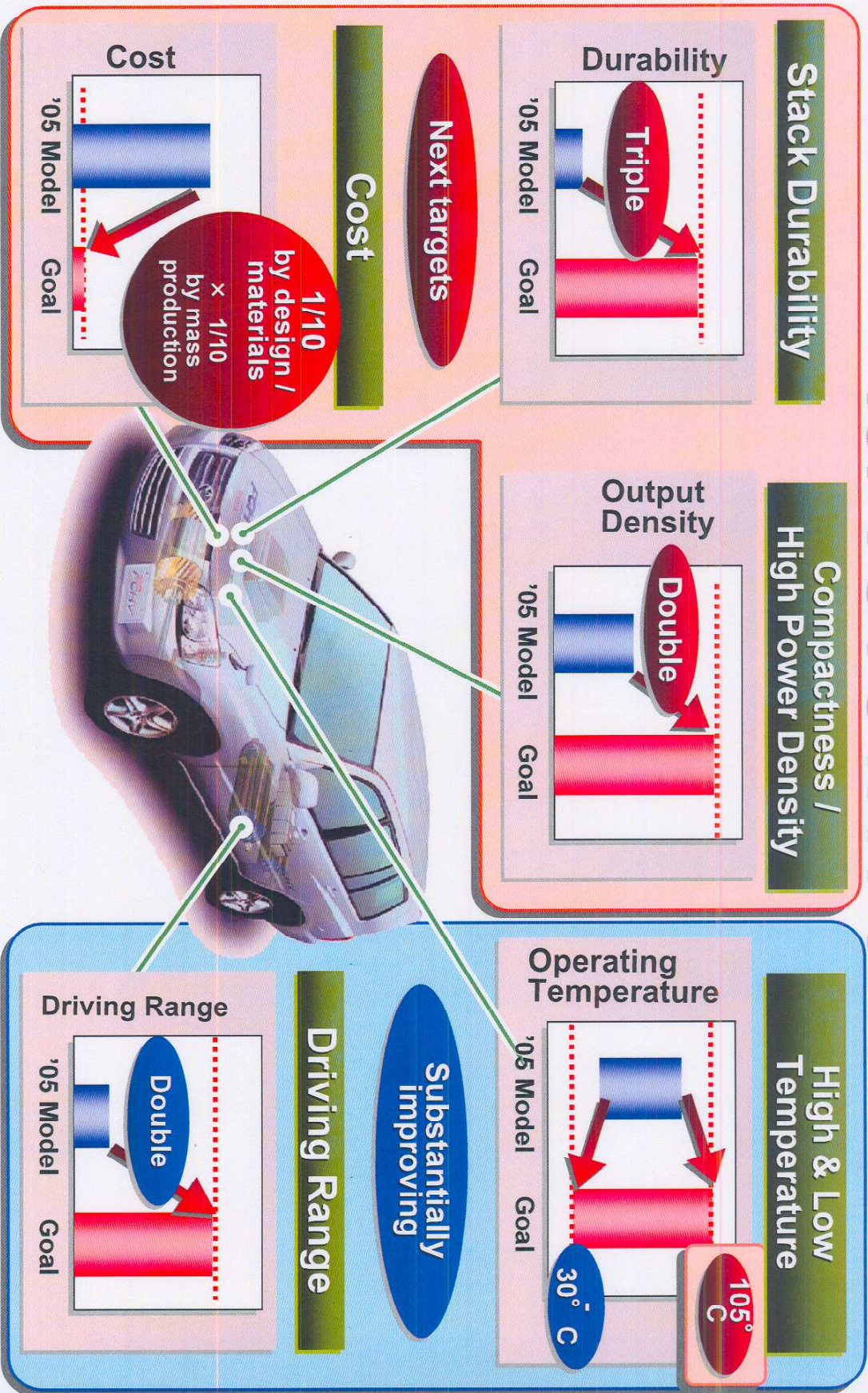# Toyota Comments on February 8th ISOR

Michael Lord, Manager
Vehicle Regulation & Certification Engineering
Toyota Technical Center
Toyota Motor Engineering & Manufacturing NA

Optimizing the ZEV Program

1. Set FC requirements at levels consistent with technical and infrastructure development

2. Recognize the value of "blended" PHEVs

3. Incentivize PHEVs in the near term

# Summary of Technical Challenges for TOYOTA FCHV

Stack Durability

Cost

Cost

Next targets

1/10 by design / materials × 1/10 by mass production

'05 Model — Goal

Durability

Triple

'05 Model — Goal

Compactness / High Power Density

Output Density

Double

'05 Model — Goal

Driving Range

Driving Range

Double

'05 Model — Goal

Substantially improving

High & Low Temperature

Operating Temperature

'05 Model — Goal

30° C

105° C

Recognition of "Blended" PHEVs

- Supports staff's proposal regarding Enhanced AT-PZEVs.

- Appreciates the recognition of Blended PHEVs

- Supports staff's proposed EAER concept and credit structure including 10mi minimum EAER.

What is the Optimal Range?

- Range is directly related to battery size.

Range

Cost
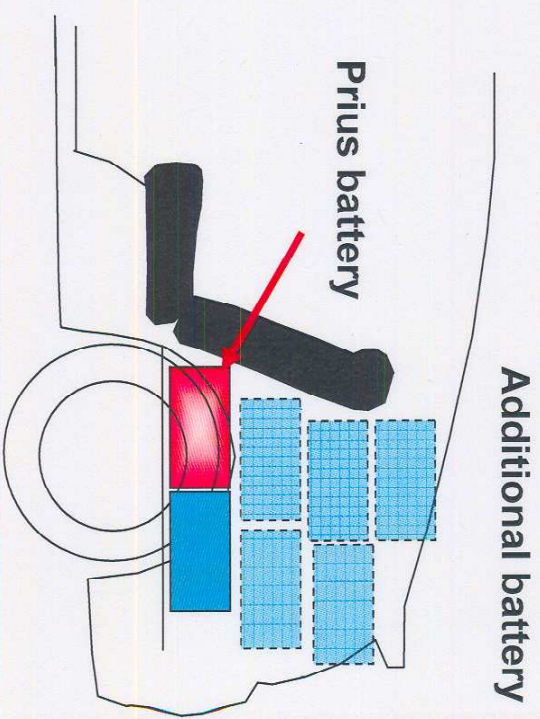Utility
Charging time
Infrastructure
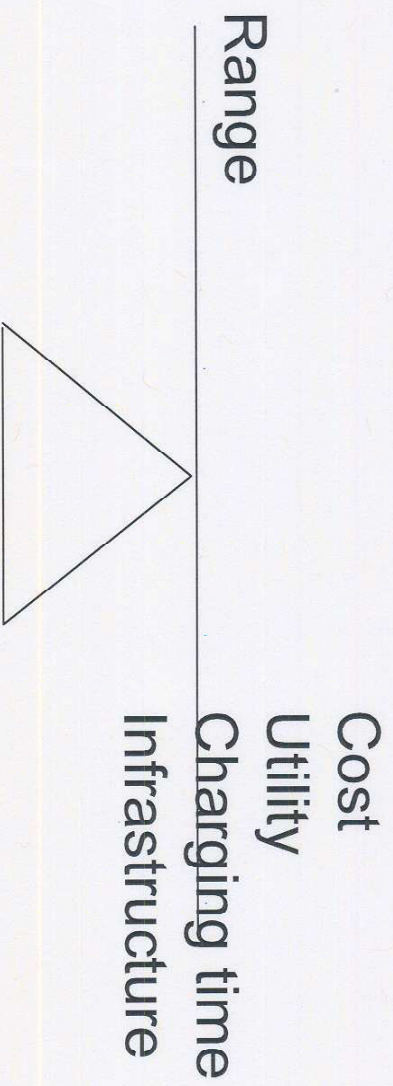
Battery Available Energy and Space/Functionality

If more
EV range is required?

More battery required
=
MORE COST &
LESS SPACE

Less practical

Critical to choose the optimal EV range

Prius battery

Additional battery

Summary

- FC volumes in Phase II and Phase III are still higher than necessary from the development perspective.

- PHEV, especially Blended, concept viable for mass market but many issues (technological and societal) remain unanswered.

- For PHEVs,
  – Keep 10 mi minimum range
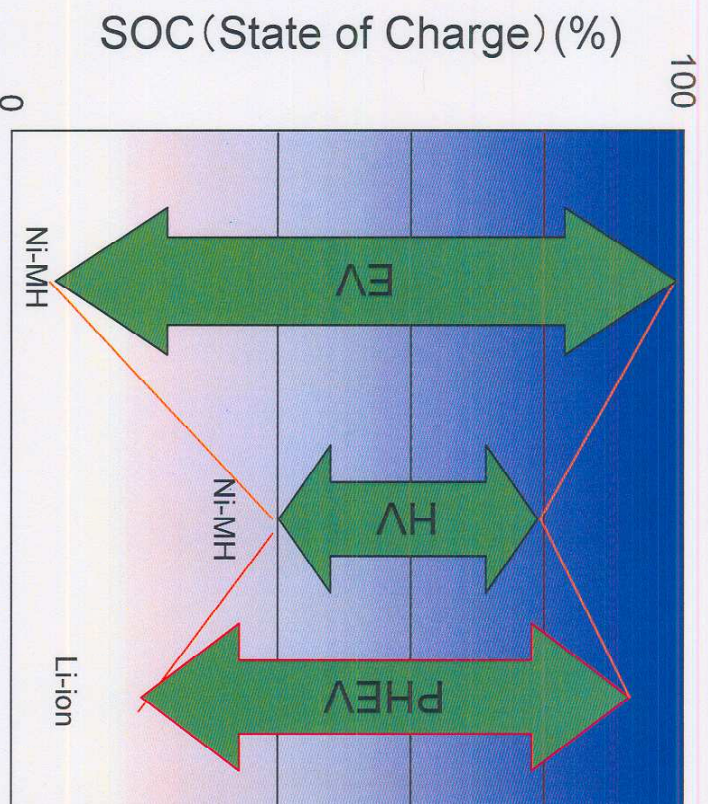 – Further incentivize PHEVs in earlier years.

Thank you!

TOYOTA

Issues for Commercialization of PHV: Battery Life

The long life of HV battery can be achieved by accurate HV power and battery control technology.

1. Limit the SOC swing range
2. Accurate SOC calculation
3. Temperature control of battery modules in the pack
4. Limit the maximum charge and discharge volt and current

SOC (State of Charge) (%)

Although battery life control technology will be continuously improved, longer battery life should be the first priority. As a result, We will consider,
1.decrease available battery energy   2.Reduce electric contribution

Powertrain Comparison

	Energy Diversity	CO2	Emissions	Single Fill Range	Infrastructure	Fuel cost
	Primary Issues			**others**		
Gasoline	△	△~×	○	○	○	△
Diesel	△	○~△	△→×	○	○	△
HV	○	○	○	◎	○	○
EV	◎	◎	◎	×	×	◎
FC	◎	◎	◎	○	××	?

PHEV

Must understand how PHEVs fit in