

**NISSAN**  
MOTOR CORPORATION

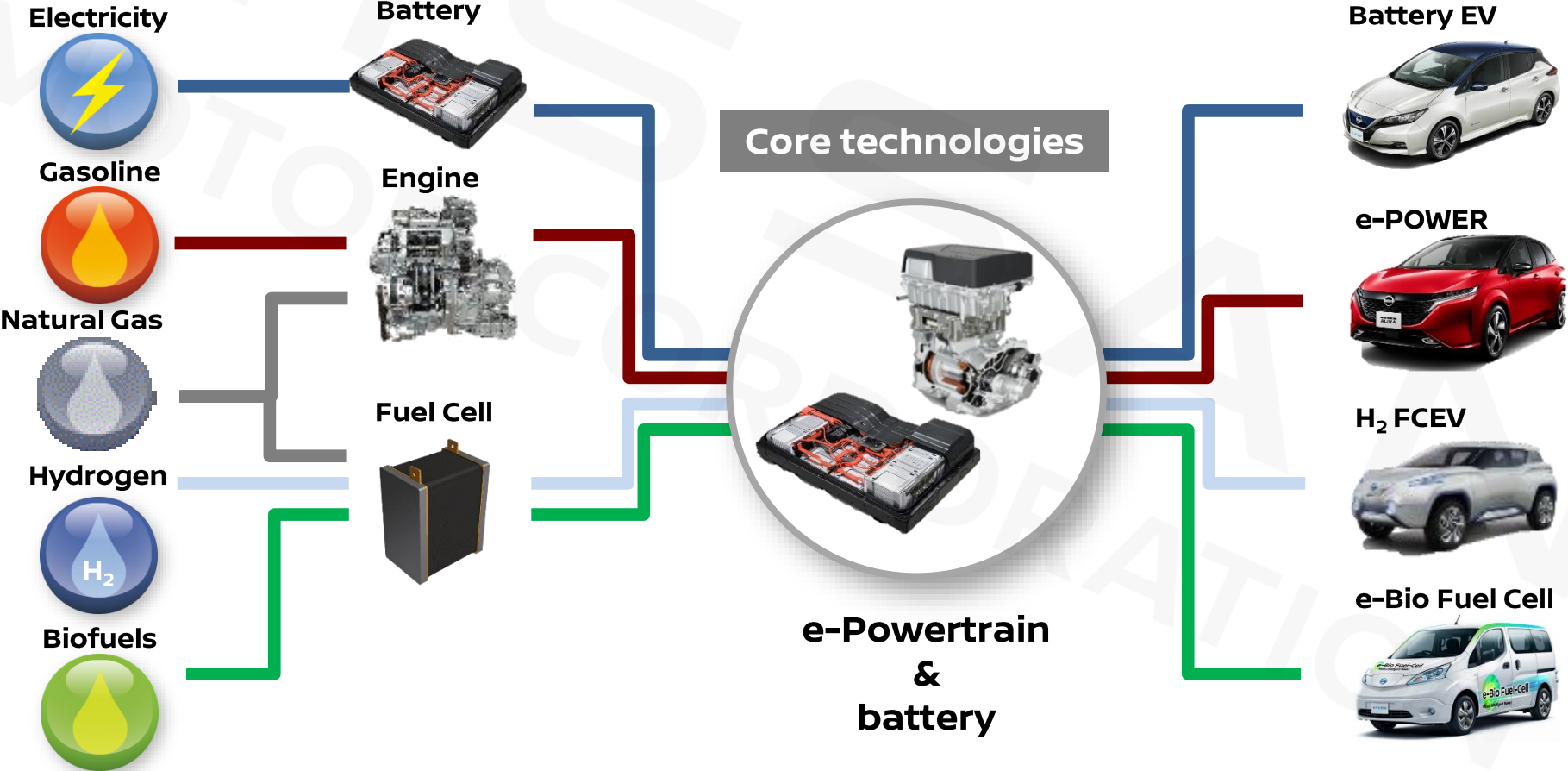
# **Technical challenges for mobility application**

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KATO, Takashi**

# EV related technology of Nissan

- Fuel diversity
- High efficiency power(generation) device for EV

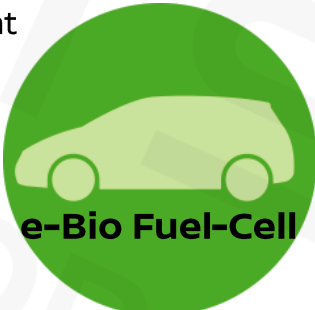


# Concept of e-Bio Fuel Cell

(In the case of Ethanol / Ethanol blended water)

## High efficiency

- Running cost equivalent to EV
- Long range



## Easy to supply

- Short refueling time
- Low infrastructure constraints
- Safe fuel (ethanol-blended water)



## Carbon neutral cycle

## Clean

- Exhaust as clean as atmosphere



Sugarcane



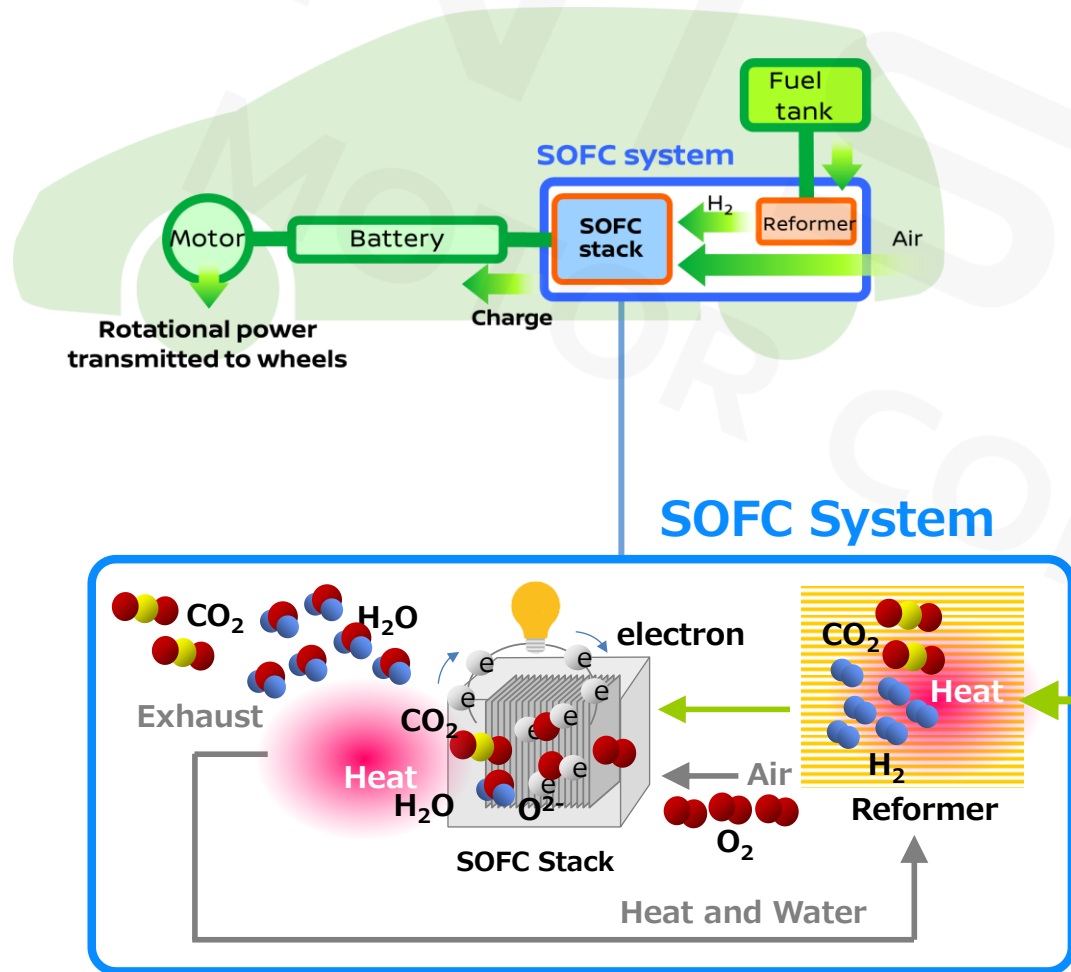
100% ethanol

Ethanol-blended water

# SOFC-EV for CO<sub>2</sub> reduction

- SOFC accepts ethanol / CNG and has potential for CO<sub>2</sub> reduction

- Produces hydrogen from fuel through reforming reaction
- Generates electricity through electrochemical reaction
- Reuses exhausted heat for reformation  
→ High efficiency



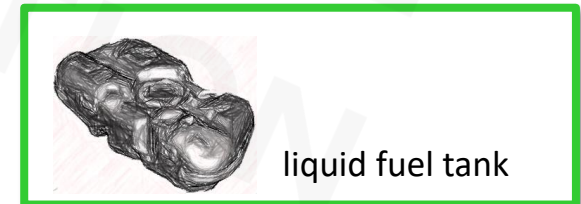
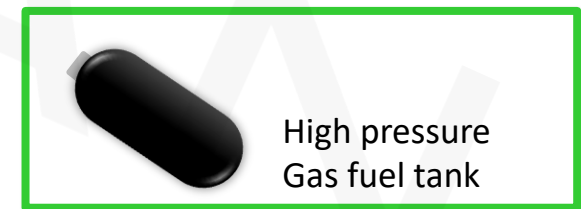
Fuel



or



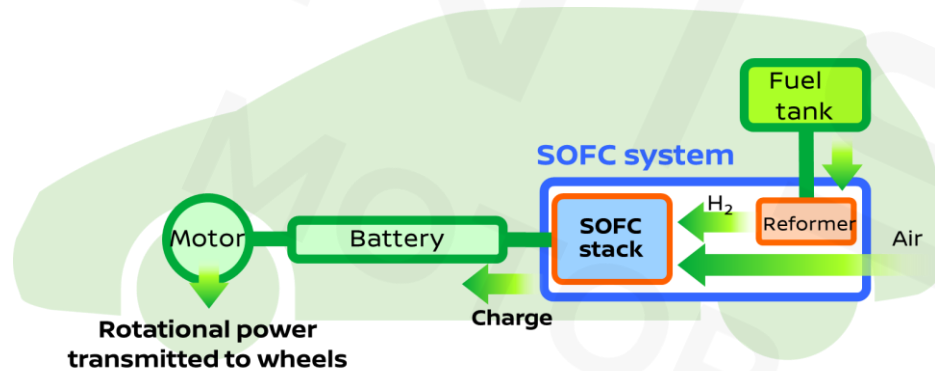
Tank



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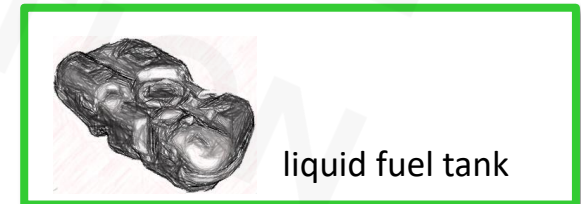
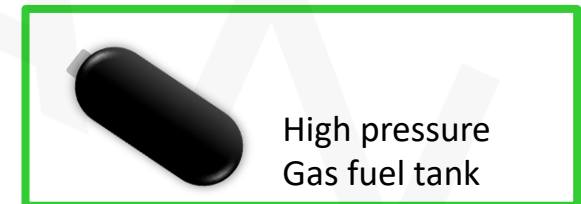
Fuel



or



Tank





# Prototype vehicle

- “Needs for automotive SOFC” and “People’s acceptability” were learnt through Prototype vehicle



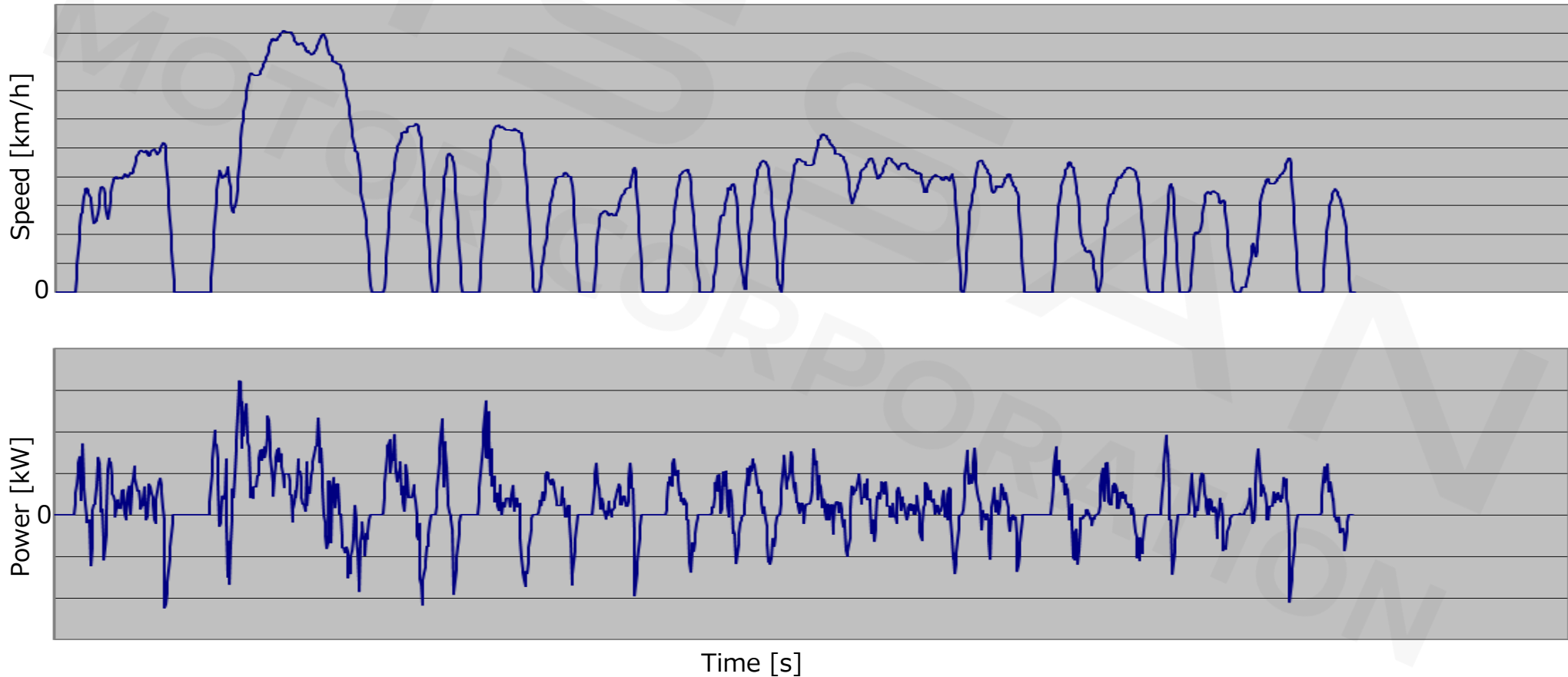
Specifications of research prototype vehicle

Features	Specs.
Base vehicle	e-NV200
Battery Capacity	24kWh
Powertrain	Electricity 100% Ethanol
Fuel tank capacity	30L
SOFC power	5kW
Driving range	Over 600km

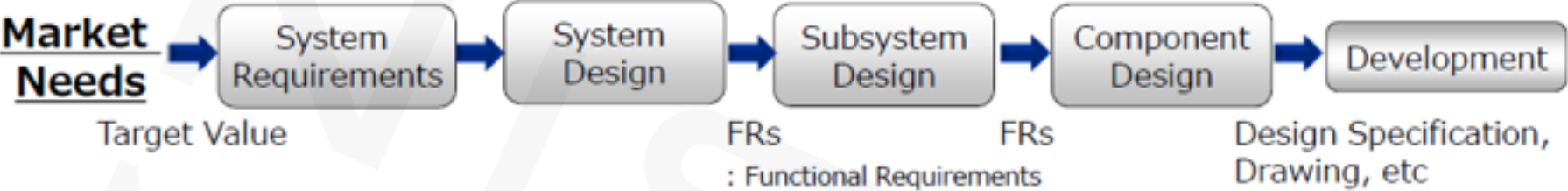
Note: specifications are for Nissan’s research prototype vehicle, and are subject to change.

# Vehicle system requirement

- Required variable speed and load operation
- Combination of SOFC with moderate power and battery as a power source is a possible candidate



# System Requirement to cell specifications



based on ISO/IEC 26702

Target Value
WTW CO <sub>2</sub> reduction
Fuel consumption
Possibility of High-speed cruising

System Requirements	
Fuel	
Rated Power	
Weight	
Volume	
Start-up	Time
	Energy
Efficiency	
Durability	At rated power
	Cold Start
	Hot Start

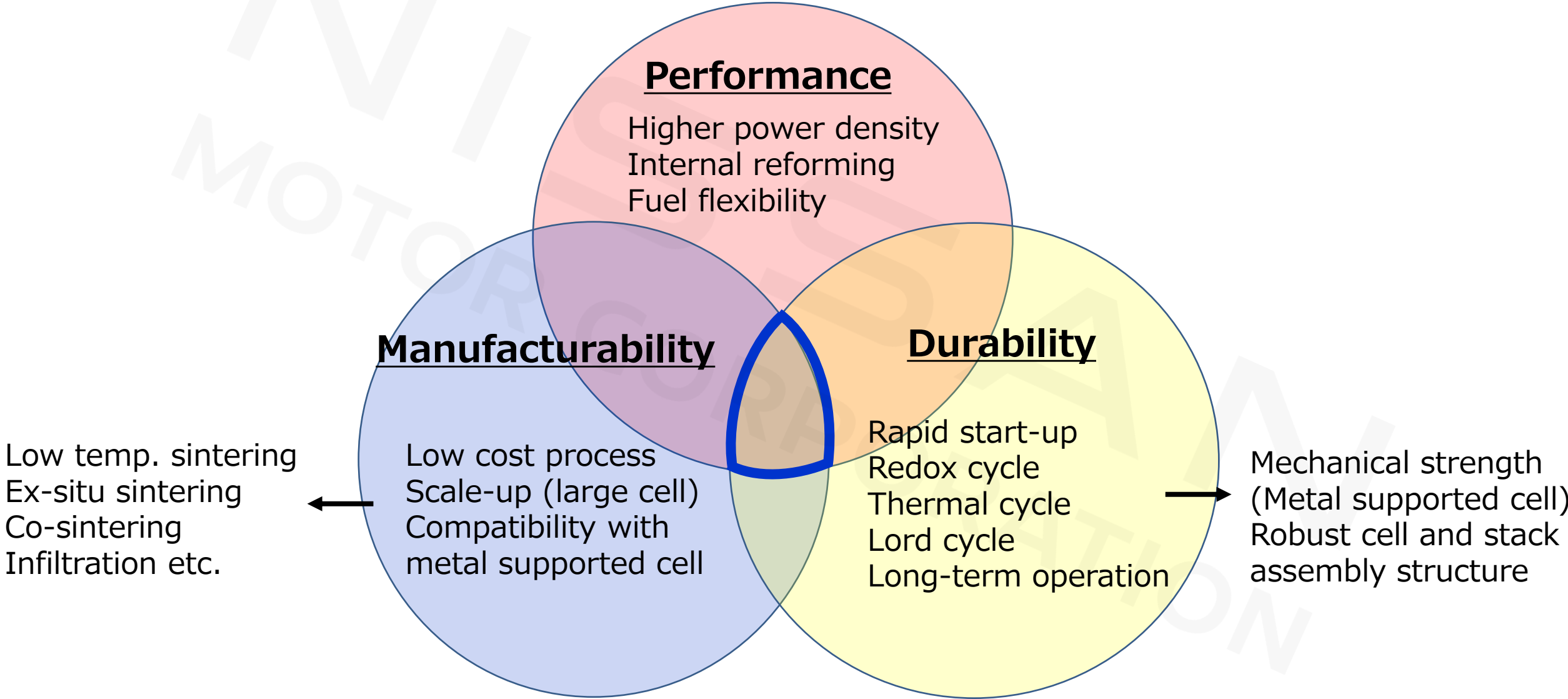
Stack	
Gross Power	
Volume	
Pressure Drop	
Start-up	Time
	Energy
Reformer	
Volume	
Conversion ratio	
Start-up	Time

Cell
Performance
Strength

- High power density
- Mechanical strength



# Requirement for Automotive SOFC



# Requirements

- Larger power density
- Cell performance at low temperature (600 deg.c)
- Stack structure with low calorific capacity
- Stacking technologies for low ASR
- Highly reliable sealing technologies
- Manufacturing process achieving flatness for large scale cell
- Highly catalytic activity and efficient supporting process
- High performance of thermal insulator
- Durability against vibration