is leading advanced technologies

According to the MIT Technology Review (January-February issue, China Rules), China is leading advanced technologies in genes, semiconductors, rockets and automobiles. China is the world's largest automobile consumer market and is leading the expansion of the electric vehicle market under the leadership of the government. As a result, there are concerns that only Chinese companies can benefit from it.

"중국이 지배한다(China Rules)." 미국 매사추세츠공대(MIT)가 펴내는 'MIT 테크놀로지 리뷰'의 2019년 1·2월호 커버스토리 제목이다. '유전자, 반도체, 로켓, 자동차까지 새해 중국이 첨단 기술을 이끈다'는 내용이다... '세계 자동차 소비 1위 시장인 중국이 정부 주도로 급격한 전기차 확대를 이끌며 중국 업체들만 수혜를 볼 수 있다'는 우려다.


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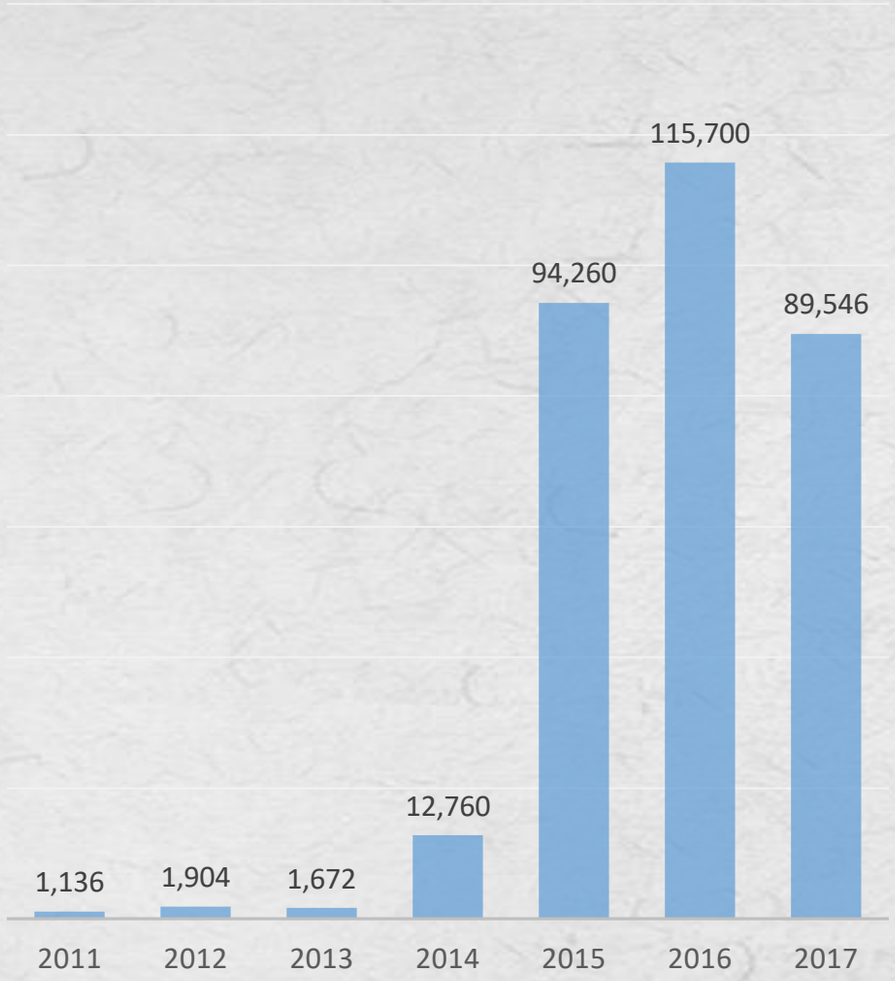
# 6. NEVs increasing 101 times in China 5 years

❖ The 2018 Annual Report of China's Motor Vehicle Environmental Management, published by the Ministry of Ecology and Environment, shows China as the world's largest motor vehicle market, … Companies are offering different types of electric buses to meet market demand, and the industry has developed rapidly, with the production and sales volume of new energy vehicles increasing 101 times increase in the last five years.

Ministry of Ecology and Environment가 출간한 2018 중국의 자동차 환경 관리 연례 보고서에 따르면 중국이 세계 최대 자동차 시장임을 나타내고 있다… 회사들은 시장의 수요를 충족 하기 위해 다양한 타입의 전기버스들을 제공하고 있다. 그리고 신에너지

차량의 생산 및 판매량이 지난 5년 동안에 101배나 증가했다.

(Source: https://cleantechnica.com/2018/02/04/china-100-electric-bus-sales-just-89546-2017/)

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# 7. China's Motor Vehicle & Subsidy

National and local governments have introduced a series of subsidy incentives and tax reductions to encourage and promote the development of new energy vehicles.
국가 및 지방정부는 신에너지 차량의 개발을 촉진하고 격려하기 위하여 보조금 인센티브 제도와 세금을 줄여주는 등 여러 인센티브를 시리즈로 내놓고 있다.

Notes: 1. The subsidy for large- and medium-sized fuel cell bus is 500,000 yuan. 2. The subsidy standards are jointly formulated by the Ministry of industry, the National Development and Reform Commission, the Ministry of finance, the Ministry of science and technology and the Energy Bureau.
참고 사항: 1. 중대형 연료 전지 버스에 대한 보조금은 500,000위안. 2. 보조금 기준은 공동으로 산업의 내각, 국가 발전 및 개혁 위원회, 재무 장관, 정부 과학 및 기술 및 에너지국에 의해 공동으로 제공된다.

Source:https://www.itdp.org/2018/09/11/electric-buses-china/

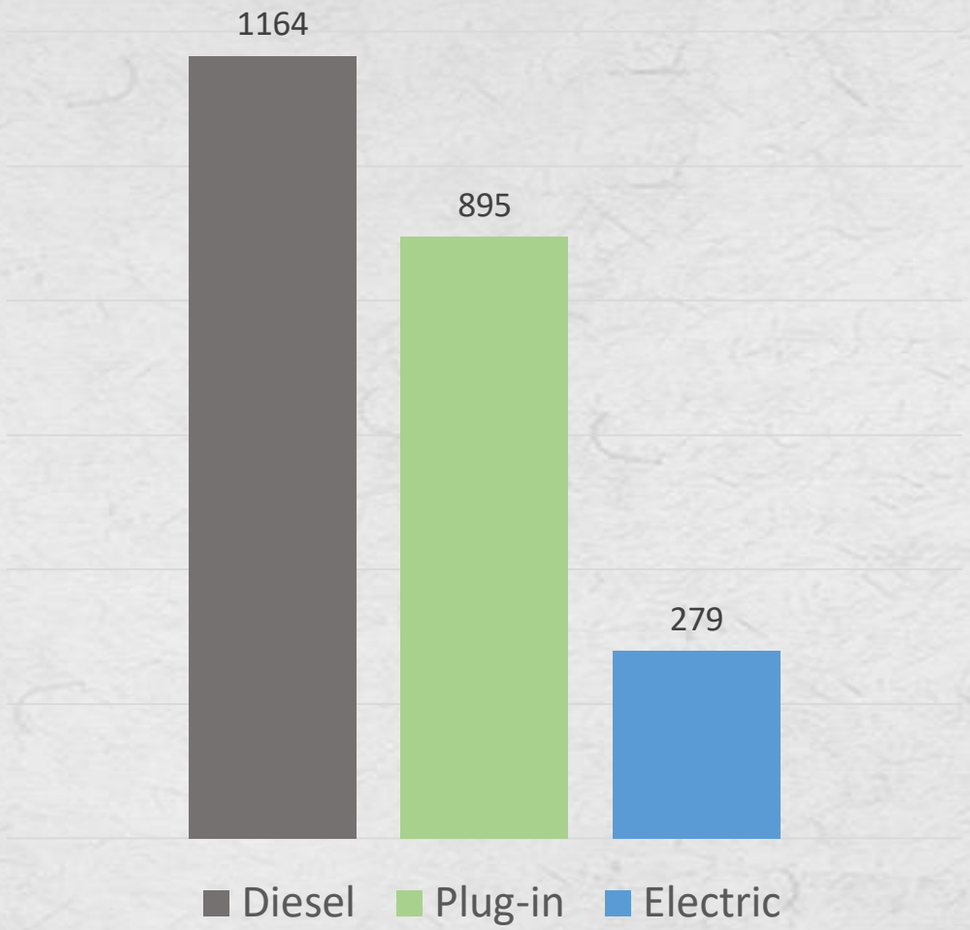
| Vehicle Type | Subsidy Standard (RMB/kWh) | Finanacial subsidy Adjustment Factor | | | Bicycle Subsidy Ceiling (10,000 RMB) | | |
|---|---|---|---|---|---|---|---|
| | | | | | 6<L≤8 m | 8<L≤10m | L>10m |
| Non-fast charging pure Electric Bus | 1800 | System Energy Density (Wh/kg) | | | 9 | 20 | 30 |
| | | 85-95 | 96-115 | ≥116 | | | |
| | | 0.8 | 1 | 1.2 | | | |
| Fast-charging Pure Electric Bus | 3000 | Fast Charging Ratio | | | 6 | 12 | 20 |
| | | 3C-5C | 6C-15C | ≥16C | | | |
| | | 0.8 | 1 | 1.4 | | | |
| Plug in Hybrid Electric Vehicle | 3000 | Fuel Saving Rate | | | 4.5 | 9 | 15 |
| | | 40%-45% | 46%-60% | ≥61% | | | |
| | | 0.8 | 1 | 1.2 | | | |

# 8. Electric vehicles make 75% reduction in emissions

The annual emissions of diesel vehicles average 1146 kg. In comparison, electric vehicles emit only 279 kg annually, amounting to a 75% reduction in emissions, while plug-in hybrid vehicles emit 895 kg annually, amounting to a 22% reduction.(디젤 자동차의 연간 배출량이 평균 1146kg인데 비해서, 전기 자동차는 연간 279kg만을 배출하여 75%를 감소시키는 반면에, 플러그인 하이브리드 차량은 895kg을 배출하여 연간22%를 감소시킨다.)

The proportion of new energy buses was extremely low in 2013, which provides a good opportunity to compare the impact of growth of China's new energy bus fleet in the following years on the environment. Using CO2 vehicle emissions in 2013 as a baseline, by 2017, about 8.56 million tons of CO2 were reduced due to the increase in new energy buses.(2013년 중국의 신에너지 버스 비율은 매우 낮았는데, 이것은 그 이후 중국의 신에너지 버스의 증가가 미치는 영향을 비교 하는 좋은 기회를 제공한다. 2013년 차량의 CO2 배출량을 기준으로 계산해 보면, 2017년까지 약 8.56백만 톤의 CO2가 신에너지 버스의 증가로 인해 감소되었다.)

Source: Study on Demonstration Promotion and Business Model of New Energy Buses

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# 9. CO2 emissions reduced by 33million tons in China

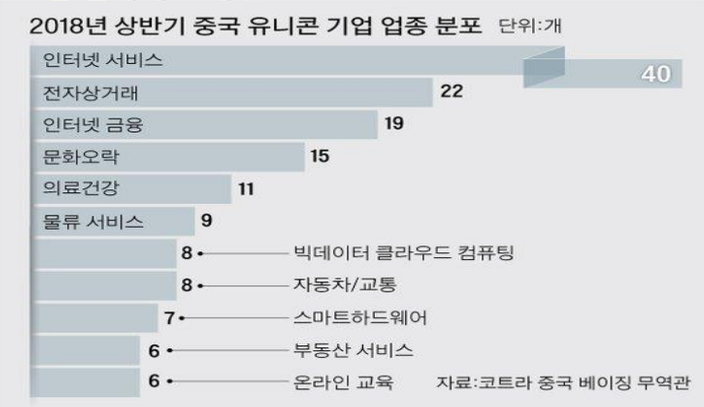
| Year | No. of Vehicles (10,000) | Vehicle Composition | | | | | Total Operating Mileage (100 million km) | CO2 Emissions Per 10,000 cars (10,000 tons) | CO2 Emission Reduction (10,000 tons) |
|---|---|---|---|---|---|---|---|---|---|
| | | Diesel | Natural Gas | Petrol | Hybrid | Electric | | | |
| 2013 | 50.96 | 59.30% | 24.30% | 3.40% | 0.50% | | 348.96 | 63.28 | 0.00 |
| 2014 | 52.88 | 52.90% | 30.20% | 2.50% | 6.73% | | 346.69 | 62.68 | 31.81 |
| 2015 | 56.18 | 45.10% | 32.50% | 1.70% | 15.50% | | 352.33 | 60.38 | 163.33 |
| 2016 | 60.86 | 37.20% | 30.50% | 1.40% | 11.50% | 15.60% | 358.32 | 55.67 | 463.57 |
| 2017 | 65.12 | 28.70% | 27.90% | 1.00% | 13.20% | 26.30% | 361.32 | 50.14 | 855.59 |
| 2018E | 69.25 | 21.05% | 25.60% | 0.65% | 13.20% | 37.00% | 364.32 | 44.02 | 1333.61 |
| 2019E | 73.63 | 13.40% | 23.30% | 0.30% | 13.20% | 47.70% | 367.32 | 37.08 | 1929.50 |
| 2020E | 78.30 | 5.75% | 21.00% | 0.00% | 13.20% | 58.40% | 370.32 | 30.08 | 2599.75 |
| 2021E | 83.26 | 0.00% | 17.70% | 0.00% | 13.20% | 69.10% | 373.32 | 23.55 | 3308.37 |

❖ Given the current trend of decreasing numbers of diesel and gasoline vehicles, if supposed that by 2021, all diesel and gasoline vehicles are replaced by new energy vehicles, CO2 emissions will be reduced by 33.08 million tons.(지금까지의 디젤과 가솔린 차량의 감소 추세를 감안할 때, 모든 디젤 및 가솔린 차량이 신에너지 차량으로 대체될 경우, 2021년까지 중국에서 CO2 배출량이 33.08 백만 톤이나 감소될 것이다.)

# 10. China Unregulated for Five Years in New Business. What about Korea?

- In China, the cradle of Unicorn companies, Unicorn companies are born every 3.5 days. There are a total of 162 places.
  유니콘의 요람인 중국에서는 3.5일에 한 개 꼴로 유니콘 기업이 탄생, 중국 내 유니콘 기업은 총 162곳 (As of June 2018, KOTRA)

- The principle of 'permitting and supplementing' is applied. When problems arise, the law is supplemented to make the industry as industry-oriented, and the problem is solved according to the problem.
  '선 허용, 후 보완' 원칙이 적용, 문제가 생기면 이를 보완하는 법을 만들어 산업은 산업 대로 키우고 문제는 문제대로 해결




- The international certification criteria for electric vehicle battery pack drop test is 1.2 ~ 2m, whereas Korea is 4.9m. The certification standard is too high: it causes 'cost increase and weaken international competitiveness'(Mass production of 'quicksand' of sand hell, not 'sandbox' to cultivate new business by breaking regulation)
  전기자동차 배터리팩 낙하시험 인증 세계 기준은 1.2~2m인데, 한국은 4.9m로 인증 기준이 지나치게 높음 : '비용 상승과 국제경쟁력을 약화시키는 결과'를 초래

- The "self-certification system" is a system that allows manufacturers to autonomously manufacture and sell their products through their own certification process in accordance with standards set by the government. However, there is a regulation called 'those who manufacture or assemble more than 2,500 cars or more than 500 vehicles of the same type per year'. Therefore, the addition of one additional battery pack confronts the challenge of having to go through the authentication process.
  '자가인증제도'는 "정부가 정한 기준에 따라 제작업체가 자율적으로 제작, 자체적인 인증과정을 거쳐 판매하도록 하는 제도"라고 하면서도 '2,500대 이상이거나 동일한 형식의 자동차를 연간 500대 이상 제작·조립하는 자'라는 규제 조항 때문에 '배터리팩 하나만 더 추가해도 인증절차를 거쳐야 하는 어려움에 직면'

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# 11. The new world in which fast fish eats slow fish

- "Connection, Big Data, Speed, and Talented person are the key elements," said Professor Kim Chang-kyung of Hanyang University in a lecture titled "How to Live in the Fourth Industrial Revolution."('4차 산업혁명 시대 어떻게 살 것인가?'라는 강연에서 "연결 · 빅 데이터 · 속도 · 인재 등이 중요한 핵심"이라고 진단 : by 김창경 한양대 교수)

- "In the new world, it is not the big fish which eats the small fish, it's the fast fish which eats the slow fish."(큰 물고기가 작은 물고기를 잡아먹던 시대에서, 이제는 빠른 물고기가 느린 물고기를 잡아먹는 시대가 도래 : **by Klaus Schwab**)


# 12. Creators Make Great Products-Google

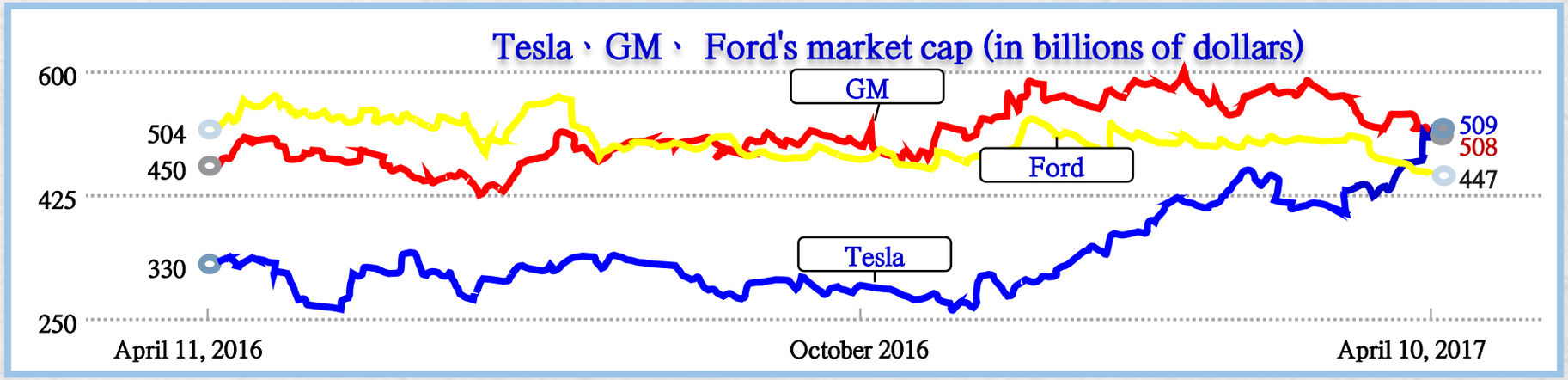
◆ "Creators Make Great Products" ⇨ Do not go looking for the labyrinth, but they leap at it.

("창조자들이 위대한 제품을 만든다" ⇨ 미로를 찾아 헤매지 않고 단숨에 뛰어 넘기 때문) : The vision of EDISON MOTORS




◆ Tesla, which has only 72,000 vehicles sold in 2017, has surpassed GM's $ 50.8 billion market, which sold 10 million vehicles, with a market capitalization of $ 50.9 billion.

(2017년 차량 판매량 7만 6천대에 불과한 테슬라가 시총 509억 달러로, 1천만대를 판매한 GM의 시총 508억 달러를 추월)

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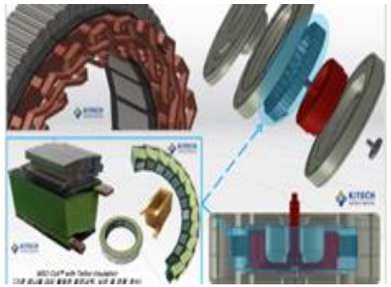
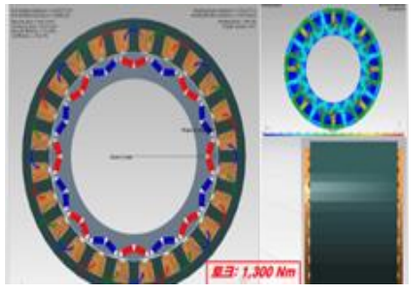
# 13. EDISON MOTORS' Competitiveness

Securing Reliability of Electric Bus : Development of 3 Major Technologies (Motor+Electronic Control+Battery)

## 1. Drive Motor Solution (with KITECH)

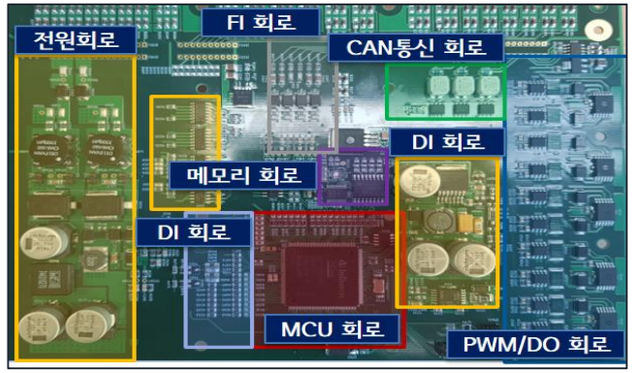


MSO Coil Motor

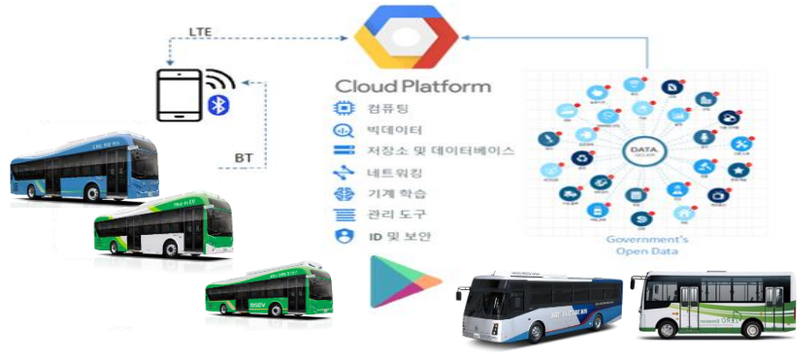



160kW Torque 1,300Nm

## 2. Electronic control technology
(next-generation integrated vehicle controller)




## 3. Battery pack based on Smart BMS




- MSO Coil Motor, which is developed with KITECH, can produce twice as much torque as its equivalent, and will be exported to the world. (생산기술연구원과 함께 개발하는 MSO Coil 모터는 동급 대비 2배의 토크를 낼 수 있으며, 세계에 수출이 가능할 것임)
- Third-generation BMS maintains Smart Balancing through active battery monitoring, health assessment and smart management to dramatically improve battery performance and battery life.(3세대 BMS는 능동적인 배터리 모니터링 · 상태 평가 · 스마트 관리 등을 통해 균형 상태를 유지시켜서 Battery 성능과 수명을 획기적으로 향상시키는 Smart BMS 관리 시스템)

# 13-1. Core Technologies : MSO Coil Motor

## MSO Coil Motor Development

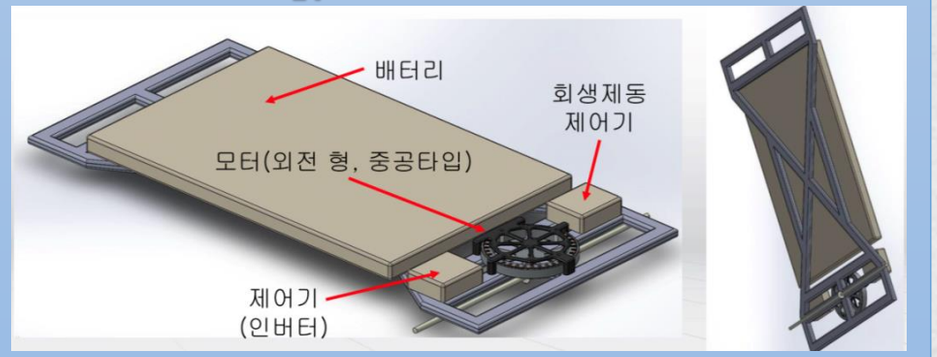
### R&D Capability

- Leveraging KITECH's researchers and high-tech equipment
- Excellent technical development engineers (hardware, software)
- Edison Motors' advanced technical equipment and facilities

### Develop a next generation MSO Coil Motor

- Developed models of 130kW motor and 160kW motor (cylindrical, disk type)

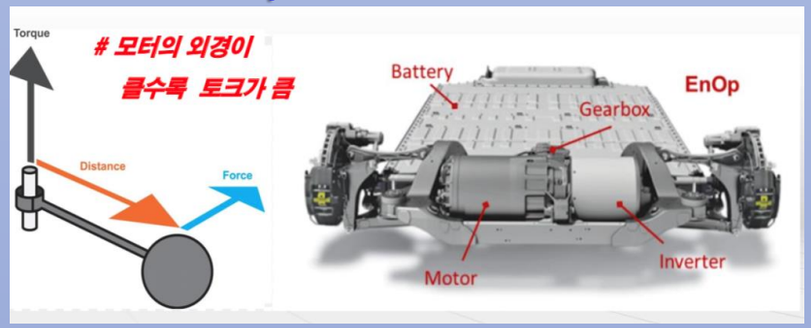
### Advantages of Disk Type Motors for EV




- With its good space utilization, the disk drive system is easy to apply a motor with a large outer diameter, and is also suitable for low speed and high load vehicles
- Because the motor is an external type with an empty interior, it is easy to reduce both motor material cost(motor material) and powertrain weight.

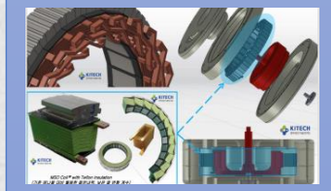
## Efficiency of MSO Coil Motor

### Problems with existing electric vehicle platforms

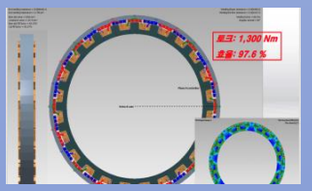



- It is difficult to enlarge the outer diameter of the existing electric vehicle motor due to insufficient mounting space, and thus the motor is designed by increasing the axial length of the motor or increasing the number of motor rotations.
- Accelerating electric motor speed results in cost increase of the drive system such as bearings and decelerators + Durability is drastically reduced due to intensive mechanical friction 〉 Noise increases

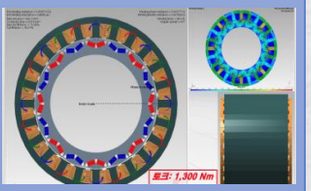
### Efficiency of MSO Coil Motor (Disk Type : 97.6% Cylindrical Type : 95.4%)



MSO Coil Motor




160kW Torque 1,300Nm



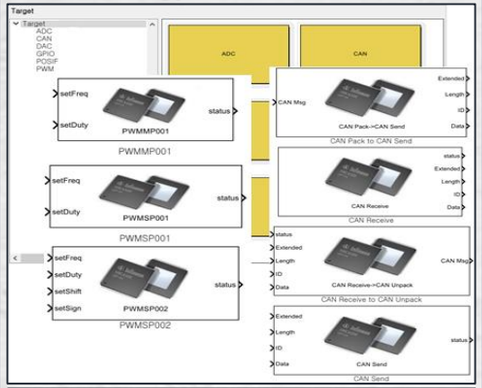
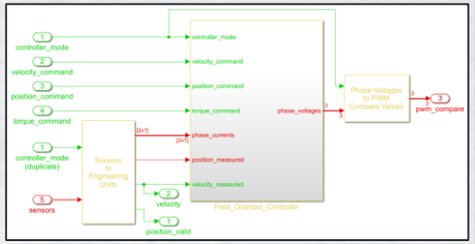
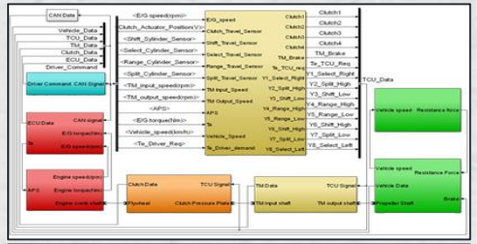
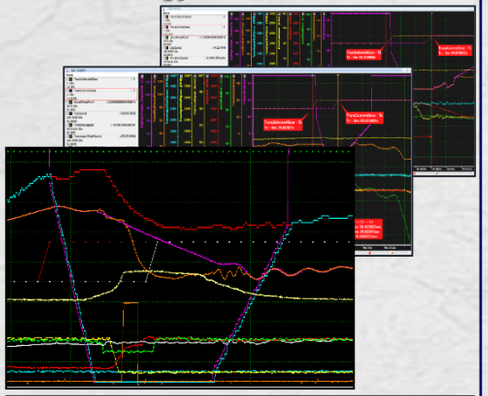
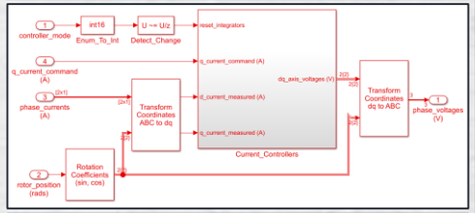
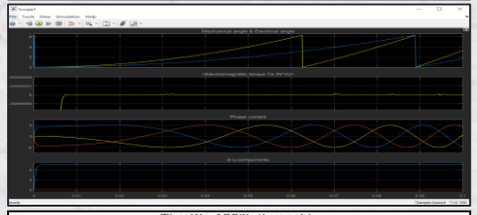
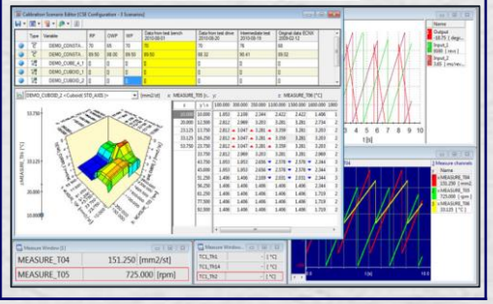
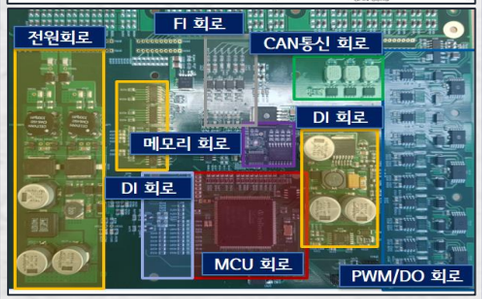
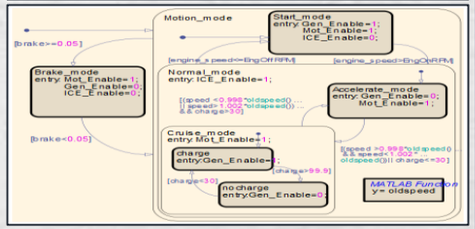
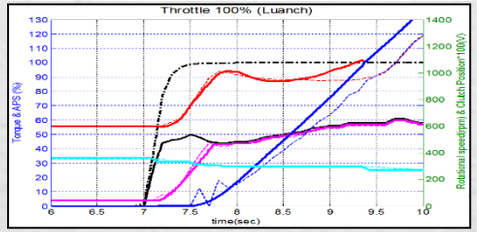

160kW Torque 1,300Nm

* 1) MSO : Maximum Slot Occupation 2) KITECH : Korea Institute of Industrial Technology

# 13-2. Core technologies : Integrated Vehicle Control Unit

## High reliability of Integrated Vehicle Control Unit(IVU) with model-based software

➢ Integrated control/management software research & development for awareness of vehicle driving mode, drive system control, fault diagnosis, safety functions, etc.(Develope 5 in 1 system)

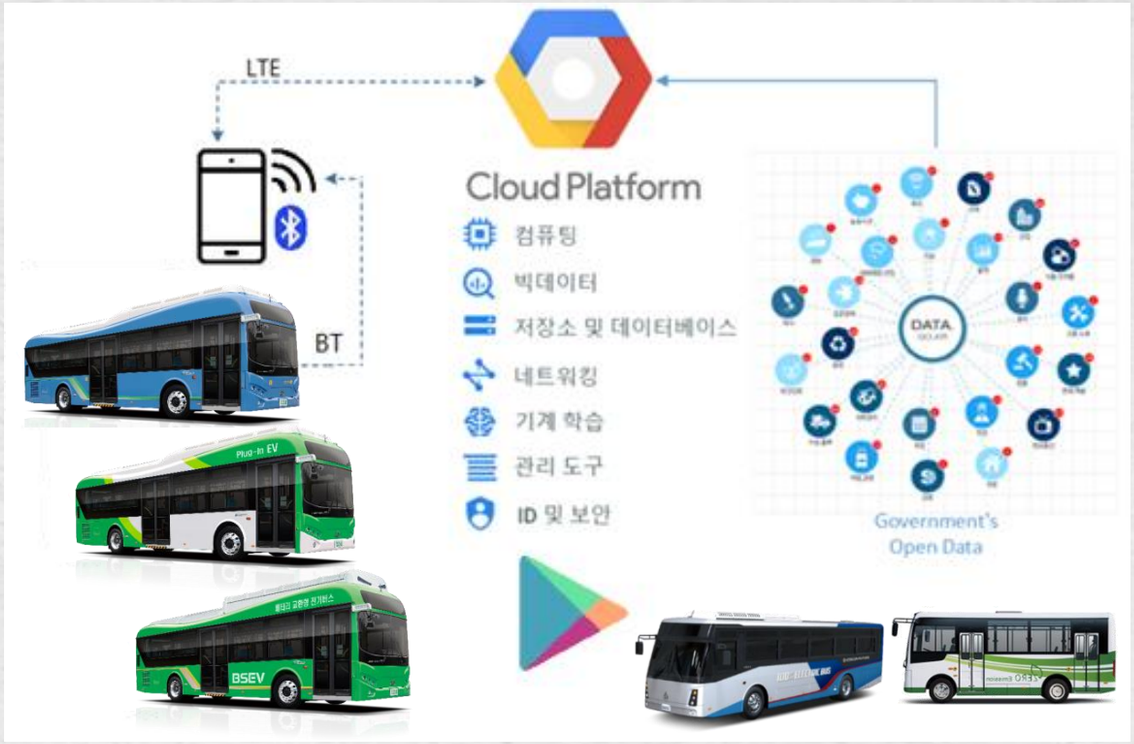
| Universal IVU S/W and H/W development platforms | Model Based Software Design Technology | V&V technology based on SILS/HILS | Calibration Technology for Optimal Control |
|---|---|---|---|
| ▪ Implementation of Target Blockset<br>▪ 32bit MCU - based circuit design technology | ▪ Model-based software design technology<br>▪ Control logic and algorithm implementation technology | ▪ Vehicle and power unit modeling technology<br>▪ Reliability Test Technology Based on SILS/HILS | ▪ Dynamometer/vehicle based calibration technology<br>▪ Vehicle Testing Assessment Technology |
|  |  |  |  |
|  |  |  |
|  |  |  |  |

EDISON MOTORS

# 13-3. Developing and Applying Cloud Platforms

## Cloud Platform Interface with Bluetooth Connection

- Smart BMS communication via Bluetooth for continuous enhanced functionality and new service support
- Driver's Smart Phone and Cloud Platform-based Smart Management System Interworking(운전자의 Smart Phone과 Cloud Platform 기반의 Smart Management System 연동 : using Smart Phone)




- ✓ Record Battery Use History
- ✓ Vehicle Driving Pattern Analysis
- ✓ Battery Status Analysis
- ✓ Smart SOC, SOH Algorithm
- ✓ Adaptive DOD Control
- ✓ Failure Awareness
- ✓ Remote Update / Remote Maintenance
- ✓ User Check of Battery Status
- ✓ EV Bus Driving Characteristics and Interlocking
- ✓ Optimal Energy Control for Returning to the Garage

- App update with Smart Phone enables continuous enhancement of functions and support for new services even after shipment.

Smart Phone으로 App update를 통해 출고 후에도 지속적인 기능 강화 및 신규 서비스 지원과 원격 고장진단 및 원격수리가 가능합니다.

# 14. EDISON MOTORS' Competitiveness : Carbon Fiber Bus Body

Autoclave

Composite Material Carbon Fiber
(전기버스 탄소섬유 차체)


Reduced 1.5 ~ 2 tons compared with equivalent models from competitors
(동급대비 1.5~2t 경량화)

- Key parts are from reliable global brands(주요 부품의 글로벌 브랜드 부품 적용)
  - ✓ PM Motor
  - ✓ EDISON ELECTRICAL EQUIPMENT
  - ✓ EDISONTECH NCM
  - ✓ ABS braking system by WABCO, Germany
- Car Design Patents registered Korea and Overseas (국내/외 승용차 디자인 특허 출원 및 보유)
- Biggest autoclave molding equipment in Korea
  - ✓ Size : 5m(D) X 30m(L)
  - ✓ Produce 2veh. of 12m length's buses simultaneously
- Super quick 1 time charging system
  - ✓ Fast charging system using 2 Port charger
    (2 Port 충전기를 이용한 급속 충전 시스템)

- Comparison of 11m EV Bus Energy Consumption(전비)
  - ✓ 72.96km/h at constant speed with A/C off(정속주행 기준)
  - ✓ EM: 1.42km/kWh VS B Company: 0.96km/kWh
- CFRP (Combined Materials) Body(복합소재 차체 적용)
  - ✓ Excellent stiffness of the bus body which is made out of carbon fiber allows to load 2.5 tons of batteries on the vehicle's roof
    (충분한 차체 강성 확보로 별도 보강 없이도 차체 상층부에 2.5 Ton 무게의
    배터리 탑재 가능함)
  - ✓ Excellent anti-corrosion capability and flame retardant(탁월한 부식 방지 능력 및 화염에 강한 소재)
- General characteristics of composite materials(CFRP)
  - ✓ Specific Strength(비중대비강도)
    : 9.6 times Steel and 4.9 times Al
  - ✓ Specific Stiffness(비중대비강성)
    : 1.7 times Steel and 1.8 times Al

# 15. Bus & Truck Line Up and Development Models

## EV Bus & EV Truck


e-FIBIRD PIEV
EV Low-floor Bus / Plug-In / Main Model


e-FIBIRD BSEV
EV Low-floor Bus / Battery-Swapping

SMART 11H(Order via Online)
EV Two-step Bus / Plug-In(Launch H1 2019)

SMART 9H(Order via Online)
EV Low-floor Bus(Launch H1 2019)


SMART 7(developing)
Compact EV bus(Launch H2 2019)

SMART T1.0(Order via Online)
EV Truck(Launch July 2019)

SMART T1.5~T4.5(developing)
EV Truck(Launch H1 2020)

## Diesel Coach Bus & CNG Bus

SMART 12D(Order via Online)
DIESEL Coach Bus(Launch H1 2019)

FIBIRD
CNG Low-floor Bus / Main Model

SMART 11HG
CNG Two-step Bus

# 16. Sedan & SUV Line Up and Development Models

## EV Sedan

SMART S(developing)
Super Class EV(Launch H2 2020)

SMART E(developing)
Medium class EV(Launch H1 2021)

SMART A(developing)
Small Class EV(Launch H1 2020)

SMART MINI E(developing)
Small Class EV(Launch H1 2021)

SMART MINI A(developing)
Small Class EV(Launch H2 2020)

## Electric SUV

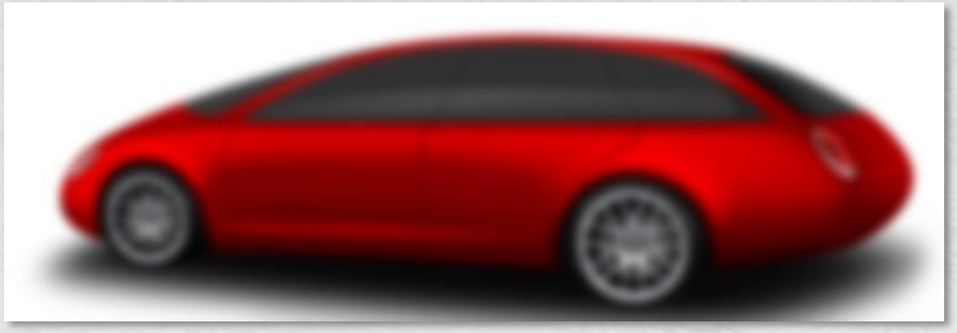
SMART X(developing)
Electric SUV(Launch H1 2020)

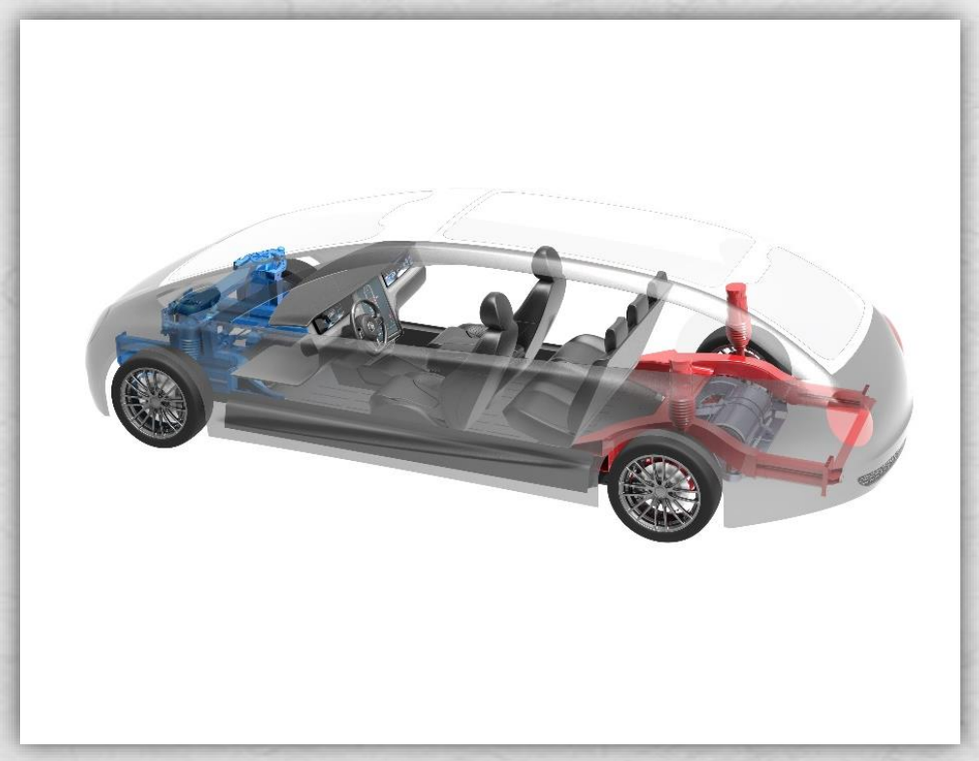
- In order to lead the self-driving car era within five years, we aims to produce EVs of design and performance that consumers really want, and to sell 6 new electric vehicles by 2019, 10 new ones by 2020 and 2025 and 30 new electric vehicles by 2030.

# 17. EDISON MOTORS' vision for the future

- EDISON MOTORS is the Hidden Champion of EV, who has the manufacturing technology of EVs that can compete with any other company in the world and is already competing with big companies.(에디슨모터스는 세계 어느 기업과도 경쟁할 수 있는 전기자동차 제조 기술력을 보유하고 있으며, 이미 대기업과 경쟁하는 굴지의 전기자동차 히든 챔피언임)

- EDISON MOTORS is negotiating to export their superior technology to India, Saudi Arabia, China, Russia and Mexico etc. The company also plans to set up 20 JVCs worldwide with $ 100 million technology royalties.(우수한 기술을 India, Saudi Arabia, China, Russia, Mexico 등에 기술로열티를 받고 수출하는 협상을 진행 중임, 각 1억 달러의 기술로열티를 받고 세계적으로 20개의 JVC를 설립할 계획임)





# APPENDIX : Comparison of total input costs on 9 year

## ➢ Comparison of Fuel and Maintenance Cost

| Item | Fuel Cost/1km | Fuel Cost | | | Maintenance Fee(Includes charging/maintenance equipment fee) | | | |
|---|---|---|---|---|---|---|---|---|
| | | 250km Mileage/1Day | 12Months/1Year | 9Years(Usage Period) | 250km Mileage/1Day | | 12Months/1Day | 9Years(Usage Period) |
| | | | | | Maintenance Fee | Equipment Fee | | |
| Low-floor EV | 50 | 12,500 | 4,562,500 | 41,062,500 | 5,000 | 4,000 | 3,285,000 | 29,565,000 |
| Low-floor CNG | 513.3 | 128,325 | 46,838,625 | 421,547,625 | 23,000 | 2,000 | 9,125,000 | 82,125,000 |
| Diesel | 700.0 | 175,000 | 63,875,000 | 574,875,000 | 19,000 | 2,000 | 7,665,000 | 68,985,000 |

## ➢ Comparison of Bus Price and Purchase Cost after Government Subsidy

| Item | Bus Price | Subsidy (2017Y Standard) | | Purchase Price |
|---|---|---|---|---|
| | | Environment Subsidy | Low-Floor Subsidy | |
| Low-floor EV | 437,000,000 | 100,000,000 | 92,154,000 | 254,846,000 |
| Low-floor CNG | 220,000,000 | — | 92,154,000 | 127,846,000 |
| Diesel | 120,000,000 | — | — | 120,000,000 |

## ➢ Comparison of Total Cost of Ownership after 9 years of Use

| Item | Purchase Price (With Subsidy) | 9 Years Fuel Cost | 9 Years Maintenance Fee | 9Years Lubrication oil/filter replacement cost | Price of Used Car | Total |
|---|---|---|---|---|---|---|
| Low-floor EV | 254,846,000 | 41,062,500 | 29,565,000 | 4,500,000 | - 40,000,000 | 289,973,500 |
| Low-floor CNG | 127,846,000 | 421,547,625 | 82,125,000 | 45,000,000 | - 3,500,000 | 673,018,625 |
| Diesel | 120,000,000 | 574,875,000 | 68,985,000 | 45,000,000 | - 3,500,000 | 805,360,000 |

- The car body and battery made of composite material resistant to corrosion can be repaired and reused, so the electric low-floor bus will be sold for 40 million won and the CNG low-floor bus for 20 million won even after 9 years use.

## ➢ Result (replacing the full amount by electric low-floor bus): Estimated Cost Reduction of Bus Use for 9 years

| Item | CNG Bus | Diesel Bus | Savings in each Area |
|---|---|---|---|
| BUSAN | 2,415 | 102 | 9,776 billion won |
| SEOUL | 7,482 | — | 28,659 billion won |
| INCHEON | 2,180 | 294 | 9,865 billion won |
| DAEGU | 1,521 | — | 5,826 billion won |

☞ OO Bus Operating Company in Busan City calculated based on actual operating data from its EDISON MOTORS' EV bus between Dec 2016 and May 2017.
(위 자료는 에디슨모터스의 전기버스를 부산시 OO여객에서 2016년 12월부터 2017년 05월까지 운행해서 얻은 실제 데이터를 통해 분석하여 추정한 예상 절감액임)

# APPENDIX : Estimated Savings over 10 Years

## ➢ Results of Review: Estimated Savings over 10 Years

| Replacement item | Replacement number | 10-year savings |
|---|---|---|
| 11m large electric bus | 68,881 | Savings of approximately 38 trillion won |
| 9m Medium Electric Bus | 34,268 | Savings of approximately 14.5 trillion won |
| 7m Medium Electric Bus | 22,846 | Savings of approximately 7.5 trillion won |
| SMART S (EV) | 3,224,188 | Savings of approximately 413 trillion won |
| SMART E (EV) | 10,030,944 | Savings of approximately 622 trillion won |
| SMART A (EV) | 1,167,965 | Savings of approximately 78 trillion won |
| SMART MINI (EV) | 1,814,048 | Savings of approximately 85 trillion won |
| SMART X (EV) | 1,354,906 | Savings of approximately 69 trillion won |
| SMART RV (EV) | 433,802 | Savings of approximately 23 trillion won |
| SMART T (EV) | 3,535,633 | Savings of approximately 236 trillion won |
| Total | 21,687,481 | Savings of approximately 1,586 trillion won |

☞ The above economic analysis data refer to the MOLIT car registration status for December 2017. This amount is estimated by applying the OO Bus Operating Company data to EDISON MOTORS.(위 경제성 분석 데이터는 국토교통부 자동차 등록 현황 2017년 12월 기준을 참고하여, 에디슨모터스 연구소에서 OO여객 데이터를 적용 분석하여 추정한 금액임)

Thank you