

Climate Change and Renewable Energy

East Asia Foundation / Coalition for Our Common Future

Moderator	KIM Sang-hyup Visiting Professor, KAIST / Chairman, Coalition for Our Common Future
Presenter	KIM Hee-jip Co-Chairman, New Energy Industry Association of MOTIE SONG Kyung-yeol Clean-Tech Leader, McKinsey & Company Thomas LEHMANN Ambassador of Denmark to the ROK
Rapporteur	CHOI Ha-eun Fellow, East Asia Foundation

- **KIM Sang-hyup** Situations have changed a lot since the signing of the Paris Agreement. The replacement of nuclear energy and fossil fuel with renewable energy is now being realized. Jeju Island, one of South Korea's great examples, is planning to convert all electric power to renewable energy by 2030 and to replace all gas cars with electric cars.
- **KIM Hee-jip** I am glad to speak here on Jeju Island, which is at the front line of the new energy industries coping with climate change. In the wake of the Paris Agreement on climate change, the United Kingdom announced an interesting policy. Its goals were to remove all coal power plants by 2025 and to reform regulations on the Energy Storage System (ESS) to meet demands for renewable energy. Thus, the prospects of industries all over the world are now changing. Four major factors - renewable energy, electric cars, rechargeable batteries, and the microgrid - are leading this change. The U.S. is providing wind and solar power, although gas is cheaper. Electric car technology has made great advances, too. Competition in the relevant industry is fierce. From the end of this year, GM will sell the Chev-

rolet Bolt, an electric car whose electric range has improved to 320 kilometers. The price is cheap, too. One can buy it at only 30,000 dollars with the federal government's support fund. Tesla Motors' new car has an electric range of 346 kilometers. Google is also developing an autonomous vehicle as well as an electric car. It is a revolution comparable to the smart phone in telecommunications industry. Google is co-producing the car with Fiat Chrysler Automobiles and preparing for the mass-production and distribution of the car to the public.

South Korea wants to be a pioneer in this industry. Its goal is to be the number one energy solution country, in terms of the system and solutions instead of sales, by 2030. South Korea will accelerate the adoption of electric cars and improve its industry structure for exports. The goal is to generate a sales revenue of 100 billion Korean Won and create employment for 500,000 people by 2030. Experiments for the microgrid or zero energy buildings will be conducted on Jeju Island. Infrastructure for charging electric cars will be established, and the investment will also be concentrated on a smart grid. The Ministry of

Trade, Industry, and Energy (MOTIE) and Korea Electric Power Corp. are moving together toward those goals.

Jeju Island's goal for conversion into a renewable energy-based system by 2030 is an important opportunity for South Korea and can also set a great precedent for the world. The coasts of Jeju Island are the optimal environment for wind power generation. Solar power generation capabilities will also be developed. The speed of the development of new energy industries is phenomenal. It is like the supply is running after the demand. The Energy Storage System (ESS) industry is also growing in Australia. It is aiming to create a 100 billion dollar-market by 2030 under optimistic conditions.

- **KIM Sang-hyup** With dependence only on renewable energy, sporadic production may emerge as a problem. Storage systems such as the micro smart grid system are important. These days, the price of oil has decreased, so eyes are on whether the utilization rate of renewable energy can go up.
- **KIM Hee-jip** Energy experts were also surprised at the continued low price of oil. They expected the supply rate of renewable energy to decrease due to the low price of oil, but that was not the case. Last year, wind and solar power generation accounted for 61 percent of energy used in the U.S., even though the prices of oil and gas in the U.S. are only about a quarter of the prices in Korea. That was because the prices of wind and solar energy have been lowered, too. When the Kyoto Protocol was adopted, the renewable energy was five times more expensive than traditional energy resources. Now, the price is higher than traditional energy by only about 10 percent, which means it has become a viable alternative for ethical reasons. I believe the price of the renewable energy in Korea will also decrease like this.
- **KIM Sang-hyup** It reminds me of the dialogue between Jeju Governor Won Heeryong and Tesla Motors' Chief Technology Officer JB Straubel. They said they will create a new industrial ecosystem through the use of renewable energy. We will now move on to Dr. Song who will talk about Jeju's Green Big Bang and the future of electric cars.



KIM Sang-hyup

KIM Hee-jip



SONG Kyung-yeol

Thomas LEHMANN

- **SONG Kyung-yeol** Jeju's Green Big Bang is comprised of four elements. They are renewable energy, an energy storage system, the smart grid, and electric cars. These four work together to create synergy and will fundamentally change society in the future. All are important, but I will focus on electric cars.

Many people are interested in electric cars because they can reduce carbon dioxide emissions. Some people, however, question if electric cars can actually reduce the exhaustion of carbon dioxide, as the electricity production comes from coal and nuclear energy. They say the electricity must also be created from renewable energy.

Let's look at the world's electric-power production. Wind and solar power generation account for small portions in the total production. Their production rate is high in Denmark, but less than 2 percent in Korea. Nobody knows how high the production rate will rise 20 or 40 years later. Even by conservative estimates, however, renewable energy will become a mainstream and this will happen within 10 to 20 years. Solar and wind power are expected to account for larger portions in the world's total power production. Some raise questions over whether the renewable energy market can grow in the low oil price era, but the two are different markets. Oil is utilized in the

transportation sector. The development of renewable energy is very fast.

It is necessary to look at the entire car market to understand the trend of electric car development. The size of the entire market is estimated at about 3.5 trillion dollars. This will grow to 7 trillion dollars for the next 15 years. The market also includes an aftermarket involving replacement parts, such as tires, as well as automotive accessories. On top of this market, new products such as electric cars and autonomous guided vehicles have emerged. This will change the paradigm of the car industry.

Let's look at the sales of electric vehicles between 2011 and 2015. In 2015, 90 million cars were sold, and 2.5 percent of them were electric cars, including not only fully electric cars such as Tesla's, but also hybrid cars. Most of the electric cars sold were hybrid cars. One important thing here is the increase rate of the sales volume. The growth rate of gasoline car sales was 4 percent, but that of electric cars was over 9 percent. McKinsey assesses that the market size is expanded by four factors: regulations, technology, user convenience, and infrastructure. Currently, electric cars are more expensive than gasoline cars, but their prices will be almost the same in about 20 years.

Regarding regulations, carbon dioxide emissions are being subjected to tighter restraint. In Europe, carbon dioxide emissions should be lower than 119 grams per kilometer. This will be less than 100 grams in 2020. Generally, gasoline cars discharge up to 140 grams of carbon dioxide per kilometer, but electric cars discharge 0 gram. This is a competitive edge.

Technological development improves the economic feasibility of electric cars. Electric car batteries were priced at 600 dollars five years ago, but the price has fallen to 400 dollars and is expected to come down to 200 dollars in the future. In this case, the economic feasibility of gasoline cars and electric cars will become equal. Surveys among customers show that many people want to buy electric cars for financial reasons. They are willing to buy them as long as the payback period is within four years.

When it comes to user convenience and infra-

structure, what counts most is recharging stations for the electric cars. There are few recharging stations in Korea, but Jeju Island is an exception. There are many recharging stations in Europe, China, and the US. The number of stations will gradually increase.

I talked about the positive aspects of Jeju Island's Green Big Bang project, but not all enterprises have succeeded in this industry. There were many that suffered failures. Competition is really fierce. Competition should be balanced with regulations.

- **KIM Sang-hyup** I will ask you a technical question. Electricity demand will be important for Jeju Island to have only electric cars by 2030. How many power plants do you think should be built? There are some concerns that Jeju Island will not be able to meet the electricity demand.

- **SONG Kyung-yeol** There are about 400,000 cars on Jeju Island. If we assume that they are all replaced by electric cars and driven 30 kilometers a day on average, the actual energy demand will not increase that much. The demand will increase by only 10 to 20 percent. But, if all 400,000 cars are recharged at the same time, big power plants will be necessary. We, therefore, need a policy to induce drivers to recharge at different times.

- **KIM Sang-hyup** There is a country whose energy consumption remained unchanged while its economy grew by 30 percent. It also succeeded in reducing greenhouse gas emissions by 30 percent. That country is Denmark. We have a lot to learn from them. We will now listen to Ambassador Lehmann.

- **Thomas LEHMANN** Climate change and renewable energy have emerged as important issues after the Paris Agreement. I would like to share the examples of Denmark and Jeju Island seeking green revolutions. Thanks to the characteristics of South Korean society, Jeju Island is changing even more rapidly than Denmark, but the phases of progress are similar to Denmark's path. It is establishing large-scale infrastructure for electric cars and a smart grid.

In the 1970s, Denmark was terrified by the oil shock. At the time, the small country, which marked a 100 percent dependency on fossil fuels,

keenly felt the instability of its energy supply. Politicians came up with plans for a change in energy use and made a decision to drastically reduce the emissions of carbon dioxide.

About 30 percent of Denmark's electricity is generated from renewable energy sources. There are various types of renewable energy, too. We use solid biomass rather than wind power generation. There is no nuclear power. Denmark decided not to build nuclear power plants through a referendum. Denmark hopes to be a Carbon-Free country by 2050.

One of our priorities is the issue related to the cost of renewable energy. We want to make consumers choose renewable energy for its high cost efficiency. We spent a lot of government funds to make the people select renewable energy sources. Our conclusion is that cheaper energy is needed even when there are no subsidies.

Denmark is maintaining or containing its energy consumption without lowering its growth rates. Even during times of economic growth, we decreased carbon dioxide and water use. Our enterprises are exporting green technologies, and



feeling the economic effects from doing so. Some would ask how it was possible. It is definitely possible to stimulate economic growth and provide welfare services while reducing energy consumption. You don't have to give up competition for the environment. People believe that green growth will be harmful for competitiveness. I would like to ask them to look at Denmark's example.

There is a substantial partnership between Denmark and South Korea regarding green growth. In 2011, the two countries formed a green growth alliance that calls for cooperation between the businessmen and politicians of the two countries. Academic and technical cooperation is also underway. Denmark's Bornholm is especially friendly with Jeju Island. Bornholm is smaller than Jeju, but a Carbon-Free island. South Korea possesses advanced technology and its pace of energy reform is surprising. Even Denmark, which earlier achieved a shift to green growth, has a lot to learn from South Korea, and this is leading to industrial and business partnerships. The public and private sectors, as well as universities and other research institutions, are also pursuing technological exchanges. We share the vision of green growth.

- **KIM Sang-hyup** I am glad to say that South Korea has been reducing its carbon emissions, although not as much as Denmark did, while maintaining its economic growth. What kind of lessons can Denmark share with South Korea?
- **Thomas LEHMANN** It is important to reduce energy consumption. Efforts by each household to refrain from using air conditioners can be a great help. It is also necessary to expand wind power generation. Denmark has had good results from onshore wind farms. As far as I know, Jeju Island is a good location for this.
- **KIM Sang-hyup** Denmark has pushed for environment-friendly development since the 1970s. I wonder whether this policy was affected by governmental changes and how the continuity of the policy can be maintained.
- **Thomas LEHMANN** It is essential to maintain the continuity of the policy. If the policy is influenced by politics, it is hard to attract investors and to

create a good business environment. Investors will never make an investment if they don't know what will happen four years later. Energy plans need to be established with long term goals in mind. There have been many governmental changes in Denmark over the last 30 to 40 years. Regardless of whether the government was conservative or progressive, however, its will to push for green policies has not been shaken.

[Q & A]

- Q.** You provided an optimistic view about the power supply. There could, however, be an inevitable failure of the power supply because of weather conditions. Is there any measure, like power storage, to cope with that possibility?
- A. SONG Kyung-yeol** There should be a coordinated effort to disperse charging demands. If many cars try to recharge at once, it raises the risk of a power shortage. Measures such as differentiating charging prices by day and night should be considered.
- Q.** The biggest difference between Denmark and South Korea is whether they operate nuclear power plants. As far as I know, Jeju Island has one in operation. I want to ask about the differences in efficiency among various power generation methods.
- A. KIM Hee-jip** Personally, I think nuclear power generation is a good method, but it is hard for me to say this in public. Gas is expensive in South Korea because the gas has to be liquefied as it cannot be supplied through pipes like in the U.S. Power generation costs are higher in South Korea, as it is hard to find sites for power plants due to high land prices. It will be possible for Jeju Island to make a complete shift to renewable energy by 2030, but nuclear power will inevitably play a major role on mainland South Korea, as it costs less.
- A. KIM Sang-hyup** Judging in terms of grid power, South Korea is an island like Japan. There is no way of exporting or importing electricity. We need to rationally choose power resources. Personally, I don't like nuclear power generation,

but in reality, it is impossible to give it up completely.

- Q.** This subject is very similar to what we research. Why do people not think about hybrid hydrogen batteries when talking about electric cars? I also wonder how a national consensus can be reached on policies regarding this issue.
- A. SONG Kyung-yeol** Hydrogen and lithium batteries always remain a hot topic. Hydrogen batteries have an infrastructure problem. Electric cars can be recharged at home if necessary. Hydrogen battery-based cars, however, need a completely new infrastructure. It might be the question of which came first, the chicken or the egg. If somebody aggressively builds the infrastructure for hydrogen refueling, the situation will change. However, it is hard to forecast. Who will be the winner in the market is not an easy question to answer, but I expect lithium batteries to win because of the infrastructure.
- A. KIM Sang-hyup** Hyundai and Kia are developing hydrogen cars.
- A. Thomas LEHMANN** You asked if there is will to forge a consensus on the policy. I think it is possible, at least on Jeju Island.
- Q. KIM Sang-hyup** Nevertheless, there are still criticisms against it. I would like to ask what kind of obstacles there are. Is it possible to realize the large-scale vision?
- A. Thomas LEHMANN** Once something is started, it is hard to retreat. It might not be achieved by 2030. It can be delayed. Electric cars will, however, be distributed rapidly. It should go along with the development of renewable energy sources. It is not a step in the right direction if we import electricity from somewhere else to operate electric cars. We need to persuade enterprises to make investments in shifting to electric car use, as it can turn a profit. Government officials and scholars should work together to realize it on Jeju Island. As all of them have the will to do this, I believe this plan will succeed.
- A. SONG Kyung-yeol** To be honest, there is no right answer. I have expertise in technology and economics, but not in politics. The important thing is that the politicians' leadership should be harmonized with the will of the people. If

the government cannot ask the people to reduce their energy consumption, an alternative would be to solicit their cooperation with subsidies. It might be difficult given the current budgetary conditions.

- A. KIM Hee-jip** Realizing the large-scale vision requires both effort and luck. It also needs technological development. Jeju Island is establishing detailed plans. It set up a budget and a policy aimed at selling 4,000 electric cars this year, 20,000 cars next year, and 28,000 cars the year after. Next year, the offshore wind farm project will kick off.

■■■ Policy Implications

- Jeju will carry out a complete shift to electric cars to become a Carbon-Free Island by 2030.
- Because the distribution of electric cars should go along with the development of renewable energy, it is essential to develop technology and establish the necessary infrastructure.
- As it is hard to meet nationwide power demands with renewable energy alone, South Korea should continue to operate nuclear power plants, but it is difficult to reach a public consensus regarding this.
- Denmark's case shows that green growth and economic growth can be made concurrently.