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Moving toward an Era Where Government Fuel Economy Regulations Give Rise to New Automotive Industries

Noriyuki KOBAYASHI

Nomura Research Institute

1 Fuel efficiency regulations are becoming increasingly stringent both in advanced and emerging economies

In recent years, there has been a global trend toward adopting increasingly stricter vehicle fuel efficiency standards. Europe now has the most stringent fuel economy standards in the world. In terms of the Corporate Average Fuel Economy (CAFE) standards, which are sales-weighted averages that must be achieved by each automobile manufacturer [Note], the European Union (EU) reduced the target from 130 grams of CO_2 per kilometer (g/km) by 2015 to 95 g/km by 2021. This means that in only six years, each automaker must reduce CO_2 emissions by as much as 27 percent, posing a major challenge to the automotive industry.

If we give credit to Karl Benz as the inventor of the gasoline-powered automobile in 1886, the gasoline engine has a history of about 130 years. During those 130 years, efforts to improve the fuel efficiency of engines have continued. Nevertheless, it would be reasonable to say that any attempt to further improve fuel efficiency and reduce CO_2 emissions solely by improving gasoline- and diesel-powered engines has become next to impossible. Recent cases of falsified fuel economy data and defeat devices involving some automakers reveal the tremendous difficulties faced by automakers in improving the energy efficiency of internal-combustion engines. Such being the case, eyes are turned toward new technologies such as hybrid cars that use multiple types of power, i.e., engine plus motor, and lightweight materials to sharply reduce a vehicle's weight.

Engaging in these efforts is not limited to advanced economies such as those in Europe. The most recent notable trend is that China and other emerging economies have begun to adopt fuel economy and CO_2 emissions standards that are as stringent as those adopted in more advanced economies. In China, which has become the world's largest market for new automobiles, the country's fuel economy rules call for the reduction of corporate average fuel consumption for passenger cars from 6.9 liters per 100 kilometers by 2015 to 5.0 liters by 2020. In the same way as in Europe, China sets a high hurdle for automakers to reduce CO_2 emissions by about 27 percent in five years. The factors behind the strong resolve of the Chinese government to cut fuel consumption and CO_2 emissions include the need to deal with severe air pollution, which is an adverse effect of rapid motorization. Another factor involves the fact that China has become the world's largest net importer of crude oil and the financial cost of oil imports has been growing. Given this situation, it is assumed that the government is trying to curb fossil fuel consumption by vehicles in consideration of energy security.

We are witnessing the expansion of these moves in China to other emerging economies. In India, which has also been experiencing a growing trend toward motorization, plans call for the adoption of the CAFE standards starting in 2017. By 2021, the country aims to achieve a CO_2 emissions target of 113 g/km for passenger cars, which is equivalent to those in more advanced economies. If regulations requiring the achievement of these targets are enforced, India will have strict fuel economy standards in place several years behind Europe.

2 Impact of the ZEV regulation

While most countries have been moving toward stricter fuel efficiency regulations, increased attention has recently been paid to Zero Emission Vehicle (ZEV) regulations. As the name suggests, zero-emission vehicles emit no exhaust gas, and battery-powered electric cars and hydrogen fuel cell vehicles are classified as zero emission vehicles. Generally, ZEV regulations require each automaker to sell a certain number of ZEVs. The first ZEV regulation was adopted by the California Air Resources Board of the U.S. in 1990. Recently, other countries have also been taking action to follow suit.

While the CAFE standards require each automaker to achieve the target with respect to sales-weighted average fuel economy among all vehicles sold, ZEV regulations specify a percentage of ZEVs to be sold in proportion to each automaker's market share.

China has been considering what it calls the "New Energy Vehicle (NEV)" rules, which are equivalent to the ZEV regulation in California. In 2016, a draft of these rules was circulated to collect opinions from the industry. Proposed rules are slated to go into effect in 2018 at the earliest and will require automakers to produce or import a certain percentage of new energy vehicles. Germany has been discussing a dramatic policy that promotes a shift from conventional cars to ZEVs. In 2016, Germany's Bundesrat (federal council) approved a resolution that calls for a ban on cars other than ZEVs by 2030. This resolution is nothing more than a suggestion to the German government and the European Commission and does not have immediate legal binding force. Nevertheless, it is a sign that Germany as well has boldly been steering towards ZEV regulation.

These tightened government regulations pose a major risk to the automotive industry. If automakers were to pursue a path toward better fuel economy, their models would likely consist of mostly compact cars, causing a drop in the average sale price. If they were to take an approach of better meeting ZEV regulations, they would need to increase the number of electric vehicles sold, which would result in having unnecessary assets such as engine factories that are now in operation. Replacing engines with electric motors and fuel cells might cause automakers to see the added value shifting from their

hands into the hands of electrical manufacturers. To complicate the situation even more, each country may adopt its own rules, which would require automakers to take different measures appropriate for each individual country. Because attaining economies of scale by mass production is an important strategy for automakers, it can be said that automakers are heading toward an era involving a laborious undertaking.

Be that as it may, global trends toward adopting CAFE standards and ZEV regulations are beginning to present a major risk to the automotive industry over a time span measured in decades.

3 CAFE standards and ZEV regulations closely associated with efforts to combat climate change

A primary reason for considering CAFE standards and ZEV regulations as worldwide and long-term trends is the growing awareness of global warming among all nations. In November 2016, the Paris Agreement entered into force for the common cause to undertake ambitious efforts to combat climate change. The Paris Agreement set an ambitious goal for the reduction of global emissions, as indicated in the United Nations Framework Convention on Climate Change as follows: "*The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.*" The Paris Agreement is the first international treaty on climate change since the Kyoto Protocol was signed 18 years ago. A significant difference between the Kyoto Protocol and the Paris Agreement is that the Kyoto Protocol imposed binding emission reduction targets only on developed countries. The Paris Agreement requires all parties to submit "nationally determined contributions" (NDCs) and to implement measures to achieve these targets. The Agreement requires all parties "to submit new NDCs every five years" and "to report regularly on progress made in implementing and achieving their NDCs and to undergo international review."

A look at the current pledges of major countries reveals that the EU's target is to reduce greenhouse gas emissions by at least 40 percent by 2030 against a 1990 baseline. China, which has become the world's biggest emitter of carbon dioxide, set a target of cutting its CO_2 emissions per unit of GDP by 60 - 65 percent from 2005 levels by 2030. In line with bold targets set by some other countries, Japan submitted its pledge to cut greenhouse gas emissions by 26 percent from its 2013 level by 2030.

Given that even developing countries have set long-term emission reduction goals, the situation has become such that it would hardly be acceptable for some countries to give priority to their own economic growth over addressing climate change. With reference to the automotive industry, not to mention the efforts taken to improve fuel economy and to reduce the emissions of greenhouse gases such as carbon dioxide, each country is required to take a more comprehensive long-term approach that involves the development of infrastructure. Specific efforts required include the expanded use of renewable energy and the promotion of vehicle electrification resulting in more zero emission vehicles.

4 Stricter fuel economy regulations bring about changes in industrial structure

Tightened fuel economy standards pose a risk to existing players, but bring about opportunities to newcomers. The areas where regulations have been strengthened offer great potential for creating new industries. For example, Tesla Motors, a U.S. electric car manufacturer, which has experienced rapid growth, is headquartered in California, which is the state leading the country in setting more and more stringent standards year by year since the adoption of the ZEV regulation. To satisfy the rapidly growing demand for electric cars, Tesla's Gigafactory, a lithium-ion battery cell factory, began mass production in January 2017 in partnership with Panasonic.

China, which is considering the adoption of NEV regulations, is witnessing the emergence of a number of electric vehicle start-up companies. The most prominent example is BYD, a Chinese automobile manufacturer that ranked first worldwide in terms of combined sales of plug-in hybrid and electric vehicles in 2015. Along with the production of electric vehicles, BYD also manufactures rechargeable batteries. While China has become the world's largest market in terms of new vehicle sales, currently, foreign companies are still dominant in terms of automobile manufacturing. Given this situation, the Chinese government has launched a series of programs to promote NEVs as a primary part of its environmental protection policies. At the same time, the government intends to foster the development of new Chinese industries such as electric motors, batteries and electric cars.

Furthermore, the strengthening of regulations to promote environmental protection such as ZEV regulations can lead to the creation of new industries from the perspective of community development. Electric vehicles require charging stations, and hydrogen refueling stations are necessary for fuel cell vehicles. If we broaden our perspective beyond a single vehicle unit to an entire community in pursuit of environmental improvements, a car-sharing scheme using ZEVs could serve as an effective option. As one of their disadvantages, electric cars are limited by range covered. However, this shortcoming makes electric cars a good match for car

sharing, which mostly involves short distances. Other possibilities include the use of IT to enable optimal control of the overall transport system. Optimization of the overall transport system will contribute to lessened traffic congestion and increased fuel economy for all types of vehicles.

As described above, tightened fuel economy standards are giving rise to new industries. Currently, in the U.S., the Trump administration plans to relax environmental regulations and review tough fuel efficiency standards. If actually implemented, such relaxation is likely to end up in retaining conventional industries in the U.S. where labor costs are high. Without efforts to constantly develop new technologies and industries, advanced economies including Japan may be likely to be outdone by emerging economies in terms of cost. Thus, it can be said that the global trend toward adopting stricter environmental regulations and tougher fuel economy standards has ushered in a new era where, along with encouraging participation by new players, existing players in both the public and private sectors must "resolve to change."

The April 2017 issue of *Chiteki Shisan Souzou* (Knowledge Creation and Integration) contains feature articles devoted to considering and introducing new business opportunities created under the above-mentioned circumstances from the perspective of strengthened environmental and fuel efficiency regulations (*in Japanese*).

Note:

The Corporate Average Fuel Economy (CAFE) standards are fuel efficiency regulations that are imposed on each automaker with respect to average fuel efficiency among all vehicles sold by that automaker.

References:

The source of each country's CAFE targets is The International Council on Clean Transportation (ICCT) (http://www.theicct.org/info-tools/global-passenger-vehicle-standards).

The sources of the statements regarding the Paris Agreement include the website of Japan's Ministry of the Environment (http://www.env.go.jp/earth/cop/cop21), the website of Climate Action Network Japan (http://www.can-japan.org/) and the website of the United Nations Framework Convention on Climate Change (UNFCCC) (http://unfccc.int/paris_agreement/items/9485.php).

Noriyuki KOBAYASHI is General Manager at NRI's Global Manufacturing Industry Consulting Department. His specialties include planning management and business strategies for the manufacturing industry, primarily for the automotive industry.

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Inquiries to: Corporate Communications Department
Nomura Research Institute, Ltd.
E-mail: nri-papers@nri.co.jp