Review of Existing Energy Framework for Vietnam

Tien Minh Do, Deepak Sharma and Ngoc Hung Nguyen

***Abstract*—** *Since introducing a market-orientation to the economy in 1986, Vietnam has made considerable socio-economic progress. For example, over the period 1986-2007, the GDP of Vietnam has grown at approximately 7 per cent per year which is the highest growth rate in the ASEAN region. In this growth, the country's energy sector has played a vital role. This role is likely to deepen in the years to come as Vietnam strives to achieve ever higher economic progress. Such deepening in the role of energy, this paper argues, will heighten concerns about the security of energy supply, increased CO2 emissions and pollution and other social and political challenges. In order to address these challenges, Vietnam has over the last decade, initiated several energy policies underpinned by appropriate legislation – called, 'institutional framework', in the context of this paper. A deeper review of this framework suggests that it is typified by a lack of cohesiveness of policy direction and purpose, fragmented institutional structures and responsibilities, and weak public constituency on environmental issues. The existing framework is therefore unlikely to be able to provide a satisfactory redress to the challenges noted above. This paper provides some suggestions to reduce the weaknesses of the existing framework. These include: articulating the significance of the link between energy, economy and environment; developing coherence in institutional purpose and design, and raising public awareness through better communication and education.*

***Keywords*— Energy policy, energy demand and policy framework.**

1. INTRODUCTION

Vietnam - a developing country - began a transition from a centrally planned to a market economy in 1986. This process accelerated in 1989, with the devaluation of the Vietnamese currency (VND) and the decontrol of most prices. In 1993, Vietnam obtained access to concessional international finance and the US embargo was lifted in 1994. Vietnam became a member of the ASEAN, APEC and WTO in the years 1995, 1998 and 2007, respectively. All these developments provided stimulus to the economy, which has responded with a growth of more than 7% pa over the past fifteen years – the highest growth rate in the ASEAN region [1]. It is expected that these growth trends will continue in the years to come. In this growth, the country's energy sector, which also provides approximately one fourth of the nation's foreign earnings [2], will play a vital role. This role will however be negotiated in the backdrop of several challenges including: (i) ensuring security of energy supply for socio-economic development, (ii) protecting the natural environment from possible damage caused by energy activities, and (iii) addressing social and political issues, for example, equity, justice and transparency.

In order to address these challenges, Vietnam has, over the last decade, initiated several policies, underpinned by appropriate legislation, for example, Petroleum Law (1993, amended 2000), Environmental Protection Law (2005), Mineral Law (1996, supplemented and amended 2005), Electricity Law (2005), and National Policy on Energy Conservation and Efficiency (2006). In addition, several institutions, for example, Electricity Regulatory Authority of Vietnam (ERAV) and National Environment Agency (NEA) have been established to implement these policies.

These energy and environmental legislation and institutions constitute – in the context of this paper – the institutional framework for energy sector. This framework provides the ambit within which the country's energy sector will evolve. This paper argues that this framework – notwithstanding the policy development of the last few years is still not adequate for addressing the challenges faced by the energy sector, as noted above. There is therefore a need to examine the efficiency of this framework so that its weaknesses could be overcome. This paper attempts to do that. The paper starts with a description of the challenges faced by the Vietnamese energy sector. It is followed by an examination of limitations of the existing energy and environmental framework. Finally, some suggestions are made for improving the framework.

2. CHALLENGES FACED BY VIETNAMESE ENERGY SECTOR

In fuelling Vietnam's development, the country's energy sector is likely to face the twin challenges of ensuring security of energy supply while protecting the environment. The key factors that are likely to contribute to worsening the security of energy supply include: (i) foreseeable energy import dependency in a situation of increasing energy demand and limited indigenous

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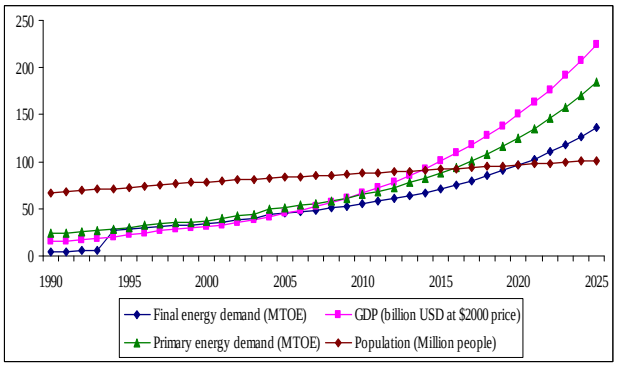
supply; (ii) continuing low energy efficiency, due mainly to poor infrastructure, provision and operation and management practices; and (iii) a shortage of funds for developing energy infrastructure. And the environmental concerns are likely due to the significant contributions that rapidly evolving energy sector is expected to make in term of increased pollution, CO2 emissions and deforestation. Further discussion of these issues is presented in the remainder of this section.

2.1 Security of energy supply

Foreseeable energy import dependency

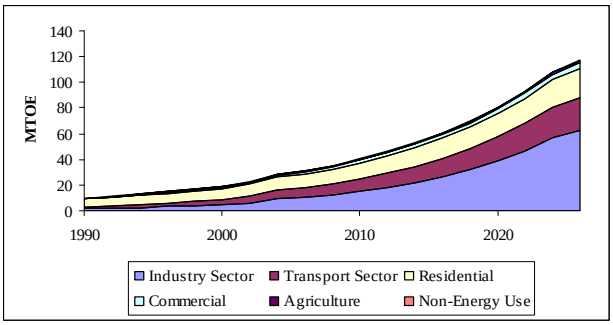
There is a general consensus among the Vietnamese policy makers and planners that the indigenous energy resources of Vietnam are unlikely to be able to meet the increasing energy demand of the nation. For example, over the period 1990 and 2006, the commercial final energy demand increased from 4217 to 28049 KTOE – an annual growth rate of 12.5% [3]. The corresponding annual growth rates of GDP and population over this period were 7.5% and 1.6%, respectively [1]. In order to sustain an GDP annual growth of 8.4% over the period 2005-2025, it is estimated that the final and primary energy supply must grow by 8.8% and 9.5% per annum, reaching 123,000 KTOE and 170,000 KTOE, respectively in the year 2025 – about six times as compared to their 2006 levels (see figure 1).



Source: IEA, (2007) [1], IEA, (2007) [3] and JICA, (2008) [4]

Fig.1. Energy demand, GDP and population

The industry, transport and residential sectors collectively accounted for 90% of total final energy consumption in the year 2006. Among three biggest energy consumers, the energy consumption shares of these sectors are 42.8, 30.9 and 16.2%, respectively [3]. The inter-sectoral trends in energy consumption are expected to undergo significant changes in the coming years. For example, the industry sector is expected to have the highest growth rate in final energy consumption. It is estimated to account for nearly 57.6% of total final energy consumption by 2025. This is due to the government's policy emphasis on industrialisation to promote economic development. At the same time, the shares of the transport and residential sector are expected to account for 19.8 and 16.2%, respectively. Most of the increased energy demand in transport will be attributable to the road sub-sector as a result of increase in per capita driving activity and vehicle population. The residential sector is characterized by increase in commercial energy demand due to improvement of access to modern energy and people's income [4] (see figure 2).



Source: IEA, (2007) [3] and JICA, (2008) [4]

Fig.2. Final energy demand by sector

In terms of fuel types, coal and oil accounted for the largest shares of commercial primary energy resources, collectively accounting for 75% of the total, followed by hydro and gas with a share of 25%. The shares of coal, gas and petroleum have tended to increase while the share of hydro has decreased over the period 1990 and 2025. In the year 2006, the shares of coal, oil, gas and hydro in total primary energy supply were 31.5, 43.5, 17.8 and 7.2%, respectively. Between 1990 and 2006, gas grew at the fastest annual rate (of 70%) driven largely by the start-up of natural gas supply from Nam Con Son Basin to Phy My electricity complex in 2002. During the same period, oil products grew at the second fastest rate of 10.5% due to the growth in transportation and industry. Hydro and coal grew at 10 and 9% respectively as a result of high demand for electricity generation [3].

Table 1: Primary energy demand

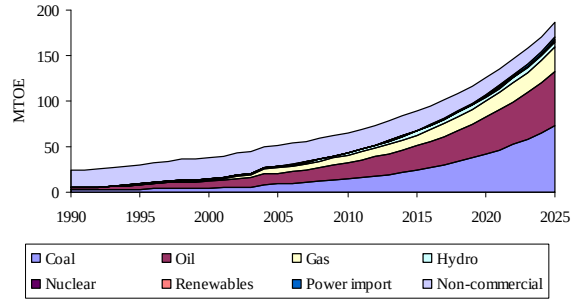
MTOE

	2005	2010	2015	2020	2025
Coal	8.79	12.98	23.92	36.27	73.19
Oil	12.01	17.29	26.80	40.70	59.47
Gas	5.60	8.94	11.65	20.67	26.51
Hydro	1.40	2.98	4.50	5.41	5.48
Nuclear	0	0	0	0.88	2.11
Renewable	0.06	0.19	0.40	0.57	0.70
E. import	0.01	0.41	0.69	2.13	2.14
Bio-mass	14.69	14.18	13.48	12.43	10.60
Total	27.86	42.33	67.95	106.65	169.60

Source: JICA, 2008) [4]

In the future, Table 1 shows that fossil fuels will continue to dominate the future primary energy mix, accounting for approximately 90% of total commercial primary energy demand. Excluding large-scale hydro,

other types of new and renewable energy sources, such as mini-hydro, wind and solar, will continue to be promoted, raising their share to 3.5% by 2025. Nuclear power – expected to be introduced by the year 2020 – is estimated to account for 1% of total energy demand by 2025. The share of biomass in total primary requirements is expected to decrease sharply, from 46.3% in 2006, to 6% in 2025 [4] (see figure 3).



Source: IEA, (2007) [3] and JICA, (2008) [4]

Fig.3. Primary energy demand by fuel type

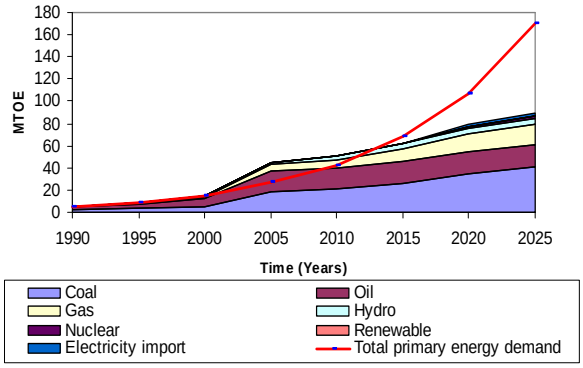
On the supply side, Vietnam is endowed with several energy resources including coal, oil, natural gas, hydro and renewable and it has generally been an energy-self-sufficient economy. The growth rate of domestic energy production for the period 1990-2006 was 14.5%, making the energy-economy elasticity equal to 2.0. Over this period, indigenous oil and gas production grew at the highest rate (16% per year), followed by coal (14.3% per year). In 2006, total domestic energy production was 47699 KTOE of which the shares of coal, oil, gas and hydro were 44.5%, 38%, 13.2% and 4.3%, respectively. At the same time, the total domestic primary energy supply (net of domestic imports and exports) in 2006 was 28049 KTOE [3]. However, as the future energy demand escalates in order to sustain the country's socio-economic development, there are concerns about energy security. These concerns get further heightened if one takes note of the fact that Vietnam currently does not have any meaningful stockpiling policies. This could clearly raise energy supply reliability issues in the future.

Table 2. Energy reserve and potential exploitation

Energy source	Proven reserve	Potential of exploitation per annum
Coal	6.00 (Bill. tons)	60 – 80 (Mill. tons)
Oil	615 – 957 (Mill. tons)	25 – 30 (Mill. tons)
Gas	600 (Bill. cubic m3)	15 – 30 (Bill. cubic m3)
Hydro	20 (GW)	80 (Bill. Kwh)

Source: Ministry of Industry, (2006) [5], JICA, 2008) [4] and Institute of Energy (IE), Vietnam (2008) [6].

Table 1 shows the precariousness of the future resource situation in Vietnam. For example, with the estimated exploitable capacity of 25 millions tons of crude oil and 15 billions cubic meters of natural gas per annum, reserve of oil and gas will not be enough for extraction in 30 years. Further, despite abundance of hydro potential, this energy resource will solely depend on the amount of rain-fall that is increasingly being affected by global warming. In addition, some new and renewable energy sources such as wind and solar are unlikely to reach commercial exploitability in the foreseeable future. In the area of electricity production, the situation is quite serious. Due to a thin system reserve and seasonal dependency, the electricity system has been experiencing power shortages recently. Power cuts, especially in the dry season have become commonplace. In the case of petroleum products, Vietnam – despite being a net exporter – still has to import its entire requirements of refined petroleum products to meet the domestic demand because the first refinery with a capacity of 6.5 million tons per year is planned to be put in operation in 2009; and the second refinery with total annual capacity of 10 million tons is scheduled for commissioning in 2015. Besides, the lack of stockpiling also makes the Vietnam's energy supply system highly vulnerable to change in the world's energy market, especially when there is an oil supply disruption due to geopolitical conflicts [7].



Source: IEA, (2007) [3] and JICA, (2008) [4]

Fig 4. Primary energy supply and demand balance

As can be seen in figure 4, with rapidly increasing energy demand and limited indigenous supply Vietnam is expected to become a net energy importer within the next decade. It is projected to import 48.6% of its total commercial primary energy needs by the years 2025. Among fuels import at the same time, coal, oil and gas are expected to account for 18.8%, 23.4% and 5.1%, respectively. Besides, electricity import also contributes to 1.3% of total commercial primary energy requirement [4]. This will lead to a substantial change in the Vietnam's energy structure. Appropriate energy policies are therefore needed to achieve a balance in the sources of energy supply and to avoid energy supply disruption caused by geopolitical disputes. For example, along with diversity of energy import sources, new and renewable energy, such as nuclear, solar and wind would play role

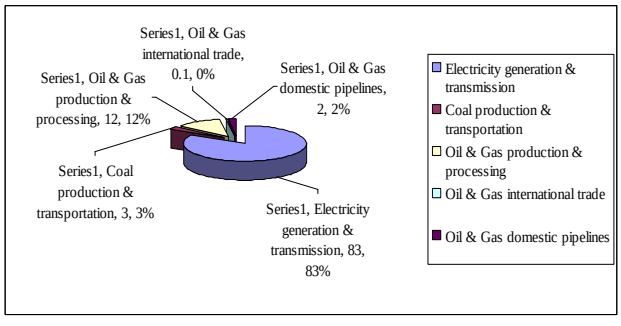
in ensuring security of energy supply for Vietnam in the future.

Low energy efficiency

Low energy efficiency (at demand and supply sides) is a major energy challenge facing Vietnam. The major sources of such inefficiency include: old technologies and poor energy management practices, from conversion to processing and end-use levels. Indeed, only new, large-scale combined-cycle natural gas-based power plants incorporate world-class technology and provide high fuel efficiency. Most existing coal and oil-fired plants have low fuel efficiency as their facilities and technology are relatively old. In 2005, energy loss in power generation amounted to 9.5 % of total primary energy consumption [3]. In 2008, transmission and distribution loss accounted for 9.35% of total electricity output [8]. The same explanation could be applied for the demand side. Old technologies such as imported second-hand vehicles and domestically-made electrical appliances are responsible for high fuel and electricity consumption. Indeed, both primary and final energy intensities of Vietnam are conspicuously higher as compared with almost all ASEAN and OECD countries. For example, in 2005, the country's primary energy intensity was 0.23 KgOE/USD while ASEAN and OECD averages were 0.2 and 0.18 KgOE/USD, respectively. Similarly, on the demand side, the final energy intensities were 0.2 KgOE/USD, 0.16 KgOE and 0.12KgOE for Vietnam, ASEAN and OECD countries, respectively [1].

Funding constraints

A very large sum of money is needed for developing Vietnam's energy infrastructure including system expansion and efficiency improvement. Total investment requirements for this purpose over the period 2000-2025 are projected to be of the order of USD 136-172 billion. The majority of these investments will be required for the electricity sector alone. Oil and gas investments will be next, accounting for 15% of total capital investment requirements (see figure 4).



Source: APECRC, (2006) [9]

Fig.5. Investment requirements for energy sector infrastructure development.

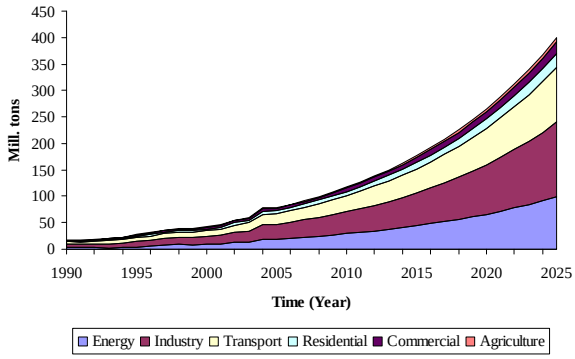
As a percentage of GDP, Vietnam's cumulative investment requirements for the energy sector will be between 4.2 and 5.3 per cent over the period 2000-2025, the highest level in the ASEAN region. For the ASEAN economies, the average investment requirements as a percentage of GDP range between 1.2 and 1.5 per cent [9]. Clearly, the mobilization of sufficient funds for developing the energy sector is expected to remain a major challenge for a poor, developing country like Vietnam where money is always hungry for many other critical programs, such as poverty reduction, education and primary health care services in the remote areas. The situation is even getting worse if one takes note of the negative impacts of the current world economic crisis. At present, Vietnam is a net energy exporter. The revenues are likely to reduce because of lower energy prices resulting from decreasing world energy demand. This is likely to cause difficulties not only for the state budget as revenue from energy exports form a large share of the nation's foreign earnings but also for the energy sector development because of the weakening financial status of the energy businesses. Further, the world economic crisis is expected to reduce the flow of foreign investment to Vietnam's economy in general. Finally, low efficiency of investment in the energy sector, especially the power industry due to unreasonable cross-subsidized electricity tariffs, is also responsible for poor mobilization of capital flow of this sector. It is interestingly indicated by the fact that while the Electricity of Vietnam (EVN) – the state entity who is in charged of developing power system – does not have enough funds for the system capacity expansion but still invests in highly profitable sectors, such as stock market and telecommunication. [8]

2.2 Environment

Vietnam is currently one of the lowest per capita emitters of carbon emissions. In 2005, the country's CO2 emissions per capita were 0.97 tons - 23% of the world average. At the same time, however, CO2 emissions per unit of GDP are very high - about 2 times the world average [10]. This suggests that energy is not being effectively used for economic activities in Vietnam. Consequently, the natural environment suffers. Further, the CO2 emissions are expected to grow rapidly as Vietnam industrialises and the economy utilises more carbon intensive fuels, substituting traditional non-commercial fuels including biomass. On average, the CO2 emissions are projected to increase at an annual rate of 8.5% and could reach 400 million tons by 2025 (see figure 5) [4]. Major sources for such emissions are energy, industry and transport sectors, accounting for more than 85% of total CO2 emissions. In addition, energy extraction and transportation, such as coal mining in the North and oil exploitation in the South, that have not been well planned and are likely to contribute to adverse environmental outcomes. For example, the high density of the open-pit coal mining activities in Quang Ninh province has caused considerable soil erosion in this region. As a result, the Ha long Bay nearby – a World's natural heritage site – is affected by dust and waste water pollution.

3. EXISTING ENERGY POLICY SETTINGS IN VIETNAM

This section reviews the existing energy policy settings of Vietnam, especially the extent to which such policies are likely to be able to address the energy challenges discussed in the previous section of the paper.



Source: IEA, (2007) [11] and JICA, (2008) [4]

Fig.6. CO2 emissions by sector.

3.1 Energy security policies

With a poor energy infrastructure and limited energy resources, Vietnam is expected to move from being a net energy exporter to a net energy importer within the next decade. In order to redress this issue, the Vietnamese government has taken a suite of policy measures including:

a) strengthening domestic energy supply capacity, through legislative reforms, and expanding the energy infrastructure to reduce dependence on imported energy that is prone to volatility, especially petroleum.

b) applying preferential policies for financing and widening international cooperation in order to strengthen exploration and development of indigenous resources thereby firming-up reserves and increasing exploitability of oil, gas, coal and new and renewable energy;

c) supporting Vietnam's national oil company to invest in the exploration and development of oil and gas resources overseas;

d) intensifying regional and international energy cooperation and diversifying energy import sources; and

e) developing clean fuels, especially nuclear and renewable energy [5].

These policies are supported by an institutional framework that includes elaborate laws and institutions. For example, The Common Investment Law and The United Enterprises Law, that became effective from 1 July 2006, encourages foreign and domestic organisations and individuals to invest in power production through Build-Operate-Transfer (BOT) arrangements; and projects in remote areas have been accorded preferential treatment under this law and tax exemptions are given for imported machine and equipment. With promulgation of the Mineral Law in 1996, the Amended Petroleum Law in 2000, and the Electricity Law in 2005, the legislative environment for businesses in the energy sector has been set up and a legal framework for formulating policies and regulations, such as policy on upstream oil and gas to enhance energy security, has been created. The Vietnamese government also promotes development of new and renewable energy in order to diversify energy sources, improve access to modern energy in off-grid areas, and to reduce negative environmental impacts of energy activities through Renewable Energy Action Plan. In addition, Vietnam is a participant in international and regional cooperation ventures, such as the Great Mekong Sub-region and oil and gas exploration in Mongolia, Indonesia, Malaysia, Iraq, Algeria, Russia, Peru, Venezuela and Cuba to stabilise energy import [11].

Notwithstanding these initiatives, the objective of ensuring energy supply security set by the government is unlikely to be easily achieved – this paper contends. This is due to the weaknesses of the existing policies on energy market, energy pricing and energy efficiency. At present, the national government is responsible for ensuring the security of energy supply and regulating most energy prices. The lack of a united domestic energy market and rational energy pricing mechanism has prevented players, including private investors entering the energy market. Hence, the role of private sector in energy security of Vietnam is limited. Consider the case of power generation as an example. In this sector, prices for power supply rise and fall in accordance with interplay of market forces, but the end-user prices are fixed by the government. The utilities in the middle are, therefore, in position to be either squeezed into bankruptcy or gain undue profits. In the long-term, therefore, the security of energy supply should not be seen as a national responsibility but a common one shared among government, energy firms and wherever applicable, individual consumers through a market mechanism. The security of energy supply could be ensured through a united domestic energy market where the government establishes the objectives and set the rules that enable firms, both state-owned and private ones to achieve those objectives. One may argue that a market-based energy system could reduce the security of energy supply and impose new risks, such as those associated with reserve capacity or consistency with environmental or economic objectives. In fact, the market could enhance the security of energy supply by increasing the number of market participants and improving the flexibility of energy system because market makes the costs of security of energy supply more transparent, which in turn can lead to a situation where consumers are prepared to pay a premium for increased security of supply or to accept a reduced level of security in exchange for lower prices. Moreover, the main effect of the market-based energy system is that it can shift the prime responsibility for achieving the security of supply from government towards market participants. This could reduce the financial pressures on

the government, for mobilising investment capital for energy infrastructure development. In addition, a competitive market could lead to an effective allocation of resources, both demand and supply sides and hence improvement of energy efficiency [12].

3.2 Energy market reform policies

In fact, the energy market in Vietnam has been developed since the country started the market-oriented economy in 1986. The purpose of developing a united energy market, both domestically and internationally is to promote investment and secure financial resources for sustainable development of the energy system. The energy market development in Vietnam is a process to move from the system of direct market control via the state firms to the system in which the energy supply and demand is decided by the market under the rules to ensure fair and efficient competition. In this process, Vietnam has achieved some important results. For examples: (i) In the down-stream markets for coal, oil and gas the prices of these fuels are set at the international prices; (ii) Private investors are encouraged to participate in energy activities, such as power generation and petroleum products trade; And (iii) Along with the Electricity Law, Vietnam has set up a roadmap that includes three phases for power market development [13]. According to this roadmap, the first phase for a competitive power generation market is scheduled to start in 2009 and complete in 2014. It is followed by the second phase that is competitive market in bulk power, from 2014 to 2022. Finally, the third phase that is a competitive retail power market will take place from the year 2022. However, there are still some obstacles to realization of the efficient energy market in Vietnam. First, the prices of coal and natural gas that are locally produced are substantially lower than international prices while prices of the imported petroleum products are at the international levels. Further, the electricity tariffs are still regulated by the Central government with so much cross subsidies. Such distorted energy price system would, in turn cause distortion to the energy market system and energy structure. In addition, unfair competition resulted from dominance of the state enterprises with advantage of controlling the existing energy businesses and having market penetrated information. Therefore, along with the deregulation process of energy market, some measures, such as, monopoly prevention, equitization and privatization are needed for developing an efficient energy market [4]

3.3 Energy efficiency policies

Among the ASEAN fraternity, Vietnam is one of the lowest per capita energy consuming countries, and it is one of the highest energy-intensity countries. This suggests that energy efficiency in Vietnam at the final user and conversion sectors is low. Such inefficiency continues to cause considerable, adverse economic and environmental impacts. This recognition has prompted the Vietnamese policy makers to develop a national program aimed at enhancing an effective use of energy, with emphasis on both, the supply and demand sides. This program envisages a saving of 3 to 5 per cent, and 5 to 8 per cent, of the total energy consumed nationwide, for the periods 2006-2010 and 2011-2015, respectively. Some key initiatives to achieve this include:

a) developing a legal framework for economical and efficient use of energy in industrial production, in management of construction projects, and in energy-using equipment;
b) raising people's awareness about the economical and efficient use of energy through public propagation and education programs;
c) conducting a pilot campaign on "Building a model of economical use of energy in every household"
d) developing standards and using energy-saving product labels on selected appliances;
e) providing technical assistance for local manufacturers that comply with energy consumption standards;
f) building management models on economical and efficient use of energy for enterprises;
g) assisting enterprises in upgrading, improving and optimising their production chains for the economical and efficient use of energy; and
h) capacity building and deployment of activities that enhance the economical and efficient use of energy in construction, designing and management of buildings [5].

Despite these initiatives of the Vietnamese government, the results in terms of energy efficiency improvement are rather modest. This, this paper argues, is due to the following inadequacies of the existing policy settings. Firstly, the policy emphasises the promotion of effective management measures and advanced technologies, in both supply and demand sides, but sufficient time is not given for the uptake of these technologies. For example, typical useful life time of the energy technologies, particularly the electricity generation plants, is 30-40 years, but the Vietnamese program on energy efficiency aims to achieve savings of 5 to 8% within 5 years (from 2011 to 2015). To meet this target, almost all old coal-fired plants must be retired. It is clearly impracticable, especially where huge investment is needed every year in the power sector in order to meet the increasing electricity demand. The current government program is clearly too ambitious. In fact it was formulated without due consideration of the country's economic conditions and the long-term perspective required when analysing the energy infrastructure and policy issues. Secondly, it is widely known that there is a link between policies on energy efficiency and other policies such as energy pricing and environmental protection. At present subsidies are uniformly distributed among various income groups, instead of focusing on improving the affordability of energy for the disadvantaged groups. There is, therefore, no incentive for the rich to save energy. Besides, the cross-subsidies contribute to making the industry less competitive, due to the relatively high unsubsidised

energy prices they have to pay. Next, the lack of focus on managing the energy consumption growth, for example, cooling and airconditioning could constraint the effectiveness of the program.

3.4 Energy pricing policies

Because energy has until now been seen as a strategic good, the pricing of most fuels has been regulated directly through the Prime Minister's Office. The State Pricing Committee (SPC – recently renamed Price Control Department under the Ministry of Finance) first evaluates the energy prices proposed by various energy enterprises and then submits them to the Prime Minister's Office for approval. Prices of most energy fuels are cross-subsidised. This sends a wrong signal to the users; and the lower the energy prices results in higher energy consumption, leading to reduced security of energy supply, decreased energy efficiency and damage to the environment. In addition, industries that pay for subsidies become less competitive in the market due to increase in their production costs resulting from high-priced energy inputs. Furthermore, the prices regulated by the government do not reflect production costs and the supply-demand relationship in the energy market, especially the long run marginal costs (LRMC), get distorted. As a result, the utilities are placed in a difficult financial position and it, in turn, prevents the mobilisation of adequate investment capital for the energy sector. Thus, there is an imminent need for Vietnam to develop a rational energy pricing mechanism that would encourage energy security and energy efficiency, through a transition from centrally administered philosophy to a system of transparently regulated rules for the market players [7].

3.5 Environmental policies

In 1991, Vietnam approved a detailed environmental plan called the National Plan for Environment and Sustainable Development (Ministry of Science and Technology 2006). The plan provides a comprehensive framework for establishing the strategies, policies, institutions, laws, regulations and programs needed to address environmental issues. The governing law on environmental protection came into force in 1993. This policy and legislation aim to develop the energy sector while promoting a clean environment. Specific objectives of the program are to:

a) determine long term objectives for energy and the environment in line with regional environmental standards;
b) establish financial rules on energy and the environment to ensure that the costs of all factors relating to the protection of the environment are taken into account;
c) implement efficient technologies to reduce pollution in energy exploration, transportation, processing and use; and
d) implement safety measures and avoid pollution of air and water during the operation of gas pipelines and transportation and use of crude oil [14].

These initiatives, laudable though they are, have so for hat limited impact on controlling environmental degradation. It also appears that this policy framework is unlikely to be able to withstand the environmental consequences of rapidly increasing energy consumption for achieving economic prosperity in the future. Some of the major reasons behind the inability of the existing environmental policies are discussed as follows. Firstly, the existing environmental policies appear to have been formulated in isolation, without carefully analyzing their wider impacts on the economy and society. In other words, they do not reflect the close relationship that exists between economy and the environment, thus limiting their ability to appropriately articulate and redress the issues that emerge at the interface of these three segments of the economy. The following discussion provides support for this argument:

e) While the National Environmental Action Plan (NEAP) emphasises the importance of CO2-mitigating options such as energy efficiency and penetration of low carbon technologies (renewable, nuclear and natural gas), there is however no consideration in the plan of other economic instruments, for example carbon taxes or tradable permits to reduce demand for energy. These policy instruments are currently viewed world-over to be quite effective in containing the growth of CO2 emissions, on the grounds that they provide incentives to the firms to operate at economic optimum levels while ensuring superior environmental outcomes. The experience with the cap-and trade scheme for trading carbon emissions in Europe and sulphur-dioxide in America is often cited to support this argument. One might argue that such market-based instrument are not appropriate for Vietnam at this stage of development, as is perhaps tacitly recognised by the non-inclusion of developing countries in the list of those required to limit CO2 emissions in Kyoto Protocol [15]. The high cost associated with the setting up of a system to implement these instruments is obviously a factor behind such viewpoint. However, the environmental impacts of energy activities are rapidly becoming obvious and Vietnamese policy makers will need to examine these instruments – as implicit in the Bali Agreement [16].
f) The Environmental Law of Vietnam is founded on the Polluter Pays Principle (PPP) as defined and adopted by the Organisation of Economic Cooperation and Development (OECD) in 1972. This principle requires that polluters to take action to protect the environment and to support all related costs. It also places the environmental authorities in the positions of enforcer and controller, not as executor. For the energy sector, if the carbon tax is applied in the future, this principle would stimulate a change in the structure of generation and drive the costs of electricity

upwards. The economy would consequently face difficulty to make rapid adjustments, especially in an inflationary economic environment. In contrast, the Shared Responsibility Principle (SRP), based on direct and indirect energy consumption, has some advantages compared to the PPP. Over the long-term, adopting this principle would lead to a more sustainable energy system, by gradually moving away from fossil fuel-based technology to cleaner technology. It would also even-handedly distribute the economic burden and encourage both energy producers and consumers to improve energy efficiency. However, in the short and medium terms, this principle has a relatively smaller impact on carbon-dioxide reduction. A careful analysis of these options is however needed before the country decides on its environmental strategies.

g) Most environmental standards in Vietnam are set based on ISO 14000, without consideration of their wide impacts. For example, recently the Environmental Protection Department has proposed to apply the EURO-2 standards for vehicle exhaust emissions [17]. However, if this proposal was approved, about 50% of total number of vehicles in Vietnam would have been prohibited from operations. This would obviously have caused the collapse of the transportation system and hence serious set back for the economy. The economic and environmental benefits of such strict standards fall far short of the costs and that would make these standards seldom enforceable.

h) Recently, the Vietnamese Government has used energy pricing policy, especially electricity prices, to regulate electricity demand by applying accumulated prices for different levels of electricity consumed, and to improve access to modern energy of the poor through cross-subsidies. This would lead to a distortion of supply-demand relation and cause other economic and environmental consequences. For example, due to cheap energy prices, some high energy intensive sectors like the steel and iron industry would not invest in improving their technologies to reduce energy consumption. As a result, energy demand would increase, leading to adverse environmental outcomes.

Secondly, poor management practices in Vietnam also limit the effectiveness of the country's environmental policies. Some factors contributing to such limitation include:

i) Wide dispersion of environmental responsibilities and poor inter-sectoral and inter-agency cooperation and coordination. Currently, two ministries in Vietnam are responsible for environmental management, namely, the Ministry of Natural Resources and Environment (MONRE) and the Ministry of Planning and Investment (MPI). Within the MONRE, the National Environmental Agency takes the lead on environmental management and implementation issues. In the MPI, the Department of Science, Technology and Environment oversees environmental issues within the context of national development plans and budgeting exercises. The provincial offices of the department are responsible for planning. The links between MONRE and MPI, and with other ministries involved in formulating and implementing environmental polices, is weak, and somewhat undefined. For example, the Ministry of Industry and Trade (MOIT) has first-line policy and supervisory responsibilities for the energy sector but it does not participate in making any laws, regulations or standards related to environmental protection in the energy sector. In addition, there are some jurisdictional overlaps between various environmental agencies. This often results in conflicts, for example, the National Environmental Agency is responsible for monitoring air, water and soil quality but the General Department of Meteorology is also responsible for monitoring air and water. The Ministry of Agriculture and Rural Development has a mandate to manage water and soil resources and the Ministry of Health has a mandate to oversee sanitary and environmental health issues. This overlap makes governance ineffective.

j) Bureaucratic management mechanism. The environment management practices in Vietnam are guided largely through "Command-and-control' mechanisms instead of market-based or volunteer ones. The government makes the rules for the firms to follow. This practice has some limitations. First, as discussed above, the "Command-and-control" mechanism that is based on fines and punishment does not provide the firms with incentives for investment to reduce negative impacts on environment. Second, due to historical reasons, most assets in Vietnam are still state-owned. This type of ownership does have some advantages in relation to implementing environmental policies because the government is the sole decision makers and there is no need to develop any bargains as is the case with private ownership. However, the absence of the private ownership of assets, together with poor transparency of the administrative system in Vietnam, creates a fertile land for corruption and as a result, the objective of environmental protection is difficult to achieve.

Finally, poor communication and education on environmental issues have also contributed to a poor public awareness and hence emergence of any pressure-constituency on these issues. For example pollution control is generally viewed by the public, including industry, to be a non-productive enterprise, viewed particularly against a backdrop where the performance of

the local government officials is judged almost entirely by how much they are able to increase the region's economic growth. Hence, environmental pollutions and polluters are not of immediate interest to such officials. This also leads to poor cooperation between the environmental monitoring agencies and the polluters.

4. CONCLUSIONS AND RECOMMENDATIONS

The population growth and the government's determination to maintain high rates of economic growth over the next decades will inevitably translate into increased energy demand. Given the modest availability of indigenous energy resources, poor energy infrastructure, and the vulnerability of global sources of energy supply, the security of energy supply is likely to be an issue of utmost importance for the Vietnamese policy makers. Other consequences of rapidly increasing energy demand include increased CO2 emissions and pollution. The existing energy policy framework in Vietnam is characterised by a lack of cohesiveness of policy direction, fragmented institutional structures and responsibilities, and weak public constituency on environmental issues. The existing framework is therefore unlikely to be able to provide a satisfactory redress to the issues noted above. This paper has provided some suggestions about how the weaknesses of the existing framework could be reduced. These include: articulating the significance of the link between energy, economy and environment; developing coherence in institutional purpose and design, and raising public awareness through better communication and education.
The proposals made by this paper, however, are still limited to what should be done to improve the weaknesses of the current policies. Some question, such as how the energy policies should be formulated and to what extent the improving actions should be taken have not been answered. To answer these questions, a comprehensive framework for energy policy analysis is needed. In this framework, not only impacts of the energy options within energy sector are examined but also the economy-wide impacts of those options are investigated. These are outside the scope of this paper and will be done in the future studies.

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The Greater Mekong Subregion Academic and Research Network (GMSARN) was founded followed an agreement among the founding GMS country institutions signed on 26 January 2001, based on resolutions reached at the Greater Mekong Subregional Development Workshop held in Bangkok, Thailand, on 10 - 11 November 1999. GMSARN is composed of eleven of the region's top-ranking academic and research institutions. GMSARN carries out activities in the following areas: human resources development, joint research, and dissemination of information and intellectual assets generated in the GMS. GMSARN seeks to ensure that the holistic intellectual knowledge and assets generated, developed and maintained are shared by organizations within the region. Primary emphasis is placed on complementary linkages between technological and socio-economic development issues. Currently, GMSARN is sponsored by Royal Thai Government.

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In the Greater Mekong Subregion, home to about 250 million people, environmental degradation - including the decline of natural resources and ecosystems will definitely impact on the marginalized groups in society - the poor, the border communities especially women and children and indigenous peoples. The complexity of the challenges are revealed in the current trends in land and forest degradation and desertification, the numerous demands made on the Mekong river - to provide water for industrial and agricultural development, to sustain subsistence fishing, for transport, to maintain delicate ecological and hydrological balance, etc., the widespread loss of biological diversity due to economic activities, climate change and its impacts on the agricultural and river basin systems, and other forms of crises owning to conflicts over access to shared resources. The *GMSARN International Journal* is dedicated to advance knowledge in energy, environment, natural resource management and economical development by the vigorous examination and analysis of theories and good practices, and to encourage innovations needed to establish a successful approach to solve an identified problem.

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