ENERGY NEEDS IN INDUSTRY*

Francisco L. Viray**

Introduction

We view energy as the starting point of all industrial activities. The reliable supply of energy is an indispensable factor if we are to move the engines of our economy. The availability of electric power sets the wheels of business and industries in greater motion, and in the process, stimulates economic growth and assures the public a better quality of life.

With a steady source of energy, local and foreign businessmen alike can set up shop, invest and expand, and provide employment and other opportunities to the people.

The energy sector is crucial to the Philippines' aggressive economic program which aims to realize the country's vision of becoming a Newly Industrialized Country (NIC) in Asia by the turn of the century.

In support of this national development thrust, the National Power Corporation (NPC) aspires to achieve energy security so as to encourage economic productivity while enhancing the general well-being of the population. Energy security shall be achieved by enhancing the country's reliance on indigenous, environment-friendly and cost-effective sources of energy.

S & T Status in Energy

The National Power Corporation (NPC) stands at the forefront of power generation and development in the Philippines. Created on November 3, 1936 under Commonwealth Act No. 120, NPC was authorized to use all streams, lakes and springs in the Philippines where power may be developed.

As the country geared up for accelerated industrialization, NPC harnessed other indigenous sources to meet the projected increase in the demand for energy. More power-generating projects were constructed to fuel the flourishing economy.

To date, NPC's total installed capacity is about 8,077 megawatts. Capacity-wise, oil-based plants account for 52%, geothermal plants contribute 21%, hydro plants share 19% and coal plants add 8%.

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Largely through the efforts of NPC, the Philippines has made its mark in the energy field by being the second largest producer of geothermal energy in the world. It is even predicted that at the rate geothermal activities are going, the Philippines might make it to the top – surpassing the United States in geothermal energy capacity before the century is over.

Present Situation

The development of indigenous sources of energy remains the main thrust of NPC's Power Development Program (PDP). The PDP embodies the total plan of NPC in meeting future loans through the coordinated addition of required generation and transmission facilities.

Recognizing that the dismantling of the Ministry of Energy was one of the main factors that brought about the power crisis in 1992 and 1993, President Ramos signed Republic Act 7638 on December 9, 1993 recreating the Department of Energy (DOE) to provide a central coordinating machinery and Cabinet-level advocacy for the implementation of energy policies and programs. Subsequently, NPC's energy program implementation was placed under the supervision of DOE.

Although NPC leads the power sector in supplying quality and reliable electricity, private sector participation in energy generation has become significant.

Soon after the EDSA Revolution in 1986, the Philippine government and NPC saw the need to rationalize the power development program of the country in light of the foreseen high growth in power demand and the financial resource limitations of the government. It was realized that power generation is not a natural monopoly and can be undertaken by the private sector or the independent power producers.

Recognizing the distinct advantages the government gets from private sector participation, Executive Order No. 215 was passed, effectively removing the legal barriers which prevented the private sector from building, owning, and operating power generating plants in the Philippines. EO 215, however, reaffirms NCP's central role in the strategic development of the country's power grids through the setting up of transmission lines and the construction of associated facilities.

As of today, a total of 1,172 megawatts independent power producers' capacity is operating under contract with NPC.

Parallel with the installation of additional capacity, NPC effectively utilizes existing resources through increased efficiency and reliability of its power plants, and through the zealous implementation of a demand-side management program.

NPC embarks on a corporate energy efficiency program aimed at improving the heat rates of fossil-fired power plants. The activities currently being undertaken to improve the energy efficiency in the plants are: (1) implementation of a preventive maintenance program; (2) regular monitoring of key operating parameters; and (3) conduct of periodic plant performance tests.

Demand side management – the promotion of energy conservation and efficiency – has been demonstrated as a viable path for meeting economic development. A reduction in the demand elasticity, through a more efficient use of energy by consumers, translates to a substantial savings in deferred capital investments.

Potential Contributions to Development

The current Medium-Term Philippines Development Plan has set the development vision of the economy which is to improve the quality of life of every Filipino through a broad-based development strategy anchored on total human development and international competitiveness.

Energy is an essential factor to attain this goal. Without power, economic prosperity would never be attained. For the economy to grow, we need an adequate and stable supply of electricity. We cannot expect economic activities such as industrial expansion, tourism and agricultural modernization to flourish without first ensuring the availability of power.

Aside from providing every community with electricity, NPC also assists in the economic development of provinces, cities, and municipalities hosting its power facilities.

As of April 1994, NPC has granted a total of P554.5 million to provinces, municipalities, and barangays where its power plants and projects are located.

NPC's community development projects include barangay electrification, reforestration, skills training programs, no interest loans to farmers' and fishermen's cooperatives, and donation of ambulances, bancas, and service trucks depending on the most-felt needs of the community.

Infrastructure projects, on the other hand, take the form of road concreting, construction of multi-purpose halls, schools, and potable water systems.

NPC also grants priority employment to qualified persons residing near its power projects.

Future Prospects/Projections

It is expected that by the year 2000, the Philippines would be well equipped with sufficient and reliable power supply. Even as early as 1996, adequacy of power supply would already be assured when the baseload plants and major transmission line reinforcements are already in place.

Construction of the 700-megawatt Pagbilao and 300-megawatt Calaca II coal plants began last year, while construction of the 600-megawatt Masinloc and 1,000-megawatt Sual coal plants, and the 440-megawatt Tongonan geothermal power plant is about to start.

Average yearly increase in power demand from 1993 to 1998 is projected at 487 megawatts in Luzon, 85 megawatts in the Visayas and 165 megawatts in Mindanao, or a total yearly increase of 735 megawatts for the whole country.

From 1999 to 2005, the annual increase in power demand for all the grids will more than double with: 1,000 megawatts in Luzon, 165 megawatts in the Visayas and 395 megawatts in Mindanao, or an equivalent countryside yearly increase of 1,700 megawatts.

Energy use generally increases with higher economic and population growth. To meet the projected demand for electricity until the year 2000 and to realize the projected 9.3% GDP growth rate in 1998 and 7.0% in the year 2005, NPC, through its PDP, has programmed a total capacity addition of 20,698 megawatts from 1993 to 2005. Capacity-wise, coal plants will contribute 2,800 megawatts (14%) to the grid, hydro at 1,872 megawatts (9%), geothermal at 1,673 (8%), oil-based capacity in the form of diesel, gas turbine, combine-cycle units at 4,753 megawatts (23%), and other baseload plants, which are still to be identified, at 9,600 megawatts (46%).

It is also expected that the country will then be well equipped with developed and/or adapted technologies which would efficiently convert indigenous raw materials into useful forms of energy.

Hand in hand with technology development, it is also expected that the country would have an increase in energy experts and scientists working in fully-equipped energy R & D facilities.

Recommendations

To achieve the desired economic growth for the Philippines to attain NIC status, the Philippine Energy Plan for 1993-2000 identifies the following strategies:

(1) **Sustain momentum in exploration and development of indigenous sources.**

Full development of the recent oil finds and exploration of frontier areas shall be pursued. Likewise, development of other indigenous resources, such as coal, hydro, geothermal and natural gas which are still marginally exploited, shall be intensified.

(2) **Diversify sources and types of energy imports while ensuring balance between cost and stability.**

Until the country attains total energy self-sufficiency, energy security shall be enhanced by reducing vulnerability to oil supply disruptions. Coal, being more geographically distributed and less prone to price fluctuations, shall increasingly replace oil imports. Sourcing of both oil and coal shall also be geared toward more politically stable and nearer ASEAN countries.

(3) **Promote fuel substitution and diversification in power generation.**

In order to reduce reliance on gas turbines which are expensive to operate, and thereby bring down the cost of electricity, more non-oil fired baseload generating plants shall be constructed.

(4) **Formulate and strictly implement comprehensive operation and maintenance and rehabilitation programs for existing power plants.**

With the commissioning of new baseload power plants into the generation system, NPC should be able to pursue the rehabilitation and/or retirement of its old and unreliable plants.

(5) **Enhance private sector participation in energy projects.**

Policies for private power generation shall be further improved to enhance the private sector. Likewise, passage of legislative measures to enhance incentives for private sector investments in other ventures, particularly oil and gas and geothermal development, must be pursued.

(6) **Extend rural electrification coverage to commercially-viable areas.**

In line with National Electrification Administration's reorientation of its thrust toward being an interested lender to the electric cooperatives, preferential bias for energization shall be toward areas which will require no or minimal subsidy.

(7) **Move toward downstream oil industry deregulation.**

R.A. 7638 requires the DOE to submit a program for oil industry deregulation by 1996. Toward this end, an inter-agency task force on oil industry regulation is currently drawing up an implementation scheme including measures to prepare the environment for this policy shift.

(8) **Promote energy research and development and commercialization of proven technologies.**

Various government agencies engaged in energy R&D are pooling efforts to maximize significant results of studies. Technical and financial assistance programs such as the REPP with GFIs shall be pursued to promote large-scale utilization of renewable energy.

(9) **Intensify promotion of energy conservation and energy-efficient technologies.**

Massive dissemination and enforcement of energy efficiency standards shall be pursued to maximize potential energy savings from energy conservation and use of energy-efficient technologies. Utilities shall be encouraged to undertake demand-side management programs to reduce generation capacity requirement.

(10) **Restructure electricity tariffs to encourage efficient use of electricity.**

Electricity tariffs shall be restructured to encourage efficiency of electricity use and optimize generation capacity expansion.

(11) **Promote greater market-based orientation of domestic petroleum product prices.**

Greater automaticity of price adjustments shall be pursued by establishing benchmarks such as Oil and Petroleum Stabilization Fund (OPSF) minimum and maximum balance levels. Likewise, cross-subsidization across petroleum products shall be rationalized.

(12) Integrate environmental concerns in the planning and implementation of energy programs and projects.

Environmental concerns shall be increasingly addressed at the planning stage to avoid undue delay in project implementation. Greater emphasis on demand side management and nonconventional energy shall also reduce overall greenhouse gas emissions.

(13) Enhance assessment of and planning for the energy needs of countryside development.

Rural energy planning and alternative energy development for electrification of isolated areas shall be pursued to hasten development and improve living standards in the countryside.

(4) Rationalize operation of energy institutions to promote efficiency and competition.

Upon demonstration of their feasibility and advantage to national interest, privatization of energy-related government agencies shall be pursued. Likewise, consolidation of private electric distribution utilities shall be encouraged.

SUMMARY OF COMMENTS TO DR. VIRAY'S PAPER

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The paper read by Dr. Francisco L. Viray presents a fairly accurate picture of the power situation in the Philippines today by identifying the basic deficiencies in the system and describing current programs and plans in order to normalize the state as soon as possible.

The programs appear "doable" and the targets attainable, but there will probably be delays in the implementation of power generation projects if concerns about the environment, particularly the noticeably increasing number of coal-firing plants, are not intensely attended to. The power crisis in recent years can be attributed largely to undue delays and/or even abortion of some projects due to problems with the environment – like the Chico River Hydro-power Project, the Bataan Nuclear Power Project, the Mt. Apo Geothermal Project, and the Calaca II coal-fired projects. There appears general agreement on the urgency to protect the environment from further damage and to add its cost to total project cost. However, the questions of availability and affordability of appropriate technology still begs solutions. Compounding the problem is the determination of who should pay or share in paying for the extra to audit how the environment has fared after environmental clearances have been issued and the projects implemented. It appears necessary to study and implement remedial measures where damage to the environment have been clearly established so that the massive resistances to development projects may be minimized.

20 times less sulfur and three times less ash than coal, and the net contribution of CO_2 to the atmosphere is zero. However, we cannot expect a very big contribution to baseload generation from this source. Except for the industries mentioned, waste biomass is too widely-scattered to be efficiently collected by power plants.

Hydro power is a highly utilized source in the country. It now accounts for 19% of NPC's installed capacity or 1535 MW. NAPOCOR hopes to add 1872 MW from 1993 to 2005. In 1991, the hydro power potential of the country was estimated at 8,667 MW, including already installed capacity. It must be noted, however, that while hydro power does not contribute to the greenhouse effect, there are other major environmental and socio-cultural concerns that have to be addressed. This includes the inundation of large tracts of land, including ancestral lands of cultural communities, and possible dam failure. The decreasing useful lifetimes of the hydro power projects is also a concern because of the unabated denudation of our forests. My guess is that it would be very difficult to expand beyond what has been planned unless we embark on a massive reforestation project now.

Geothermal power is another indigenous source that has a great potential for further development. The initial assessment shows a potential capacity of up to 4035 MW of which only 1696 MW is being utilized and 1673 MW is planned up to 2005. Geothermal power has some advantages over other sources of power. It is the second cheapest source of electricity indigenous to the country. However, there are problems that have to be tackled including hydrogen sulfide emissions, very highly saline and corrosive geothermal fluids, subsidence, and thermal pollution. The problem of subsidence and corrosive fluids can be minimized by reinjection. The thermal pollution is due to the low operating range of geothermal plants which leads to low thermal efficiencies compared to fossil fuel plants. This problem is localized, however, and does not lead to global warming as claimed by certain groups. The biggest problem is the noxious hydrogen sulfide which is difficult to remove. There are also socio-cultural concerns that have to be addressed especially in relation to the cultural communities residing in the area.

Nuclear power is considered to be a relatively environmentally benign option. However, it has been a highly emotionally charged issue in the Philippines and I doubt that it will be politically wise to consider it in the near future. Nuclear power does not contribute to the greenhouse effect. However, the issues of reactor safety and waste storage facilities continue to deter even the more advanced countries to add to their existing nuclear power plants. The issue of safety is even more crucial in our country because of our lack of discipline and our "bahala na" attitude.

The other option is natural gas which, compared to coal, generates 70% more energy per unit of CO_2 produced and contains less sulfur. The problem with natural gas, if not available in the Philippines, is the cost of piping it into the country. Our best hope of course are the very promising on-going explorations and developments within the country for natural gas.

It is quite obvious from the above discussions that if we close the nuclear option, we have no choice but to use fossil fuels which of course will bring us back to the problems of SO_2, NO_x and global warming. Technologies already exist for reducing SO_2, NO_x to acceptable levels. However, there are no cheap technologies for reducing CO_2. One can think of sequestering CO_2 via reforestation, chemical absorption, or even piping it deep into the ocean. All of these options are very expensive. The cheapest is reforestation and yet a 500 MW plant requires 1000 square miles of forest to absorb the CO_2 emission.

There is no such thing as "clean energy." The challenge for us, therefore, is to implement the best energy mix possible for our industrial and other needs while minimizing environmental risks and in a manner that is politically acceptable. A broad consensus building is necessary such that the people who will be most affected by whatever decision is taken will understand better the basis of such a decision. The assistance of developed countries for the transfer of cleaner technologies should be sought especially since some of the environmental concerns such as SO_2, NO_x and CO_2 do not respect national boundaries. Besides their contribution to these pollution loads is disproportionately large compared to their population and we should not be left with the burden of higher costs of maintaining the environmental risks at acceptable levels.

REACTION TO THE PAPER OF DR. FRANCISCO VIRAY

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and Energy Research & Development

I am aware that in the Philippine Energy Plan: 1993-2000, energy supply and demand projections were drawn up for three different scenarios which have been tagged as "expected", "aggressive" and "ambitious". The first scenario assumes the continuation of existing policies and implementation of strategies, while the last two scenarios project positive impacts of policy and program enhancements. The corresponding energy mix for each of these scenarios gives estimates of the energy to be supplied by indigenous and imported energy sources. While oil and gas, coal, hydro, geothermal, bagasse, and agriwaste are explicitly mentioned in this energy mix, nuclear energy does not appear. Is there no plan to harness nuclear energy for power in the future?

Rapporteur's Report

PLENARY SESSION V

"ENERGY NEEDS IN INDUSTRY"

Speaker	:	**Dr. Francisco L. Viray**
Panelists	:	**Dean Alfredo L. Juinio**
		Dr. Estrella F. Alabastro
		Dr. Ester A. Garcia
Moderator	:	**Academician Bienvenido F. Nebres, S.J.**
Rapporteur:		**Academician Apolinario D. Nazarea**

SUMMARY

The report of Dr. Francisco L. Viray, President of the National Power Corporation (NPC) discussed the relevant parameters of the growing energy needs of Philippine industry and how the Department of Energy, the NPC in particular, is trying to meet these needs. This process has been facilitated by the 1993 emergency powers granted by the President of the Philippines – which effectively allowed the reorganization of the NPC, the waiver of the public bidding requirements for power projects, the remittance of 10% of PAGCOR's total earnings to the NPC, the authority to raise the NPC's rate base and the streamlining of the process of obtaining environmental clearances for power projects.

All these have contributed positively to the current level of installed capacity of the NPC which is currently about 8000 megawatts, of which capacity 52% is accounted for by oil burning plants, 21% is accounted for by geothermal plants, 19% is accounted for by hydroelectric plants, and 8% by coal burning plants. Thus, at present, fossil-fuel-burning plants account for 60% of NPC's total installed capacity.

RECOMMENDATIONS AND IMPLICATIONS

(1) Short-term projections indicate that for 1993 to 1998, average annual increment in power demand will be at 487 megawatts in Luzon, 85 megawatts in the Visayas and 165 megawatts in Mindanao or a total annual incremental growth of 735 megawatts for the whole country.

Budgetary support is recommended for the continuance of the construction of the Pagbilao (700 megawatt), and Calaca II (300 megawatt) thermal plants, which were begun in 1993, and the soon to be started Masinloc (600 megawatt) and Sual (1000 megawatt) thermal plants; as well as the Tongonan geothermal plant. These plants are all projected to assist in meeting the annual incremental power over the last decade of this century.

It is noteworthy that the Philippines, even now the second largest producer of geothermal energy in the world, is poised to surpass the United States by becoming the world's leader in terms of geothermal energy capacity before the turn of the century.

(2) Longer-term projections further show that: For 1999 to 2005 the annual increase in power demand for all the power grids will be more than double: 1,000 megawatts in Luzon, 165 megawatts in Visayas and 395 megawatts in Mindanao, or an equivalent countrywide yearly increase of 1,700 megawatts. To meet the projected demand for electricity until the year 2000 and to realize the projected 9.3% GDP growth rate in 1998 and 7.0% in the year 2005, NPC recommends a programmed *total capacity build-up of 20,698 megawatts from 1993 to 2005.* Capacity-wise, coal plants will contribute 2,800 megawatts (14%) to the grid, hydro – 1,872 megawatts (9%), geothermal – 1,673 (8%), oil-based capacity in the form of diesel, gas turbine, combined-cycle units – 4,753 megawatts (25%), *and other baseload plants which are still to be identified – 9,600 megawatts (46%).*

The "still to be identified" baseload plants and their chosen technologies are of course only vaguely cited in the report, but those of us who are worried about environmental degradation wish to see consciously embodied in NPC's planning program, a greater role given to three environmentally-friendly technologies: in particular, *photovoltaic* (e.g. the newest thin-film amorphous silicon technology), *biomass (BM) conversion* [direct BM combustion, thermo-chemical BM conversion (such as gaseous pyrolysis and gasification, hydrolysis, anaerobic digestion/permentation to liquid fuels like ethanol and methanol] and *windpower conversion technologies* – to decrease the present dominant role in the Philippines of fossil-fuel-burning generating plants.

In particular, the technology for producing *low-cost thin film amorphous silicon flexible panels* with capture (conversion) efficiency of 10.2% is now a practical reality, in the form that it has most recently been developed through the joint efforts of United Solar Systems, Canon Corporation of Japan and Energy Conversion Devices Corporation, three of the leading companies at the forefront of applied research in this area of energy conversion.

Although large photovoltaic facilities will still not be competitive at present in comparison with fossil fuel burning plants in areas where electrical transmission lines are *already set-up,* in other, more isolated areas of the country where such transmission lines would be prohibitively expensive to build (and such areas from a sizable fraction of the total landmass of the Philippines) the national government, through the NPC, should be encouraged to apply third wave (and therefore less environmentally degrading) energy conversion technologies.

The implications of conservation have been pointed out more than once: Who is the sensible person who would leave a household heating system on during the hottest days of summer? – or, who is the sensible person who would keep his car running while parked in his garage?

Yet, although there has been really no global conspiracy to vandalize the earth during the better part of the last two centuries, industry for centuries (since the beginning of the industrial revolution) has been getting the power it needs from the fuel it burns, and in the process has been allowing roughly 50% of the energy to "go up in smoke" – to merely escape.

"In economic terms alone, it is not sensible; in terms of wastage, it is alarming. In terms of global environmental damage, it is nothing less than frightening."