Making the Green Revolution work

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Making the green revolution work requires an understanding of the issue in both the larger context of energy history and in specific case studies of effective — and revolutionary — projects that offer solutions.

Let's start with energy history. We all know that there have been relatively smooth transitions from the use of wood to the use of coal and, later on, from coal to oil and/or natural gas. Why were these transitions smooth? Well, perhaps mainly because the new fuel had an obvious superiority over the existing fuel as the new opinions offered convenience as well as being more economically viable choices.

But the next great historical shift we are facing is not so clear cut. What we do know is that we will be moving from oil, not to a single fuel, but rather to multiple fuel sources. While the green revolution is arriving with many alternatives, which may be good, it does mean by the very fact that there are so many new choices this time around the transition will not be as smooth.

Another thing to consider is that the green revolution will require great commitment from both government and private sector. As the IEA forecast fossil fuels — oil, coal and natural gas — will remain the dominant energy sources until 2035. I feel the greatest hope for increasing the use of renewables in absolute terms lies in the power sector. In the *New Policies Scenario* by the IEA we see renewable-based generation triple between 2008 and 2035 and the share of renewables in global electricity generation increasing 19 per cent in 2008 to almost one-third (and, in effect, catching up to the level of coal). The increase will come primarily from wind and hydropower, though hydropower will remain dominant from 2008 to 2035. But, when grid parity is achieved, renewable energy will take the bigger share of electricity. Finally, the IEA emphasises that the future of renewables hinges critically on strong governmental support.

For wind energy, grid parity is very close. For photovoltaic power, it is still further behind. Right now solar PV generation costs about US$0.22/kWh, compared to traditional generational costs of about US$0.08/kWh. It is expected that the cost of solar power generation will reach grid parity with other fuels by 2013. The economics of other renewables such as ocean energy and bio-energy are far behind those of conventional fuel. Great effort has been focused in these areas in order to increase economic viability and shorten the time to achieving grid parity.

Replacing oil in the transportation sector is much harder than in the power industry. The automotive industry is seeking a solution in the form of the hybrid car. This trend will continue throughout the transition period. Hydrogen is considered as a future automotive fuel, however many obstacles remain thus making this an area that demands much effort in RD&D.

In terms of renewables the government's role has been to provide feed-in tariffs (FIT) and offer the renewable portfolio standard (RPS) systems. Some countries have seen success with FIT, while the effectiveness of the RPS system needs to be decided by further evaluation. Until grid parity is achieved, these types of governmental support should be continued.

In addition to FIT and RPS systems, governmental efforts are indispensable in the realm of RD&D. Basic research should be initiated by government funding because in an era of financial turbulence it is very difficult for the private sector to take the lead. In the long-term, the sphere of RD&D necessitates a partnership between the public and private sectors. Here I would now like to turn to two successful case studies.

The first is a Korean-Mongolian PPP project which began in 2009 in Ulaanbaatar, Mongolia. This initiative, the Green Eco-energy Park (GEEP) Project was designated a flagship project by WEC for the Asia-Pacific region and offers a solution to the FEW (food-energy-water) challenge. The concept is to generate power using SolaWin (a hybrid solar and wind power system). Groundwater is then pumped to be used for drinking and irrigation so that not only can appropriate local crops be grown, but also desertification combated in vulnerable regions. The Korean half of the partnership as represented by Daesung Group provided funding and technology while the Mongolian side offered a 40-year lease of the land at no charge.

The success of GEEP has inspired a number of similar projects. Last year the SolaWin system was installed in Mandakh, a village 550 kilometers south of Ulaanbaatar which serves 150 households (approximately 600 people) providing them with electricity and drinking water. Now the villagers are able to grow vegetables, also with the water produced by the pump.

In addition SolaWin was selected by the Korea International Cooperation Agency (KOICA) for installation in other areas around the world with significant off-grid energy and water needs. SolaWin will be providing electricity, drinking water as well as water for agricultural use in countries KOICA serves such as Kazakhstan, Bangladesh, and Ethiopia. After a

recent trip to Africa by Korea's president, the introduction of SolaWin on a much larger scale in the Congo and other countries in the region is planned.

The second case study involves a RD&D effort, Korea's first concentrating solar power (CSP) project, which launched in June 2011 in Daegu, South Korea. It is situated on a 20,300m² area with 450 heliostats two metres in diameter, which reflect solar heat and a 50m tower equipped with a solar heat absorber and a 200kW power generator. Initiated by the Korean government, private sector participants were lead by Daseung Group.

As the IEA forecasted, there is promise in CSP especially in arid and semi-arid lands including North Africa, southern Africa, the Middle East, northwestern India, the southwestern United States, Mexico, Peru, Chile, and the western parts of China and Australia. Finally, in order to enhance the value of CSP capacities, thermal storage and backup or hybridisation are a must.

The construction of this solar power system developed to be used solely as a power generating cycle is a major achievement for Korea. Looking ahead plans are to build on this technology and expand into the worldwide CSP market including countries such as Mongolia by utilising high technology such as sun tracking and high-efficient light concentration.

The beautiful natural environment that surrounds Daegu was selected for the building of the solar power tower system because the area receives little rain and is sunny throughout much of the year. In addition, as the 2013 World Energy Congress will be held in Daegu, it is expected this will be the perfect opportunity to let people not only in Korea but also from all over the world learn about CSP. Moreover, with the 2013 Congress in mind, Daegu would like to show the world the prominence of the city as an eco-friendly energy leader.

Yet amid all these positive developments, the aftermath of the earthquake and tsunami in Japan in March has caused us to pause. With the destruction of the Fukushima nuclear power plant we have seen two types of reactions from countries with nuclear power. One reaction has been to maintain that there is no substitute for nuclear power and therefore it will continue to be used. The other reaction can be summarised as "we dare not to use it." In any event, it is now no longer clear what exactly the role of nuclear energy is in the green revolution.

In conclusion it is obvious that the green revolution, in order to be truly "revolutionary" still needs enormous input from both the public and private sectors. Especially in the area of RD&D there needs to be strong and sustained government support. As this historical shift occurs, the private sector should make more effort to shorten the time to grid parity for every type of renewable energy source. With successful implementation, the green revolution will become our green reality. ❑

Korea's first solar system project