

The future of electric vehicles

Utilizing Chances in Electric Vehicle Industry



Hiroshi Shimizu

Professor Emeritus, Keio University,
CEO, e-Gle Co. Ltd



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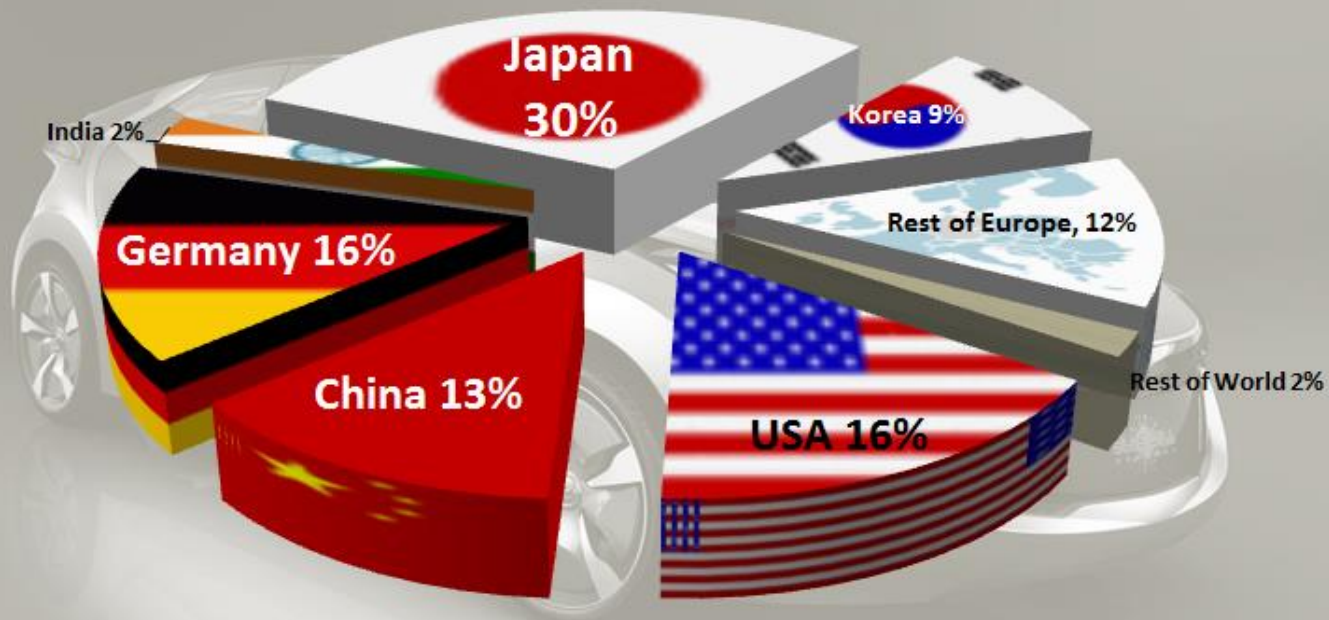
Japan is the most successful country in the fields of Electric vehicles and Hybrids



- ❑ Why Japan was successful?
- ❑ Which direction will be the future trend of Japanese electric vehicles?
- ❑ What is the supporting innovation concept?

About 82 Mio Vehicles were produced in 2012

Shares of production by origin of technology / capital

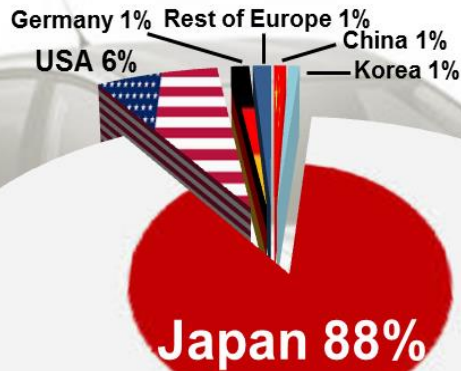


(Source: Marklines)

Global Shares of Electric vehicles & Hybrid vehicles sales 2012

About 1.6 Mio EVs were sold in 2012 worldwide

Shares of sales by origin of technology / capital



- **~1.6 Mio. Units Hybrids and Electric vehicles sold in 2012 worldwide!**
- **~1.4 Mio. units were Japanese brands!**
- **~900 000 units sold in Japan!**

(Source: Marklines)

Japan is the biggest producer and consumer market for Electric vehicles & Hybrids

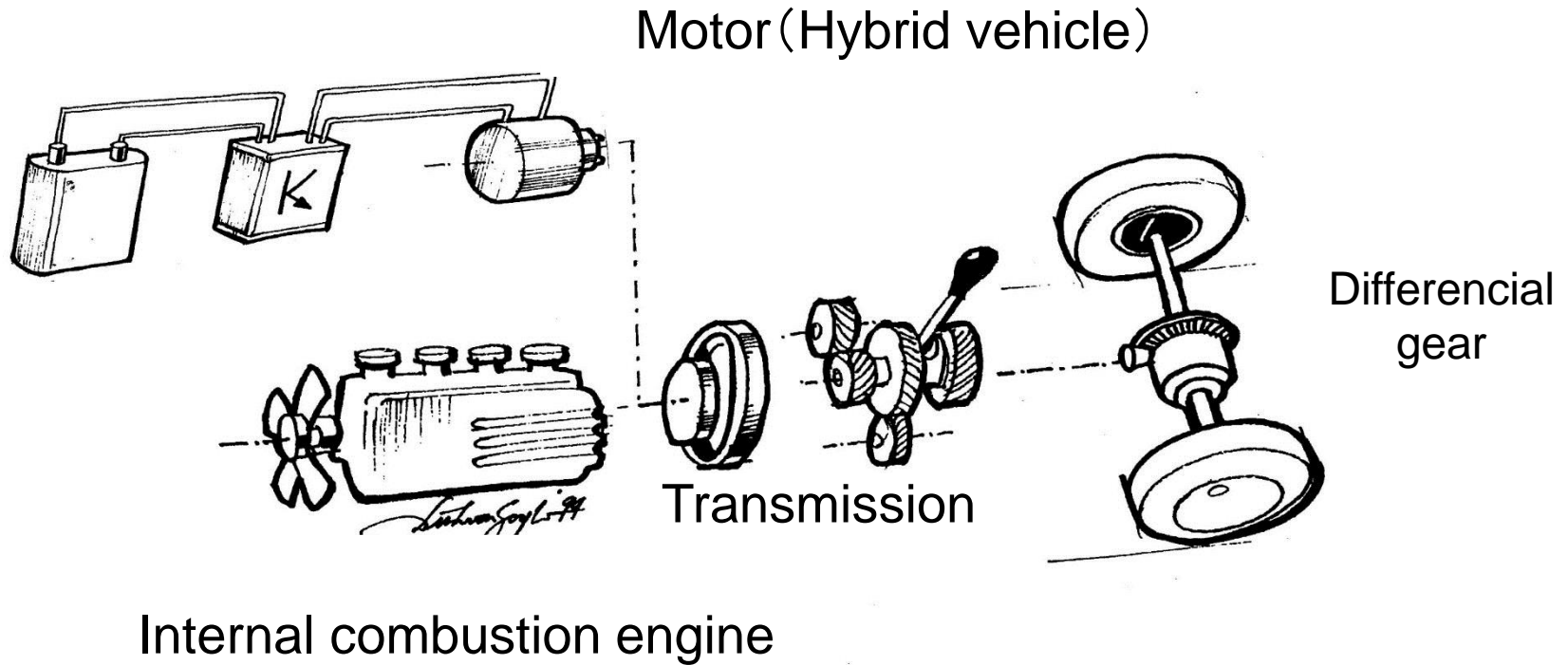
Why Japan was successful in the field of Electric vehicles and Hybrids ?

Government, OEMs and Suppliers all played a vital role with their efforts in the early stage

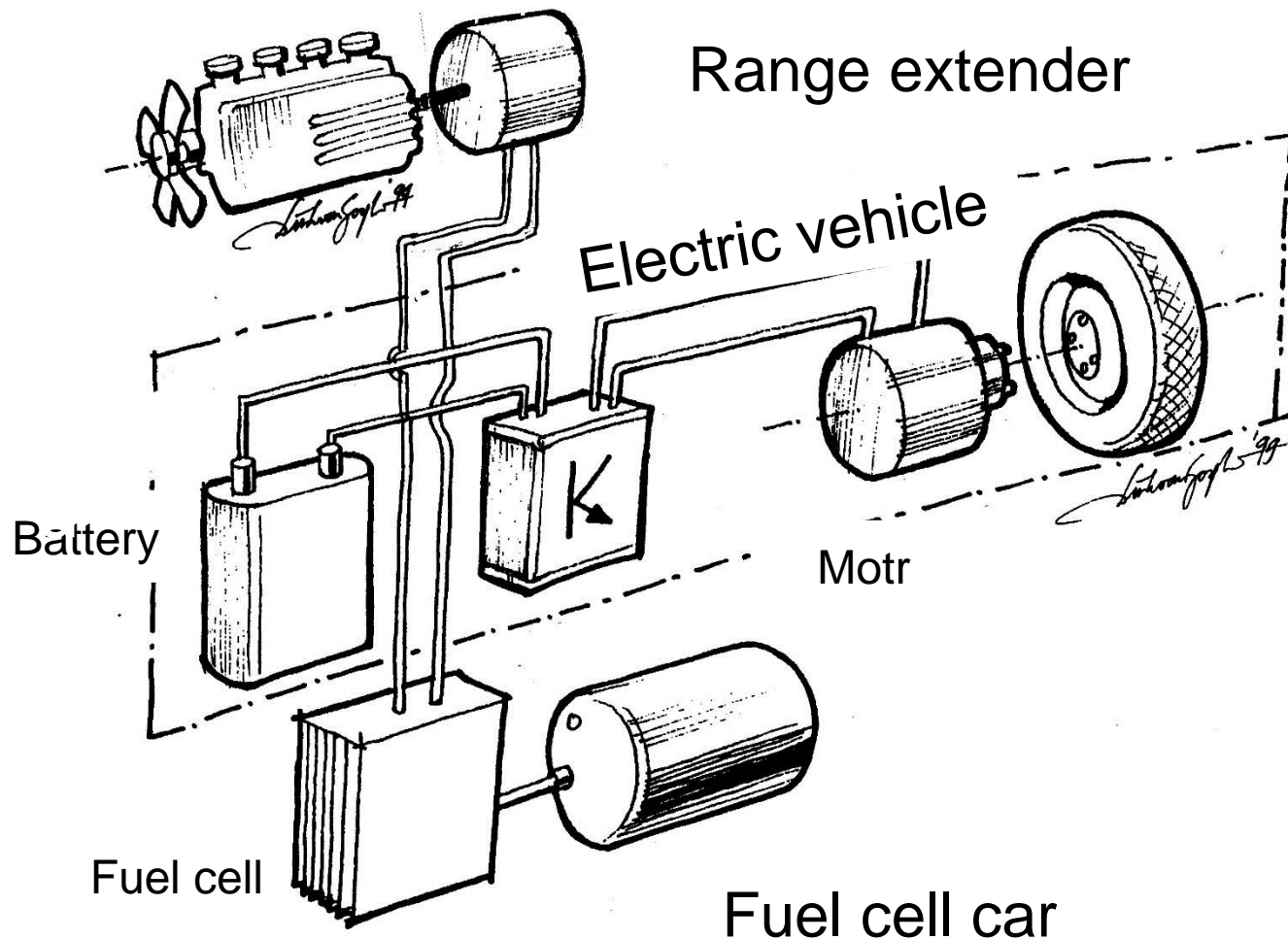
- ❑ Japanese people have suffered from big air pollution in 1960's and damaged economically by oil shock in 1973
- ❑ Fundamental research and development activities (science and industry) have been done continuously from 1970's supported by the government
- ❑ Decision of car OEMs to go for EVs and HEVs

People's mind, fundamental research and decisions of industry & government were combined together at an early stage

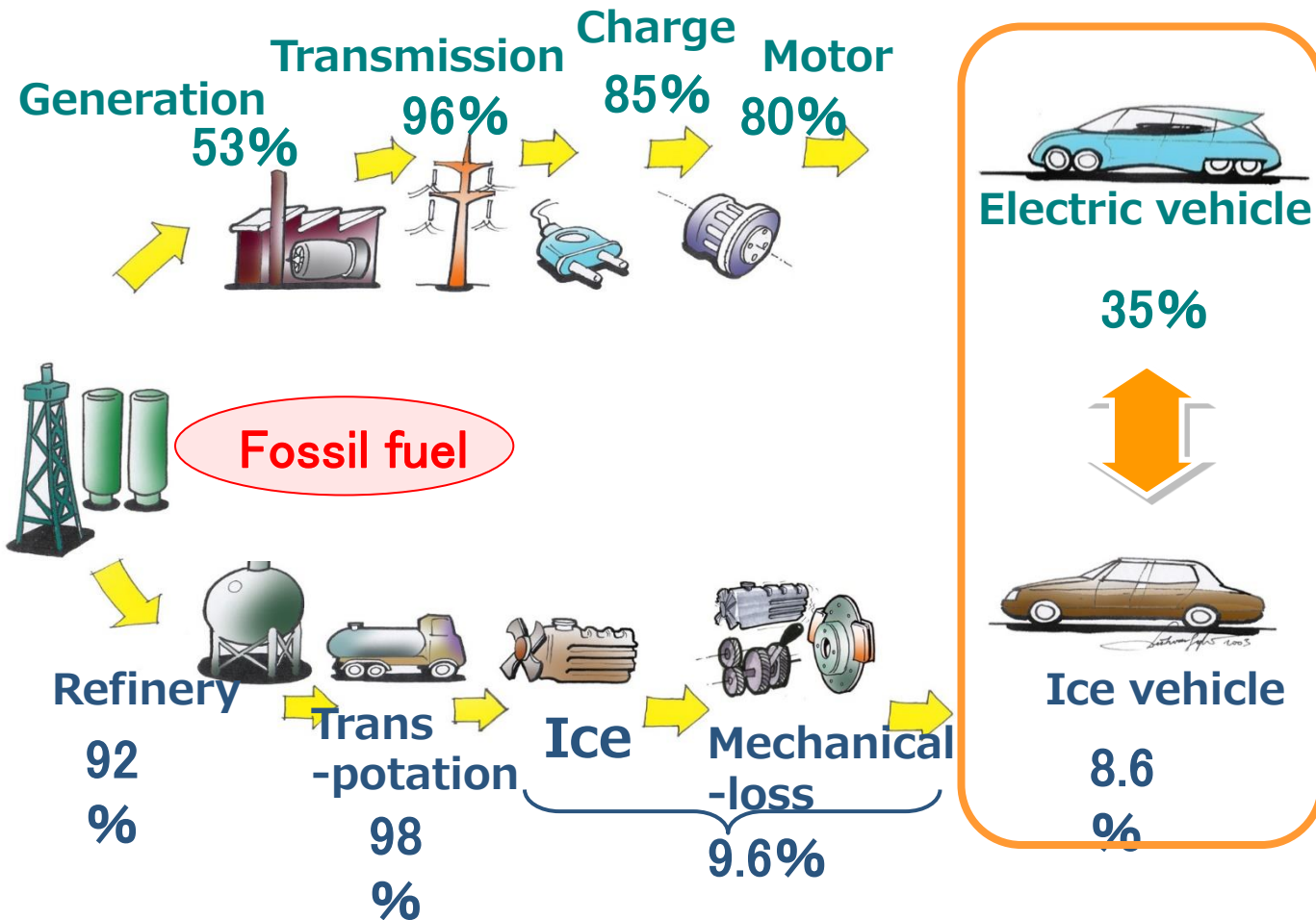
The structure of Internal combustion engine vehicles



The structure of Electric vehicles



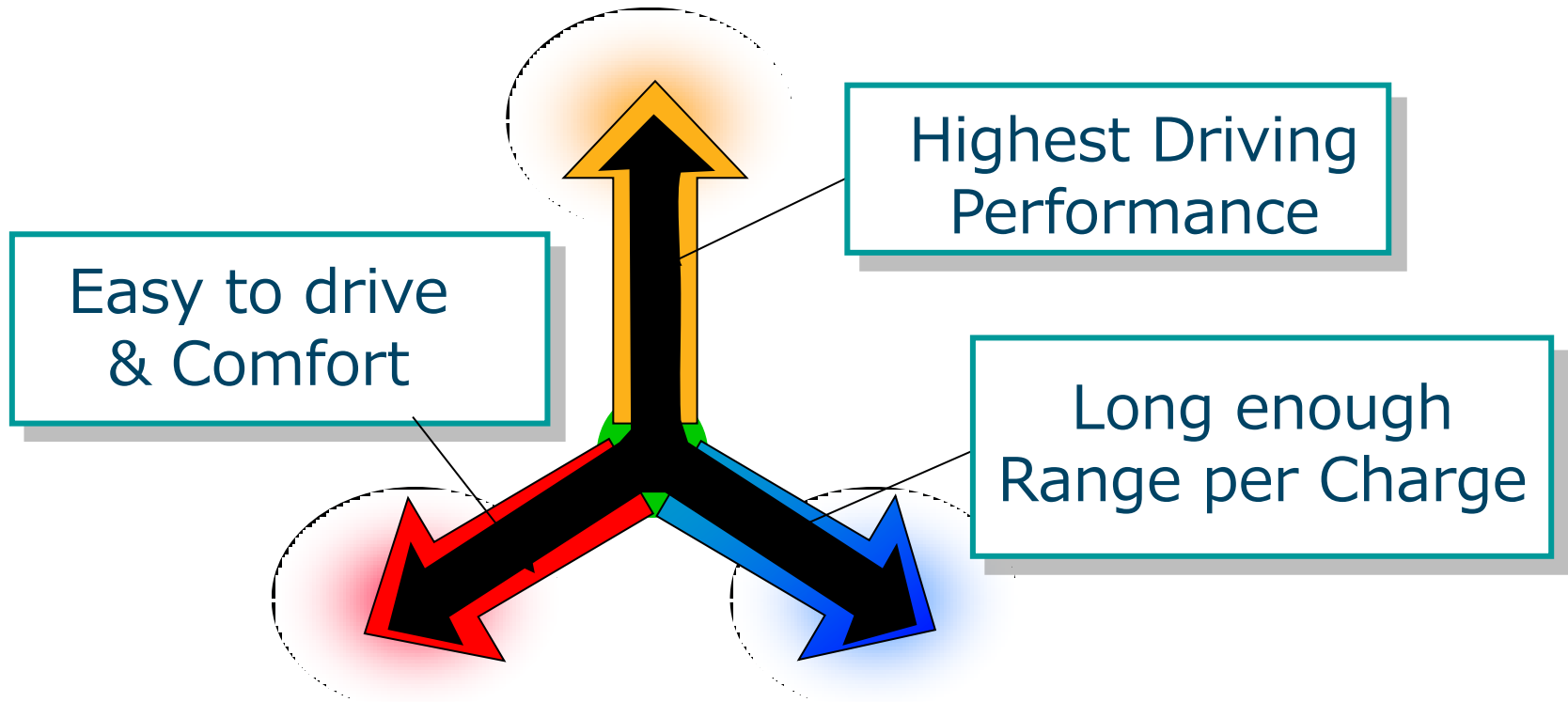
Efficiency of ICE and Electric vehicles



Why electric vehicles? Very high energy efficiency.



The value of outstanding electric vehicles everyone want to buy



Realize by the performance of components and the structure of the vehicle.

Which technology will survive ?

Not necessarily the “best” technical solution survives!

Other Key Success Factors have to be met

- ❑ **Consumer orientated** - usability, service etc.
- ❑ **Production orientated** - low production costs, easy to make etc.
- ❑ **High efficiency** - running costs, energy consumption etc.

**Technologies succeeded as a combination of these factors:
LCD display (against plasma), ICE & TGV against Linear Magnet**



	HEV	EV		
		Pure battery	Range Extender	Fuel cell
Usability	+++	++	+++	+
Efficiency	++	+++	+++	++
Simplicity	++	+++	+++	+

- ❑ The evaluation of technology shows that currently EVs with range extender seems to be most promising.
- ❑ In-wheel motor has a 30 % higher efficiency than the conventional drive system.
- ❑ Only considering optimization of total drive system will create the best electric vehicle



BMW i3

Li-Ion Battery, Ne-Fe Magnet, IGBT invented and developed so far are enough to realize the high-performing EV

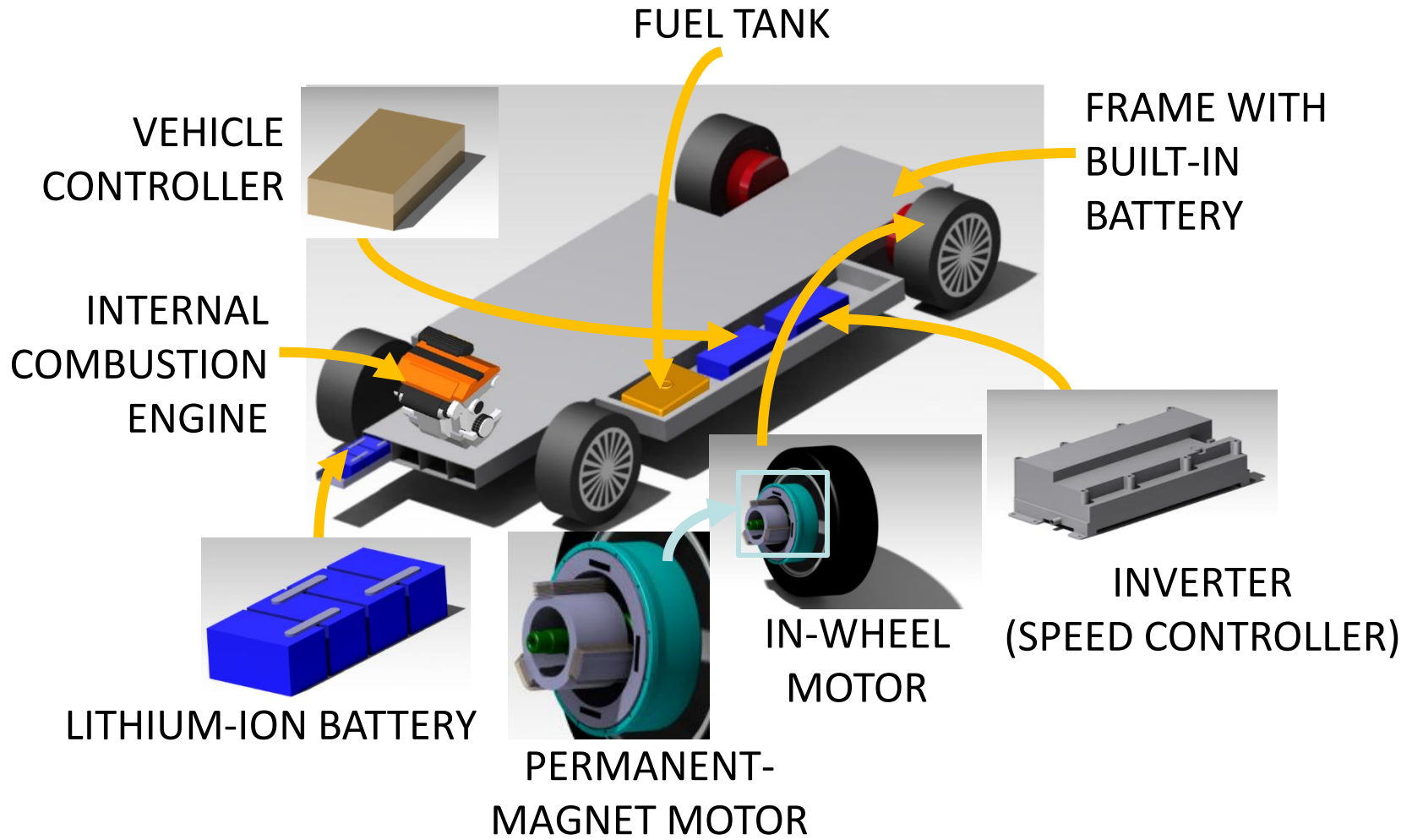




Image of an Electric with In-wheel motors and a range extender

**INTERNAL
COMBUSTION
ENGINE**



**IN-WHEEL
MOTOR**

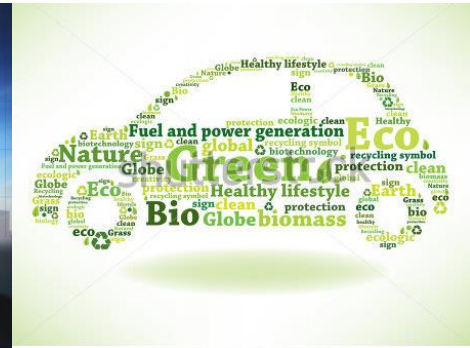
The automated driving.

Electric vehicles should be driven without drivers.

- ❑ Avoid accidents and traffic jam.
- ❑ Save the time for traffics.
- ❑ Everyone can go anytime and anywhere.



- ❑ Developing the next generation vehicle
 - High performing and environmental friendly
 - Capability have to enough to be accepted in the society
- ❑ Distribute the vehicle to all over the world
- ❑ People in the world should have comfortable mobility and sustainable environment



Collaboration among all the people in the world are the key of developing mobility for the global future