Electricity energy outlook in Malaysia

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Abstract: Population and income growth are the key drivers behind the growing demand for energy. Demand for electricity in Malaysia is always growing in tandem with its Gross Domestic Product (GDP) growth. The growth for electricity in Malaysia forecasted by Economic Planning Unit (EPU) has shown an increase of 3.52% in 2012 compared to 3.48% in 2011. This growth has been driven by strong demand growth from commercial and domestic sectors. The share of electricity consumption to total energy consumption has increased from 17.4% in 2007 to 21.7% in 2012. The total electricity production was reported at 122.12TWh in 2012, where gas is still the major fuel source contributing to 52.7% of the total generation fuel mix of electricity followed by Coal, 38.9%, hydro, 7.3%, oil, 1% and others, 0.2%. This paper aims to discuss the energy outlook particularly the electricity production and ways toward greener environment in electricity production in Malaysia

1. Global Energy Status

Energy is the foundation that supports and spurs the socio-economic development of a country. Development is not possible without energy and sustainable development is not possible without sustainable sources of energy. Therefore planning for future energy demand is very crucial. Different countries may have different approaches in planning their future energy demand. Nonetheless, the future energy demand is always influenced by various non-energy policy factors such as population growth, economic growth, energy prices and adoption of technological advancement. At the global level, the most fundamental relationship in GDP remains robust – more people with more income means that the production and consumption of energy will rise as shown in Figure 1.

![Figure 1. Correlation between economic activity, population, and energy demand between 1970-2010](image-url)
The primary energy demand is highly dependent upon the price of fuels used as well as the technology utilized in providing the energy to the various sectors. Thus, energy demand is sensitive to the changes in energy price; type of fuels used at different sectors or industry and the pace of technological change which impacts directly or indirectly on energy supply and demand. Nevertheless, government policies and energy prices will have an influence towards the pace of development and deployment of new technologies, taking into account the economic factors and global market conditions.

It is reported that oil is still the major consumption worldwide with 34%, followed by natural gas 22%, coal 26%, nuclear 6%, Biomass/Waste 9%, hydro 2% and other renewable 1% in 2010. The global energy demands will increase to around 35 percent from 2010 to 2040 [2]. Therefore, a diverse, reliable and affordable fuel mix will be needed to provide energy that enables economic growth and societal advancements. Projection shows that oil will still remain the largest single source of energy demand until 2040. However, it is projected that natural gas will displace coal as the second-largest fuel by 2025. Natural gas has been seen as an economical, clean and abundant fuel as compared to other fuel sources. It will help to meet the rising power generation demand in the near future.

Thus, oil, natural gas and coal will continue to play a major role in the long-term energy supply. Together, these three fuels will provide approximately 80 percent of the total global energy supply by 2040. Nuclear will grow significantly, mainly due to rising electricity demand and a desire to reduce CO2 emissions. From 2010 to 2040, the use of nuclear energy is predicted to increase from 5.5% to 8%. Another notable shift in the energy fuel mix is the significant growth in renewable energy such as wind, solar and biofuels. These renewable energy technologies will grow rapidly. By 2040, renewable will only make up of 3 to 4 percent of the total world energy supply. Therefore greater advances in technology are needed to increase the commercial viability and associated economics of developing these resources to its full potential.

The projections for fuel mix changes significantly, whereby natural gas and nuclear will become the most economic fuels for power generation. Even though coal is a very competitive economic option for generating electricity, however due to it costs arising from greenhouse gas policies, natural gas becomes increasingly competitive. This is due to the fact that natural gas emits up to 60 percent less CO2 than coal when generating electricity. Renewable energy is already playing a bigger role globally – particularly through wind and solar. However, there is also a potential downside due to the intermittent renewable resources that may have on the cost and reliability of electricity supply.

2. Malaysia Energy Status

There are many challenges and issues with regard to energy- supply and demand in Malaysia namely energy security, fuel supply and pricing, especially gas pricing, renewable energy, energy efficiency and conservation, sensitivities of nuclear option and the restructuring of the electricity supply industry.

Energy security has always been an important issue highlighted by various agencies in supporting Malaysia’s socio-economic growth trajectory towards becoming a high income nation by 2020. However, the underlying concerns in Malaysia with respect to its national energy security is on how to ensure continuous supply of the energy at affordable prices as a result of depleting indigenous oil and gas resources in the country. While Malaysia is expected to revert to being a net oil importer by 2015 [3] such a situation will pose considerable long-term economic, environmental and energy security challenges.

Malaysia energy development is currently guided by the National Energy Policy, which was introduced in 1979 with three objectives namely, supply objective, utilization objective and environment objective. Supply objective is to ensure adequate, secure and cost-effective supply of energy, while the utilization objective is to promote efficient utilization of energy and discourage wasteful and non-productive patterns of energy consumption, and finally the environmental objective is to ensure factors pertaining to environmental protection are not neglected in the production and utilization of energy.
To achieve these three objectives, various related policies were formulated such National Depletion Policy was introduced in 1980 to safeguard the exploitation of natural oil reserves. The Four-Fuel Diversification Strategy policy was introduced in 1981 (i.e., oil, natural gas coal and hydro). These policies accelerated the transition from a dependence on oil as the main energy source to natural gas as a cleaner and cheaper source of energy. This policy was then succeeded by the Five-Fuel Diversification Policy in 2001, with the addition of Renewable Energy (RE) as a fifth fuel source to complement oil, natural gas, coal and hydro.

Although the general objectives of the 1979 National Energy Policy remain unchanged, the Five-Fuel Diversification Policy signaled the intention of the Government of Malaysia for concentrated efforts to usher energy sector development on a greener path, by encouraging the use of renewable sources of energy. As part of its initiative to ensure adequate, reliable and cost-effective supply of energy, the adoption of clean-coal power generation technology was also encouraged. All these policy initiatives were conscious efforts by the Government to diversify fuel sources for power generation to ensure sufficient and reliable power at affordable prices.

Under the Tenth Malaysia Plan (2011-2015), Feed-in Tariff (FiT) is designed and targeted to achieve 985MW and 2080MW by 2015 and 2020 respectively from various types of RE resources. In addition, Malaysia plans for an additional 6 GW of new generation capacity between 2015 and 2020[3] to meet increasing demand.

The total primary energy supply in Malaysia has increased by 2.99% from 74,582 ktoe to 76,809 ktoe in 2009 and 2010 respectively. While the total final demand has increased by 1.54% from 40,845 ktoe to 41,476 ktoe in 2009 and 2010 respectively. The electricity gross production has increased by 2.3% from 105,706GWh to 108,175GWh in 2009 and 2010 respectively. In terms of electricity demand, it has increased by 8.53% from 96,302GWh to 104,519GWh. As for commercial primary energy mix in 2010, natural gas accounted for 46%, followed by crude oil and petroleum for 33%, coal for 19%, and hydropower for 2% while RE is negligible [4,5].

However, the growth for electricity in Malaysia forecasted by Economic Planning Unit (EPU) has shown an increase of 3.52% in 2012 compared to 3.48% in 2011[6]. This growth has been driven by strong demand growth from commercial and domestic sectors. The share of electricity consumption to total energy consumption has increased from 17.4% to 21.7% in 2007 and 2012 respectively. The total electricity production was reported at 122.12TWh in 2012, where gas is still the major fuel source contributing to 52.7% of the total generation fuel mix of electricity followed by Coal, 38.9%, hydro, 7.3%, oil, 1% and others, 0.2%.

Table 1. Electricity Production and its share in 2005, 2010 and 2030

| Fuel by Type | Electricity Production (GWh) | Share of Electricity Production (%) |
|--------------|-----------------------------|-------------------------------------|
|              | 2005 | 2010 | 2030 | 2005 | 2010 | 2030 |
| Coal         | 23,134 | 49,675 | 154,686 | 26.5 | 41.6 | 49.0 |
| Oil          | 2,489 | 2,855 | 3,107 | 2.9 | 2.4 | 1.0 |
| Natural Gas  | 55,899 | 55,700 | 139,025 | 64.0 | 46.6 | 44.0 |
| Hydro        | 5,784 | 11,245 | 18,166 | 6.6 | 9.4 | 5.7 |
| Total        | 87,306 | 119,475 | 315,984 | 100.0 | 100.0 | 100.0 |

Based on the projections Malaysia electricity production will increase from 87,306GWh to 314,984GWh in 2005 and 2030 respectively with an annual growth rate of 5.3%. However, the projection does not take into consideration of nuclear and RE is insignificant [7].

3. Ways towards Greener Environment in Electricity Production in Malaysia
In order to build a sustainable greener environment in energy platform for growth, it is important to manage our high dependence on fossil fuels. Therefore, moving towards cleaner power generation
such as advanced efficient coal and gas power plant (i.e., Ultra Supercritical boiler for coal power plant and H-Frame turbine for gas power plant technologies) with carbon capture and storage technology and, simultaneously, intensifying the development of Renewable Energy as the fifth fuel resource as well as instituting demand side management, Energy Efficiency and Conservation may be regarded as another substitute energy source for national energy balance in the country. Due to the Fukushima Nuclear Accident in Japan, many countries have started reassessing their nuclear policies including Malaysia due to safety reasons.

4. Conclusion
Globally, the energy projection has shows a continued increase in electricity production for the years to come. Malaysia electricity production is also projected to be increased with a growth rate of 5.3% from 2005 to 2030. Deployment of RE and advances of RE technology will increase with FiT implementation in Malaysia. RE will contribute in the electricity production in the near future. Therefore, in order to ensure diversity of fuel sources, a balanced fuel mix is important.

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References
[1] World Bank database
[2] Exxon Mobile The Outlook For Energy A View To 2040
[3] Kettha 3 Nov 2010 Green Economy, Clean Technology And Sustainable Development – The Wave Of The Future The Second World Chinese Economic Forum Palace Of The Golden Horses, Kuala Lumpur
[4] National Energy Balance 2009 Malaysian Green Technology Corporation Malaysia ISSN No: 0128-6323
[5] National Energy Balance 2010 Energy Commission Malaysia ISSN No: -0128-6323
[6] Economy Planning Unit (EPU) The Malaysia Economy in Figures 2012.
[7] IEE Japan March 2009 Energy Supply Security Planning for the ASEAN (ESSPA) The 2nd ASEAN Energy Demand Outlook 47-52 Malaysia.