ENERGY DEMAND OUTLOOK AND IMPLICATION TO ENERGY CONSERVATION POLICIES OF THE REPUBLIC OF SOUTH AFRICA

Yoshiaki SHIBATA, The Institute of Energy Economics, Japan, +81.3.5547.0215, yoshiaki.shibata@edmc.ieej.or.jp

Overview

The Republic of South Africa has ever supplied electricity at exceptionally low and stable prices by taking advantage of abundant coal resources available domestically. However, since the introduction of a democratic government in 1994, the country has been experiencing an increasingly tight demand-supply balance of energy due to rapid electrification and high economic growth. In order to tackle with stringent energy demand-supply situation, the "National Energy Efficiency Strategy of the Republic of South Africa" was approved by the cabinet in 2005 with the goal of improving energy intensity by 12% compared to the trend case by 2015. Nevertheless, South Africa was forced to implement rolling blackouts in 2007 and early 2008 because of power demand surge, dealing a serious blow to its major industries such as the mining. The electricity price, that has been kept low due to the once surplus power supply capacity and the government requirement for social reasons, is skyrocketing over the past several years with a view to covering the cost for construction of new power plants. As is often the case that new power plants construction fails to keep pace with electricity demand growth, effective energy conservation policies in demand side are required to be established immediately.

Long term energy demand outlook taking into account energy efficiency scenario is *sine qua non* for establishing energy conservation policies. This study forecasts final energy demand in South Africa through 2035 in business-as-usual (BAU) case and Energy Efficiency case, and also addresses energy conservation policies that should be introduced in conformity with the forecast results.

Methodologies

Energy demand in two cases, BAU case and Energy Efficiency case, is estimated. The econometric model developed in this study forecasts the energy demand by energy source and by sector (industry, transport, commercial and residential sector) in the BAU case.Energy demand in the Energy Efficiency case is calculated by subtracting energy savings from BAU energy demand. The energy savings are estimated by Bottom-Up Energy Analysis System (BUENAS) [1] model, except for industrial production process, where the energy saving is assumed to be attained the saving potential analyzed in "Energy Technology Perspective 2012" [2] in 2050 and interpolated for 2035. Energy cost savings and investment cost for energy efficiency are also analyzed.

Results

The estimated energy saving potential in 2035 excluding solar heat use increase in solar water heater represents 20 MTOE, while including solar heat use reduces potential to 16 MTOE. The largest energy savings come from air conditioner in the commercial sector, which accounts for 32%, followed by passenger vehicle (17%), freight vehicle (17%) and water heater (11%).

The final energy demand grows at 2.5% annual rate reaching 115Mtoe in 2035 from 61Mtoe in 2009. The greatest annual growth rate is found in the commercial sector with 4.7%, followed by residential sector with 3.2% and transport sector with 2.5%. The energy demand in the commercial sector is boosted by building floor space area growth accompanied with a strong tertiary industrialization. Increasing ownership rates of household appliances and light duty vehicles contribute energy demand growth in the residential and transport sector. In terms of energy source, 43% of the increment of energy demand come from oil, followed by electricity of 39%. Increase in oil demand mainly stems from vehicle ownership rate growth. Electricity consumption grows at 3.1% annual rate reaching 39Mtoe in 2035 from 17Mtoe in 2009.

Comparing the BAU and Energy Efficinecy case, the total final energy demand is expected to decrease by 11% (12Mtoe) in 2035 (16Mtoe if excluding solar heat). The commercial sector shows the largest energy savings ratio of 29%, due majorly to huge energy saving potential in air conditioners. The second largest energy saving ratio is 17% in the transport sector. On the other hand, energy savings in the industrial sector is not substantially expected, though it should be noted that production process in all industry is not included in this study. In the residential sector, conventional energy can be saved by 14%, due majorly to introduction of solar water heater replacing electric water

heater. However, lower energy conversion efficiency in solar water heater than electric water heater leads to 2% increase in final energy demand in the residential sector.

In terms of investment cost and energy cost savaing, the cumulative energy efficiency investment cost through 2035 is estimated to be USD 170 billion, which is significantly smaller than energy cost saving USD 310 billion.

South Africa is an energy resource-rich country. The domestic abundant coal and petroleum produced by Sasol's coal-liquefaction technology have met most of the domestic energy demand. Even though experienced large scale black out in 2008, demand side measures still lag behind supply side measures. Lack of a hub organization with which energy conservation policies are to be structured hinders energy conservation activities. Although some measures have been implemented, labelling program, for example, has failed in being effective due to strong opposition from local manufacturers. "National Energy Efficiency Strategy of the Republic of South Africa" sets the target of improving energy intensity by 12% compared to the trend case by 2015. Nevertheless, longer term target and strategies are required for realizing energy conservation economy.

According to the results from this study, 11% of savings in energy demand compared to BAU case could be realized in 2035 only if best available technologies are rapidly introduced. In the commercial sector, tertiary industrialization forces more installation of air conditioners and lighting equipments. More and more electric water heaters, lighting equipments and refrigerators will be owned by households associated with income growth and accelerated electrification in low income households. It is highly likely that vehicles will be chosen in the situation where the public transportation system is poor.

Among energy conservation measures widely implemented around the world are energy management system, energy audit system, labelling program, energy performance standard. These measures are very important to get energy saving activities entrenched in the economy from a long term perspective. However, immediate action should be taken before peoples come by low efficient products.

Conclusions

The econometric modelling and bottom-up analysis found that if a business as usual path is followed and no energy efficiency measures are taken, energy consumption is expected to grow 1.9 times between 2010 and 2035. One of the driver of this increase will be the switch to electricity from other energy sources in the residential and commercial sector as the country's electrification objectives are met and as the penetration rate of new and additional appliances/equipments continues to increase. The other driver is ownership rate growth in vehicle. The energy saving potential in commercial air conditioner, vehicle and water heater is huge.

The promotion and implementation of energy-saving measures and programmes is essential to curb this rapid increase in energy consumption. It is thus recommended that policies are established which not only ensure that existing appliances/equipments/vehicles are replaced with high-efficiency units, but that consumers who are purchasing appliances/equipments/vehicles for the first time are persuaded to opt for the highest efficiency units, as the expected lifespan of these electrical appliances, once they are installed, can be as high as 10 years. In order to back up such measures, financial incentives and support mechanisms are indispensable.

Last but not least, South Africa's electricity rate is no longer as cheap as they used to be. Starting in 2007 the rate has been increasing by 20% annually. These increases are against a backdrop where the rate actually stayed at low level since mid-1990s, due to the surplus supply capacity available and a government requirement to keep the tariffs low for social reasons. Although the electricity price hike has negative impact on economic activity, it also might be a driving force for energy saving.

Acknowledgement

The study described in this paper is one of the key products of "The Study on Energy Efficiency in South Africa" funded by Japan International Cooperation Agency (JICA). All contents of this study are the copyrights of JICA unless otherwise stated.

References

- [1] Michael A. McNeil, Virgine E. Letschert and Stephane de la Rie du Can, "Global Potential of Energy Efficiency Standards and Labeling Programs", Lawrence Berkeley National Laboratory, Environmental and Energy Technologies Division, 2008
- [2] "Energy Technology Perspective 2012", International Energy Agency
- [3] "Integrated Resource Plan for Electricity 2010-2030, Revision 2 Final Report", March 2011.
- [4] Income & Expenditure of households 2005/2006, Statistics South Africa
- [5] Covary T. Energy Performance and Labelling Requirements for Specific Electrical Appliances and Equipment. March 2012.
- [6] "Energy Efficiency and Reliability Improvement Strategies in Industrial Electric Motor-Driven System (EMDS), Onwunta, CPUT, 2008