
MULTIPATHWAY
WORKSHOP

I am Nakajima of Toyota Motor Corporation.

Thank you for attending the Multi-pathway Workshop today.

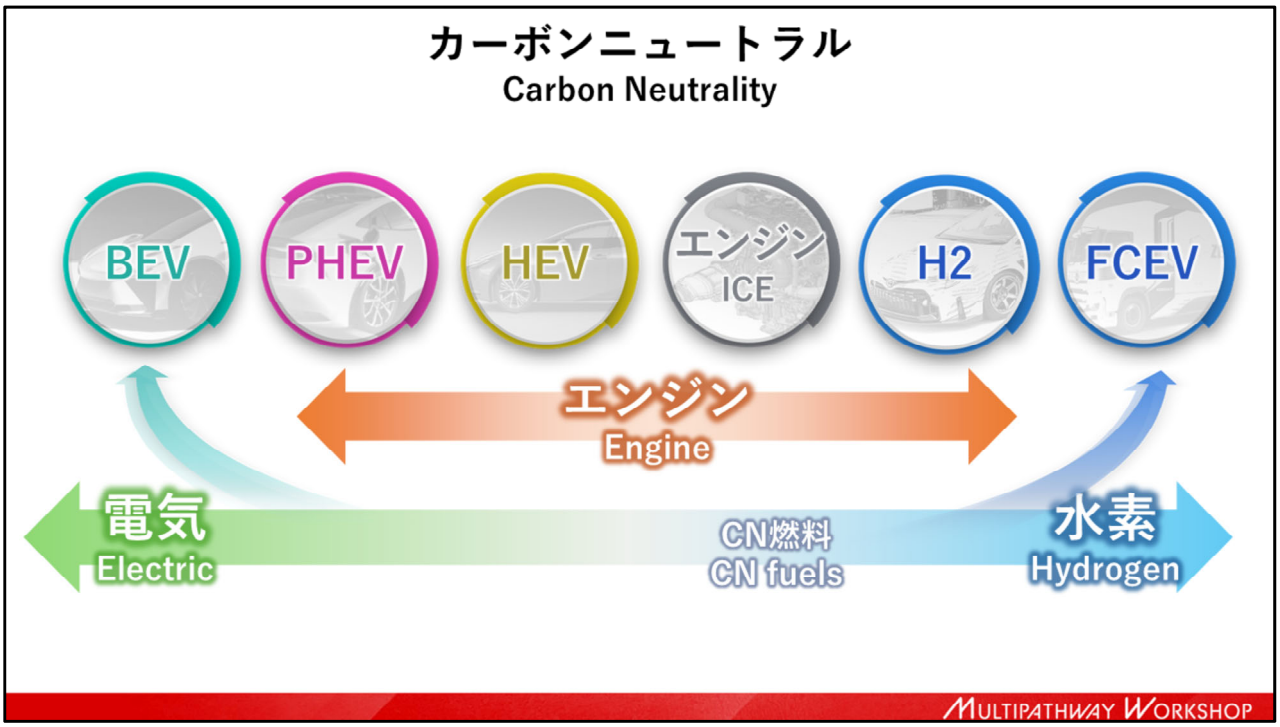
I would like to elaborate more on Engine ReBorn, which President Sato explained earlier in his presentation.

This vehicle is the BEV LF-ZC, which we unveiled at the Japan Motor Show last year.
By downsizing the low-height battery, motor, A/C, and other components, we were able to achieve more flexible vehicle packaging.

There is no doubt that BEVs are an important piece of the puzzle on the path to carbon neutrality.

In the same way, we are developing hydrogen engines that do not emit carbon dioxide while driving.

The Corolla on the left was the first vehicle in the world to run on liquid hydrogen fuel in a Super Taikyu race last year in Japan.
Using what we learned from the race for the practical application of hydrogen engine technology, we conducted a driving demonstration on Australian public roads at the end of last year, using the commercial HiAce on the right.

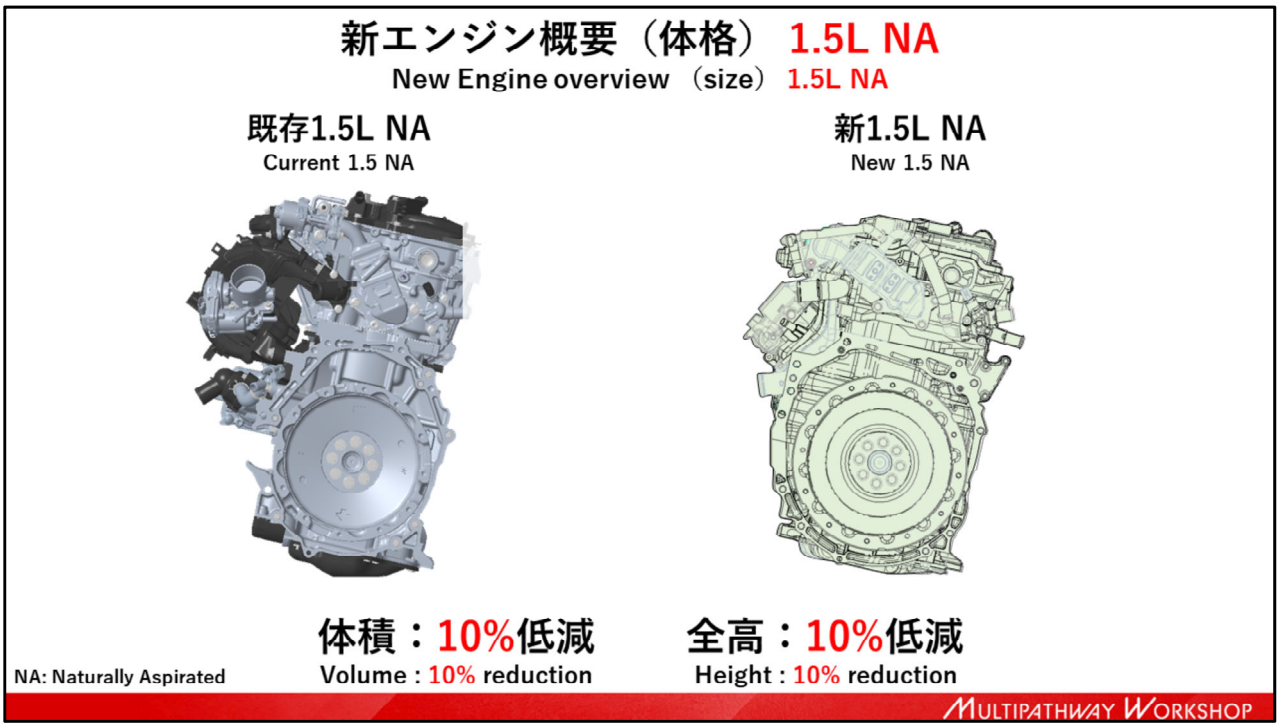


In the future, we believe electricity and hydrogen will be the main sources of energy, and BEVs and FCEVs will become mainstream. However, considering the current energy situation in each country, engine-based solutions such as PHEVs and HEVs are still important.

In addition, yesterday four companies, Idemitsu Kosan, ENEOS, Mitsubishi Heavy Industries, and Toyota announced they have started studying the introduction and spread of carbon-neutral fuel.
This expansion of carbon-neutral fuels will make further options possible.

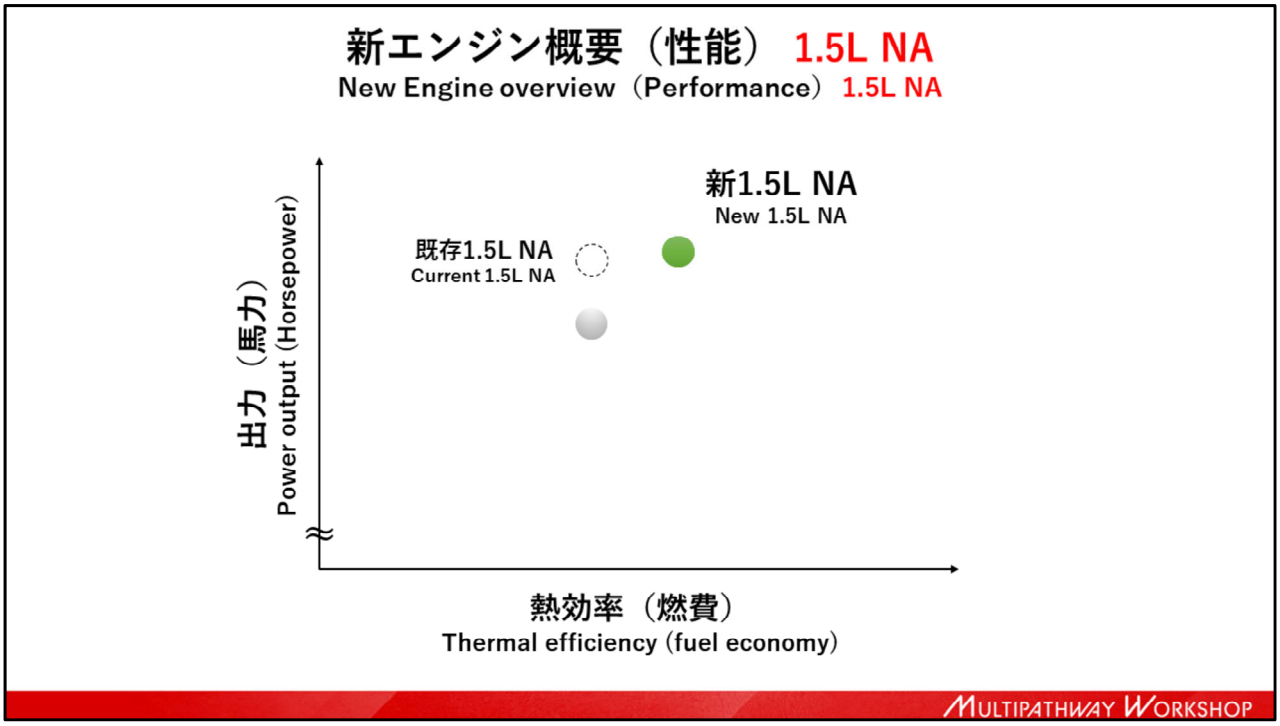
At the Tokyo Auto Salon in January of this year, driver Morizo sent out the messages that “The enemy is carbon!” and “We will keep the fire of the engine going.”

In response to Morizo’s thoughts, I would like to explain the details of the newly reborn engine.



The concept is a compact, high-efficiency, high-output engine that is designed to be electrically powered.
Furthermore, it will be compatible with various carbon-neutral fuels.

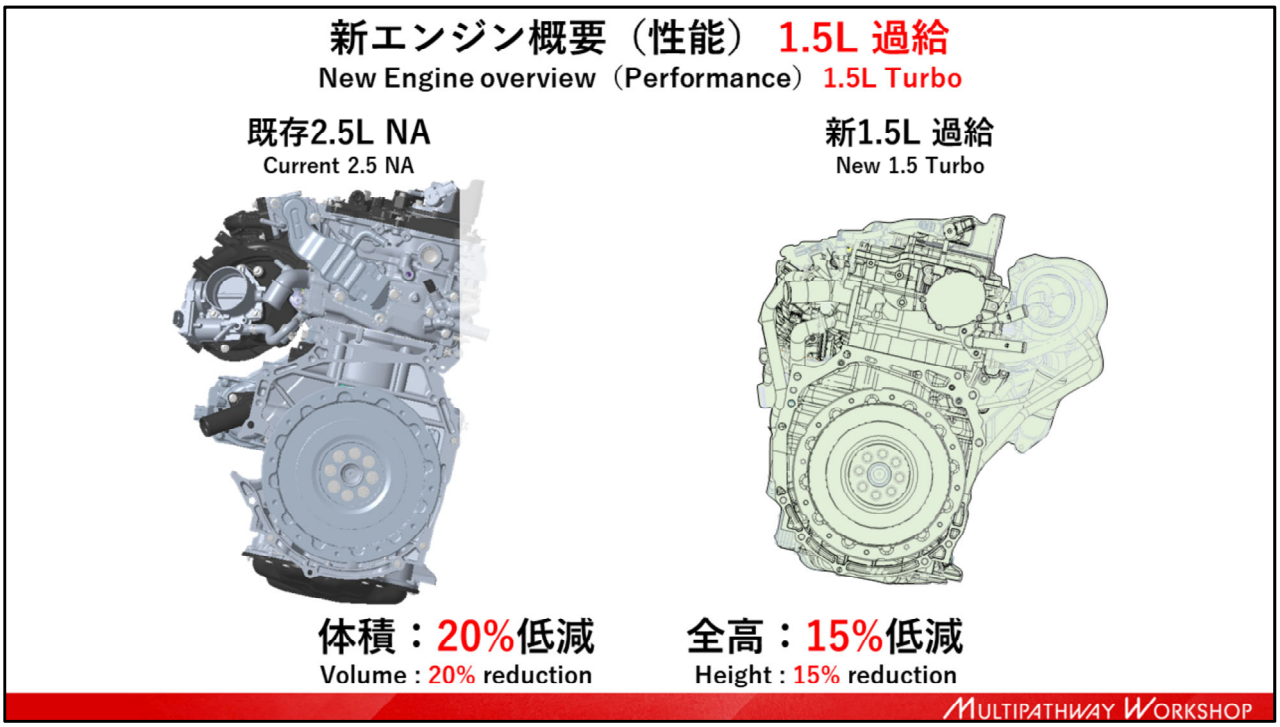
This 1.5L engine has a 10% reduction in volume and overall height compared to the same existing model.
Also, the engine is a 4-cylinder instead of the existing 3-cylinder, with a lower stroke and smaller size.



Next, I would like to talk about its performance.
The horizontal axis is thermal efficiency or fuel economy.
The vertical axis is power output or horsepower.

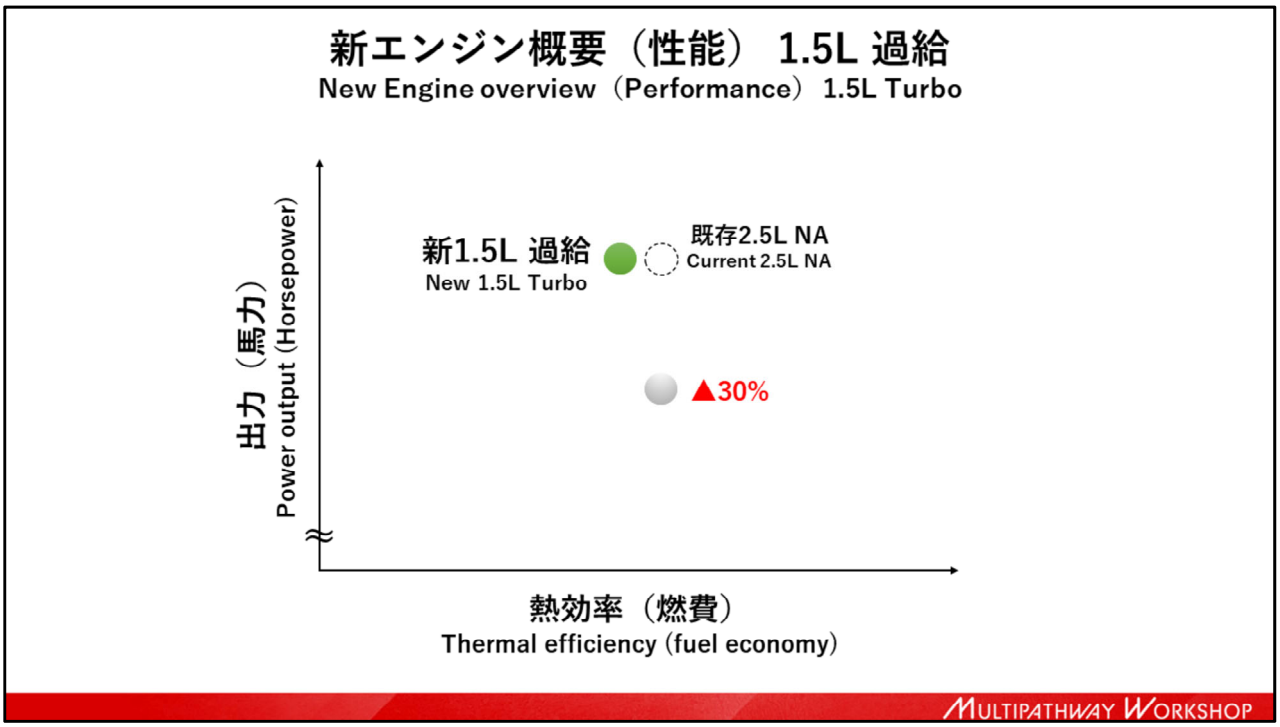
In the future, when strict exhaust emission regulations in Europe and North America ban engines as we know them, the output of existing engines will also need to be reduced to comply. However, this new engine will maintain its output while still complying with emissions regulations.

To give you an idea of what it will be like, the new 1.5L engine will improve fuel efficiency by 12% in the sedan class. This will be done not only by improving the fuel efficiency of the engine, but also by reducing aerodynamic drag through a lower hood due to the smaller engine size.

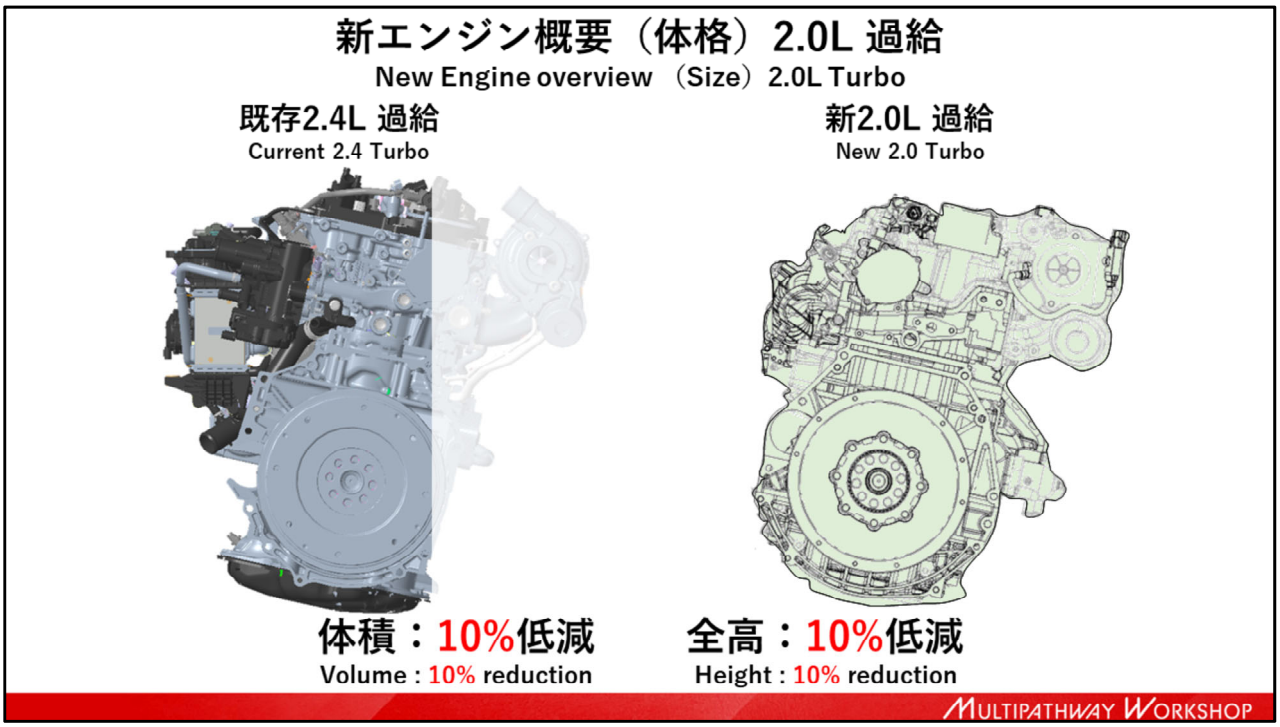


In addition, this new 1.5L engine with turbo can be mounted on large 3-row SUVs in North America that carry a 2.5L engine, as well as tow up to 3500 lbs.

Also, compared to the 2.5L engine, the volume is 20% smaller and the height is 15% lower.

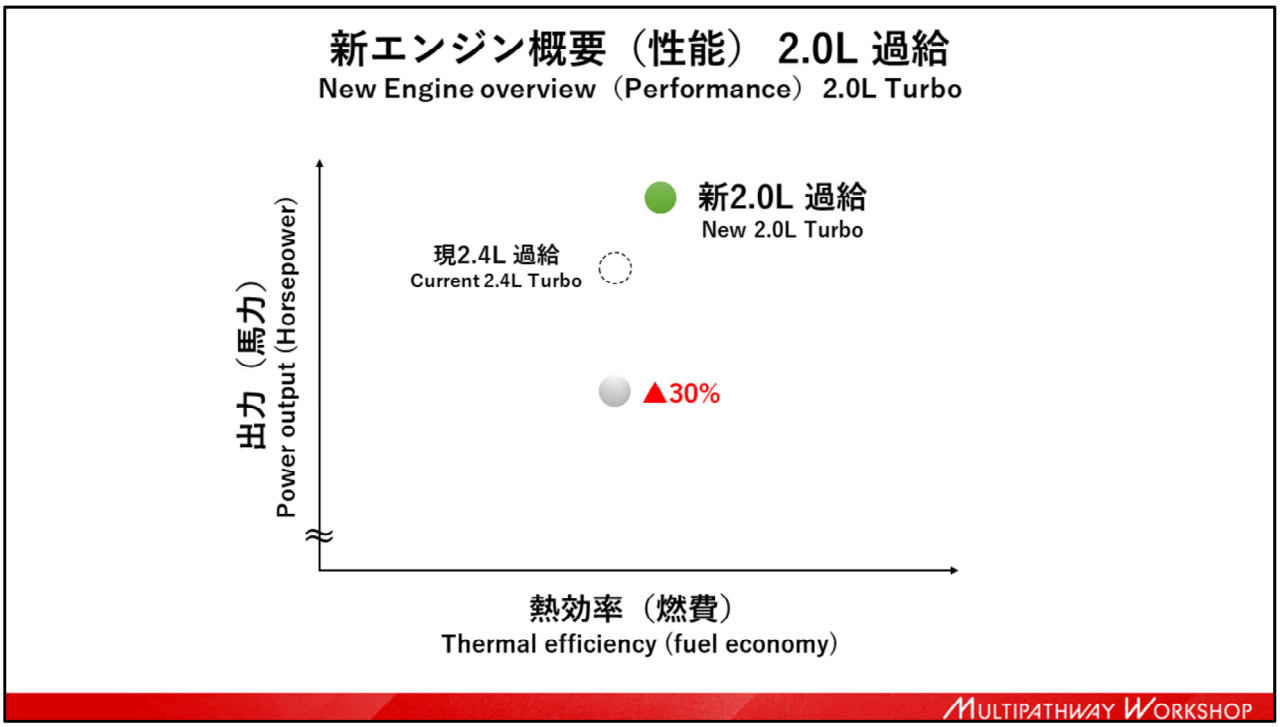


The new engines will make up for the 30% drop in performance which would be required of existing engines, and still comply with future strict emissions regulations.

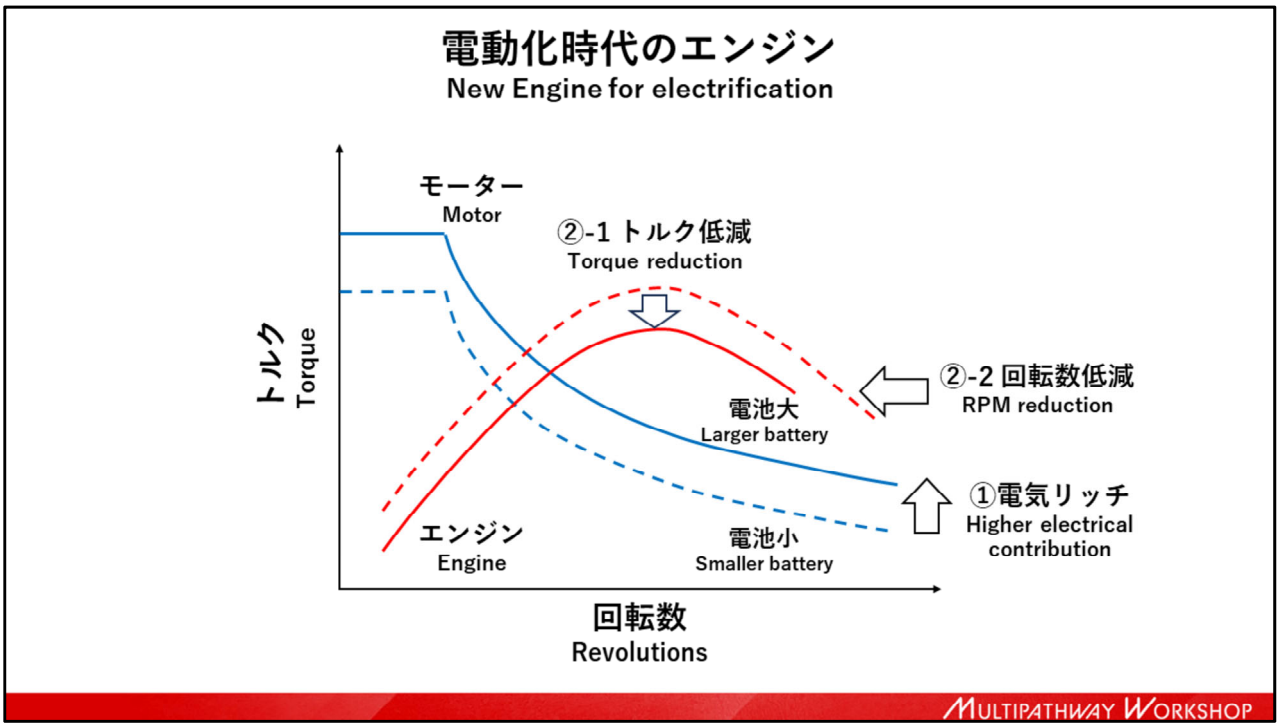


Next is the new 2.0L Turbo engine.

The 2.0L Turbo's volume and overall height are reduced by 10% compared to the existing 2.4L Turbo.
This also uses a lower stroke.



In terms of performance, it is significantly higher than that of the existing 2.4L Turbo, while maintaining the 30% output reduction in response to future exhaust emission regulations.
The new 2.0L Turbo engine is suitable for a wide range of vehicles, from trucks and other heavy vehicles to sports cars, that require high power output.



Let me explain again about engines in the electrification era.
In this graph, the horizontal axis represents RPM, the vertical axis is torque, and the dashed lines are the characteristics of the engine and motor, which together determine the output.

The solid line represents a large battery, showing that the combination of the battery and engine expands the possibilities for variation.
By making the engine electric-rich, the motor's power can be increased, the engine torque can be reduced by increasing the motor torque, and the maximum engine speed can be lowered because the motor can maintain its maximum output.
With the engine doing less work, the mechanism and structure of the engine itself can be simplified and, in fact, the stroke can be reduced when the maximum RPM is lowered. Why is this?

This is because conventional TNGA engines were designed with a long stroke to achieve maximum power output and to homogenize the air mixture mainly in the high-RPM range.
However, as the maximum RPM could be lowered, the advantages of the long stroke diminished, and the stroke was drastically reduced to achieve a lower height.

That is why it has become possible to offer more affordable BEVs by combining a highly efficient, smaller, and more powerful engine with electrification.

電動化時代のエンジン
New Engine for electrification

MULTIPATHWAY WORKSHOP

Mazda, Subaru, and Toyota are three like-minded companies that will continue friendly competition and pursue engine possibilities to achieve carbon neutrality.
Thank you very much.

クルマの未来を変えていこう！
Let’s change the future of cars!


MULTIPATHWAY
WORKSHOP