

Future Automotive Power-trains

**Does hybridization enable vehicles to meet the challenge
of sustainable development ?**

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Takehisa Yaegashi**

Challenges for the Automotive Industry

Realize Sustainable Development



Environment

Global Warming/Air Pollution

Energy

Diversified Energy Sources

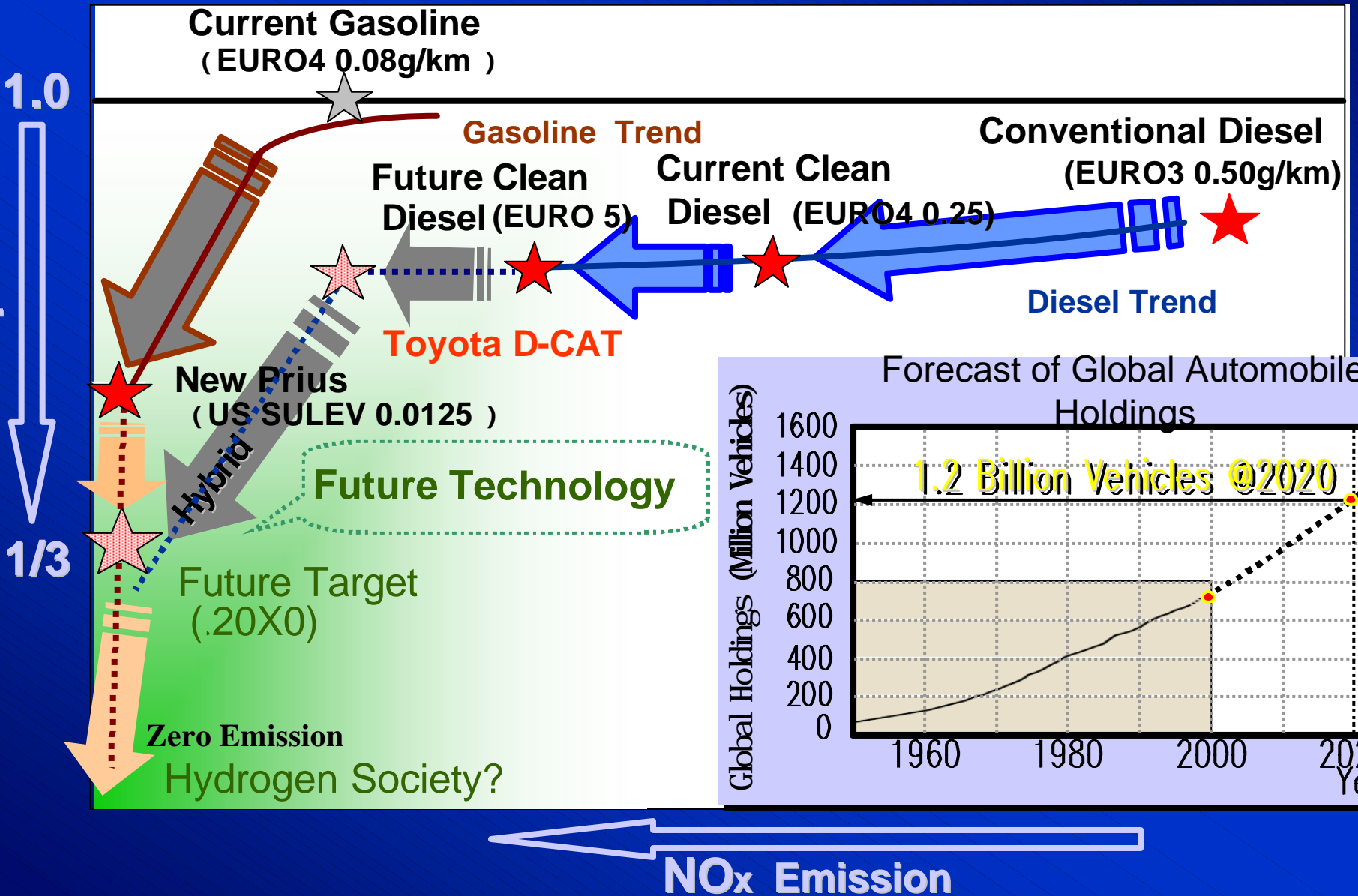
Safety

Traffic Accidents, Security

Traffic

Traffic Congestion, ITS

Challenge for Future Environmental Vehicles



Toyota's Environmental Initiatives

Diesel

Toyota D-CAT(with low sulfur fuel)

Hybridization (Future)



2003 Avensis with D-CAT

Gasoline

Direct Injection/VVTi

Hybridization

Cost; needs societal support



1998 Prius



2004 New Prius

FCHV

Hybridization

Cost; hard to achieve target cost



2003 Toyota FCHV

The Ultimate Eco Car

City Scale

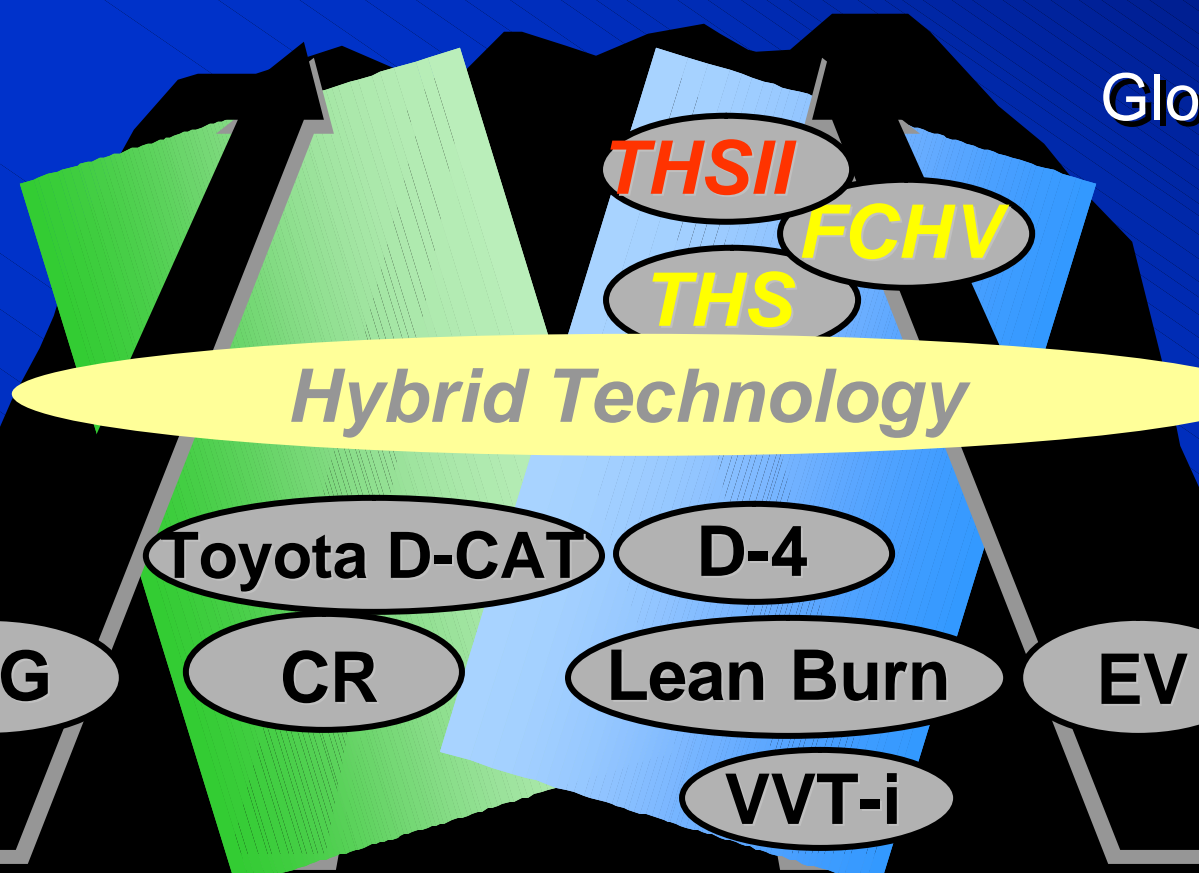


Clean Air
Disposal

Global Scale



Global War
Energy Reso



Hybrid Technology

CNG

CR

Toyota D-CAT

D-4

Lean Burn

VVT-i

EV

Alternative
Fuel

Diesel
Engine

Petrol
Engine

Electric
Vehicle

THSII

FCHV

THS

Toyota Hybrid Vehicle World Sales

Cumulative volume of Toyota hybrid vehicle sales



Hybrid Functional Categories

Application of Hybrid Tec.

Hybrid

Low Voltage

High Voltage

60V

★ Toyota Vitz

Stop & Go (Engine Stop)

Regeneration Brake

★ Crown Mild

★ Mid Size Truck

Motor Assist

★ Honda Insight

★ Honda Civic

EV Drive

★ Prius

★ Estima H

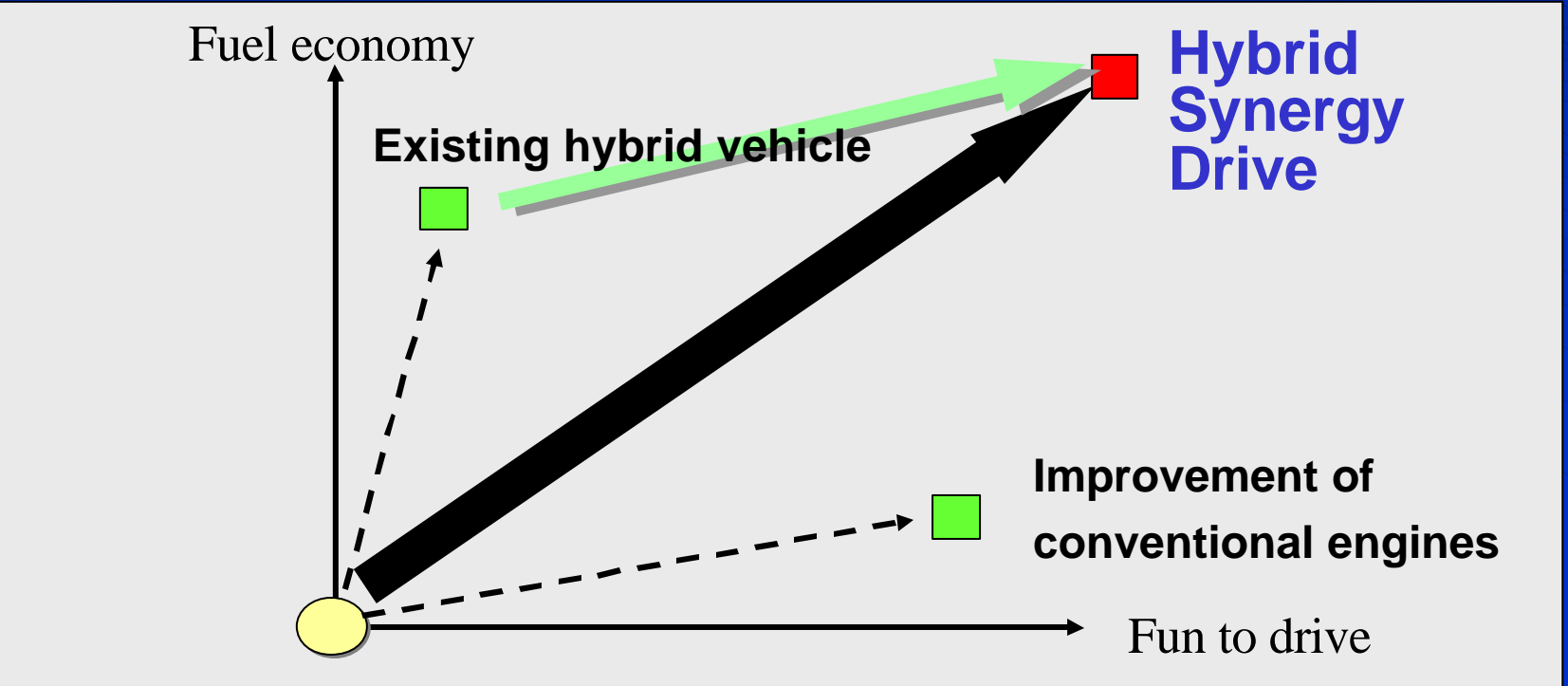
★ Alphard H

Low V Mild

High V Mild

Full/Strong

New Prius with new Generation Hybrid System (THS)

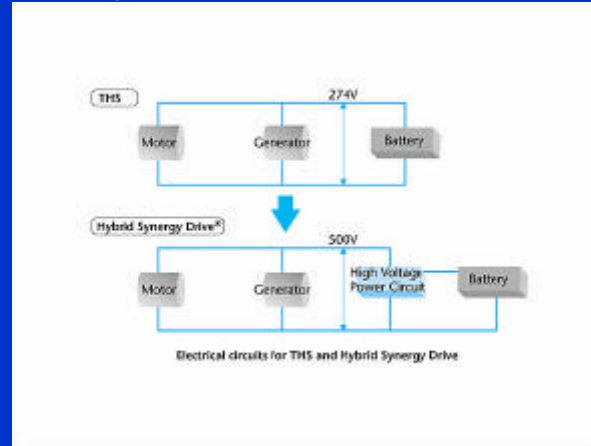


Outline of THSII Technology

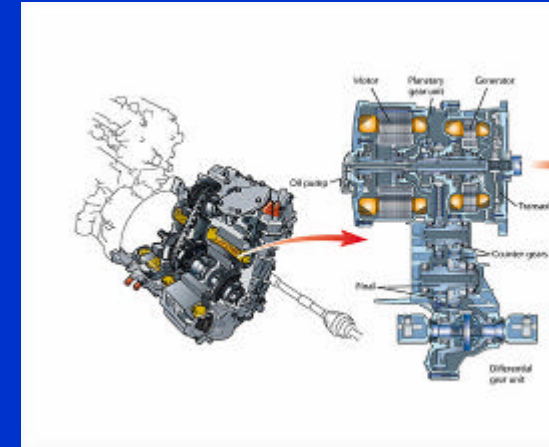
THSII Power-train



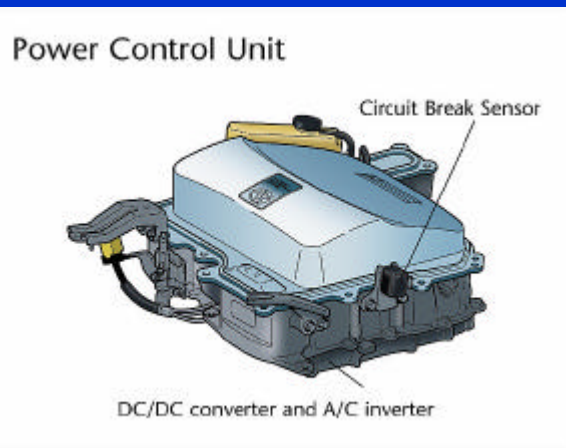
Voltage Booster



THSII Transmission



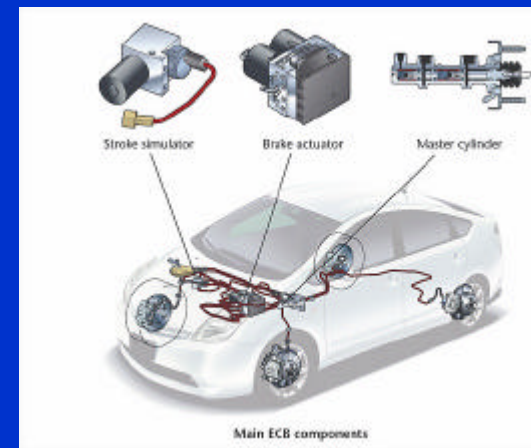
THSII Power Control Unit



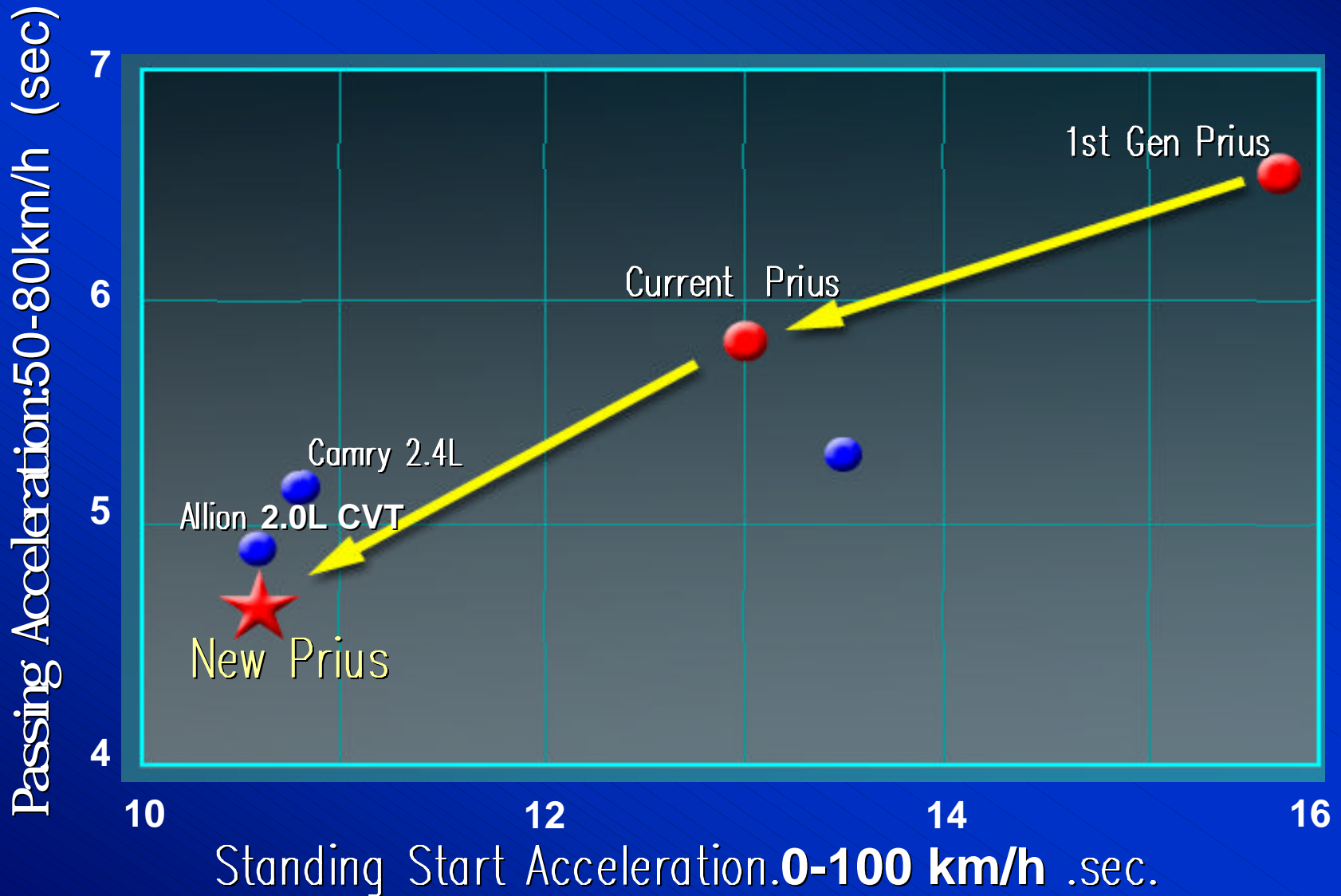
THSII Ni-MH Battery



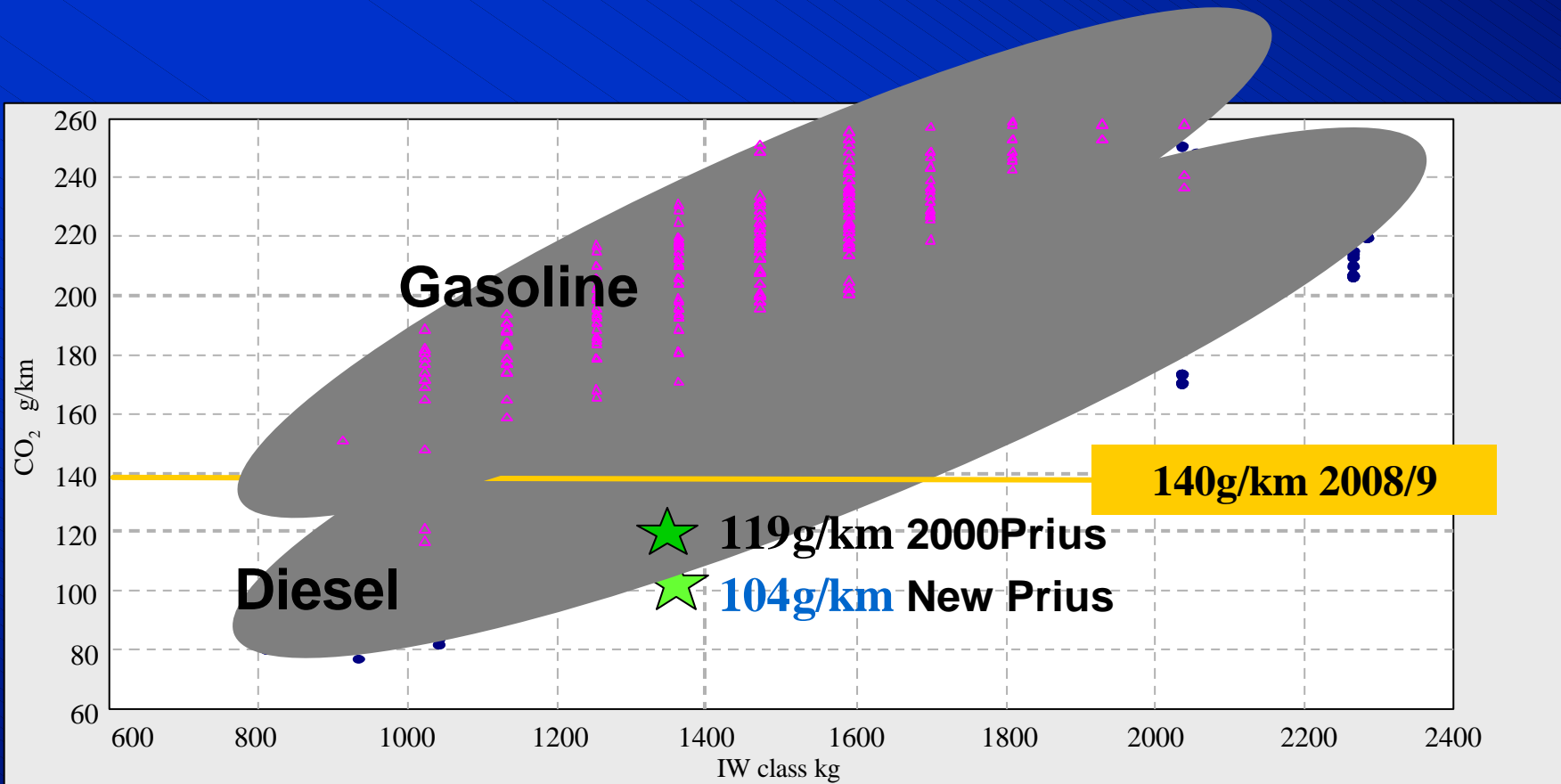
THSII ECB



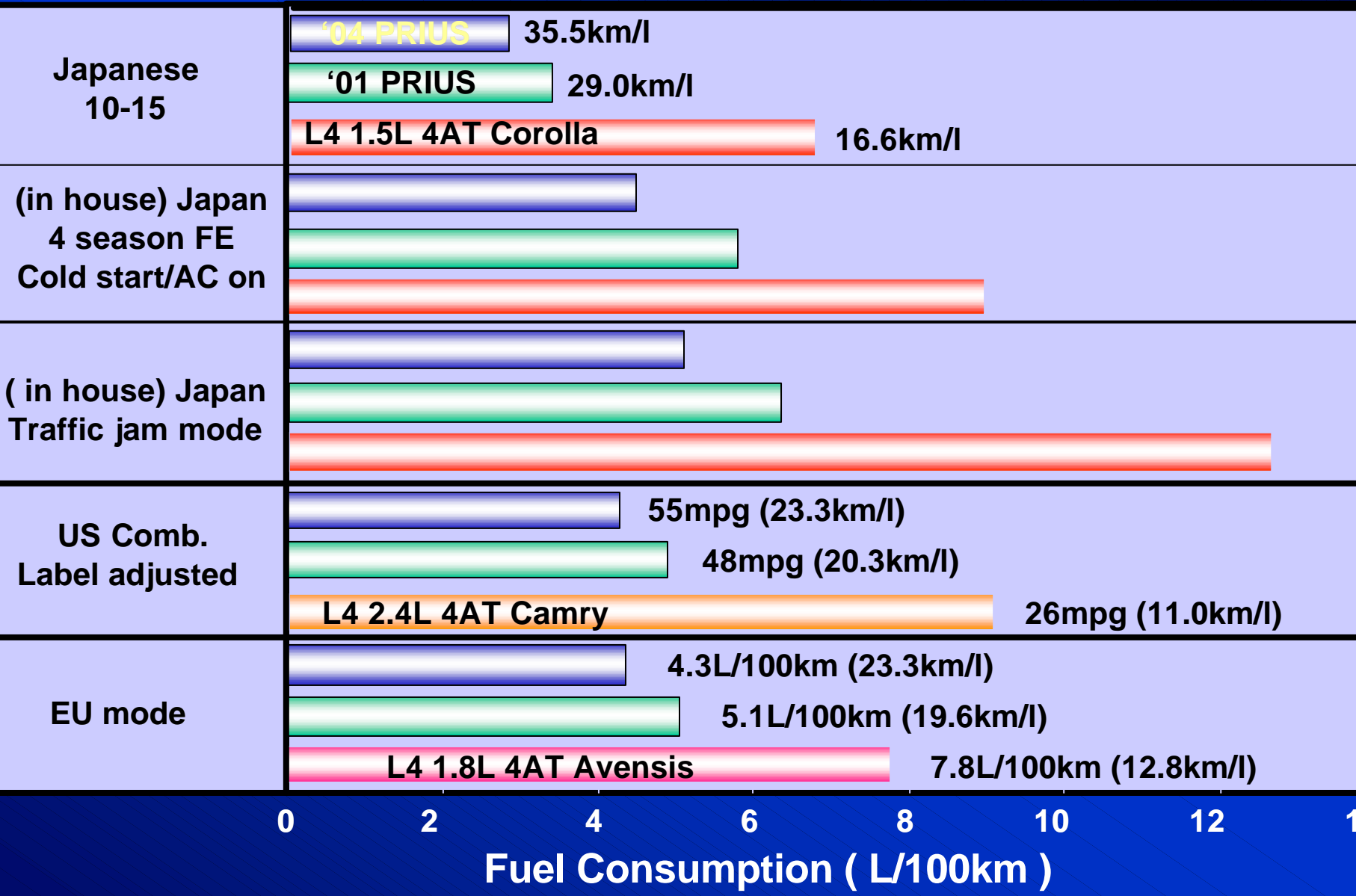
Evolution of Driving Performance



CO₂ Data of Latest Models



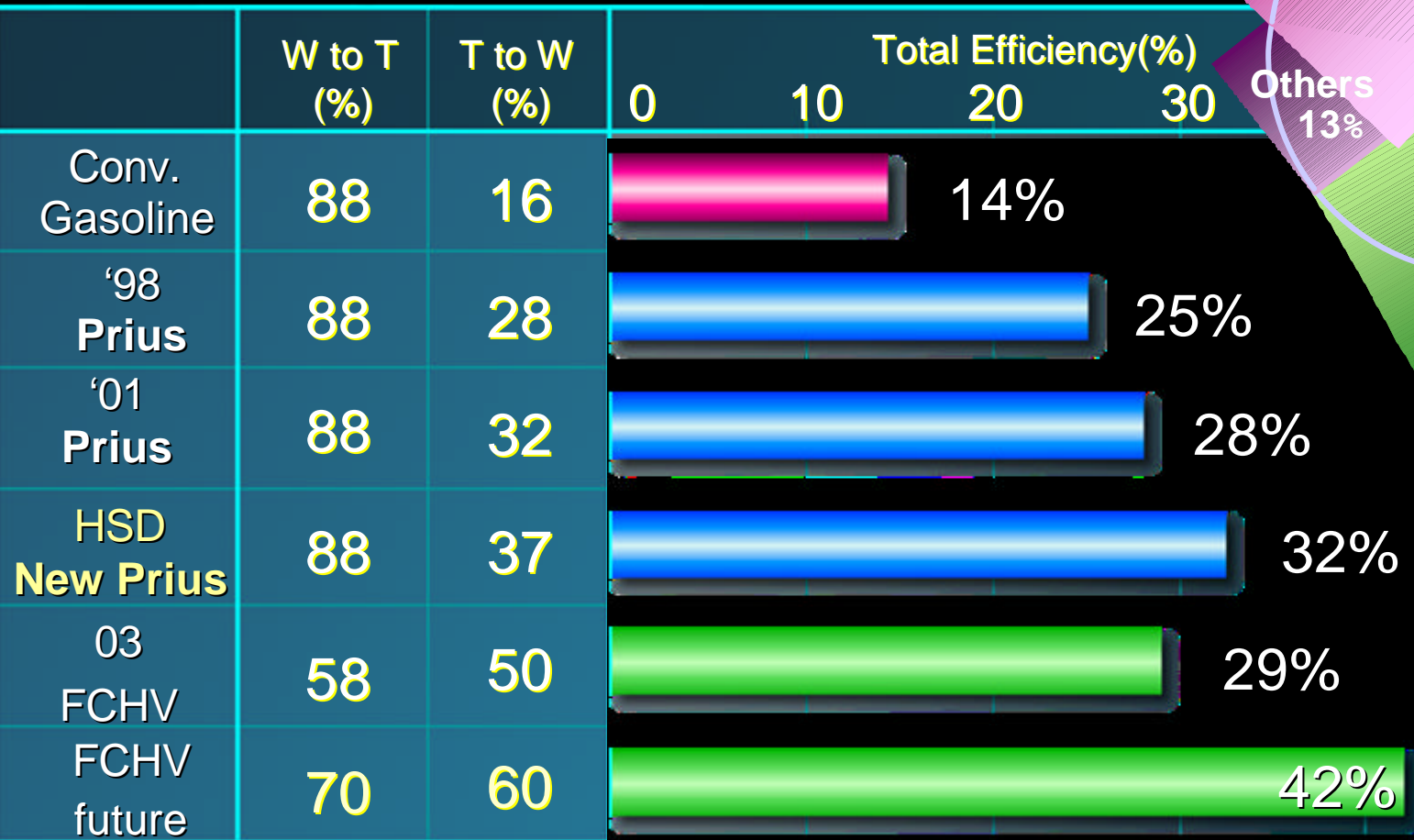
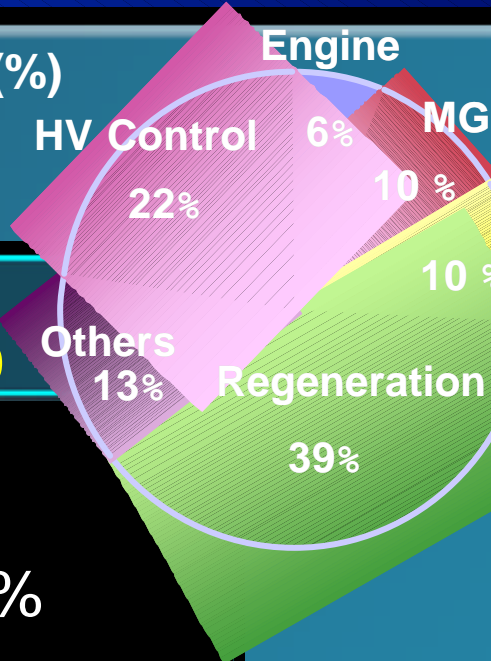
New PRIUS Fuel Economy



Well to Wheel total efficiency

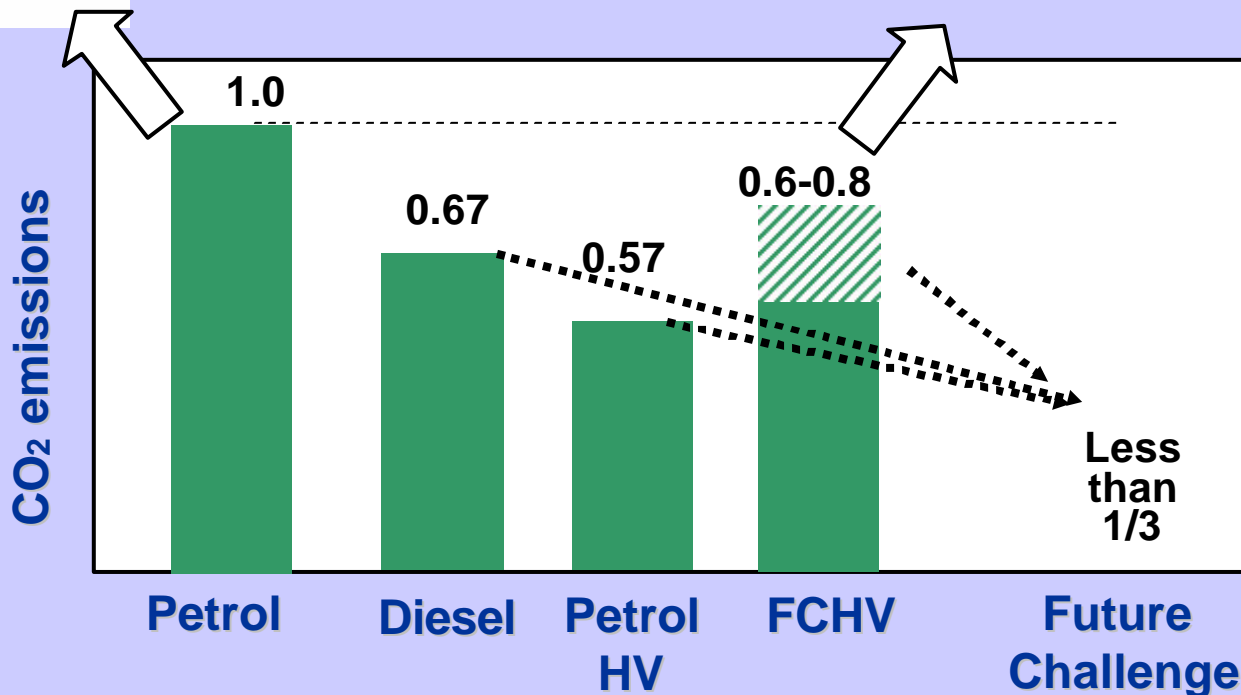
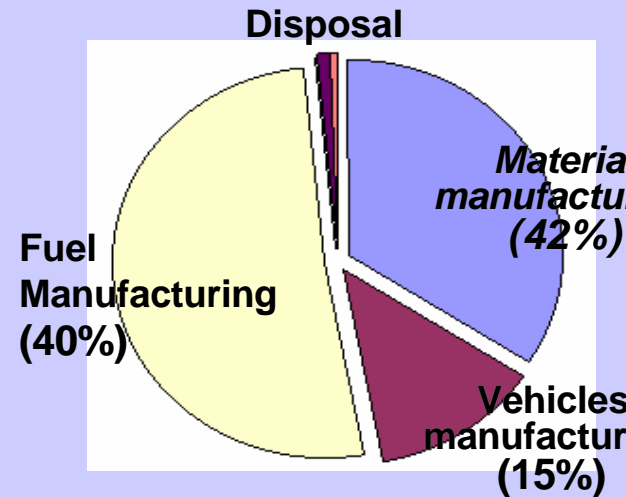
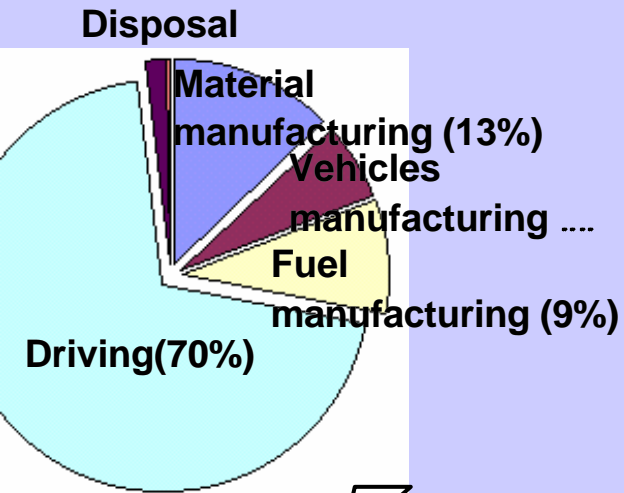
Improvement Rate(%)

'01 — '04 HSD



(Toyota Data: 10-15 model)

Total CO₂ in an Automobile's Lifecycle



Conclusion

♣ Hybridization allows the ICE vehicles to stay competitive in the future, by enabling total energy efficiency that is comparable to future FCHV.

♣ Before we rush into the hydrogen society by hydrogen fueled FCHV, there should be an option for ICE vehicles to spare fossil fuel with ultimately efficient and low CO₂ technology.

♣ In long term, it is necessary for FCHV to adopt evolved and matured hybrid technologies .

The hybrid technologies is the core in the coming future automobile.