

Energy Conservation and Competitiveness

ENERGY CONSERVATION AND COMPETITIVENESS

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I will develop this topic along the following outline:

- Why manage energy?
- Resources for Energy Security and Sustainability
- Energy as a Resource for Competitiveness
- Energy Management and Conservation – Our Responsibility
- Global Competitiveness – an Industry Perspective
- Government Interventions in Energy Sector

Why Manage Energy?

Energy is derived from renewable and non-renewable sources. At present most of our energy for power and transportation are derived from petroleum, coal, and natural gas, all of which are finite non-renewable sources. When these are burned, they generate considerable amounts of gases which are primarily responsible for global warming and climate change. We all have experienced the fury and effects of climate changes in the floods and earthquakes that have visit our planet, becoming more frequent and intense in recent years.

These finite resources are also becoming increasingly expensive because global demand is rising with the rise in the economies of developing countries and of China, India, Russia and Brazil. As a result of these cost increases, there have been attempts to replace these with alternatives like biofuels which has caused a rapid escalation of food prices throughout the world. Hence, there is now a growing connection between the costs of fuel and food, to the point of making both commodities unaffordable to many poorer countries.

As we can see, energy today is becoming very expensive to the point of sourcing alternatives from our global food supply and making both food and fuels unaffordable. Therefore it is incumbent on us to manage it well, in the same way that we manage other valuable resources like our finances, human resources, and technology.

Resources for Energy Security and Sustainability

There are of course also renewable sources of electric energy, and we are fortunate that our past energy leaders had shifted our power generation

away from the use of petroleum sources. So that today, we are only dependent on 10% of our power generation from petroleum.

Many of these renewable resources have been exploited already and are familiar to us, such as the following :

- Hydroelectric and Run-of-River have a certain amount of seasonality because they depend on replenishment by rainfall. There are a few more dam-sites that are practical to develop, but most of these are relatively small in capacity.
- Geothermal steam is converted to electricity. We now rank second in the world in terms of electricity generated from geothermal sources, with the United States taking the lead. In fact there are many more sources of geothermal industry that there is thinking in the United States that they can supply all their power from geothermal energy. Similarly, there are many more such energy sources in our country that remain to be exploited, if only our people will understand that their exploitation is not going to degenerate our natural resources.
- Biomass are traditional sources of energy. For example, sugar cane bagasse has long been used in the sugar mills for heating and also to generate electric power. The thing to remember is that sugar, among all the cultivated plants, provide the most biomass per hectare per year. In fact sugar cane bagasse is now the focus of considerable research to derive ethanol via hydrolysis of the cellulose and subsequent fermentation to alcohol, as biofuel. Until such time, the more traditional route of fermenting sugars to alcohols is the current method of producing bio-ethanol. Meanwhile, coconut oil is also being converted to biofuel substitutes for and additives to diesel oil. In fact, there have been trials conducted in Japan that reveal the positive contributions of coco-methyl ester when used as an additive in diesel fuel. The results show that increases in efficiency up to 7% can be obtained from adding 1% of coco-methyl ester in diesel fuel. This is attributed to the detergent qualities of coco-methyl ester which tend to clean the valves and valve seats of carbon deposits thereby providing full compression and full power from the diesel engines. In addition there is evidence that the lubricity of coco-methyl ester also will contribute to the extended life of diesel injection pumps which normally require maintenance every 100,000 kilometers of travel.
- Wind power has also been exploited in the Pagudpud area of Ilocos Norte. And there are many areas in our archipelago where the wind normally passes through at great velocity as it crosses from and to the Pacific Ocean. In fact, wind power has become so extensively exploited by many developed countries that there is today a backlog of about three years in the order list of wind turbines. So much progress has also been attained that the normal commercial machines are now in the size range of 1.5 MW with 3 MW machines being introduced to the market – when only a decade ago these were in the range of 750 KW units.

There exists tremendous potential also throughout our country to exploit the combination of wind turbine for power generation and hydraulic pumping stations to be used to store energy when power is not needed. This is especially useful for areas that are not connected to the power grid, but where the topography of our country lends itself to such combinations. This concept was used in connection with our nuclear plant which contemplated storing excess power at night by pumping water up from Laguna Lake to the elevated Caliraya Lake.

- Solar power has been used commercially by the Cagayan Electric Power and Light Company or CEPALCO in a 1 MW installation jointly financed with a US AID grant. Apparently the installation is satisfactory because I understand that CEPALCO is planning to expand this capacity, which generates around 30 percent of the nominal capacity, comparable to wind power. There are considerable technology improvements in the production of solar cells in terms of energy gathering capacity per cell and also in terms of reducing costs per watt capacity – which makes the use of solar cells more and more interesting. In fact, the Lopez group of companies involved in Meralco and First Generation Holdings are reported to be investing in the manufacture of solar cells in the country.

- Nuclear power had been installed in Bataan for a capacity of 600 MW but was never operated due to various reasons, least of which were associated with technical considerations that could not be resolved. Certainly, nuclear power is clean and at today's terms can be very competitive because of the concentrated capacities that can be generated for large urban and industrial requirements. From the standpoint of safety, health, and climate considerations, there are many arguments that would justify giving nuclear power a hard second look. All the major industrial countries have substantial amounts of nuclear power, with France leading the group in terms of percentage of electricity generated from nuclear plants. It should be noted that our nuclear plant has two sister plants operating in Korea for the past twenty years without any incident. Of course at this time we have lost most of our trained personnel and must undertake very long term preparations if we are to revive our mothballed nuclear plant. It might be interesting to note that at present conditions, this nuclear plant would probably be worth up to US\$ 3 Billion if it were in running condition. As a matter of foresight, former President Ramos had commissioned a group to locate ten possible sites for future nuclear plants to make us ready to utilize this form of energy again in the future.

There are however a few renewable resources that we remain to exploit, which are the following:

- Wave energy has been exploited in the developed countries but as far as I know these have not been commercialized extensively because of the very large investments needed to cope structurally with the strong wave

forces of nature. I understand some experiments are being conducted by our DOE in the areas where the water current flows are significant.

- Tidal energy has also been exploited in the developed countries but the capital costs are prohibitive at present. It is not as practical to exploit by countries near the equator because of the very small tidal variations.
- Ocean Thermal Energy Conversion or OTEC was tried in Hawaii several decades ago but I have not heard of any significant commercial attempts. Our country can exploit this type of energy in the future because of our proximity to very deep waters, which generate greater thermal differences between the deep water and surface water. Again these require relatively high capital investments which would tend to discourage commercialization.

All told, these renewable resources that have not yet been commercially exploited will probably remain curiosities with no serious attempts to commercialize them while there remain tremendous amounts of renewable energy still ready to be harnessed.

Meanwhile, the more popular sources of energy remain the non-renewable ones which include coal, gas, and petroleum including shale oil. The reason for this is because the capital costs to harness these resources are comparatively cheap, generally just a fraction of the capital investments to harness most of the renewable energy resources. In other words, most of the renewable resource power generators have very little operating costs but are very high in capital costs; and the reverse is true in the case of non-renewable power sources.

- Coal is the most extensive among the energy resources, and is available in most countries, even in our energy-shy country. Because of this, coal is the least volatile among these resources although recently it has been rising at a faster rate because of shortages in handling and delivering the coal supplies. The rate of price increases should therefore settle down when there are sufficient capacities for handling and delivering coal supplies throughout the world.
- Shale Oil is extensive in Venezuela (Orinoco River Basin) and in Canada (Alberta's Athabaska Oil Sands) amounting to billions of tons of supply. These are now being investigated to produce synthetic crude oils as feedstock for petroleum refineries. Even the USA has some limited amounts of tar sands which are also being investigated to produce synthetic crude oils.
- Petroleum Oils are still sourced to the extent of almost 50% from OPEC countries which operate as a world cartel responsible for regulating the supply and price of petroleum. As a result of recent oil price increases, there is again an active search for oil sources mainly from off-shore sources with recent large finds in Brazil and the Arctic region. These finds can be developed within a decade which seems to signal that oil prices are bound to settle somewhat from their recent highs. But to a large extent these will be due to curtailments in the wasteful use of oil and some changes in the life styles of

those countries with a high oil per-capita consumption. While oil as a source of power is no longer so critical in most countries, transport energy is still largely depended on fuels from petroleum sources.

- Natural gas is probably going to be more available as new sources are being exploited and developed, by converting to Liquefied Natural Gas or LNG. There are considerable amounts of gas still being discovered in the Asian off-shore areas which ensure that we will probably be sourcing a lot of electric power from this source in the decades ahead. One reason for the rising popularity of gas even in power generation is the fact that when used in combined-cycle gas turbines (CCGT) the thermal conversion efficiency can reach as high as 60+% while the traditional thermal power plants from coal and petroleum only yield 40% in thermal energy efficiency to electricity. In addition, the CCGT plants are lower in cost and faster to install. Another reason for the rising popularity of natural gas is the fact that it is cleaner burning than coal or petroleum in terms of particulate and CO₂ emissions per unit of electricity generated.

There is also great interest to bring natural gas into the urban areas because it can be used not only to generate electricity but the residual thermal energy can be used to run air-conditioning or heating units thereby further increasing the total thermal energy conversion efficiency. In addition, even cars and buses are now being converted to run on compressed natural gas.

Because of these advantages, our country should prepare to import natural gas from the region by installing LNG receiving facilities in the same way that Japan and China have done. One advantage is that gas cannot be stored or inventoried economically and so the prices cannot be manipulated as much as petroleum can – unless we are prepared to spend on large underground storage areas e.g. abandoned mining pits, like is done in industrialized countries.

There are also natural gas that come out together with the more expensive petroleum resources which are called associated natural gas. In general, these are converted at site into chemicals like methanol or fertilizers like ammonia and urea. At present, prices of these chemicals have been rising rapidly reflecting the heating values of their natural gas raw materials. Fertilizers especially have been rising rapidly in prices due to the food prices and damage to agriculture caused by climate changes, which damage has to be replaced to provide better food security.

Energy as a Resource for Competitiveness

There is no doubt that energy today constitutes a greater percentage of the total cost of every product and service delivered than ever before. Because of this, the sensitivity to energy prices is becoming very critical to the country's competitiveness. This is the reason why there is a clamor from all

sectors to remove or reduce the taxes on energy. At one time PCCI advocated the removal of all taxes on energy because it has always been a primary input to our goods and services; the principle was that private sector should first be allowed to compete and make a profit and then it should be taxed on the profit that it makes – rather than preventing it from becoming competitive from the start. This view however has to be balanced against the sad state of our infrastructure and education which robs us of competitiveness and which can only be addressed by having sufficient funds and budgets for these purposes. Therefore, perhaps the middle view would be to simply reduce the rate of these taxes.

Energy use should always be viewed as essential to productivity, so it is the efficient and wise use of energy that should be considered in all its applications. For example, proper or sufficient lighting should always be available, but the use of the inefficient hot incandescent lamps should give way to the cooler safer compact fluorescent lamps in our households, factories, commercial, industrial, and public establishments.

For the transport sector, we should avail more of water transport whenever practical, because it moves cargo at the lowest cost per ton-kilometer than road or air transport. We are fortunate to be an archipelago with numerous waterways. Other continents build man-made canals to be able to transport their goods by water.

Another form of transport by water is the Roll-On Roll-Off or RORO which act as moving bridges along the shortest distances between islands, which interconnect our island nation so that road transport can provide the most direct routes to their end-destinations. In a sense this is more economical than the present hubs and spokes routes which is prevalent in the country today, where the hubs are major ports connected by shipping, and the spokes are both smaller shipping routes or roadways to the final destination.

Yet another form of transport that will pay for us to develop is a North-South railway system because our country is fairly long running from north to south. Rail transport in many countries are run by electricity and this is the way to go for the long term future in order to avoid dependence on petroleum fuels if possible.

We all need affordable energy to be able to use it for productive and competitive purposes. And the other side of affordability is the value that we create out of the energy that we use. This is the main thrust of countries like Japan and UK where the value of goods and services produced from their use of energy makes almost any cost of energy affordable to them, while unaffordable to many others. Thus, Japan has much more expensive cost of power than the Philippines but the average Japanese can afford this high energy cost because his output is valued more than our individual outputs. This is why Japan is able to absorb many oil-price shocks with more equanimity than other countries, including ours. We should therefore always monitor the value

of our produce versus the cost of electricity, and keep striving to increase the ratio as we keep progressing.

In this regard, the Philippines ranks higher in value added per unit electricity used than Indonesia, Thailand, and Malaysia but this is mainly due to the fact that many of our heavy industries folded up from non-competitiveness with the advent of globalization, and we shifted more of our economic activities to services. I would not consider this a favorable sign because it leads us vulnerable to predatory pricing when it comes to global shortages of some vital commodities like steel, etc. It would still be essential for us to maintain a strategic local supply of every vital commodity in order to prevent unduly sharp price fluctuations of vital inputs to industry and our daily life. On the other hand, countries which depend mainly on high energy using industries will be subject to severe shocks when the costs of energy climb sharply. China is one such example and this is the reason why she has had to sign up energy supply contracts to ensure that her industries are not shocked into non-competitiveness.

Energy Management and Conservation – Our Responsibility

Energy Management begins at the Planning and Design stages – and is a primary responsibility of everyone, government and private sector. If energy resources are going to be tight and expensive, then it is our responsibility to make sure that we can afford to run our investments, our homes, our offices, our factories competitively against others who are going to demand from that limited or finite supply. Therefore, we must attempt to match our energy supply with our uses in the most cost-effective or least cost operations.

As I stated earlier, natural gas can be used to generate electricity and the waste heat can be used to provide air-conditioning in a most cost-effective and efficient manner. Such an arrangement which generates maximum value will make natural gas affordable to our people even when others can no longer afford them.

One of the ways that we can use our investments in the power sector most effectively is to consider demand-side management practices. One of these is to increase the load factor by spreading the electricity load more evenly through the day, so that the capacity utilization is raised to the highest level possible. This reduces the capital costs per unit of electricity generated, and brings down our costs. Another way is to increase the power factor so that we can reduce the electricity line losses, and in some cases even reduce the size of transmission wires needed.

Energy conservation should always be foremost in our care for energy. In air-conditioning practice, the raising of the thermostat setting by just one degree centigrade can mean savings of about 10% of the energy requirements. Add to this insulation requirements, and you can deliver most

of the comfort to the human occupants of a building instead of to cooling the massive building structures.

There is also the need to use efficient technologies and apparatus. For example, air-conditioners and refrigerators now carry energy efficiency labels and energy efficiencies of these apparatus keep increasing with competition and rising energy efficiency standards imposed by regulatory agencies of the Departments of Energy and Trade & Industry. The most important of these is the advent of compact fluorescent lamps that are 80% more efficient than the incandescent lamps. There will soon issue efficiency standards to regulate the use of these lamps before the year 2010.

Global Competitiveness – An Industry Perspective

Industry is most sensitive to the high cost of energy and transportation for competitiveness. Therefore there is continually a search for ways to reduce energy costs while improving the reliability of energy delivery systems.

One approach in planning ahead is to match energy generation to the user requirements. For example, a new paper mill being designed was planned to have its own power supply. With the advent of cost-effective coal-burning fluidized-bed plants for steam and power generation as small as 25MW of capacity make it possible to self-generate power at the site. This avoids the transmission, distribution and systems loss charges that amount to about 20% of the total electricity charges. As a result also of the availability of smaller power plants, and advances in technology, there is also a trend towards decentralization of former large scale manufacturing operations into many distributed manufacturing plants. There are some strategic advantages also that accrue from this arrangement, to ensure the continued availability of products in the event of accidents in any of the manufacturing units.

Another reason for limiting over-centralization is the tremendous capital sunk in one location. It must be noted that for every dollar sunk into manufacturing capital investment, an equal amount of investment is usually needed for the corresponding power and energy supply units.

Government Interventions in Energy Sector

The government has a large stake in the energy sector since it is one of the major sources of government revenues. Among these are Import Duties, E-VAT, Income Taxes, Royalties, and Universal Charges, which together amount to more than 15% of the sale of energy. Therefore, next to the actual cost of energy source and capital, the government take is the largest of the remaining costs of energy generation and delivery. This is the reason why the government has been often requested to remove or reduce some of these taxes. On the other hand, as earlier stated, the government hesitates to forego

most of these except import duties which it has eliminated on petroleum products by reducing from 3% to zero, when the petroleum prices rose.

There is a valid argument however to reduce the royalties on natural gas to a level that will make our natural gas comparable with imported natural gas. The reason for this is because we expect soon to be importing natural gas because it is clean and more environmentally friendly than coal. It would be unfair if our domestic natural gas will come out more expensive than the imported gas, now that the costs of development have been met.

The government has considerable leeway to equalize the cost differences among the different sources of energy by its taxing authority. It would be good if the government can see its way clear towards using these powers to promote energy efficiency, environmental compliance, and competition among the different generating stakeholders through a more level playing field.

The government also has strong regulatory powers which it exercises through the Energy Regulatory Commission. In recent months, these regulatory powers have been much highlighted by varying claims and counterclaims from different stakeholders. What have become evident are the need for greater transparency in the actuations of the ERC vis-à-vis its multifaceted functions to :

- >Balance the interests of all the stakeholders in its decision making process;
- >Promote competition by leveling the playing field along the entire energy supply chain;
- >Explain publicly, thoroughly and clearly its decisions for a better understanding of the energy industry;
- >Favor environmentally friendly supply of energy
- >Encourage energy conservation, demand-side management, and similar good practices, by enunciating general rules that shall accomplish these.
- >Reward good practices in Performance Based Rate systems that trend towards decreasing rates instead of increasing rates.

To summarize, the government through its fiscal authority, the DOE through its policy advocacy and the ERC through its specific rulings and general rules, can lead in making energy sourcing, supply, and application an important factor in the competitive and sustainable development of our people and nation.

