



Evaluation of Vehicle Performances of an Electric Bus in Service

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Introduction



独立行政法人
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NALTEC is an unique agency for

Research for type approval tests

基準策定支援研究



≫ 自動車の使用実態や技術情報を踏まえ、基準化する内容を検討し、安全環境に係る基準案を策定

Type approval

型式指定審査



≫ 試験走行路や衝突試験設備等において、型式指定に係る基準適合性審査を行うことにより不適合車両の流通を未然防止

Periodic technical inspection

自動車検査



≫ 全国93箇所の車検場において、年間700万件以上の基準適合性を審査するなど、使用過程での基準適合性を確保

Verification of recall cases

リコール技術検証



≫ 自動車の不具合事象の原因やリコール措置について技術的に検討することにより基準不適合車両を排除

NTSEL of NALTEC has researched technologies to improve environmental compatibilities of heavy duty vehicles.

Reduction of both pollutants and energy consumption remains as the important issues of the environment protection.

Electrified Heavy Duty Vehicles

Plug-in Hybrid Electric Truck



Hybrid Electric Bus with Inductive Power Supply System

Hybrid Electric Truck with Electric Super Charger System



Advanced Fuel Heavy Duty Vehicles

LNG



DME



FTD



Hydrogen



Electric Bus

Electric vehicles demonstrate an environmental compatibility because they do not emit exhaust gas.

On the other hand, heavy duty electric vehicles are not predominant in comparison with light duty vehicles.

This presentation reports performances of the electric bus which provides **long service length by supplemental charging** between services.



Agenda

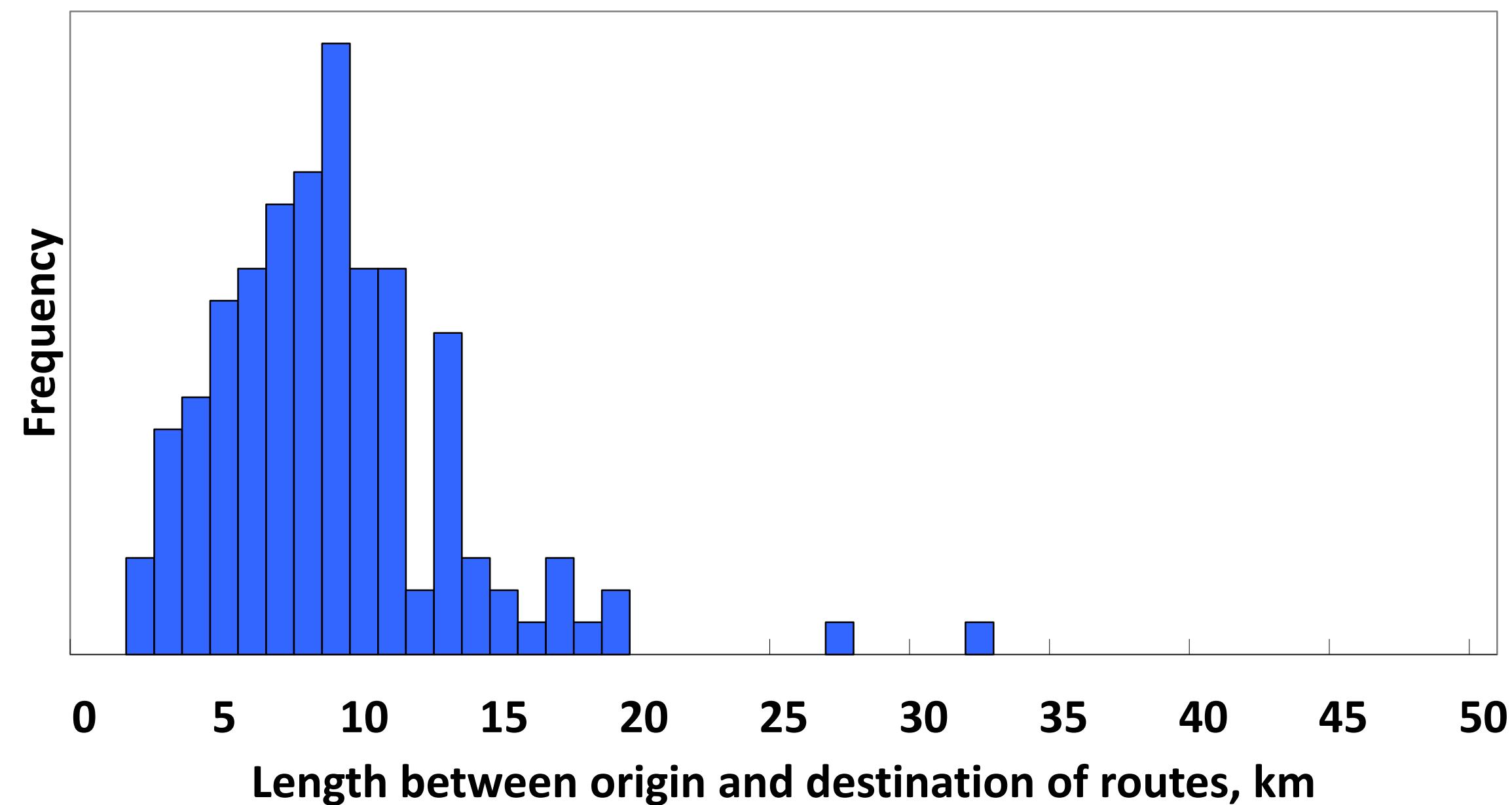
1. Outline of the Electric Bus and Service Sites
2. Measured Results
3. Issues on Electric Bus
4. Conclusion

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1. Outline

Heavy duty electric vehicles have possibilities on some applications, such as **route buses** and refuse collection vehicles.



The distribution has a peak below 15 km.

However, at least 100 km of range of an electric bus will be demanded for route bus applications.

Figure 1: Frequency distribution of length between origins and destinations of route buses

Route buses need to be designed to provide sufficient services for people who might have difficulties on traffic.



For instance, low and flat floor is usual as passenger-friendly design.

However, such design approach limits spaces to install large batteries. Providing 100 km of range under actual traffic conditions is very challenging.

Concept of the Electric Bus:

- Installing basic passenger friendly technologies
- Providing at least 100 km of range
- With supplemental charging between services



Table 1: Specification of the Electric Bus

Parameters	Value
Number of Passengers	67 (includes 1 driver)
Weight	11,560 kg
Maximum Speed	85 km/h
Battery Pack	621.6V / 150 Ah / 93.24 kWh
SOC(State Of Charge)	10 – 90 %
Window	In normal operations
Usable Electric Energy	74.6 kWh In normal operations
Estimated Range (with JE05 Mode)	100 km

Sites of Services

Kitakyushu-city



Satsumasendai-city



Japan



Tokyo

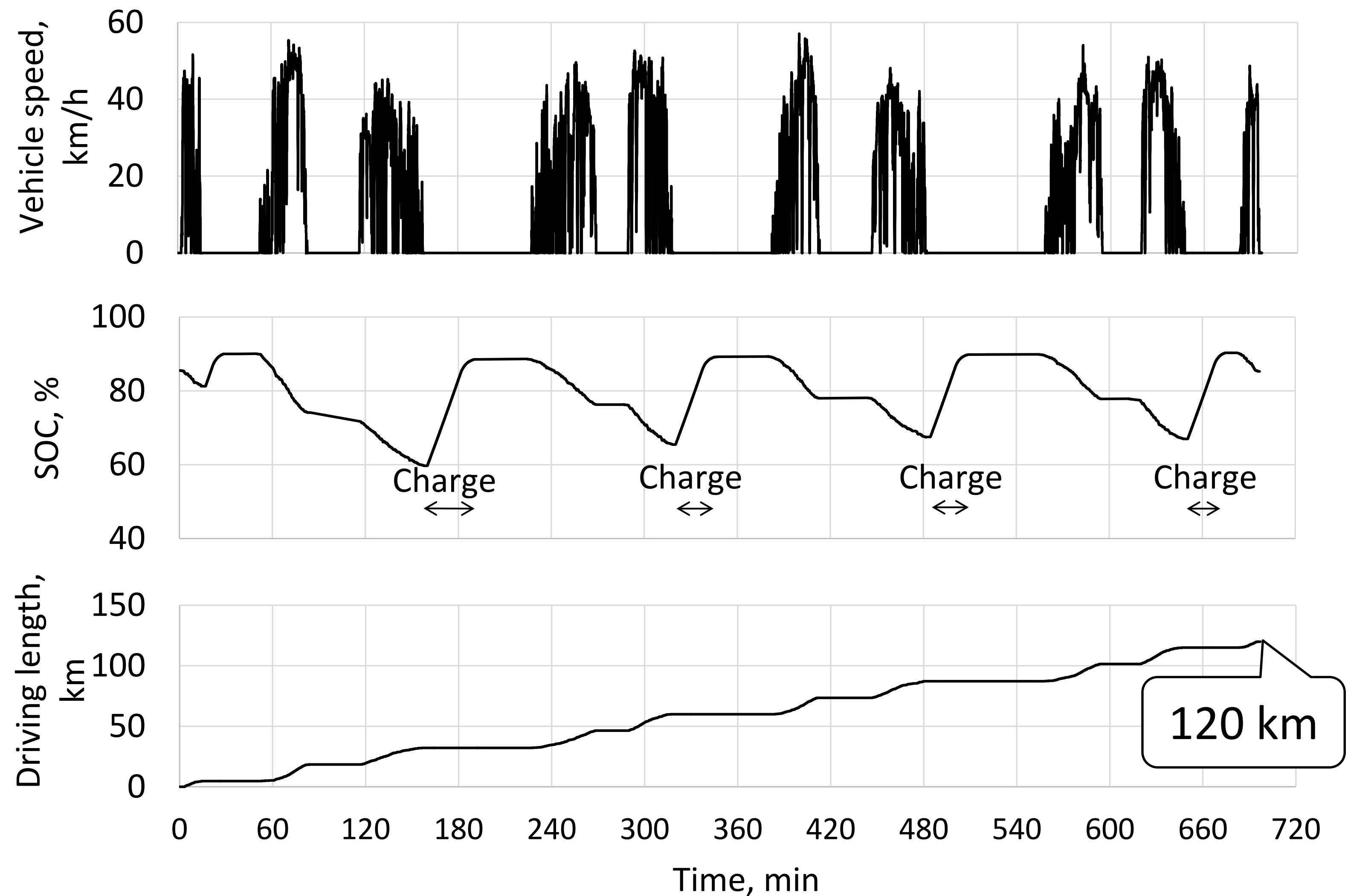
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2. Results

➤ Drive Length of All Day

In this service schedule, 120km drive length per day was delivered inserting several supplemental charges.

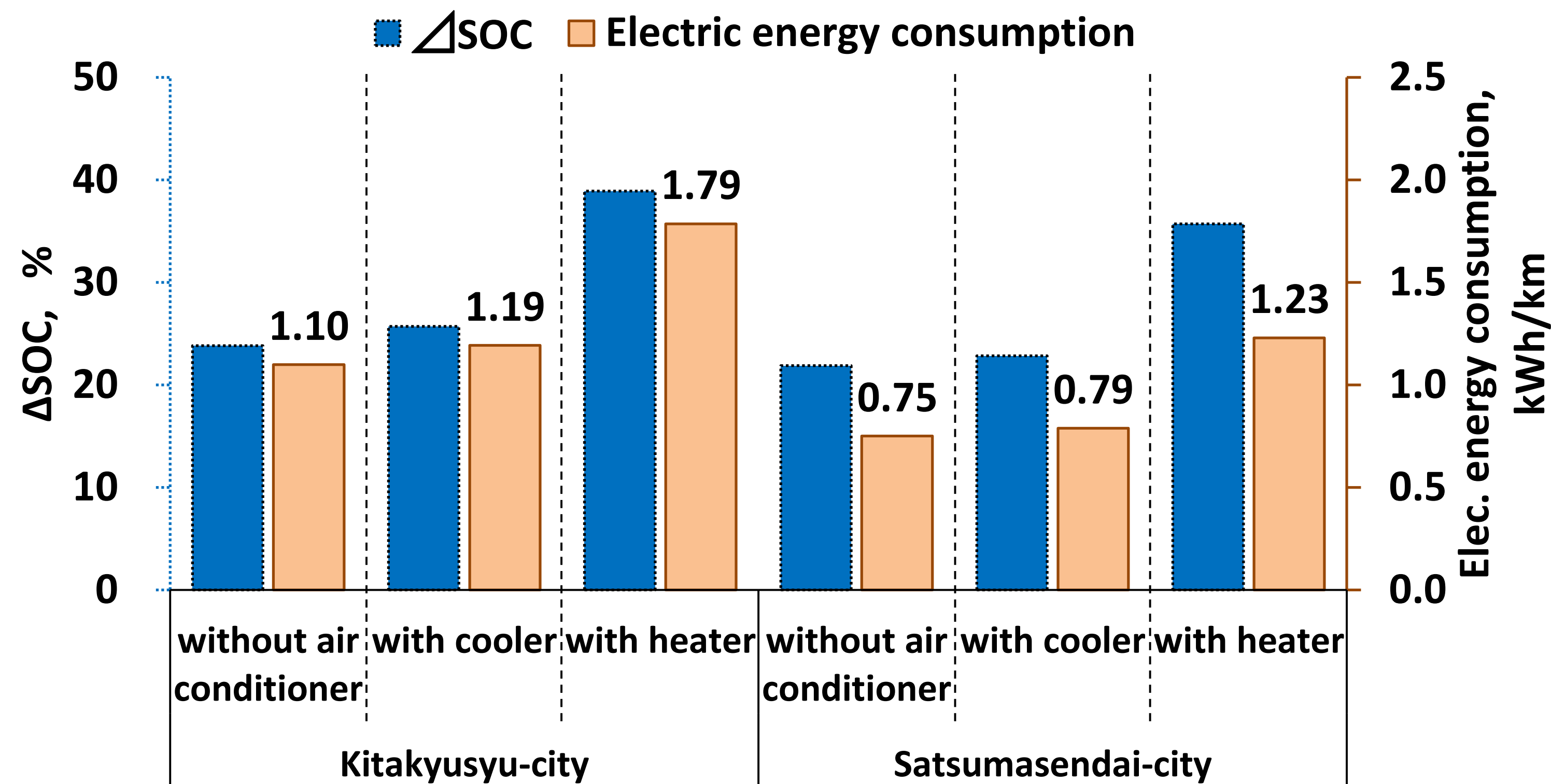


2. Results

➤ Electric Energy Consumption

Electric energy consumption in Kitakyushu-city was higher than that of Satsumasendai-city.

The regional features in each route gave impact on electric energy consumption.



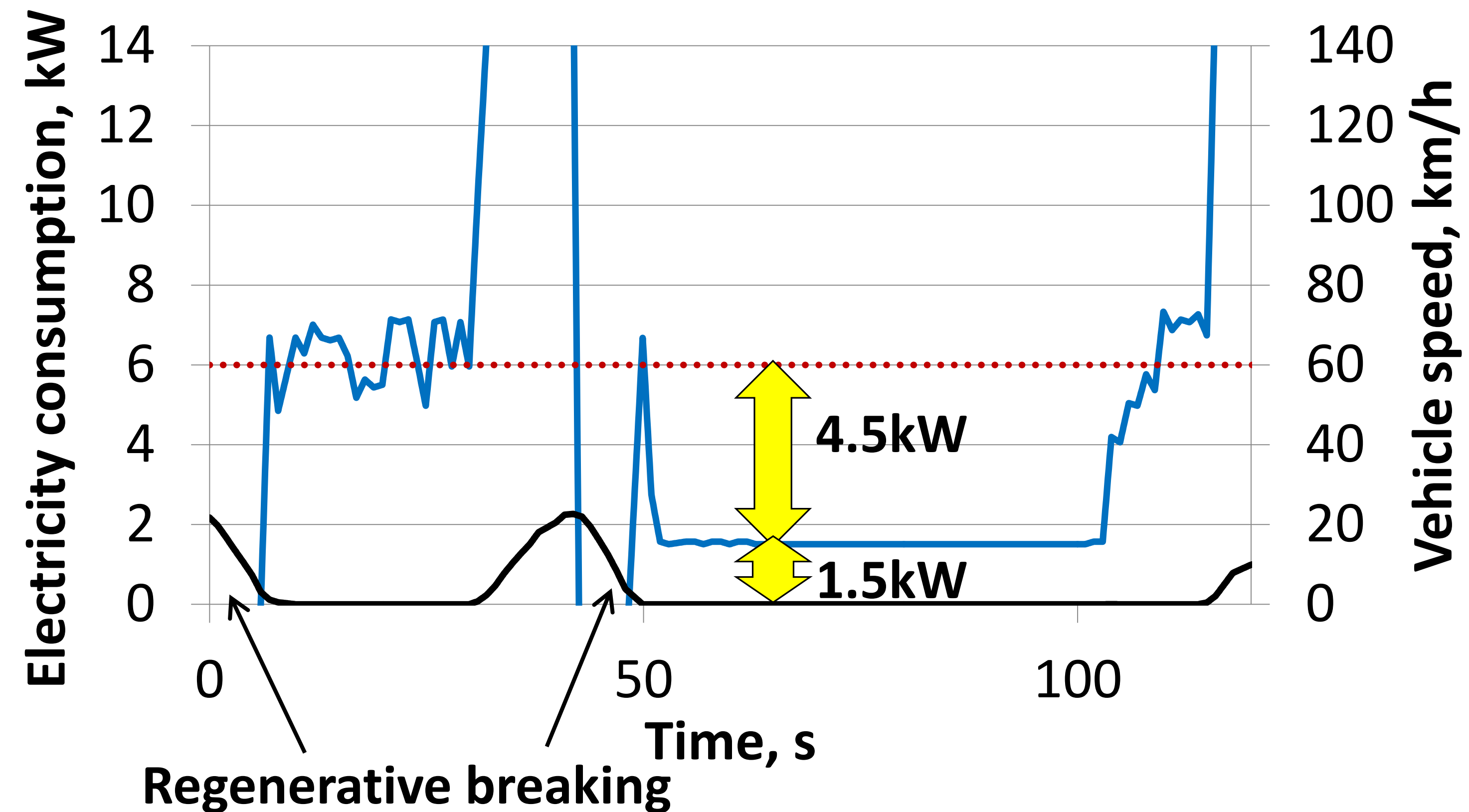
2. Results

➤ Electric Energy Consumption of Auxiliary Units

4.5 kW was consumed by the air compressor.

1.5 kW was consumed by other auxiliary units.

Around 6 kW was regularly consumed in operations without driving.



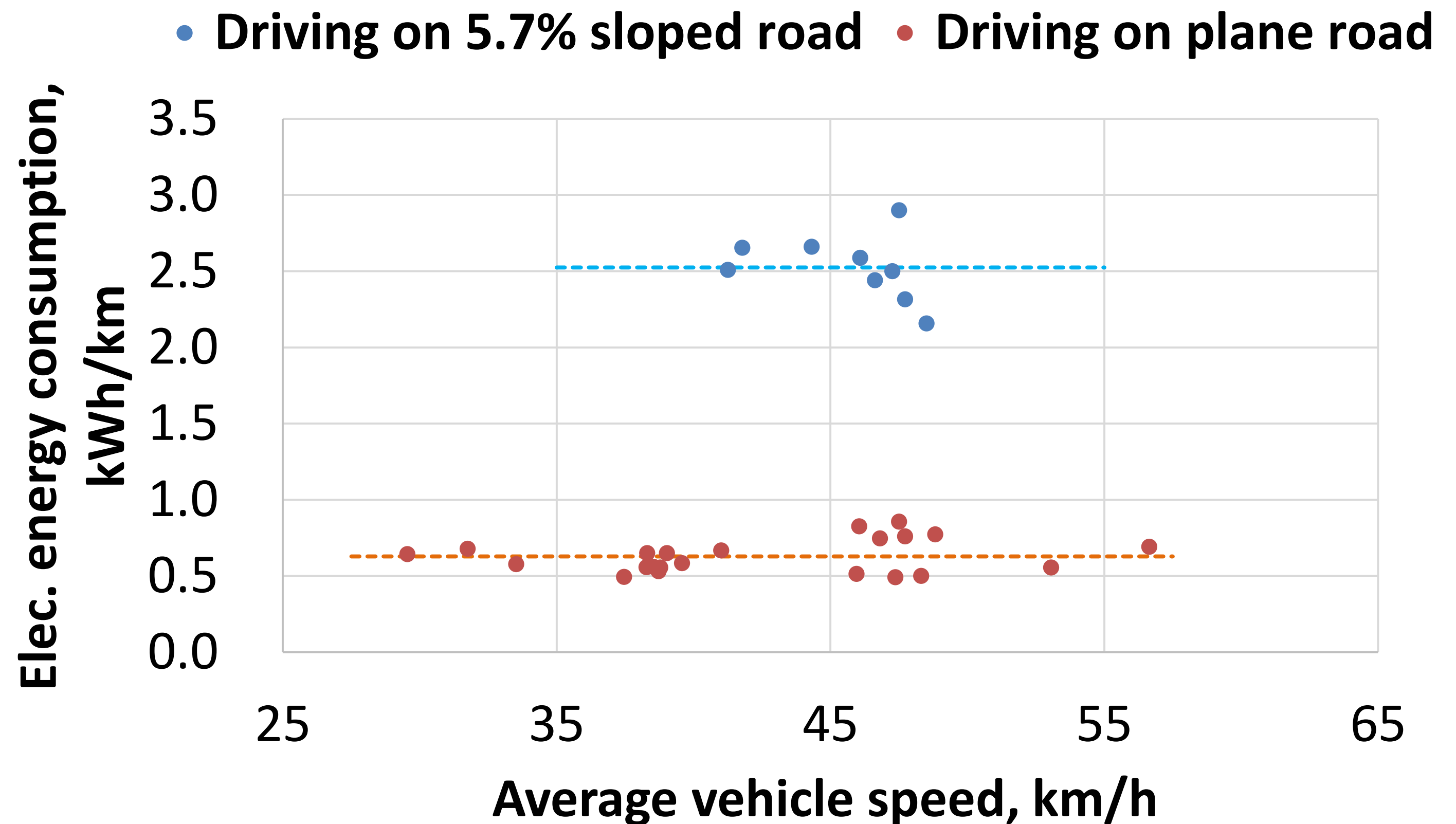
2. Results

➤ Impact of Slope

The electric energy consumption between sloped and plane road in Kitakyushu-city was investigated.

The electric energy consumption on the slope was 3 times higher than that of plane roads.

The major factor of high electric energy consumption in Kitakyushu-city was the sloped road in the route.



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3. Issues (Institutional Issues)

(from views to arrange new rules to provide user information)

Short Range:

Supplemental charges between services were needed to serve long length for all day services.

⇒Charging speed (duration) will be necessary information for bus operators.

Specific test method to measure charging speed (duration) will be necessary.

(The test method has not been available for passenger electric vehicles, yet.)

Energy Loss of Chargers:

Total electric energy consumption of the system which includes off-vehicle dedicated charger is the information which should be informed to bus operators, also.

Specific measurement of high voltage and current of the chargers should be taken carefully.

These are issues which have not been considered on vehicle test methods in Japan, yet.

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4. Conclusion

- This electric bus provided services with 120 km length in day time under the time table which was specially arranged for the electric bus with supplemental charges.
- Charging speed (duration) and electric energy consumption considering the energy loss by off-vehicle charger are necessary information for bus operators. However, no specific vehicle test procedures for these parameters are provided yet.

Thank you!



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