

Development of New Units for Heavy Duty Hybrid City-Buses



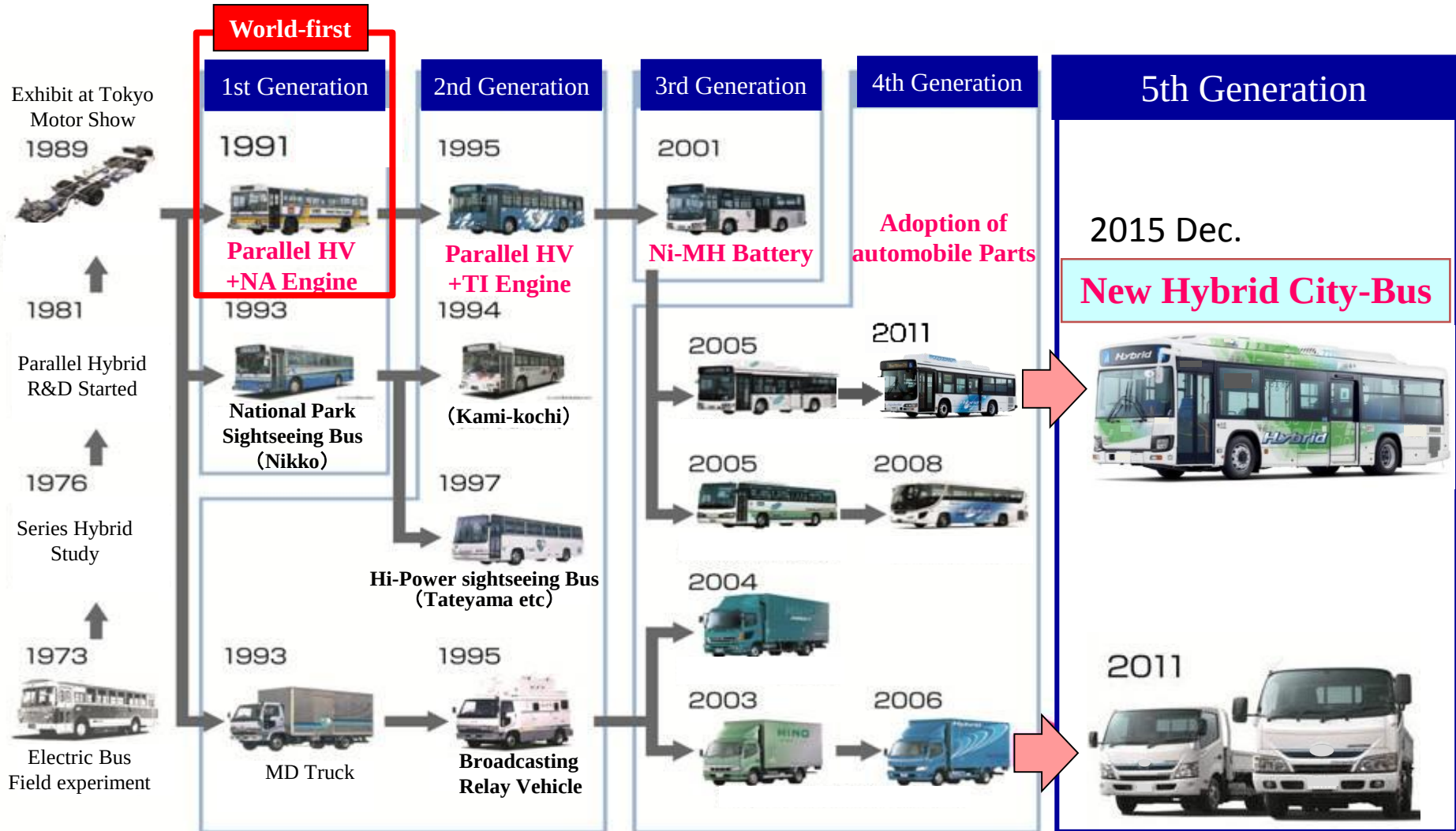
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JAPAN

- 1. Background**
- 2. Development Goal**
- 3. Development Approaches**
-hybrid system-
- 4. Development Contents**
-hybrid units ; motor, inverter, battery-
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1. Background

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History of Hybrid Vehicle Developments



2. Development Goal

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■ Fuel economy Improvement

Over 40% as compared with conventional diesel vehicle

※The unit is km/L



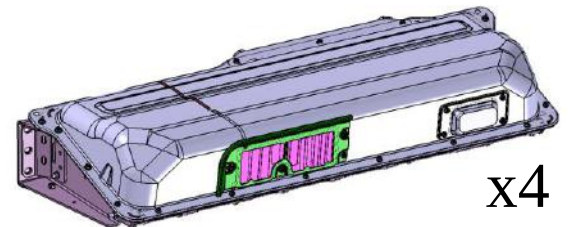
■ New Hybrid Units



E-Motor



Inverter



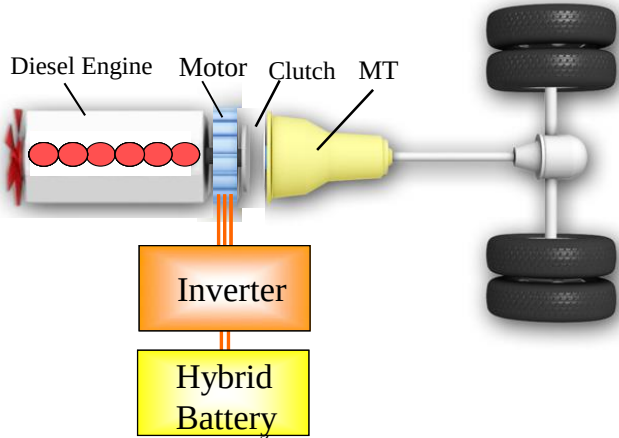
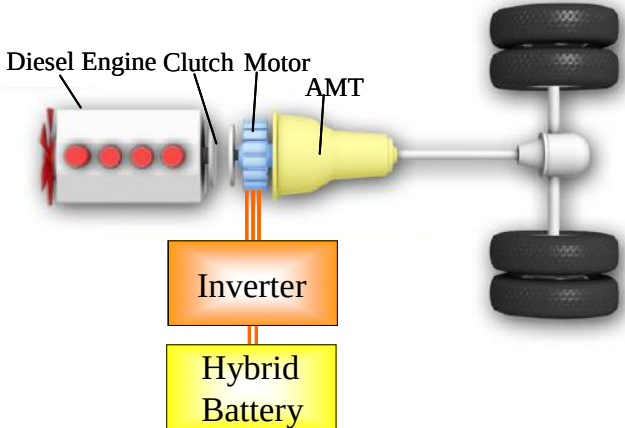
Battery

x4

3. Development Approaches

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Vehicle Specifications

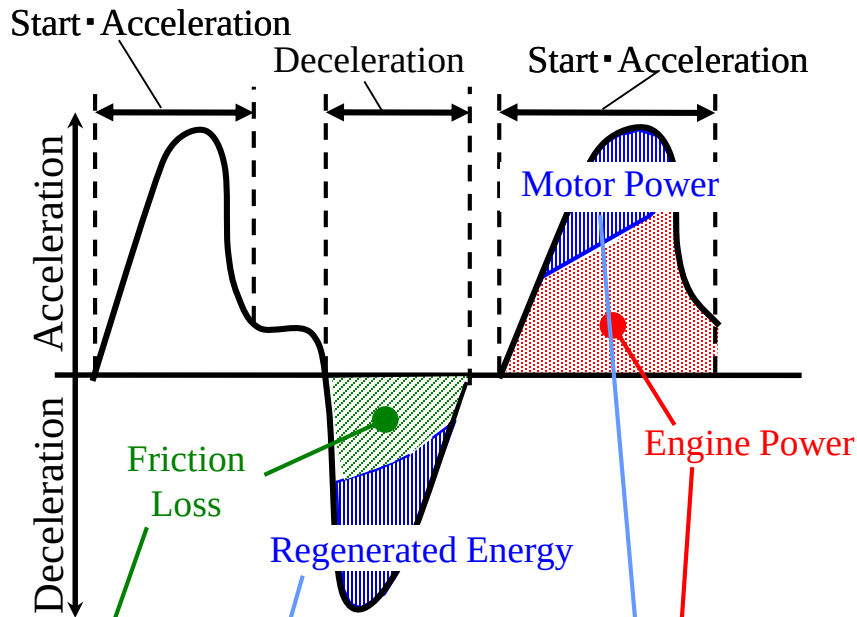
	Previous Vehicle	New Vehicle
Engine	6-cylinder inline(7.684L)	4-cylinder inline (5.123L)
Transmission	Manual Transmiion(5speed)	Automated Manual Transmission (6speed)
Vehicle Size (L×W×H mm)	10,525×2,490×3,285	10,555×2,485×3,105
Gross Vehicle Weight	15,280kg	14,365kg
Hybrid System		

3. Development Approaches

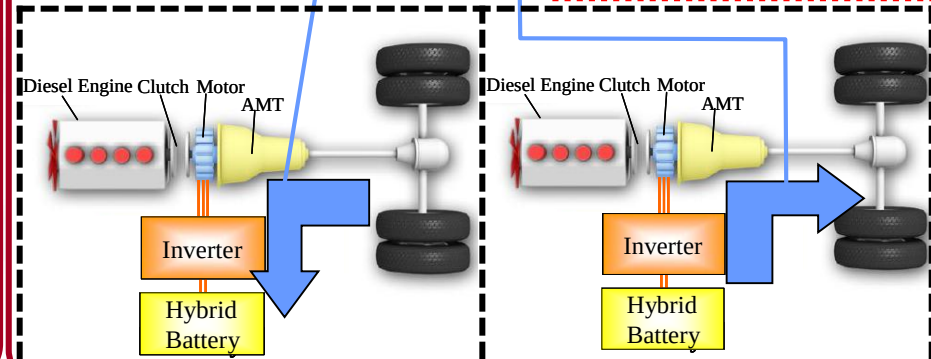
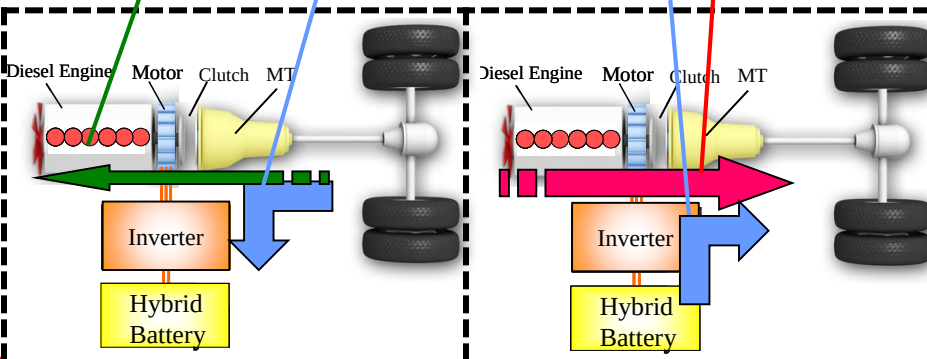
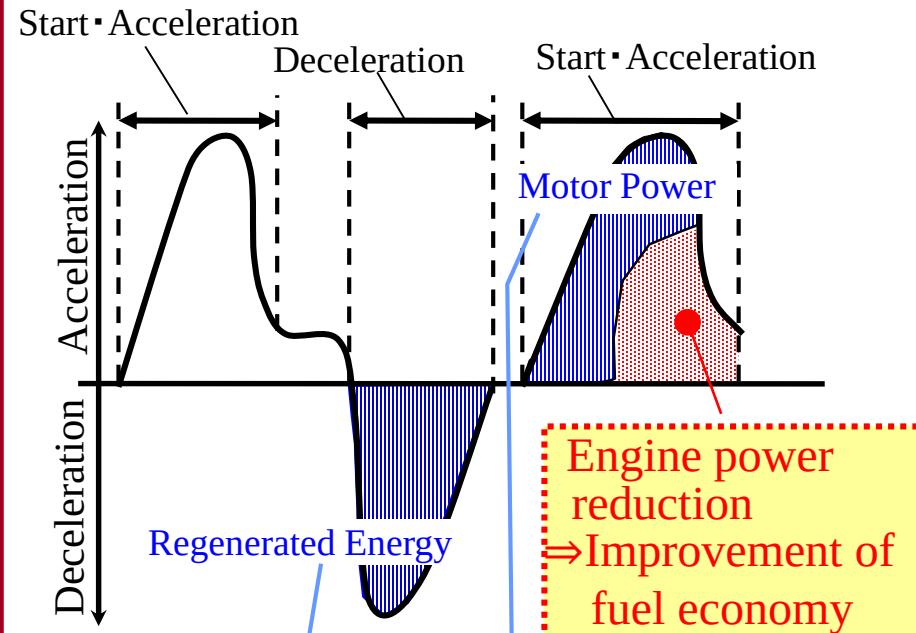
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Hybrid Operating Principle

Previous Vehicle



New Vehicle

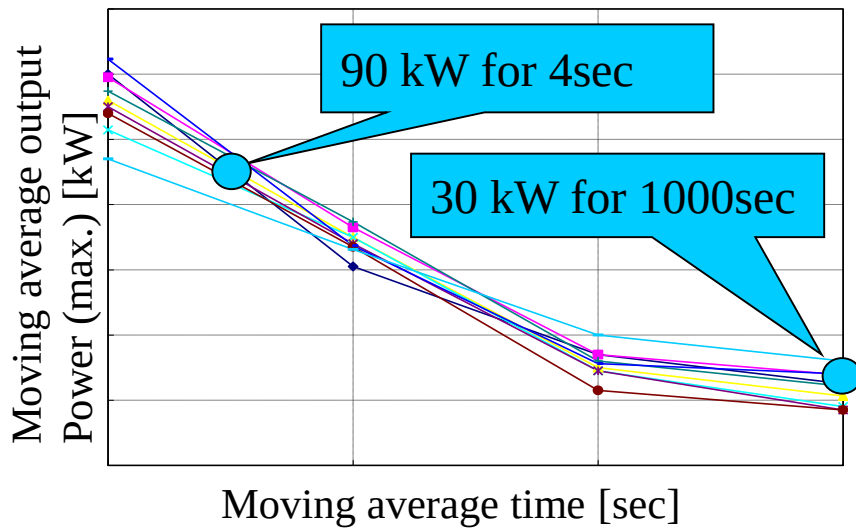


3. Development Approaches

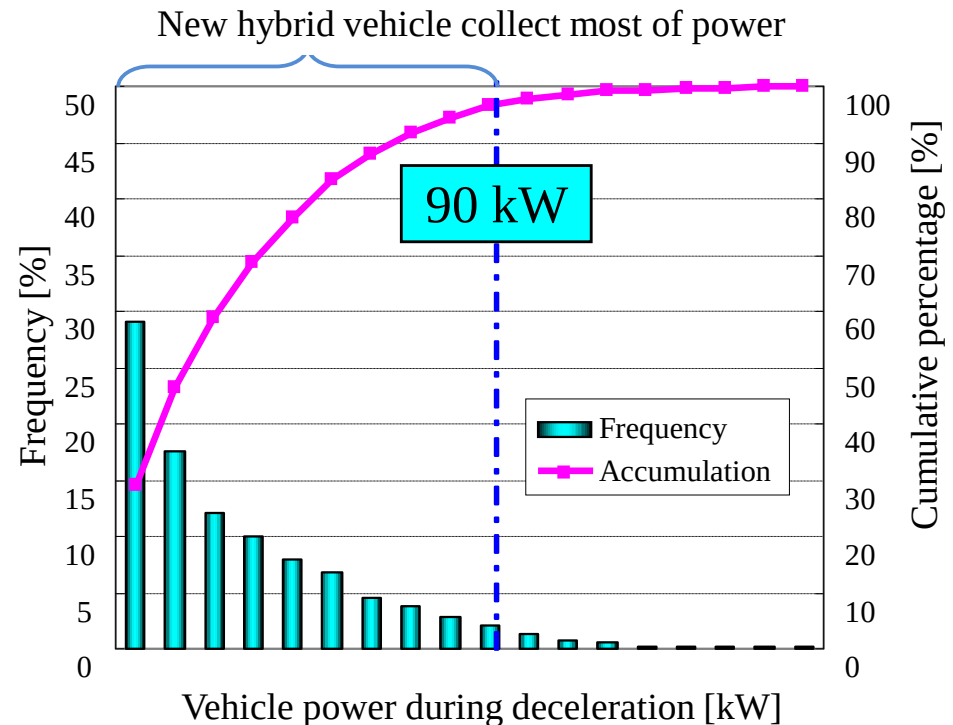
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■ Target Output Power of Units

Moving average
output power of
vehicle during acceleration



Frequency of
vehicle power
during deceleration

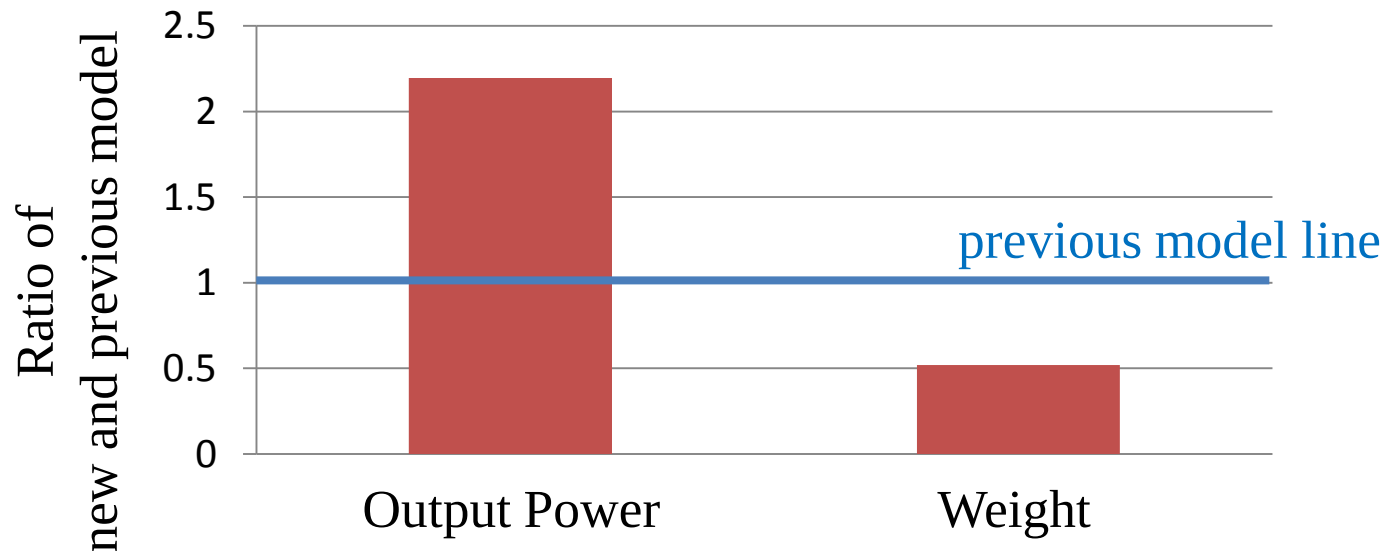


4. Development Contents

■ Motor Specifications

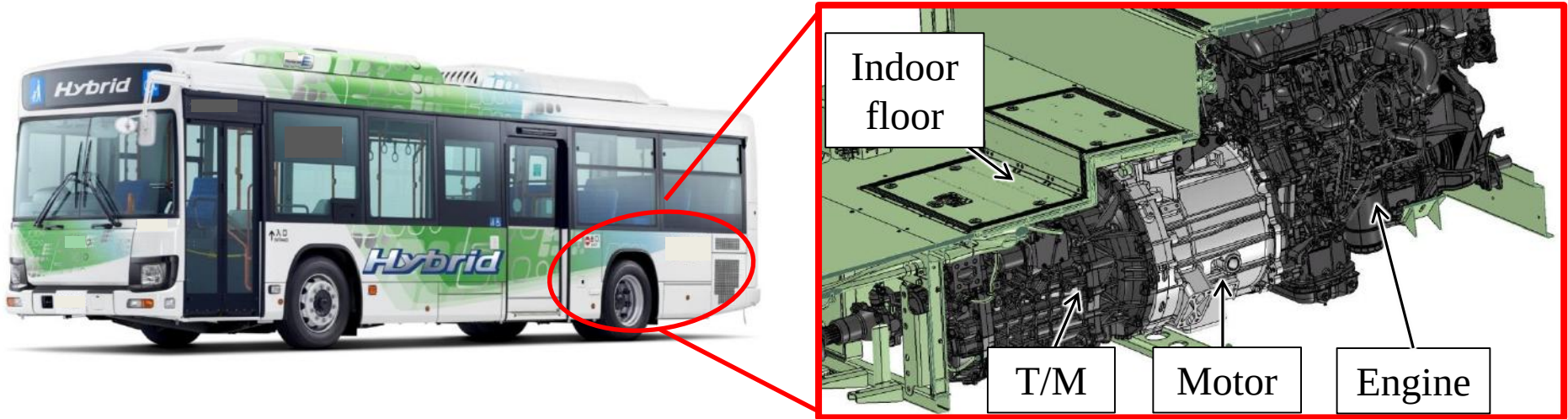
		Previous Model	New Model
	Motor Type	Induction Motor	Synchronous Motor
	Maximum Output Power	41 kW	90 kW
	Continuous Output Power	6 kW	30 kW
	Cooling System	Air	Oil

■ Comparison of Previous and New Models

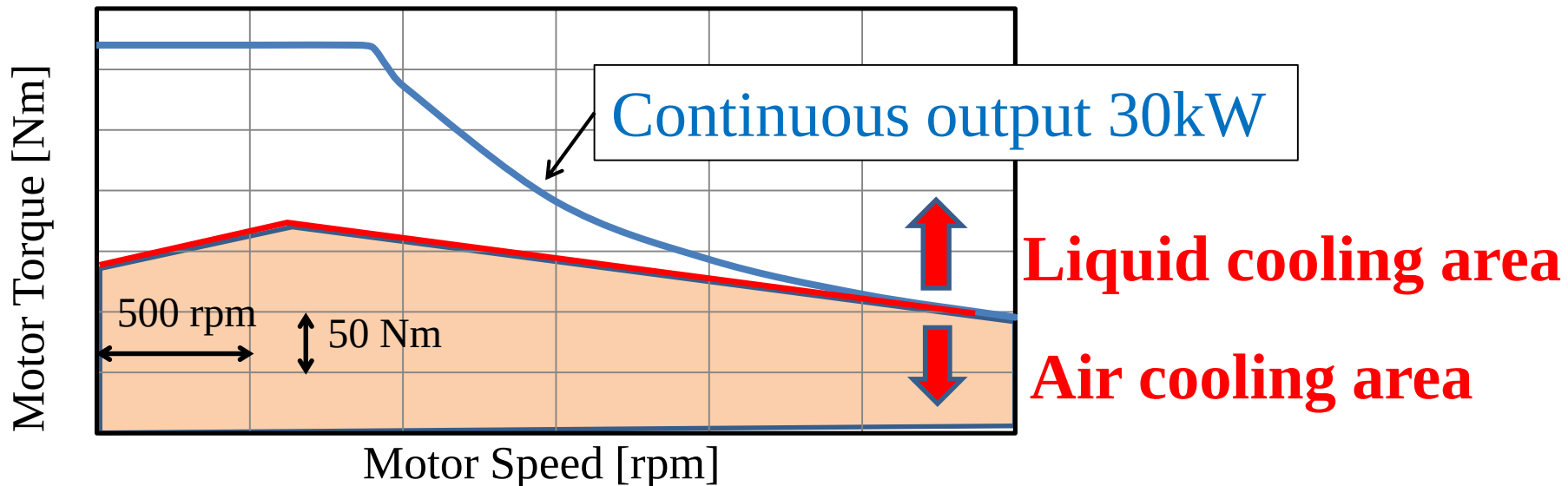


4. Development Contents

■ Motor Mounted Environment



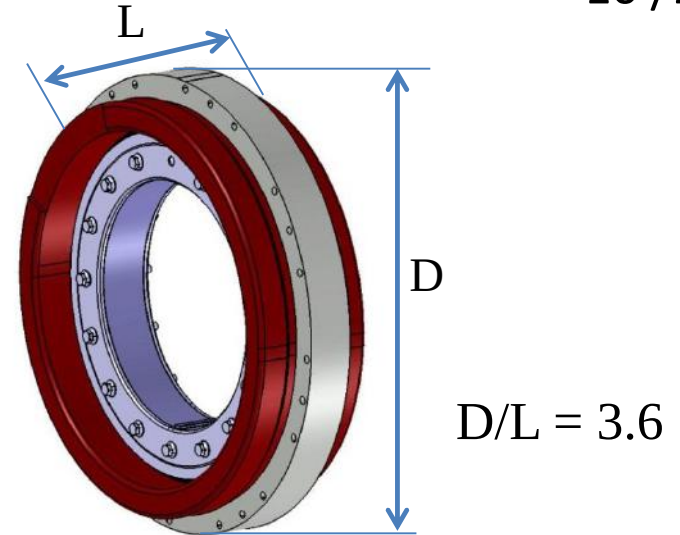
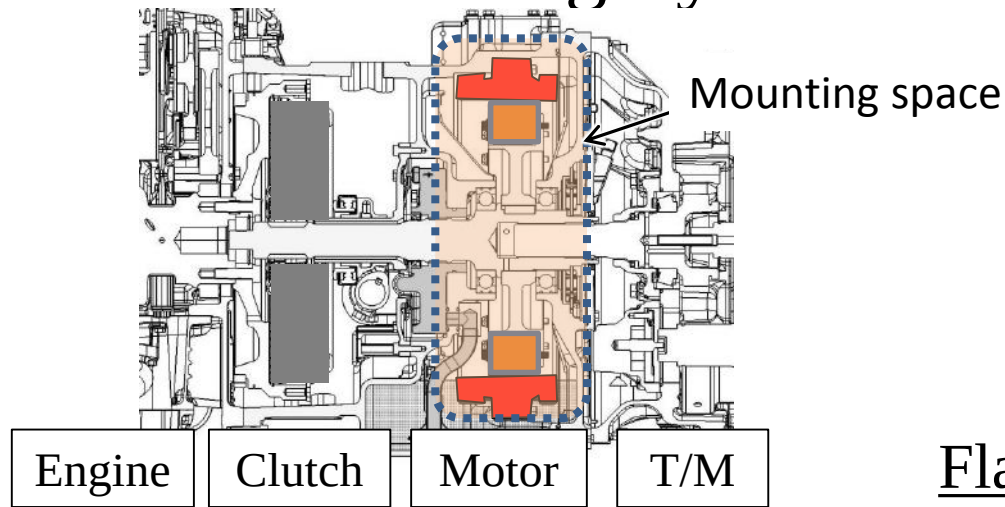
■ Motor Cooling Performance



4. Development Contents

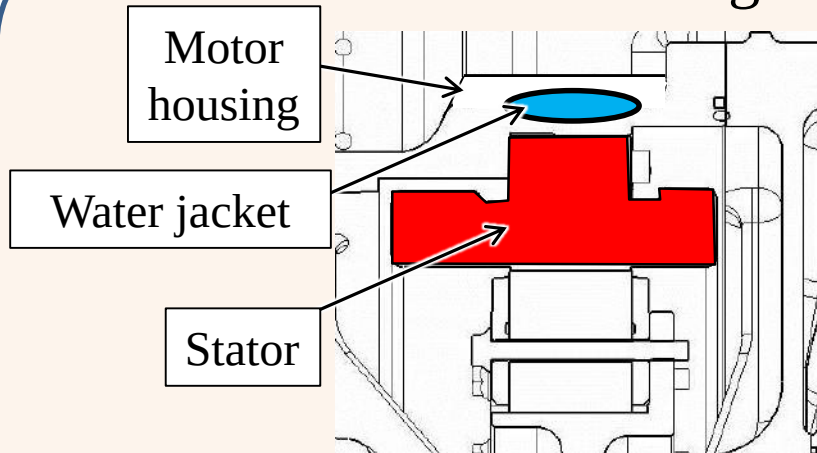
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Motor Cooling System

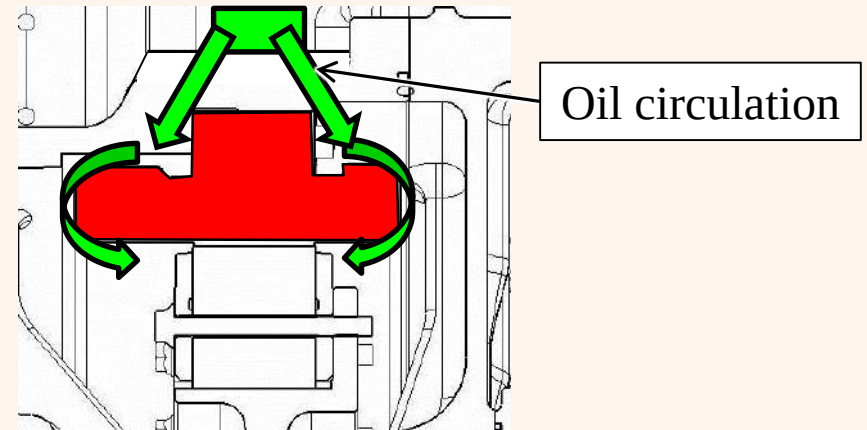


Flat large-diameter motor

Water cooling



Oil cooling

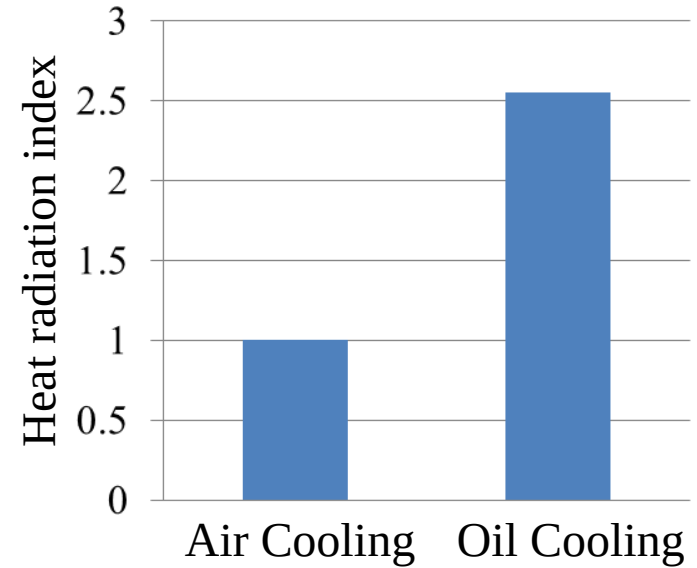
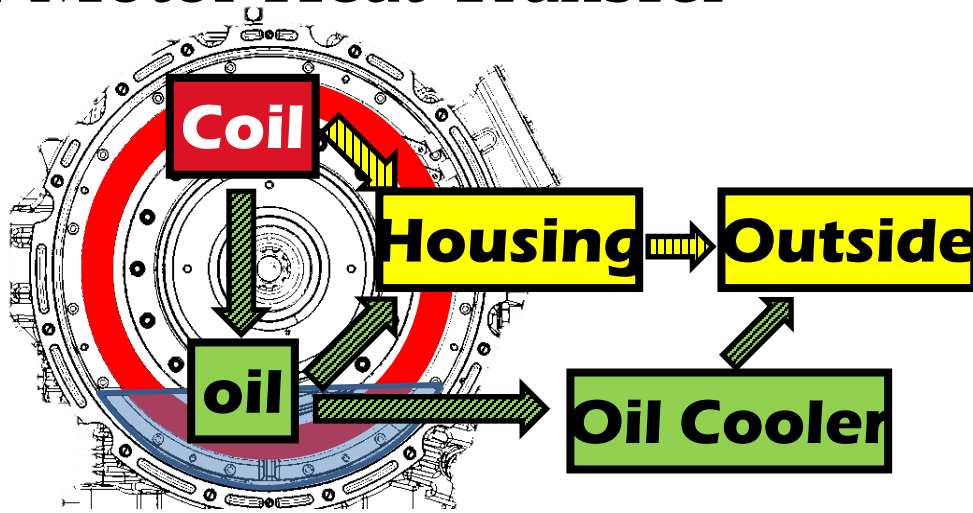


Adopted oil cooling.

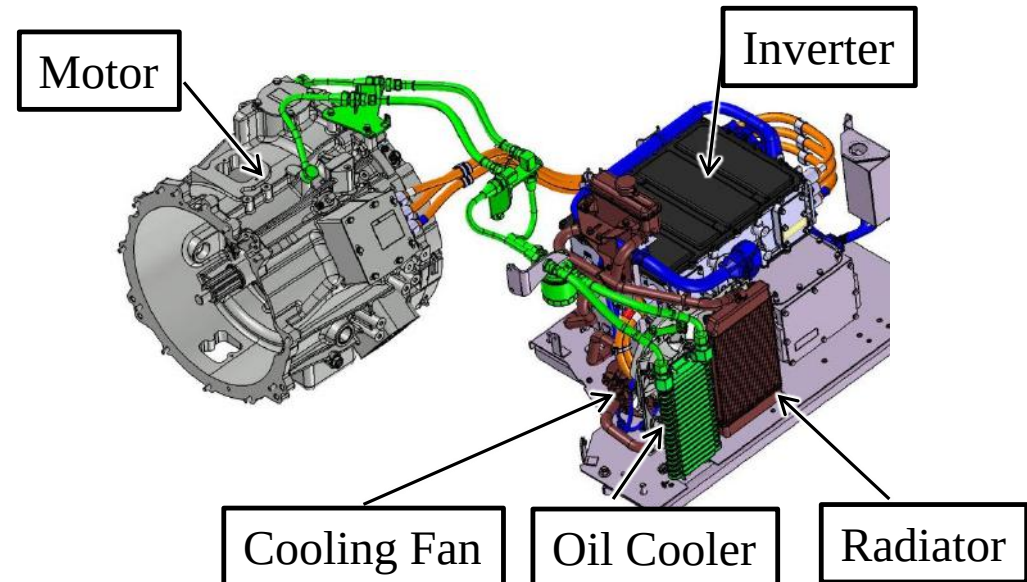
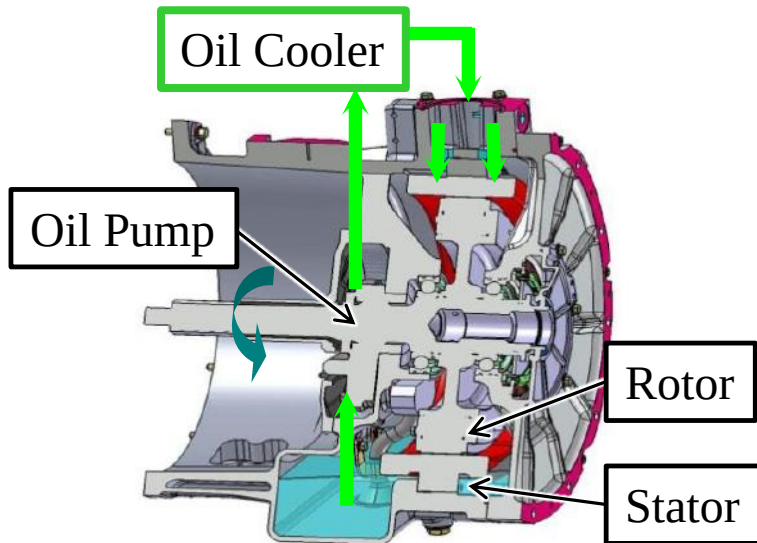
4. Development Contents

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■ Motor Heat Transfer



■ Motor Cooling Structure

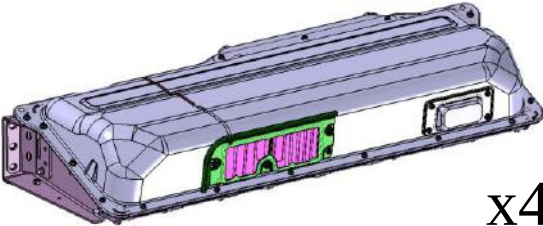


4. Development Contents

■ Inverter Specifications

		Previous Model	New Model
	Maximum Output Power	41 kW	90 kW
	Continuous Output Power	6 kW	30 kW
	Cooling System	Air	Water

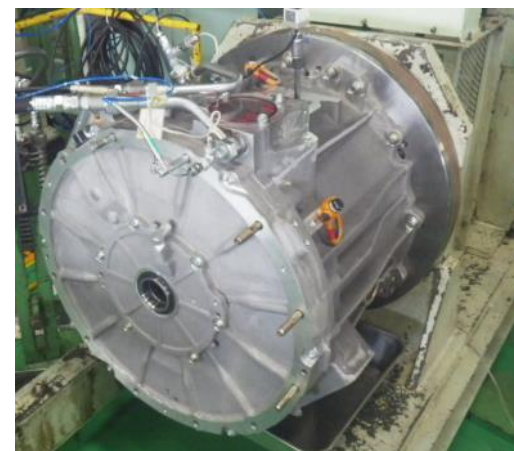
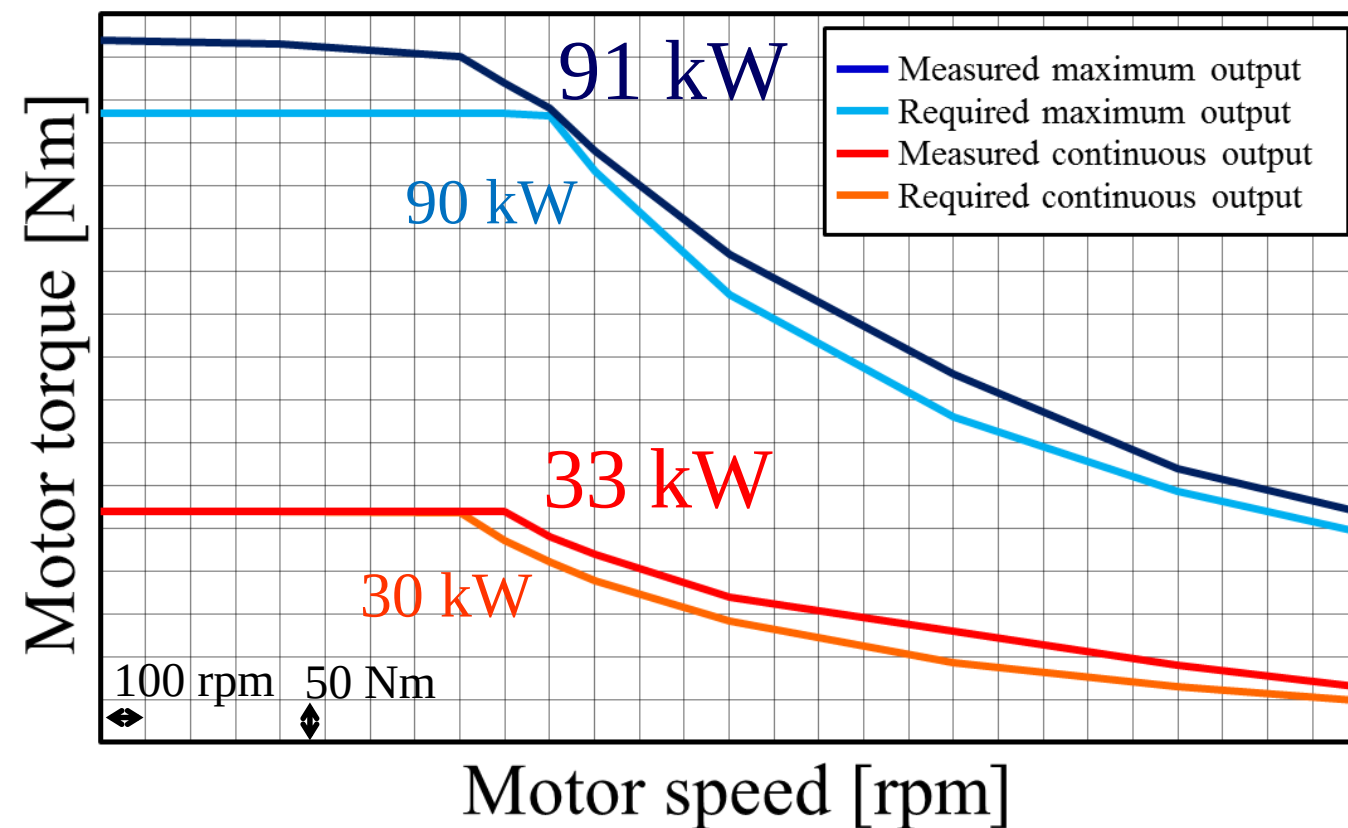
■ Battery Specifications

 x4		Previous Model	New Model
	Capacity	4.8 kWh	7.5 kWh
	Rated Voltage	403 V	288 V
	Cooling System	Air	Air

5.Result

■ Bench Test Result of Motor and Inverter

Units performance result

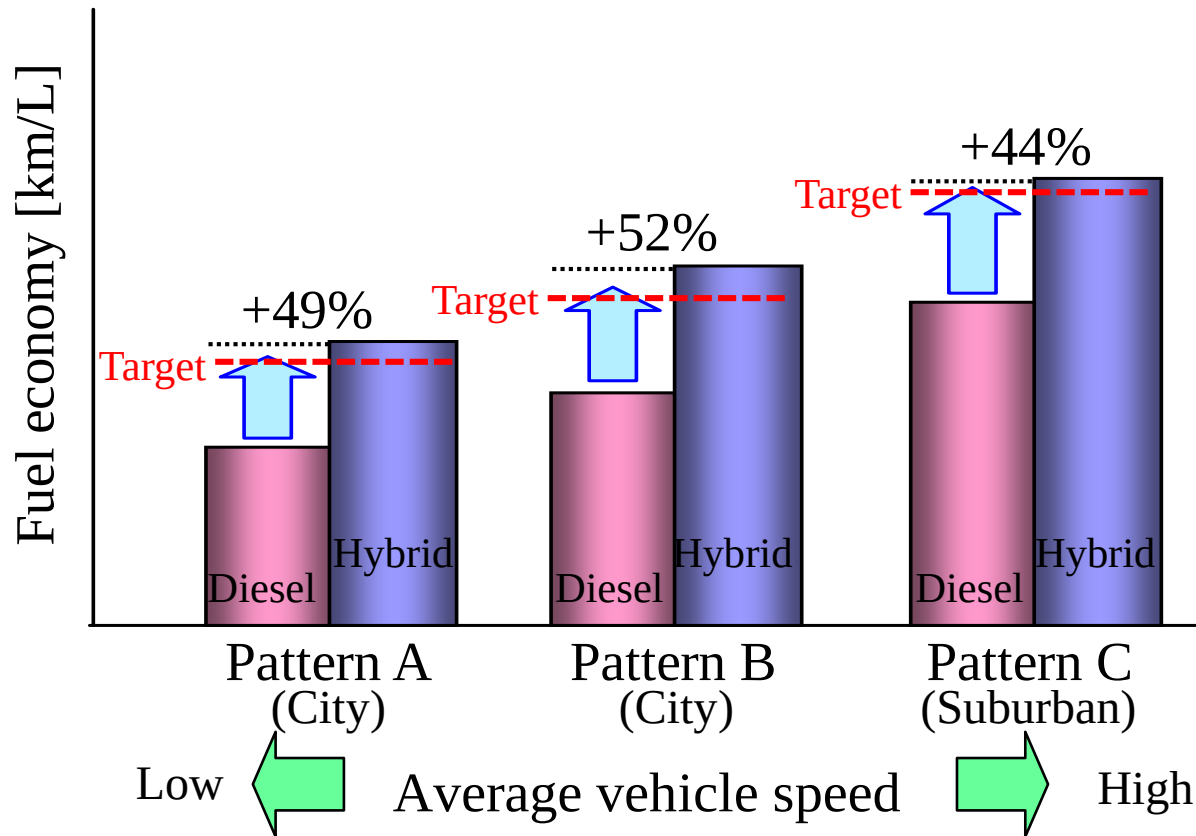


5.Result

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■ In-house Evaluation Results

Fuel economy



Test results achieved the development goal.

5.Result

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■ Demonstration Test Results

Fuel economy

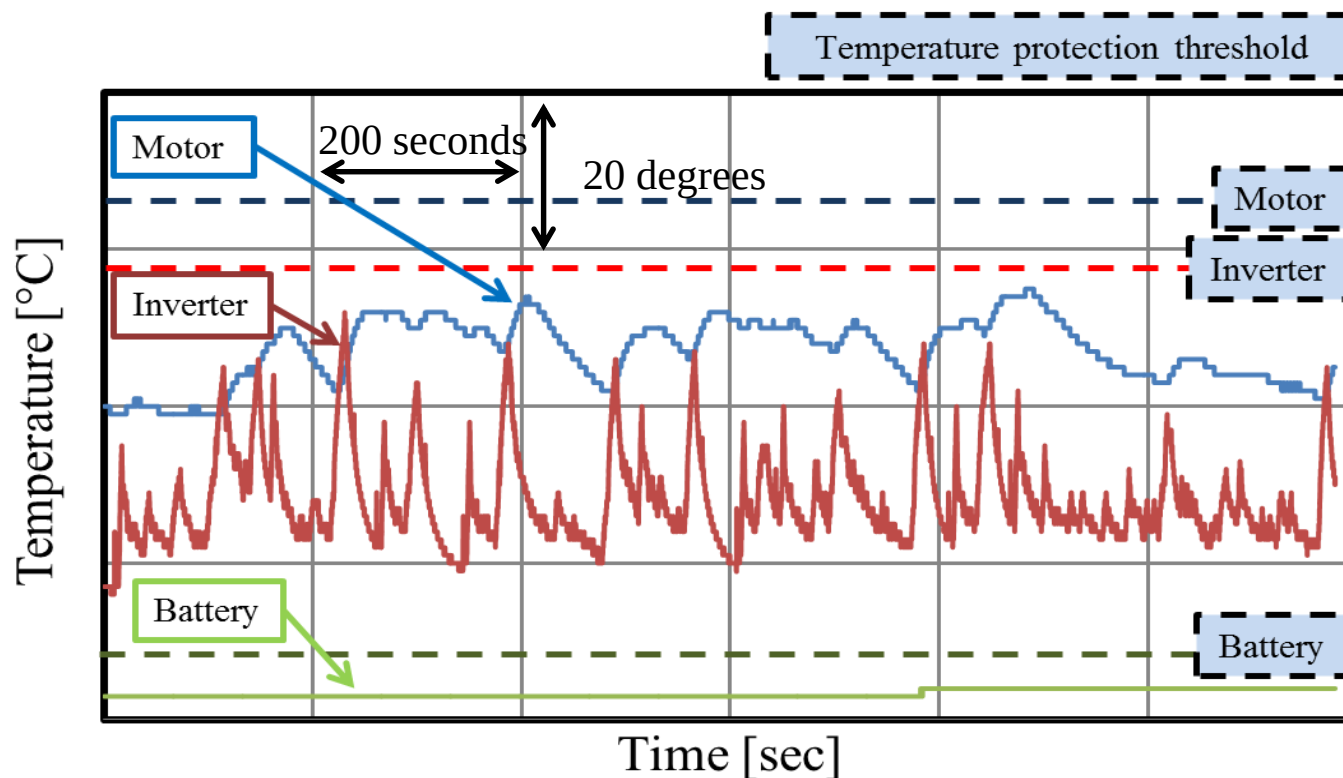


Test results achieved the development goal.

5.Result

■ Demonstration Test Result

Units cooling performance result



6. Conclusion

- We developed new hybrid units for heavy duty hybrid city bus.
- The new hybrid bus achieved 40% fuel economy improvement as compared with conventional diesel buses.
- We continues to develop commercial hybrid vehicles aimed at further performance improvement.

Thank you for your attention!