

Nissan Motor Co., Ltd. (Japan)

Optimizing Fuel Economy

Building Eco-Friendly Vehicles

For automakers, reducing carbon dioxide (CO₂) emissions remains a top priority in developing environmental technologies. While conducting research and development on fuel cell and other clean energy vehicles for future production, Nissan continues to improve the fuel economy of its vehicles for the current market as well. Optimizing fuel economy requires a comprehensive approach that improves the transmission and engine efficiencies of the vehicle, while ensuring the design is both lightweight and aerodynamic.

Boosting Engine Efficiency

Friction is one of the main causes of energy loss within the engine and lowers its efficiency. Reducing friction improves engine efficiency, and enhances the engine's overall fuel economy. Drawing on a finishing technique traditionally used for matching parts of engines in racing cars, Nissan has successfully lowered friction resistance over the past several years by 30 percent compared to previous models. Our Tiida and Lafesta models are already equipped with the new family of HR15DE and MR20DE engines and plans are in place to install these engines in a range of models worldwide.

Improving Transmission Efficiency

Transmission efficiency is another requirement to be fulfilled in order to achieve optimal fuel economy, and an area in which there remains significant room for improvement. In Japan, about 95 percent of all vehicles use automatic transmissions, meaning transmissions that select gears automatically based on the power required in various driving situations and conditions. In driving conditions in which there is a series of uphill and downhill slopes, conventional automatic transmissions shift gears repeatedly.

Continuously variable transmission (CVT) is a technology that overcomes this issue, enabling smooth shifting in uneven driving conditions by continuously altering the gear ratio during acceleration or deceleration of the vehicle without requiring any predefined steps. CVT is a special type of automatic transmission that enables "seamless" acceleration and deceleration, using the engine at more efficient condition, and thus improving fuel economy as well as driving performance.

At present Nissan's the world's only automaker with CVT-fitted models ranging from compact to full-size passenger vehicles. We introduced its first CVT-fitted vehicle, the 1.0-liter class March, in 1992. We went on to equip the 3.5-liter class Murano and Teana with CVT in 2003.

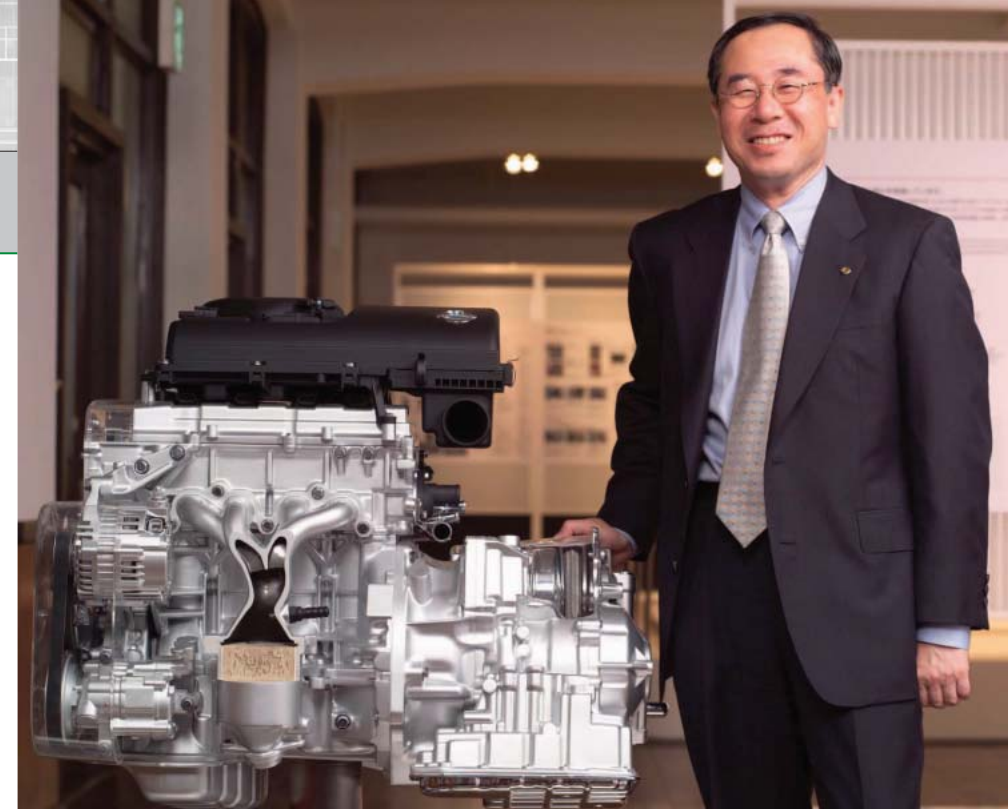
The process of reaching this milestone challenged us to innovate and proved to be a true test of our engineering capabilities. One of the obstacles we faced while creating this CVT technology occurred in the early stages of development. CVT uses metal belts for uninterrupted changes in gear ratio, which are fine-tuned through the use of hydraulic pressure.



Engineer's Challenge – Finding a breakthrough



MURANO with CVT



Senior Vice President, Powertrain Engineering Division: Yo Usuba



Lafesta (Japan)

The kind of high-pressure pumps required for high torque CVTs however, were not available during this first phase of development. It began to appear as if this new transmission would only be suitable for smaller vehicles.

In fact, due to the complexity of the technology, many parts suppliers gave up halfway through development projects. The words of Nissan Senior Vice President Yo Usuba say it all: "When it came to building a CVT for the 3.5-liter class, there were plenty of people, even here at Nissan, who couldn't believe we'd embark on such an ambitious undertaking. However, a large number of Nissan engineers and engineers at our subsidiary JATCO Ltd. were convinced, despite the many challenges and setbacks they had faced along the way, that this was a technology with outstanding potential. They were confident that we would succeed in the end and boldly pushed ahead with the development. Nissan's CVT achievement today is undoubtedly the fruit of such untiring commitment and devotion".

The combination of the new engine and other vehicle improvements optimized real-world fuel economy* by 20 percent in the Tiida and by 37 percent in the Lafesta. Nissan will increase the number of CVT-fitted vehicles to more than one million units worldwide in fiscal year 2007, about four times the number today. One of the drivers behind this plan is our estimate that putting one million high fuel-efficient CVT-fitted vehicles on the road will reduce CO₂ emissions by roughly the same amount as selling 200,000 hybrid vehicles.

Building Technologies to Meet Customer Needs

Like everything at Nissan, we strive to create new technologies for our vehicles that meet the needs of society as well as the needs of our company. By harnessing the best possible combination of technologies, we aim to build vehicles that achieve class-leading fuel economy, while offering real-world benefits for our customers.

"Developing innovative technologies is a very tough process - every step of the way". Yo Usuba continues, "But all the fatigue and frustration are outweighed many times over by the deep sense of accomplishment when we see the successful results of our efforts. That is what I believe is the most exhilarating and gratifying aspect of being a Nissan engineer. When I walk down the street and see a vehicle driving by with the technology that we developed, I have a strong feeling of pride and achievement".

Perfecting technology that contributes to a better environment, while satisfying customers all over the world, is a responsibility that we at Nissan plan to continue pursuing now and in the future.

* Real-world fuel economy: This calculation was developed in-house and is based on fuel economy tests conducted under actual driving conditions experienced in congested cities and on highways.