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Energy Demand Situation and Outlook in the Philippines: 2005-2014

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ABSTRACT

The Over-all Energy Balance (OEB) Table as an approach in presenting the country's demand and supply outlook was re-introduced in the 2004 Update of the Philippine Energy Plan (PEP). The OEB provides a more detailed accounting of the flow of energy resources from supply to end-users, which covers three stages, namely: (i) production and importation of primary energy supply; (ii) transformation process; and, the (iii) final consumption of finished energy products and services by the end-users.

Using historical trends (or time series) and other indicator variables such as economic growth and population, among others, the country's final energy demand is estimated on a per sector/end-user basis. The end-users are classified as follows: residential, transport, industrial, commercial and agriculture.

For the ten-year planning period (2005-2014), transport will be the most energy-intensive sector amongst the sectors, which will account for the largest share in the country's final energy demand registering an average of 34.5 percent. Residential sector is the second largest user of energy with 28.8 percent share followed by industrial with 25.3 percent. The commercial and agricultural sectors will have the least energy requirements with minimal share of 9.9 percent and 2.5 percent, respectively.

An important component in the energy demand estimation of the residential sector is the result of the 2004 Household Energy Consumption Survey (HECS). The report showed that while biomass remains as the primary fuel in meeting the sector's energy requirements, its consumption will decline by 0.6 percent as households shift to more efficient and convenient fuels such as LPG and electricity for cooking and lighting instead of charcoal and fuelwood. Meanwhile, as a result of the Expanded Rural Electrification Program of the government, which aims to energize all of the country's barangays by 2008, electricity will account as a major source of energy in the sector.

The DOE has utilized various statistical tools in its energy demand forecasting exercises. End-use electricity demand is based on the aggregated Distribution Development Plans annually submitted by the distribution utilities (DUs). The methodologies used by DUs include the deterministic approach, econometric modeling, trend analysis and other engineering and accounting exercises. On the other hand, total energy demand estimations are derived largely using an Excelbased econometric system called *Simple E* which was developed by the Institute of Energy Economics in Japan as well as other energy modeling tools such as Longrange Energy Alternative Program (LEAP). Meanwhile, the DOE used the bottom up development planning approach in demand forecasting activities for the formulation of the Regional Energy Plan as part of the 2006 PEP Update. Linkages were established with concerned agencies and institutions at the regional levels to gather area-based data and information.

I. Introduction

This paper presents the process utilized by the Department of Energy (DOE) in formulating long-term energy forecasts. The process involves close collaboration with the Department's attached agencies, namely: National Power Corporation (NPC), Philippine National Oil Company (PNOC), National Electrification Administration (NEA), National Transmission Corporation (TransCo), Power Sector Assets and Liabilities Management (PSALM) Corporation. The forecasts together with the energy supply expansion are incorporated in the Philippine Energy Plan (PEP) – a ten-year energy development framework – which is being formulated or updated annually by the DOE.

The DOE formulates two types of demand forecast for the PEP update, namely: total energy demand and power demand. Total energy demand takes into account the aggregate energy consumption of five (5) economic sectors consisting of indigenous and imported fuels that also include fuel demand for power generation. Meanwhile, total energy demand at the end-user level includes electricity requirement by the different sectors.

In this paper, an important part of the discussion is the country's energy demand scenario for the next ten years based on primary economic variables such as Gross Domestic Product (GDP), population and foreign exchange rates. The reference plan for this presentation is the 2006 Philippine Energy Plan Update covering the horizon 2005-2014. The 2006 PEP used the bottom up development planning approach in energy demand forecasting for the formulation of the Regional Energy Plan covering the country's 16 administrative regions. Coordination and linkages were undertaken with concerned agencies and institutions to gather specific data and information at the regional levels.

The concluding part summarizes in brief the issues and constraints confronting the DOE in its energy demand forecasting activities.

II. Over-all Energy Balance

The Over-all Energy Balance (OEB) Table as an approach in presenting the country's demand and supply outlook was re-introduced in the 2004 PEP Update. Prior to its adoption,

the previous PEP utilized the primary energy mix to present the energy demand and supply data accounting both indigenous and imported energy on per resource basis such as oil, coal, geothermal and renewable energy. However, energy losses incurred through the chain from supply sources to end-users were not necessarily recorded.

The OEB Table provides a more detailed accounting of the flow of energy resources from supply to demand which involve three stages, namely: (i) production and importation of primary energy supply; (ii) transformation process which also includes power generation and oil refining; and, the (iii) final consumption of finished energy products and services by the end-users. In the OEB, energy commodities are expressed in common unit of measurement, i.e. thousand tons of oil equivalent (KTOE), which is the standard international energy unit of measure.

Meanwhile, the country's final energy demand is projected on a per sector basis using historical/time series trends and other indicators/variables like economic growth rate, population, and foreign exchange, among others. The sectors are classified as follows: residential, transport, industrial, commercial and agriculture.

III. Final Energy Demand

Total final energy consumption reached 23.2 MTOE (actual figure) in 2006, registering a decline of 4.0 percent from the 24.2 MTOE in 2005. The downtrend in energy demand of most sectors of the economy for the period was attributed to the continuing increase in the prices of petroleum products, which prompted the consumers to utilize energy in more prudent ways. Despite escalating oil prices, simulations indicate that final energy consumption shall increase by 3.3 percent, on the average, to 29 MTOE in 2010 and 32 MTOE in 2014. Petroleum products will remain a dominant fuel to address the high demand of both the transport and industrial sectors.

Oil products requirements are projected to increase at an average rate of 3.6 percent. Demand for liquefied petroleum gas (LPG) will register the fastest growth at 5.2 percent per annum largely due to the growing needs of the residential and commercial sectors *(LPG for transport was not yet accounted in 2006 PEP Update)*. Meanwhile, electricity will emerge as the second fastest growing fuel in the end-use sectors with an annual average growth of 5.1 percent over the planning period. The rapid growth of electricity demand will be seen in the residential, commercial and industrial sectors.

Transport will be the most energy-intensive amongst the sectors, which will account for the largest share in the country's total final energy demand posting an average of 34.5 percent. Meanwhile, residential sector is the second largest energy user with 28.9 percent share followed by industrial with 25.2 percent. Commercial and agricultural sectors will have the least energy requirements with minimal share of 9.9 percent and 2.5 percent, respectively.

Following are the demand prospects per sector:

Transport Sector

Energy demand of the transport sector covers the fuel consumption of the different types of vehicles for land, air and water. The projected population growth, road and rail infrastructure development and other indicators will all contribute to a greater demand for fuel by the sector, which is estimated to account for the largest average share of 34.5 percent of the country's total energy demand.

Within the planning period, the energy consumption of the transport sector will post an average growth of 3.5 percent. Petroleum products such as gasoline, diesel and fuel oil will remain as the dominant fuel for transport use. Meanwhile, in line with the government's effort to promote alternative energy sources for transport use, particularly with the enactment of the Biofuels Act of 2006, the utilization of bio-fuels particularly coco-methyl ester and ethanol is seen to increase within the planning period.

In 2006, the sector's energy consumption stood at 8.12 MTOE, which exhibited a 5.5 percent decrease from 2005 level of 8.59 MTOE due to continuous increases in oil prices in the world market during that period. The consumption of CME for the period increased to 0.54 KTOE while ethanol use reached 1.4 KTOE. Meanwhile, the use of LPG for transport has significantly increased reaching 4 KTOE. Conversion to auto-LPG has become popular amongst taxi fleets and to some extent privately-owned cars due largely to price differential of LPG with gasoline. The electricity demand for transport increased by 5.9 percent from 7.8

KTOE in 2005 to 8.3 KTOE in 2006, which is due to the growing ridership of the Light Railway Transit 1 and 2 (LRT 1 & 2) and the Metro Rail Transit (MRT).

The share of air transport to the energy consumption reached 12.9 percent exhibiting an increase of 6.8 percent from the 2005 level of 1.0 MTOE.

Residential Sector

With the projected 1.9 percent average annual growth rate in the country's population within the planning period, the residential sector will be the second largest user of energy accounting for an average share of 28.8 percent of the total energy demand. Residential energy demand is estimated to grow at an average annual rate of 1.4 percent.

The 2004 Household Energy Consumption Survey (HECS) result was used as an important component in energy demand estimation of the residential sector. The report showed that while biomass remains as the primary fuel in meeting the sector's energy requirements, biomass consumption will slide down by 0.6 percent as households shift to more efficient and convenient fuels such as LPG and electricity for cooking and lighting instead of charcoal and fuelwood. As such, demand for LPG will steadily rise by 5.1 percent due to urbanization trends. Meanwhile, household demand for kerosene is estimated to decline by 6.8 percent due to reduction of its use for lighting and cooking.

As a result of the Expanded Rural Electrification Program of the government, which aims to energize all of the country's barangays by 2008, electricity will continue to account as a major source of energy in the sector. Household consumption of electricity will post a 5.6 percent growth over the planning period.

In 2006, the sector's energy utilization dropped by 7.1 percent compared with the previous year level of 7.3 MTOE. The decline in demand was attributed to a decrease in petroleum products consumption brought about by increasing retail prices of petroleum fuels. Other indicators that might have contributed to the decline were lower sales of household appliances and government advocacy and promotion of energy efficiency and conservation.

Industrial Sector

The industrial sector's (manufacturing, mining and construction) energy requirements will grow at an annual average rate of 4.3 percent and registering an average share of 25.3 percent to the total final energy demand over the planning period.

Petroleum products will comprise the bulk of the sector's total demand posting an increase of 3.9 percent over the planning period. Further, the promising prospects in the industry sector activities will inevitably drive up the electricity requirement of the country with an average rate of 3.8 percent. Other important energy sources that will be required by the sector over the planning period are biomass and coal (not including coal for power generation), which will contribute an average share of 13.1 percent and 7.0 percent, respectively.

In 2006, the sector's final energy consumption reached 5.75 MTOE – one-fourth of the total energy consumption for that year. The manufacturing industries utilized about 95 percent of the energy consumed by the sector while the remaining was used by construction (2.3%) and mining (2.3%). The key manufacturing industries that accounted for around 44 percent of the sector's total energy demand are paper and pulp, chemicals, non-metallic minerals, iron and steel and non-ferrous metals, among others.

Commercial Sector

The energy demand for commercial sector is estimated to increase by 5.7 percent at the end of the planning period. Such growth in demand is based on the upward trend in the services sector comprising of trade, transportation, communication, storage and private services. The sector will account an average share of 10.0 percent to the total final energy demand d the country. Electricity will predominantly provide the sector's fuel requirements followed by biomass and petroleum products

In 2006, the sector's energy consumption increased by 1.9 percent from 2.05 MTOE in 2005 to 2.09 MTOE in 2006. Electricity accounted the highest share at 56.5 percent of the sector's energy demand followed by petroleum products (29.1 percent) and renewable energy (14.4 percent) as fuel substitutes such as fuelwood, charcoal and agriwaste.

Agriculture Sector

The agriculture sector is the least energy-intensive, which only registered a minimal growth and a meager share of 1.5 percent of the country's total final energy demand. With the current trend in agricultural modernization, energy requirements for agricultural activities will slightly inch up by 2.5 percent within the planning period. Petroleum products will be the main fuel of the sector with an average growth of 2.5 percent over the reference period.

The sector's total energy consumption in 2006 stood at 0.41 MTOE -a decline by 9.1 percent from last year's 0.45 MTOE. The sector only posted 1.8 percent share of the country's total energy demand for the same period.

IV. Power Demand Forecasting

With the enactment of the Electric Power Industry Reform Act of 2001, the formulation of the Power Development Plan (PDP) was transferred from the soon-to-be privatized National Power Corporation to the DOE. The PDP, which is a major component of the PEP, is an indicative plan that allows consumers to manage their electricity demand vis-à-vis projected supply expansion program to ensure supply security, adequacy and reliability. It is essentially a synchronization of inputs taken from the Transmission Development Plan (TDP) and the consolidated Distribution Development Plan (DDP).

In view of the importance of PDP, any overestimation or underestimation in forecasting may result in the untimely infrastructure development, which could trigger some consequences such as higher rates. Therefore, it is important that the DOE should establish a simple and participative forecasting methodology to generate more accurate and responsive forecasts of the electricity demand movements.

Starting with the 2004 PEP, the peak demand forecasts of the distribution utilities became the bases for the PDP formulation. This was made possible through the preparation of the DDP by the different distribution utilities, which enabled the DOE to consolidate the actual and forecasted electricity demand at the distribution level. The methodologies used are deterministic econometric modeling, trend analysis as well as engineering and other accounting exercises.

Aside from these simulation tools, consultative workshops are held in the regions to validate data and ascertain the demand forecasts of Luzon, Visayas and Mindanao regions, as well as capture other relevant information that could explain the historical trends and cyclic movements of demand at the distribution levels.

In 2006, the country's total installed capacity stood at 15,803 MW, which was higher by 1.18 percent level compared with the previous year's level of 15,619 MW due to the commissioning of the 210-MW Mindanao Coal. For the same year, total dependable capacity was 13,639 MW – about 86 percent of the total installed capacity. Dependable capacity refers to the maximum output that a power plant can provide under adverse conditions for a specified period of time and taking into account the plant's wear and tear conditions.

In terms of capacity mix, fossil-based power plants were the primary source of electricity with coal as the leading fuel contributing about 26.4 percent followed by oil with 22.7 percent. For indigenous energy resources, hydroelectric power contributed the largest share at 20.6 percent while natural gas and geothermal plants provided 17.5 percent and 12.5 percent shares, respectively.

The gross power generation in 2006 reached 56,782 GWh – an increase of 0.4 percent from the 2005 level. Natural gas has become the dominant fuel since 2005 replacing coal, which produced 16,366 GWh or about 26 percent of the total electricity generated in 2006 – lower by 2.9 percent due to the 25-day maintenance schedule of the Malampaya Gas-to-Power Project. Electricity generation from coal posted a 27 percent share (15,294 GWh) in the mix. Geothermal generated 10,465 GWh of electricity or 18.4 percent while hydroelectric power provided a total of 9,938 GWh or 17.5 percent share of the total. Meanwhile, oil-based plants only produced 4,664 GWh, lower by 24.1 percent from 2005 level. The decline is attributed to the ongoing program of NPC to limit the utilization of oil-based plants in light of the increasing oil prices in the world market.

Challenges and Opportunities

Despite efforts of continuously improving its energy demand forecasts for more accurate results and effective energy planning, the DOE is still confronted by several challenges as follows:

- Need to strengthen linkages and collaboration with concerned line agencies in government, the academe, research institutions and other partners in the industry for more appropriate and reliable sourcing of much-needed data and information for a particular sector;
- Need to establish baseline data on energy consumption levels of various sectors. Currently, the DOE has just finalized the results of its 2004 Household Energy Consumption Survey, the third in a series since 1989. This is a joint undertaking with the National Statistics Office. While surveys can be cost-intensive and time-consuming, plans are underway b pursue parallel initiatives for the other sectors such as commercial and industrial;
- Need to continuously capacitate the distribution utilities, particularly in the area of demandsupply forecasting, with the end view of improving its output on the preparation of the DDP.

On the other hand, the opportunities are enumerated as follows:

- It has been a top priority for the DOE to empower its planning unit with skills on energy and economic forecasting and improvement on demand-supply database taking advantage of foreign-funded technical assistance, trainings and similar sponsorships on the subject matters/fields; and,
- The DOE has taken initiative to subject its forecasting methodologies, particularly the PDP, to a third party review and evaluation. The methodologies used by DOE will be reviewed in the light of past performance of the forecasts and international best practices. A joint World Bank and Japan Policy and Human Resources Development Fund (PHRD) provided technical assistance to the DOE on the review of power demand forecasting.