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Expanding Opportunities for
Energy Efficiency

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Acronyms and Abbreviations

ADB	Asian Development Bank	IEA	International Energy Agency
AFD	Agence Française de Développement	IFC	International Finance Corporation
CEEP	Commercial Energy Efficiency Program	IMS	Vietnam Institute of Material Science
CFL	Compact fluorescent lamp	ISO	International Organization for Standardization
CNG	Compressed natural gas	JICA	Japan International Cooperation Agency
CO ²	Carbon dioxide	kcal	Kilo-calories
CPC	Clean production center	kgoe	Kilogram of oil equivalent
CP-EE	Cleaner production and energy efficiency	kWh	Kilowatt-hour
DANIDA	Danish International Development Agency	LPG	Liquefied petroleum gas
DSM	Demand-side management	METI	Japan Ministry of Economy, Trade and Industry
ECC	Energy conservation centers	MOC	Vietnam Ministry of Construction
ECCJ	Energy Conservation Center, Japan	MOIT	Vietnam Ministry of Industry and Trade
EE	Energy efficiency	MOST	Vietnam Ministry of Science and Technology
EE&C	Energy efficiency and conservation	MW	Megawatt
EE&CP	Energy Efficiency and Conservation Program	NCST	Vietnam National Center for Natural Science and Technology
EECO	MOIT's Energy Efficiency and Conservation Office	PC	Power distribution company
EMS	Energy Management System	PECSME	Promoting Energy Conservation in Small and Medium Enterprises
EPC	Energy performance contracting	PROPARCO	Promotion et Participation pour la Coopération Economique
ERAV	Electricity Regulatory Authority of Vietnam	Sacombank	Saigon Thuong Tin Commercial Joint Stock Bank
ESCO	Energy service company	SDC	Swiss Development Cooperation
ESF	Vietnam Energy Savings Fund	SECO	Swiss State Secretariat for Economic Affairs
EU	European Union	SIDA	Swedish International Development Agency
EVN	Electricity of Vietnam	SME	Small and medium enterprise
FTL	Fluorescent tube lamp	T&D	Transmission and distribution
GDP	Gross domestic product	TA	Technical assistance
GEF	Global Environment Facility		
GOV	Government of Vietnam		
GWh	Gigawatt-hours		

Techcombank	Technological and Commercial Joint Stock Bank	UNIDO	United Nations Industrial Development Organization
toe	Ton of oil equivalent	VDB	Vietnam Development Bank
TOU	Time-of-use	VNCPC	Vietnam Cleaner Production Centre
UNDP	United Nations Development Programme	VNEEP	Vietnam National Energy Efficiency Program
UNEP	United Nations Environment Programme	WB	World Bank

Currency Unit

(as of December 31, 2009)

1 Vietnamese dong (VND) = 0.00005 U.S. dollar (US\$)
1 U.S. dollar (US\$) = 18,346.9 Vietnamese dong (VND)

Executive Summary

More aggressive efforts to increase the efficiency of energy use are now an urgent imperative for Vietnam. Energy demand tripled over the last decade, and it is likely to triple again over the next decade if economic growth remains robust. Improving energy efficiency is by far the lowest-cost and most environmentally benign way to meet energy demand. Potential energy savings across the economy remain largely untapped. Realizing this, energy savings potential does not happen automatically—policies and programs need to be put into place to stimulate the capture of energy-saving opportunities. Vietnam has made a good start with the launching of a new National Energy-Efficiency Program and the drafting of a new Law on Energy Conservation and Efficient Use for consideration by the National Assembly. Following through on these initiatives can lay a good foundation for the future. Even greater work, however, will be required to put details in place carefully and begin to roll out implementation effectively. The next three years will be critical for success.

Completed through the review of readily available information and discussion with counterparts in Vietnam, this report seeks to (a) provide a general overview of energy demand trends in Vietnam and needs to promote energy efficiency further, (b) summarize the main current government and international donor efforts in the area of energy efficiency in Vietnam, and (c) provide the government with suggestions and recommendations on how to expand energy-efficiency results in the future. The report's chapters are organized accordingly.

The Importance of Promoting Energy Efficiency in Vietnam Today

Meeting the pressure of another tripling of energy demand during the next decade will be a much more difficult and costly challenge than in the past. Growth in energy consumption of over 12 percent per year from 1998 to 2007 was achieved with a net reliance on Vietnam's own energy resources and during a period of relatively low energy costs. A further tripling over the next decade, however, would be another matter. Vietnam does not have easily developed domestic resources that can sustain this magnitude of energy demand growth, and will have to rely increasingly heavily on imports, including imports of steam coal and net oil imports. Such

an increasing reliance will come at a time of growing global competition for energy supply, and virtually certain large increases in costs compared to the past.

Vietnam's consumers currently pay some US\$14–15 billion per year for energy (at international petroleum product prices roughly associated with US\$65/barrel of crude oil). Rising consumption, introduction of large-scale steam coal imports, and expected increases in international oil prices will only make this cost rise. Costs for standard, yet unimplemented, renovations and equipment improvements typically run at one-quarter of the cost of commercial energy supply at today's prices. By undertaking efficiency measures, consumers and the country as a whole can gain major cost savings. Industries can improve competitiveness by lowering production costs, families can ease household budget pressures, and government resources can be freed up for investment in other socioeconomic areas.

The anticipated further large increases in energy supply and use also bring the potential for serious local environmental consequences at levels never witnessed in Vietnam before—especially air pollution. Improvement in energy efficiency is a particularly cost-effective way to help mitigate these problems. In addition, energy-efficiency improvements can perhaps yield the greatest contribution over the medium term in Vietnam's case to mitigating the growth of carbon dioxide (CO²) emissions, which contribute to global warming.

Vietnam's fast rise in final commercial energy demand has been driven by three key factors: (a) increasing industrialization; (b) expansion of motorized transport; and (c) increasing household use of modern fuels, especially electricity. These three drivers also are expected to continue to account for most of the energy demand increase over the next decade. About 65 percent of final energy demand is fuel—mainly coal and petroleum products. Electricity (including accounting of energy used to produce electricity) accounts for about 35 percent. In addition to energy savings in the electric power industry, the key target areas for energy conservation, which accounted for 85 percent of Vietnam's final energy demand in 2007, include: (a) fuel and electricity use in industry (28 percent and 17 percent, respectively); (b) fuel use in transportation (25 percent); and (c) residential

electricity use (15 percent). Energy use in all four of these target areas has been growing faster than the gross domestic product (GDP).

However, achievement of meaningful energy savings in these target areas and other economic sectors will not just happen by itself. As is common in other countries, a host of barriers prevent cost-effective savings from being realized, including lack of information, lack of readily available expertise, pricing issues, insufficient cost-consciousness in some sectors, assignment of a lower priority to cost savings compared to expansion in investment, transaction costs, perceived high investment risks, and market failures in some sectors. As in other countries, specific policies, regulations, promotional programs, capacity-building efforts, market transformation initiatives, financing initiatives, and market construction activities are needed to achieve large-scale results.

Meeting the Energy-Efficiency Challenge

Vietnam initiated its first-ever comprehensive national energy-efficiency program in 2006, focusing especially on capacity building during 2006–10. A further rollout of a wide range of activities has been planned for a second, 2011–15 phase. The draft Law on Energy Conservation and Efficient Use is currently being reviewed by the National Assembly. A wide range of international donor activities has been launched to help. The key for the future is to construct a strong and sustainable institutional platform from these initiatives that can deliver large and measurable energy savings year after year. Backed by concrete policies, an effective platform requires institutional clarity as to who is responsible for what, a major effort to build capacity in the government and its implementing entities as well as in the market at large, strategic planning, sufficient funding, step-by-step follow-through on implementation, and focus on achieving measurable energy savings results.

All countries with mixed or fully market economies that have had success in promoting energy efficiency use a mix of government regulation combined with policies and programs to encourage energy-efficiency investment through the market. Vietnam will need to promote new administrative and regulatory measures and, especially, to ensure that they are implemented effectively. Vietnam will also need to develop and implement a variety of market-based programs to spur investment and behavioral change.

Developing and Implementing Energy-Efficiency Regulations.

Enactment of the proposed Law on Energy Conservation and Efficient Use will be essential to provide the

necessary foundation for instituting and enforcing regulations, providing legitimacy to organizations and their work, and assigning responsibilities and associated funding. Enactment of the law can send a clear message to society and the market on national intentions. If enacted, the real challenge of developing and implementing effective regulations will then begin. This will be a huge task, and establishing priorities and ensuring implementation of the strategically most important measures will be very important during the next several years. Similar to the laws enacted in China, Japan, Thailand, and other countries, recent drafts of Vietnam's law include introduction of a new mandatory system for energy management in large energy-consuming industries and buildings. The system would require large consumers to report on energy consumption and plans to improve efficiency, and to designate internal energy managers responsible for energy-efficiency work. Meeting the training, monitoring and reporting, and supervision requirements of such a system would be a large and important undertaking. Experience (in Japan and China in particular) shows that maximum government support is critical to make such a system productive both for enterprises and the country's long-term interest.

Unleashing Market Forces. For Vietnam, review and adjustment of consumer energy prices to best reflect true costs, as well as continued state-owned enterprise reform, can help bring market forces to bear, especially in the industrial sector. However, effort is also needed to foster development of effective delivery systems for investment projects. Experience elsewhere shows that effective delivery systems for energy-efficiency investment projects are not likely to develop without some forms of initial public sector encouragement, but once they are operational, investment can continue sustainably with more limited public involvement. Examples of delivery systems for consideration include development of energy service companies (ESCOs), utility-executed demand-side management (DSM), commercial energy-efficiency loan programs, and special public resource funds.

Some suggestions on putting regulatory and market-based program concepts together in the key energy conservation target subsectors are summarized in the next four sections.

Improving Energy Efficiency in Existing Industrial Plants. Two key challenges are the development and implementation of new energy use and conservation reporting, planning, and management systems for large energy-consuming industries (if the law is enacted), and the development and implementation of new financing programs for retrofitting industrial energy conservation projects.

Effective implementation of the new designated industry programs will require a huge effort by the Ministry of Industry and Trade (MOIT) and its provincial affiliates to provide specific guidance on energy-use and energy conservation planning requirements, to construct an effective data management system, to define requirements for energy managers and supervision of compliance, to launch a wide range of energy auditing efforts and, especially, to plan and deliver a variety of large-scale training programs. The human resource requirements within government agencies to deliver this effort effectively should not be underestimated. Intensive review of experiences gained with such systems in other Asian countries is also recommended.

Several international donors are working with the government to prepare new financing programs for industrial retrofit projects. Such programs can be quite constructive. One suggestion is to try to focus on projects with strong financial viability, with an aim to create project development and investment mechanisms that are inherently profitable and hence have strong potential for being sustained after donor involvement is concluded. Another suggestion is to ensure that technical assistance for project identification and development are blended together with financing programs.

Encouraging More Energy Efficiency in New Industrial Plants.

A continued industrial growth rate of 10 percent per year as in the past would mean that the new industrial capacity built over the next seven years will produce more than all of Vietnam's industry today. The energy-using characteristics of new industrial plants will be a critical determinant of Vietnam's future energy demand and import needs. In 1998, industry accounted for one-third of final energy use. In 2007, it accounted for 46 percent, and in the future it is likely to grow yet further. The key questions are (a) what type of industrial capacity will be developed and (b) how energy-efficient will the adopted technologies be?

Government planners and policy makers need to weigh more systematically the energy demand and cost implications of developing new energy-intensive industrial capacity. As reliance on energy from outside and energy costs increase, what types and scale of new energy-intensive plants are in Vietnam's long-term comparative advantage? In addition, the government should consider review of the energy-efficiency aspects of key processes and certain key types of industrial equipment as part of the permitting process for new industrial production projects. Adoption of wasteful, backward, and highly polluting technology can and should be blocked.

Improving access to financing for more energy-efficient and environmentally friendly new industrial processes, production lines, and equipment is another important means to impact positively new industrial development. Adoption of new, more efficient, and less resource-intensive technology can yield substantial operating cost savings over the long term. However, upfront investment in capital and in learning something new is usually required. The government can help by working with banks to develop new programs to help bank clients adopt "greener" technology for operating-cost savings.

Increasing Energy Efficiency in Transportation. Use of petroleum products in motorized transportation will continue to be the main driver of Vietnam's future oil import levels. Broad transportation policies and long-term development plans can have a key impact on overall energy use in transportation, especially where policies and plans affect (a) the role of automobiles versus motorbikes, buses, and light rail transport for urban and suburban passenger movement; (b) trucks versus coastal and inland waterway freight movement; and (c) automobiles versus buses, boats, and airplanes for intercity passenger movement. Fuel pricing policies also have a particularly strong impact on consumer choices and behavior in this sector.

One specific measure that has yielded energy savings in other countries is increasing fuel-efficiency standards for motor vehicles, and strict enforcement of these standards. Another set of measures includes vehicle inspection and maintenance programs (serving multiple objectives) and programs to promote earlier retirement of old, particularly inefficient vehicles. Promotion of vehicles using alternatives to liquid petroleum fuels (for example, hybrid electric vehicles, compressed natural gas, and biofuels) also have produced noticeable results in some countries, including programs to convert publicly owned or captive high-use fleets, such as taxis, or programs to provide financial incentives.

Transforming Markets for Household Electrical Appliances.

Electricity use by household electrical appliances accounted for 39 percent of total electricity use in Vietnam in 2007. This includes lights, air conditioners, refrigerators, water heaters, washing machines, drivers, televisions, fans, and so forth. The sector involves millions of consumers. Successful efforts to improve energy efficiency in this sector have involved concerted efforts to "transform markets"—guiding increased penetration of more energy-efficient appliances into specific appliance markets through regulation and selective public intervention, but still relying on market forces for efficient and sustainable market operation. This involves (a) programs to provide customers with commonly available,

credible, and correct but simple information about the efficiency characteristics of the choices in front of them; (b) government initiatives to work with suppliers to encourage expanded marketing of reputable and more efficient products, and to discourage particularly wasteful or fraudulent market offerings; and (c) programs to help customers cope with initial higher costs in some cases until market transformation can take hold.

Vietnam has launched a number of initiatives relating to market transformation, but these efforts need to be consolidated and more strategically designed to achieve a sustainable impact over the medium term. Energy-efficiency labels need to be visible, understood, and credible for consumers at large. Systematic surveys need to be completed to understand all aspects of the markets targeted for transformation, initiatives need to be developed to work in concert to meet specific medium-term objectives, and subsidy programs need to be designed so that they can catalyze sustainable change and be withdrawn in due course.

Recommendations for Follow-Up

The necessary major strengthening of the institutional platform for promoting energy efficiency in Vietnam will require good planning, upfront public investment, dedication, and time. Planning needs to consider realistic assignment of priorities for the near term—there is insufficient human capacity now to try to achieve everything at once. Responsibilities among different organizations, as well as leadership and coordination mechanisms, need to be clear. It is also very important to systematically monitor and evaluate the actual energy savings achieved by different programs that compete for management time, expertise, and money. Even training results can be systematically evaluated.

The Bank study team recommends consideration of a number of new or scaled-up initiatives, which are outlined below and described further in chapter 3. Many of these can be or already are being discussed as areas of future World Bank Group support.

Economic Studies. At least three strategic areas appear to warrant more extensive review and analysis:

- Review of the energy implications of industrial development policy
- Review of consumer energy pricing
- Review of the energy implications of alternative transportation development scenarios.

Development of an Energy-Efficiency Promotion System.

Three areas where well-targeted advisory assistance to the government may be especially useful include assistance on the following:

- Development of Vietnam's new industrial energy-use supervision system
- Policy development to encourage energy efficiency in new industrial plants
- Review of fiscal incentive options to promote energy efficiency.

Energy-Efficiency Investment Programs. New energy-efficiency investment programs that the government may wish to consider include the following:

- A clean production and energy-efficiency financing program for new industrial capacity
- Expanded commercial financing for energy-efficiency retrofit projects
- Expanded development of the third-party energy-efficiency service sector
- Consolidation and rollout of appliance market transformation efforts.

Needs and Directions for Improving Energy Efficiency in Vietnam

The objectives of this report are to (a) provide a general overview of energy demand trends in Vietnam and needs to further promote energy efficiency, (b) summarize the main current government and international donor efforts in the area of energy efficiency in Vietnam, and (c) provide the government with suggestions and recommendations on how to expand energy-efficiency results in the future. Analysis was completed in a short timeframe by relying on readily available materials. Many topics or types of analytical work could not be conducted because systematic information is not yet readily available—for example, on the technical energy savings potential in key industrial or other economic subsectors. Where further analytical work was considered especially important, recommendations for undertaking it are included.

Energy-Use Trends in Vietnam

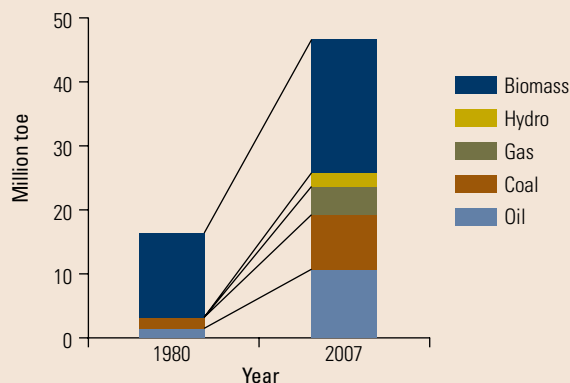
The Increasing Energy Intensity of Vietnam's Economy

Vietnam's energy economy has changed radically over the last several decades with the transformation from an agricultural society relying primarily on traditional biomass fuels to a modern mixed economy. As shown in figure 1, commercial energy consumption—including hydro-power, natural gas, coal, and oil—has increased eight-fold from an extremely low base in 1980. This increase has been driven by the increasing popularity of modern commercial fuel and electricity for household use, the development of motorized transport, and the steady and rapid growth of industry to become a key pillar in the economy. Figure 2 shows country comparisons of total primary energy supply.

Commercial energy use¹ has grown much faster than the country's economy overall. During the nine-year period from 1998 to 2007, commercial energy use grew at an average rate of 12.1 percent per year, while Vietnam's GDP grew by 7.3 percent per year. The commercial energy-use/GDP growth elasticity registered was a very high 1.7. The energy intensity of Vietnam's economy grew from 387 kilograms of oil equivalent (kgoe) per US\$1,000 of GDP in 1998 to 573 kgoe per US\$1,000 in 2007, in constant 2000 prices.

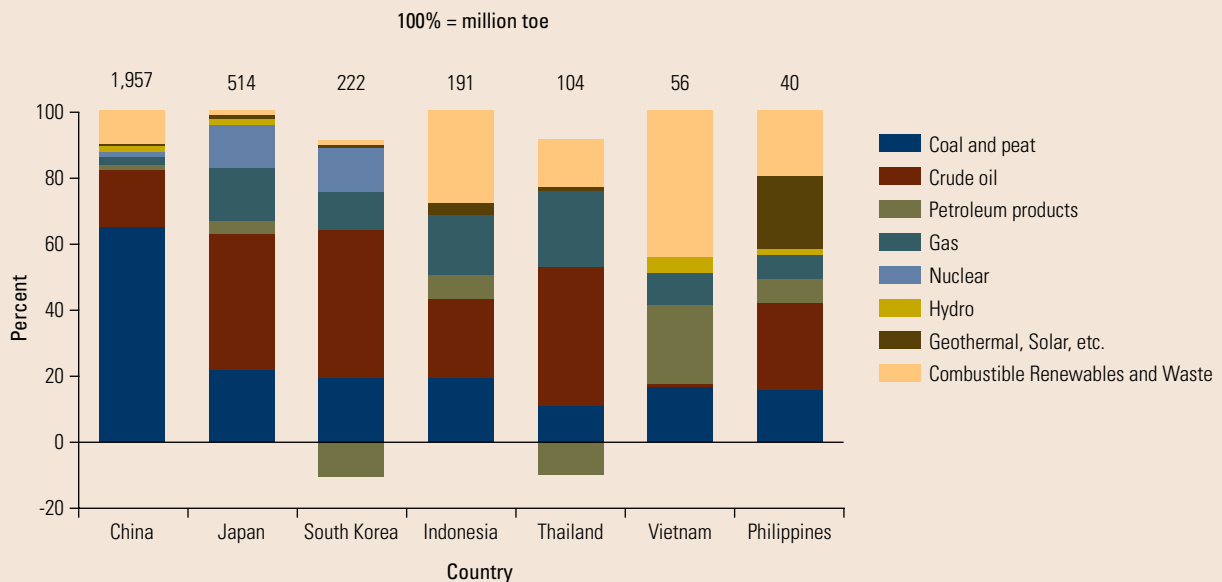
1. The term *commercial energy* in this report refers to coal, petroleum products, natural gas, and electricity. Traditional biomass fuels are excluded, since data on their use, and especially use trends over time, are scarce and unreliable.

FIGURE 1: VIETNAM PRIMARY ENERGY CONSUMPTION, 1980 AND 2007



Sources: Asia-Pacific Energy Research Centre, *APEC Energy Supply and Demand Outlook, 2006*; International Energy Agency, *Energy Balances of Non-OECD Countries* (2009 edition).

FIGURE 2: TOTAL PRIMARY ENERGY SUPPLY BY COUNTRY, 2007



Source: IEA.

Figure 3 depicts the growth in final (commercial) energy consumption by type of energy during 1999–2007 by year. Final energy consumption is the energy used by final end users, such as households, commercial establishments, industries, and vehicles. In figure 3 and throughout this report, energy used to generate and distribute electricity to final users is included in the energy valuation used for final electricity consumption.² Final energy consumption grew from 10.8 million tons of oil equivalent (toe) in 1998 to 30.1 million toe in 2007. The main forms of commercial energy used by final consumers in Vietnam include coal, petroleum product fuels, and electricity. (Except for a very small amount used in industry, Vietnam’s natural gas has been used in power generation and not by final consumers.) Final use of all three main types of energy grew faster during 1999–2007 than GDP. Direct burning of coal in industry, households, and commercial establishments grew the fastest, at 15.7 percent per year, but this

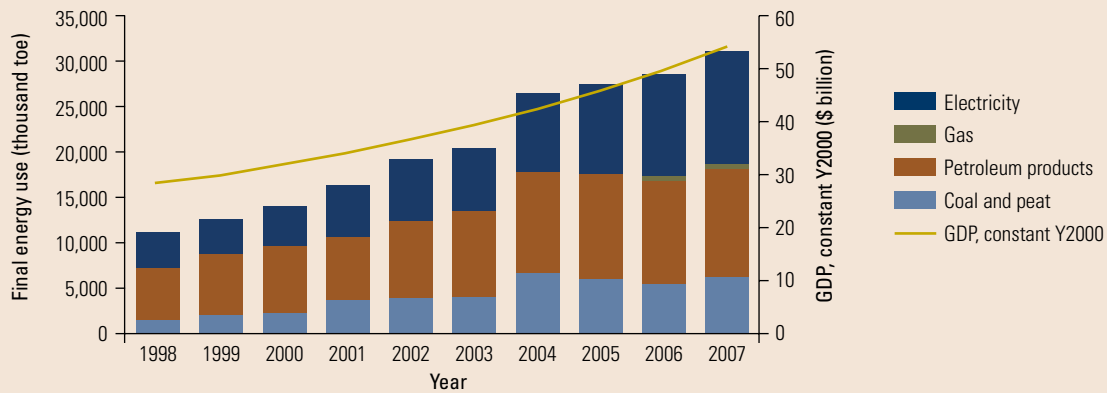
2. This is a different approach from the methodology used by the International Energy Agency (IEA) for calculating final energy consumption, where all final electricity consumption is valued at 860 kcal/kWh. Including energy used (or lost) in generating and distributing electricity in the valuation of electricity raises the value to 2,000–2,200 kcal/kWh, depending on the year. The adjustment is made so that analysis of electricity use, and especially savings by users, shows the full energy-use and savings implications for Vietnam. It should also be noted that, because conversion losses outside the power sector have been negligible in Vietnam, total final energy consumption in these calculations is basically equivalent to total primary energy consumption.

growth was concentrated, especially during 1998–2004. Growth in kilowatt-hours of electricity use averaged 15.1 percent,³ while petroleum product use grew by 8.7 percent per year.

Key Drivers

Industrial growth has been one key driver of Vietnam’s increasing energy intensity. Industrial energy use grew from 3.6 million toe in 1998 to 13.9 million toe in 2007—almost four times in just nine years (figure 4). In 1998, industry accounted for one-third of final energy use; in 2007, it accounted for 46 percent. A rapid growth in industrial value added provided the impetus for this growth in energy use. Industrial value added in constant prices grew by 9.5 percent per year during 1999–2007, and the share of industry in GDP rose from 34.7 percent in 1998 to 41.6 percent in 2007. Because industry is the most energy-intensive main economic sector, this increase in the industrialization of Vietnam’s economy by itself contributes to the increase in Vietnam’s overall energy intensity. However, while the industrial value added doubled, industrial energy use more than tripled over the same period. The energy intensity of industrial production itself rose very sharply, from 129 kgoe per

3. Tons of oil equivalent of energy for power production, transmission, and distribution to final consumers grew slightly more slowly, at 13.9 percent per year.

FIGURE 3: VIETNAM COMMERCIAL FINAL ENERGY USE, 1998–2007

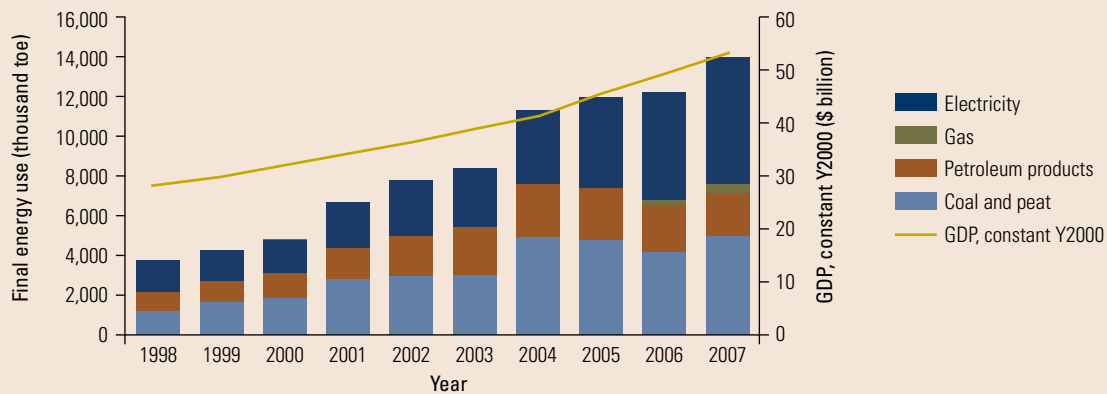
Source: IEA, Energy Statistics of Non-OECD Countries (2009).

US\$1,000 in 1998 to 264 kgoe per US\$1,000 in 2007, in constant prices. This indicates that the types of new industrial production put on line this decade are substantially more energy intensive than what was in place at the end of the 1990s. More energy-intensive industries, such as cement, have been growing faster than the less energy-intensive industries.

Household use of modern energy has also grown faster than GDP, at an average of 10.7 percent per year during 1999–2007. It also contributed to the increase in Vietnam's energy intensity (figure 5). Substitution of coal and liquefied petroleum gas (LPG) for traditional cooking fuels caused modern fuel use in households to triple during the period. However, household modern fuel use

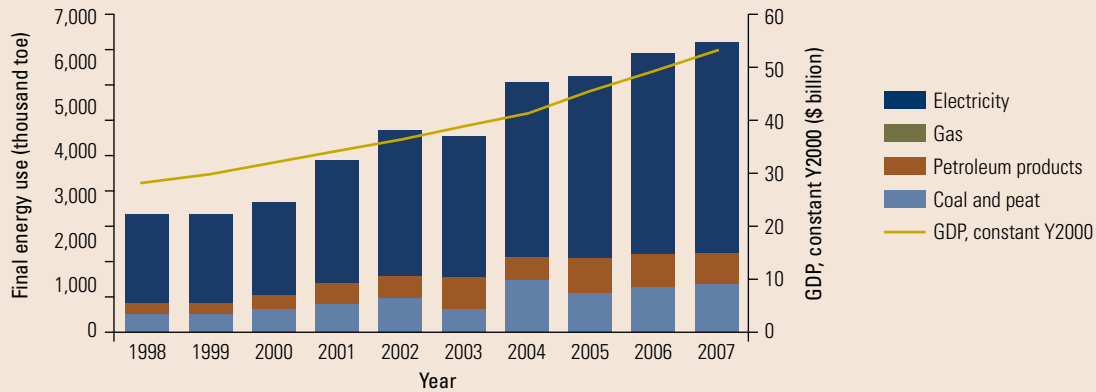
grew from an exceptionally low base of 8 kgoe per capita nationwide to some 20 kgoe per capita in 2007, with coal use in northern Vietnam representing about half the total. Per capita household use of LPG and kerosene in 2007 was only a bit less than in the Philippines (7 kg compared to 10 kgoe per person), but only one-third of that in Thailand (29 kg per person).

Electricity currently accounts for almost 73 percent of household modern energy use. Residential electricity grew by 10.2 percent per year over the period, in part because of a big expansion in rural connections, but even more because of increases in lighting fixtures and a wide variety of appliances in homes. Average residential electricity consumption in Vietnam, at 276 kWh/capita in 2007,

FIGURE 4: VIETNAM INDUSTRIAL FINAL ENERGY USE, 1998–2007

Source: IEA, Energy Statistics of Non-OECD Countries (2009).

FIGURE 5: VIETNAM RESIDENTIAL FINAL ENERGY USE, 1998–2007



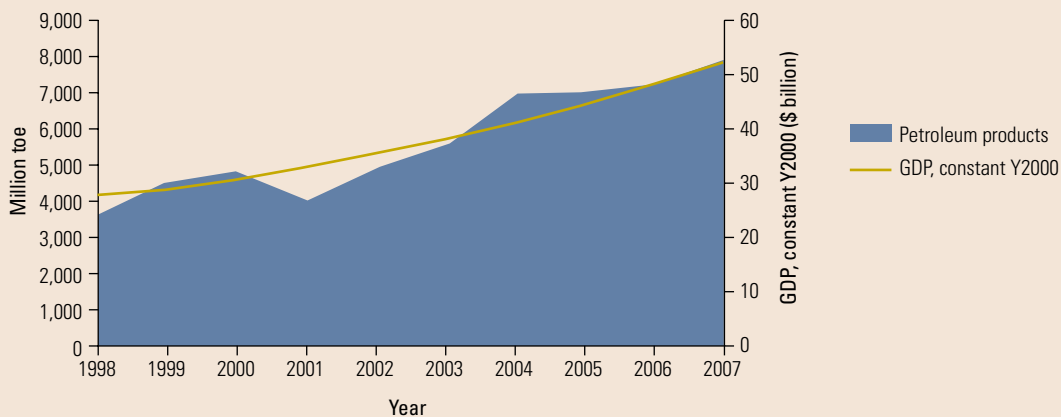
Source: IEA, *Energy Statistics of Non-OECD Countries* (2009).

is now about the same as in China (282 kWh/capita), a bit higher than in the Philippines (186 kWh/capita), but still significantly less than in Thailand (440 kWh/capita).

Expanded motorized transportation also occurred during this period. While the choppiness in the annual statistics suggests some accounting problems with the annual statistics on petroleum product use by sector, it is clear that use of fuel in transportation has also grown faster than GDP (figure 6). Use of transport fuel grew from 3.6 million toe in 1998 to 7.9 million toe in 2007. A little over half of fuel use was diesel oil, while gasoline accounted for about 39 percent, and jet fuel and fuel oil combined accounted for about 7 percent.

Total freight service volumes, measured in ton-kilometers, increased at an average rate of about 12 percent per year from 1999 to 2005, while passenger transport volumes, measured in passenger-kilometers, increased at about 10 percent per year. In 2005, some 65 percent of the total freight tonnage moved was by road, but coastal water transport continued to account for by far the greatest freight service volume, with 76 percent of total ton-kilometers in 2005. Passenger road transportation increased to 34 billion passenger-kilometers in 2005, accounting for about 65 percent of total passenger service volume.

FIGURE 6: VIETNAM TRANSPORT FINAL ENERGY USE, 1998–2007



Source: IEA, *Energy Statistics of Non-OECD Countries* (2009).

Energy Use in 2007

Table 1 summarizes Vietnam's final energy use by sector and energy type in 2007, the latest year for which full energy balance data are available. Total final energy consumption amounted to 30.1 million toe, of which 18.3 million toe, or 61 percent, was fuel directly used by final consumers.

Electricity (including, in this accounting, the 4.9 million toe of natural gas, 2.2 million toe of coal, and 0.5 million toe of petroleum product used in thermal power production) accounted for 11.8 million toe of Vietnam's energy use, representing the remaining 39 percent. Industrial and residential consumers are the two dominant electricity-use sectors in Vietnam, with industry consuming 53 percent of the total and residences 39 percent. Commercial and public sector electricity use was reported at 8 percent.

Direct fuel use continues to dominate Vietnam's commercial energy use. Fuel use in industry totaled 7.6 million toe, accounting for 55 percent of industrial energy consumption. This included 4.9 million toe of coal, representing almost half the country's total use coal use in 2007. Industrial fuel consumption also included a large amount of fuel oil and diesel use, amounting to 2.7 million toe. The second largest fuel-using sector is transport, which consumed 7.8 million toe of petroleum product fuels in 2007. The last piece of modern fuel consumption, then, is use in the residential, commercial, and public sectors, which totaled 2.9 million toe of both coal and petroleum products in 2007. Fuel use in this sector is growing in importance, however, with a growth rate that averaged 10 percent per year during 1999–2007.

Why Promote Energy Efficiency?

With a continuation of past trends, energy demand in Vietnam is poised to triple again in the next 10 years. Unlike the past decade, however, meeting this demand through a tripling in supply in the coming decade will be a far more daunting challenge than before. Even if supply infrastructure and logistics can be put in place, the costs will most certainly be higher in real terms, especially because much more of the required supply will need to be imported. Now, more than ever, Vietnam cannot afford to continue to waste energy. If stronger programs and policies are put in place, current wasteful practices can be reduced, and people can take advantage of more efficient energy-use technology. This can meet a sizable portion (typically 20–30 percent) of the business-as-usual demand for increased energy services at costs that are typically one-quarter as much as for additional energy supply.

Continuing industrialization, rapid growth in motorized transport, and natural increases in the use of modern energy in households can be expected to continue to combine to drive Vietnam's energy demands at rates well in excess of economic growth. Despite the current global recession, Vietnam's prospects for economic growth during the medium term are strong. If Vietnam's GDP grows at some 6.9 percent per year during the decade of 2009–18, and the country's energy-use/GDP elasticity continues at the 1.7 witnessed during the last decade, energy demand would grow by about 12.1 percent per annum. This average growth rate for 10 years would yield another tripling in energy use, with final energy consumption exceeding 100 million toe by 2018.

TABLE 1: VIETNAM FINAL COMMERCIAL ENERGY CONSUMPTION, 2007 (MILLION TONS OF OIL EQUIVALENT)

Sector	Coal	Petroleum products	Natural gas	Total fuel	Electricity	Total
Industry	4.9	2.2	0.5	7.6	6.3	13.9
Transport	0.0	7.8	0.0	7.8	0.1	7.9
Commercial and public services	0.3	0.8	0.0	1.2	0.9	2.0
Residential	1.0	0.7	0.0	1.7	4.6	6.3
Total	6.2	11.5	0.5	18.3	11.8	30.1

Note: Nonenergy use and traditional biomass excluded.

Source: Based on IEA, Energy Statistics of Non-OECD Countries (2009)

The tripling in energy consumption during the previous decade of 1997–2007⁴ was achieved with a net reliance on Vietnam's own energy resources during a period of relatively low energy costs. Beginning from a fairly low level of 10.8 million toe in 1998, the development of supply capacity and logistics, while challenging, was manageable. A further tripling over the next decade, however, would be another matter. Vietnam does not have easily developed domestic resources that can sustain this magnitude of growth in energy demand, and the country will have to rely increasingly on imports, including imports of steam coal and net oil imports. Such an increasing reliance will come at a time of growing global competition for energy supply, and virtually certain large increases in costs. Potential environmental consequences of such absolute increases in energy supply and use may also be at levels never witnessed in Vietnam before.

As discussed in the paragraphs below, more aggressive efforts to improve energy efficiency are key to address these anticipated energy supply security, cost, and environmental concerns. However, as demonstrated in many examples from other countries around the globe, energy-efficiency improvements will not develop sufficiently through market forces alone, and require effective public sector intervention. These issues, and how they may be overcome in Vietnam, are further discussed in chapter 3.

Resource Constraints and Energy Security

Vietnam has enjoyed a position as a net energy exporter, with domestic resources more than meeting its overall needs. Although petroleum products have all been imported until substantial refinery capacity came on stream in 2009, crude oil exports have steadily surpassed imports in both volume and value. Total coal production also has exceeded domestic use severalfold. Domestic hydro and natural gas resources, combined with some local coal, have been the backbone fuels for electricity production.

Vietnam's oil production, however, fell steadily during 2005–08, while oil demand grew rapidly. As a consequence, Vietnam is expected to become a net oil importer very soon. On the coal side, Vietnam is also beginning large-scale steam coal importation for new coal-fired power plants. Domestic production is dominated by

anthracite coals in the north, which provides for a mix of high-value metallurgical coal exports and lower-value coal for relatively inconvenient combustion. Domestic, economically exploitable coal resources are also limited. As a result, internationally priced and sourced coal for combustion will become a larger and larger component of Vietnam's energy balance.

In conclusion, Vietnam is expected to need to rely increasingly on energy sources from abroad over the next decade, raising issues of energy supply security and vulnerability to international energy price fluctuations. As in other countries facing such issues, meeting demand by improving energy efficiency and utilizing energy that is currently wasted is perhaps the best single option for reducing any potential vulnerability.

Energy Costs

The cost of energy to Vietnam's consumers currently amounts to some US\$14–15 billion per year (at international petroleum product prices roughly associated with US\$65/barrel of crude oil). Introduction of large-scale coal imports and expected increases in international oil prices will only make this cost rise.

Capturing the wide variety of most financially attractive energy-efficiency gains is unquestionably the least-cost way to meet energy demand. Costs for standard, yet unimplemented, renovations and equipment improvements typically run at one-quarter of the cost of commercial energy supply, at today's prices. Improving energy efficiency increases industrial competitiveness by lowering production costs, eases pressure on household budgets, and reduces government energy bills, which can free up government resources for investment in other socioeconomic areas.

Environmental Concerns

Energy-efficiency improvements are an ideal way to reduce pollution emissions, since they reduce the extent of fuel combustion to begin with. Environmental concerns relating to increasing fuel use in power plants, industry, and vehicles will certainly increase in Vietnam as demands continue to rise. Air pollution from energy use carries a range of socioeconomic costs, including public health concerns that can manifest themselves as respiratory illnesses and premature death. Energy-efficiency improvements are one of the main mitigation tools. In addition, shifts of technology that provide energy-efficiency gains often also provide other environmental cobenefits,

4. Primary and final commercial energy consumption grew by about 2.8 times during the nine-year period from 1998 to 2007. IEA data for 1997 are not available, but if it is assumed that energy consumption grew by at least 7 percent from 1997 to 1998, primary and final commercial energy use at least tripled during the decade of 1997–2007.

increasing the overall value of such shifts, especially over the medium and longer terms. Improving energy efficiency is also one of the most cost-effective measures for mitigating growth in CO₂ emissions, one of the key greenhouse gases that contribute to climate change.

Target Sectors for Promoting Energy Efficiency

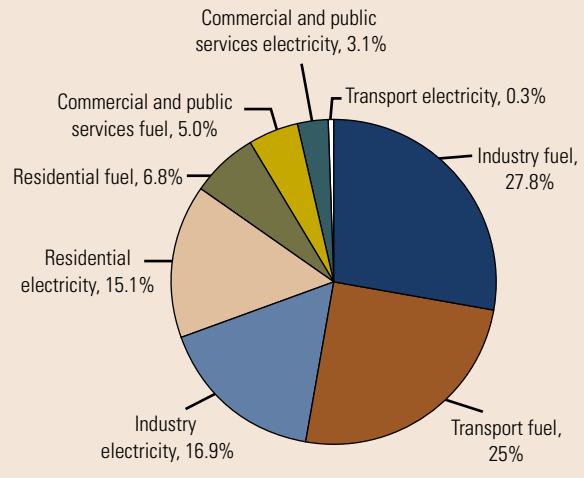
The energy consumption landscape is often best divided into target market sectors in order to assess priorities and specific energy-efficiency promotion program designs. Target market sectors should be grouped to exhibit common patterns in energy-use technology, common types of energy-user entities, and similar potential institutional mechanisms for promoting energy-efficient behavior and investment. In Vietnam's case, a useful grouping of target market sectors may include the electric power industry and four large end-use sectors: (a) industrial fuel use; (b) industrial electricity use; (c) use of petroleum products for transportation; and (d) residential sector electricity use. As shown in figure 7, these four large end-use sectors together account for about 85 percent of Vietnam's final commercial energy consumption.

Energy Efficiency in the Electric Power Industry

Vietnam's current power-generating capacity and medium-term expansion plan includes hydropower, natural gas and petroleum-fueled thermal power, and coal-fired power. With growth in generation expected to continue at some 15 percent per year for up to a decade, the biggest issue concerning energy efficiency in this sector is to ensure that new thermal power plant capacity being brought onstream is as energy-efficient as possible. The planning and investment approval process needs to focus on achieving scale economies, maximum use of combined-cycle, natural gas-based plant, and the introduction of supercritical boiler technology for coal-based power generation. Several additional needs include proper attention to energy-efficiency goals in the development of pricing and dispatch rules in the new competitive power generation market, and further, urgent efforts to secure natural gas supply for new capacity designed for natural gas but currently using petroleum fuel as an interim measure.

Averaging 11 percent in the system as a whole, current power system losses are not unreasonable for a developing country. However, losses in rural systems are often in the 20–30 percent range where medium and low-voltage system development has not kept pace with load growth.

FIGURE 7: VIETNAM FINAL ENERGY CONSUMPTION BY ENERGY MARKET SECTOR, 2007



Source: Based on IEA, *Energy Statistics of Non-OECD Countries* (2009).

In addition, rapid growth in loads additional to lighting in urban areas suggests a need to review potential needs for increased power factor compensation.

Industrial Fuel and Electricity-Use Sectors

Accounting for about 53 percent of final commercial energy use in 2007, and growing particularly fast, improving energy efficiency in Vietnam's industry deserves special attention. This includes attention to cutting energy waste in existing industry, where potential savings of 25–30 percent are likely. However, continuation of industrial value-added growth at rates similar to the 9.5 percent per year growth witnessed during 1999–2007 means that the most important issue concerning industrial energy efficiency is the efficiency of new plant. A continued growth rate of 10 percent per year would mean that the new industrial capacity built over the next seven years would produce more than all of Vietnam's industry today. The energy-using characteristics of new industrial plant will be a critical determinant of Vietnam's future energy demand and energy import needs. The key questions are (a) what type of industrial capacity will be developed and (b) how energy-efficient the technologies they use will be.

Changes in the structure of industry play a major role in determining industrial energy demand and the intensity

of energy use per unit of industrial value added. Figure 8 shows how the structure of industry has been evolving in Vietnam since 1998.⁵ Figure 9 plots the growth in production of several key energy-intensive commodities. Each of these has been growing faster than industrial output value as a whole—indicating a movement toward more energy-intensive basic commodity production. Supply of these basic commodities is key to underpinning new construction and downstream industrial growth. However, it is very important for policy makers to consider Vietnam’s comparative position for rapid development of energy-intensive industries versus reliance on imports from elsewhere, because of the implications for Vietnam’s energy balance and sourcing of future energy supply.

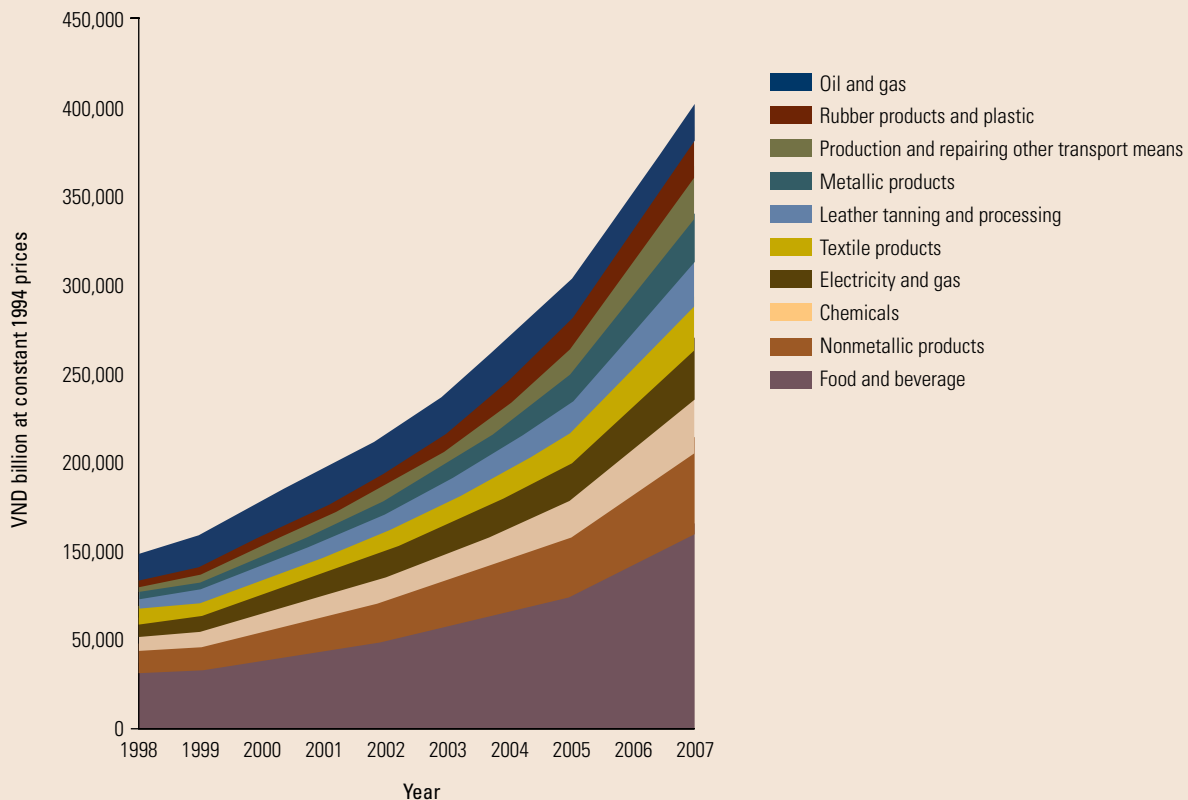
Aside from industrial structure, industrial energy use is determined by fuel and electricity consumption levels

5. Assessment of the impacts of changes in industrial structure, however, will require subsector energy-use data, which are not currently available.

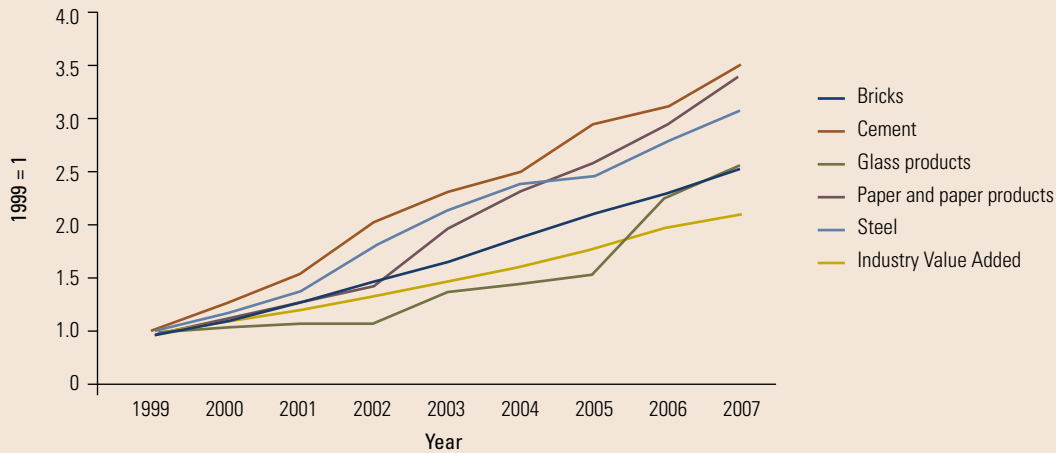
per unit of physical output (for example, per ton of steel, per 1,000 bricks, and so forth). For Vietnam, it is important to review how the efficiency of existing capacity can be improved through retrofits. It is even more important, however, to pay attention to the technologies being deployed in new plant, since this will play the biggest role in determining future unit energy consumption levels. A key task for the government is to assess the nature of energy-using technologies being deployed by companies in new facilities, as well as the potential gaps in energy-efficiency characteristics compared to the best available and potential means to encourage such gaps to close.

Improving the efficiency of industrial fuel use involves deployment of efficient boiler technology and its efficient matching with steam or hot water demands, tightening of steam use systems, modern kiln development, schemes to use waste heat and gas, and industrial cogeneration, as well as specific process technology advancements and Energy Management System (EMS) standards. Improving the efficiency of electricity use involves technologies

FIGURE 8: GROSS INDUSTRIAL OUTPUT IN VIETNAM’S KEY INDUSTRIES, 1998–2007



Source: World Bank, Vietnam Development Report 2009.

FIGURE 9: GROWTH IN PRODUCTION OF SELECTED ENERGY-INTENSIVE INDUSTRIAL COMMODITIES, 1999–2007

Source: World Bank, *Vietnam Development Report 2009*.

such as improved and often variable-speed motors and motor drive systems, efficient matching of equipment capacities, efficient internal electricity distribution, electric furnace improvements and management, power factor correction, utilization and careful capacity matching of cooling equipment, improved lighting technology, and so forth.

Petroleum Product Use in Transport

Accounting for one-quarter of Vietnam's final commercial energy consumption, gasoline, diesel oil, fuel oil, and jet fuel use in transportation will be the main driver of the country's future petroleum import levels. Measured in terms of energy used per passenger-kilometer or ton-kilometer of freight, the energy efficiency of transportation is determined in some ways by the specific fuel use of vehicles, but even more so by broad patterns of transport modal development. Reducing energy costs is of course only one of many important concerns for transportation development strategy. For Vietnam, three broad transportation development trends that have an especially important bearing on fuel efficiency include (a) the role of automobiles versus motorbike, bus, and light rail transport for urban and suburban passenger movement; (b) truck versus coastal and inland waterway freight movement; and (c) automobile versus bus, boat, and airplane intercity passenger movement. Some of the narrower, more energy-specific issues include vehicle fuel-use levels (including both vehicle technology and operating practices) and potential interfuel substitution,

such as the use of gaseous fuels in buses or high-mileage automobiles, or the introduction of electric motorbikes.

Residential and Commercial Electricity Use

The residential electricity-use sector accounts for about 39 percent of the country's electricity use and 21 percent of total final commercial energy demand. Involving millions of individual consumers, this market sector requires unique approaches to achieve energy-efficiency gains. In Vietnam, where heating is not a critical load, the key issues concern lighting technology; air conditioning technology; and the efficiency of household appliances such as refrigerators, water heaters, washing machines, driers, televisions, fans, and so forth. The basic tracks for promoting improved energy efficiency are the provision of improved information to consumers, the introduction and enforcement of mandatory energy-efficiency standards for certain new appliances, and the introduction of incentives, such as rebate programs, to encourage appliance market transformation. Typical of East Asian nations, the urban areas of Vietnam account for about 70 percent of economic growth. The Ministry of Construction (MOC) predicted an urbanization level of 45 percent by 2020. With the rapid urbanization accompanied by high economic and population growth, big cities in Vietnam are subject to climate change and its associated problems. Adaptation to climate change and the integration of energy-efficiency measures to urban planning and "green" building design are important elements to be developed and integrated into Vietnamese codes and standards.

Recent Efforts to Promote Energy Efficiency in Vietnam

Vietnam's government launched a series of efforts to expand its energy-efficiency promotion work during the last decade. In 2003, the government issued the Decree on Efficient Utilization of Energy and Energy Conservation. In 2006, the prime minister approved the Vietnam National Energy-Efficiency Program (VNEEP) for the period 2005–15, which was prepared by the MOIT. A draft energy conservation law is now under review by the National Assembly. The energy sector has been receiving support from a variety of international donors since 1990s, also covering a wide range of activities to promote energy efficiency.

Vietnam's National Energy-Efficiency Program

The VNEEP is the first-ever comprehensive plan to institute measures for improving energy efficiency and conservation (EE&C) in all sectors of the economy in Vietnam. Phase 1 (2006–10) aims to start up actively all components of the program, and Phase 2 (2011–15) aims to expand each component, based on lessons learned from Phase 1. The program includes a set of activities to encourage, promote, and propagate EE&C with the public for science and technology research, and for the development and implementation of management measures needed to carry out synchronous activities on EE&C in the whole society. Through these activities, the VNEEP aims to reach certain targets of energy savings, reduce investment requirements for energy supply system, achieve broad socioeconomic benefits, improve environmental protection, help rationalize the extraction of energy resources, and foster socioeconomic sustainable development.

In 2007, VND 30 billion (about US\$2 million) of state budget funds were allocated for some 28 projects registered under the VNEEP. About a third of these funds were allocated to support two energy-efficiency lighting manufacturers. In 2008, VND 36 billion (about US\$2.25 million) were allocated for some 48 projects, many of which were projects initiated in 2007. Of this, about a third was used to set up an energy-efficiency laboratory for air conditioners and refrigerators.

The program's energy savings targets are 3 percent to 5 percent of total national energy consumption during 2006–10 and 5 percent to 8 percent of total national energy consumption during 2011–15. The program includes 6 components and 11 projects. These, and the major achievements of the VNEEP during 2007–08, are highlighted below.

Component 1: State Management on Energy Efficiency and Conservation

Project 1 aims to complete the legislative framework on EE&C in industrial production, construction site management, domestic activities, and energy-consumed equipment. Achievements during 2007–08 include the following:

- Completion of the draft Law on Energy Conservation and Efficient Use
- Issuance of Joint Circular No. 142/2007/TTLT/BTC-BCT of November 30, 2007, guiding the management and use of nonbusiness funds for the implementation of the national target program on economical and efficient use of energy

- Direction and guidance to all localities to carry out the EE&C activities
- Establishment of the EE&C center in Hanoi, which will help to coordinate program activities in the whole country
- Organization of workshops, seminars, and training on EE&C laws, policies, institutional issues, and technology and solutions
- Development of the VNEEP Web site
- Publication of leaflets, handbooks, and technical guidelines on EE&C.

Component 2: Education and Information Dissemination

Project 2 focuses on raising public awareness about EE&C concerns and opportunities, *Project 3* serves to integrate EE&C into the national education system, and *Project 4* aims to develop pilot models for the “EE&C in households” movement. Achievements include the following:

- Broadcast of EE&C news and releases on national television and radio
- Development of documentary films on energy-efficient technologies
- Printing of EE&C information in various newspapers and electronic media
- Organization of contests on energy-efficient buildings
- Provision of guidelines for dissemination of EE&C information at all levels of the school education system.

Component 3: High Energy-Efficiency Equipment

Project 5 focuses on developing standards and energy-use labels for selected products, and *Project 6* provides technical assistance to domestic producers on how to comply with energy-efficiency regulations. Achievements include the following:

- Completion of demonstration models for solar water heaters and industrial biogas
- Implementation of labeling programs for three appliances—the T8 fluorescent tube lamp (FTL) (36 W), the T5 FTL (32 W), and electronic ballasts
- Collaboration with the Vietnam Standard Center to develop and issue three sets of standards on energy-efficiency and testing methods for refrigerators, air conditioners, and electric fans

- Conducting of pilot EE&C public awareness activities for households by the Vietnam Women’s Union in six provinces and cities
- Implementation of two programs to support lighting manufacturers in their technology transition from production of incandescent lamps to productions of compact fluorescent lamps (CFLs).

Component 4: EE&C in Industrial Enterprises

Project 7 develops EE&C management models in enterprises. *Project 8* supports industrial enterprises in improving, upgrading, and optimizing technology aiming at energy savings and efficiency. Achievements include completion in 2008 of an energy-use survey of more than 500 large enterprises to identify energy conservation potential and to determine energy consumption rates in the most energy-intensive industrial sectors.

Component 5: EE&C in Buildings

Project 9 aims to improve the capacity for understanding EE&C issues and developing potential projects involving EE&C in building design and management. *Project 10* focuses on developing pilot models for uptake of EE&C management activities in building operation. During 2007–08, the MOC led implementation of a variety of information dissemination activities.

Component 6: EE&C in Transportation

Project 11 aims to foster optimal use of transportation facilities and equipment, minimize fuel consumption, and reduce discharge of air pollutants from transport systems. Achievements have included undertaking research activities on how to enhance public passenger transportation in cities and the developing fuel-use measurement equipment for diesel-engine ships to help them improve fuel management.

The VNEEP has provided a national platform for implementing a variety of EE&C activities in all sectors. Although the first two years of VNEEP implementation have focused mostly on education, capacity building, and study, much work remains to be done. With the progress achieved, VNEEP is now in a good position for further review of its objectives and targets, and development of more detailed implementation plans to achieve these targets. It would be useful for future programming to

focus strictly on maximizing energy savings results and the capacity enhancements, which are the highest priority for achieving those results. Strict focus on monitorable energy savings results also can aid the government in determining appropriate levels of funding for various initiatives, allowing for increased competition and accountability among implementing partners, and providing clearer roles for private sector participation and leverage.

Major Energy-Efficiency Partnership Programs

In addition to the government's VNEEP, a number of parallel or supportive efforts have been initiated in direct cooperation with donor agencies. Some of these programs predated VNEEP, while others were developed alongside the national program. Support has not only included financial packages, but also technical assistance

to local agencies and consultants implementing the projects. Some of the larger-scale programs that have been completed or that are currently under implementation in Vietnam are summarized in table 2.

Current Donor Support and Activities

Because there is a wide variety of donor activities, coordination of donor support in the future months and years is important. In October 2008, the MOIT and the World Bank cochaired an Energy-Efficiency Donor Coordination Meeting, which included presentations from each participating donor agency on its programs and planned activities, as well as a roundtable discussion on ideas for coordination of efforts and further sharing of information. The participants agreed that an annual donor meeting of this kind would be beneficial in the future. The following sections summarize the major donor activities in the energy-efficiency field in Vietnam, based on the

TABLE 2: MAJOR COMPLETED AND ONGOING ENERGY-EFFICIENCY AND CONSERVATION PROGRAMS IN VIETNAM

Project name	Years	Sponsor	Implementing agency
Energy-Efficiency and Conservation Program for Vietnam (EE&CP)	1995–2001	GOV and Netherlands, EU, SIDA, UNDP	MOST
Vietnam Demand-Side Management (DSM) and Energy Efficiency—Phases 1 and 2 ^a	2000–10	WB, SIDA and GEF	MOIT, EVN
The Pilot Commercial Energy-Efficiency Program (CEEP)	2004–10	WB and GEF	MOIT/ERAV
Compact Fluorescent Lamp (CFL) Promotion Program	2004–07	WB and GEF	EVN and PCs
Fluorescent Thin Tube Lamp (FTL) Promotion Campaign	2004–07	WB and GEF	EVN
Swiss Government and UNIDO Activities			
Clean Production Center (CPC)	1998–2008	SDC	VNCPC
Energy-Efficient Brick Project	2001–04	SDC and UNIDO	Entec (Swiss consultant)
Green Credit Line	2008–12	SECO	VNCPC and commercial banks
Promoting Energy Conservation in Small and Medium Scale Enterprises (PECSME)	2006–10	UNDP	MOST
Vietnam Energy-Efficient Public Lighting	2006–10	UNDP and GEF	NCST, IMS
The Study on Master Plan on Energy Conservation and Effective Use in Vietnam	2008–09	JICA	J-Power (Japanese consultant)

Source: Compiled by author.

a. The project also included a number of technical assistance efforts, including building code development (Phase 1); creation of a standards and labeling regime and development of select standards for electrical appliances (Phase 1); DSM planning, program design, and evaluation (Phases 1 and 2); load research (Phases 1 and 2); analysis of time-of-use (TOU) schemes and other load management efforts (Phases 1 and 2); marketing and awareness raising (Phases 1 and 2); and solar water heating and appliance labeling pilot programs (Phase 2). EVN implemented an expanded TOU program with its own financing in 2001.

TABLE 3: MATRIX OF DONOR ENERGY-EFFICIENCY PROGRAMS, ONGOING AND PLANNED

Donor	Policy	Industry	Commercial buildings	Residential	Public	Power sector
ADB	<ul style="list-style-type: none"> Energy-Efficiency (EE) Law Energy Savings Fund (ESF) 	<ul style="list-style-type: none"> Industrial survey and audits Training of energy managers, ECCs, ESCOs 		<ul style="list-style-type: none"> Carbon financing for CFLs and solar water heaters 	<ul style="list-style-type: none"> Carbon financing for lighting in public buildings 	<ul style="list-style-type: none"> EVN power plant rehabilitation (proposed)
AFD				<ul style="list-style-type: none"> EE housing credit line (proposed) 	<ul style="list-style-type: none"> Urban EE strategies (proposed) 	<ul style="list-style-type: none"> Load management DSM
DANIDA		<ul style="list-style-type: none"> Energy audits Training of energy managers, auditors Economic incentives for investment 				
JICA	<ul style="list-style-type: none"> EE Law EE Master Plan/VNEEP Roadmap EE Database 	<ul style="list-style-type: none"> Concessional loans for high EE equipment Energy audits Training of energy managers, auditors 				
SDC		<ul style="list-style-type: none"> Creation of VNCP Energy and clean production audits Study of brick making Green credit line for clean production 				
United Nations	EE Law	<p>UNDP</p> <ul style="list-style-type: none"> Energy audits in SMEs Loan guarantee program for SMEs Training of energy auditors, ESCOs Information dissemination, demonstrations for EE in SMEs <p>UNIDO</p> <ul style="list-style-type: none"> Clean production audits in industry Energy management system standards 	<ul style="list-style-type: none"> Building code development (proposed) 	<ul style="list-style-type: none"> Regional appliance and labeling phase-out 	<ul style="list-style-type: none"> Public street lighting Lighting in schools 	
WB (IDA)	EE Law	<ul style="list-style-type: none"> Audit and investment grants for electric equipment Training of auditors, ESCOs 	<ul style="list-style-type: none"> Audit/investment grants Training of auditors, ESCOs 	<ul style="list-style-type: none"> Bulk CFL purchase Promotion of EE FTLS 		<ul style="list-style-type: none"> Transmission & distribution (T&D) loss reduction Load management DSM programs
IFC		<ul style="list-style-type: none"> Clean production financing and business support EE financing credit line/enhancement 				

Source: World Bank Study Team.

respective donor's public documents, as well as notes gathered during the donor coordination meeting. Table 3 provides a matrix of donor energy-efficiency programs, both ongoing and planned.

Asian Development Bank

The Asian Development Bank (ADB) is now undertaking a US\$1 million technical assistance program entitled "Supporting Implementation of the National Energy-Efficiency Program," which aims to promote energy conservation in the industrial sector in Vietnam. The technical assistance includes (a) industrial survey of energy use, (b) energy manager training, (c) energy audits in select large factories, (d) training of ESCOs and energy conservation centers, and (e) development of suitable financing mechanisms. Based on the findings from the technical assistance, the ADB will consider options to create an industrial energy-efficiency financing program. The focus may be on five subsectors, such as cement, beverages, chemicals, plastics, and steel. The ADB also expressed ideas to support EVN power plant rehabilitation and to help mobilize carbon financing for the procurement and distribution of CFLs, solar water heaters, and more efficient lighting for public buildings.

Agence Française de Développement

The support of the Agence Française de Développement (AFD) for Vietnam's development targets is set out in the Partnership Framework Document signed between France and Vietnam in 2006. One of the AFD's support efforts within the framework of the 2006–10 National Socio-Economic Development Plan is to develop and modernize financial, banking, and nonbanking sectors. The AFD activities support financial sector reforms and small and medium enterprise (SME) development. The AFD also undertakes its operations in Vietnam through Promotion et Participation pour la Coopération Economique (PROPARCO), a development financial institution for the private sector. Energy and environment, including climate change, fall within the AFD's priorities in Vietnam. The AFD cosponsored a symposium on energy-efficiency policies in Vietnam, which was held in Ho Chi Minh City in April 2008 as part of French Week in Vietnam. Other ongoing support from the AFD to the energy sector in Vietnam includes hydropower investments, load management and DSM, CO₂ emission mitigation efforts, and provision of modern energy access for all. Early ideas for future activities include development of urban energy-efficiency strategies and perhaps the establishment of credit lines to support energy-efficient construction in the housing sector.

Danish International Development Agency

The Danish International Development Agency's (DANIDA's) programs in Vietnam are aligned with the government's Socio-Economic Development Plan 2006–10. The Environment Program is intended to focus on three thematic areas that include (a) urban and industrial environmental management, (b) sustainable energy, and (c) management of natural resources. Danish programs generally aim to build capacity and knowledge in Vietnamese institutions and to target key sectors identified by the Vietnamese government. DANIDA has recently approved a multiyear technical assistance program of about US\$15 million to directly support MOIT's energy-efficiency program. While some details had yet to be worked out as of March 2009, the program is expected to focus primarily on technical training for energy managers and auditors or consultants (including a certification program with local universities), industrial energy audits, and economic incentives for the implementation of audit recommendations.

Japan International Cooperation Agency

Since October 1, 2008, Japan's Official Development Assistance loans provided by the Japan Bank for International Cooperation (JBIC) and the grant aid disbursed by the Ministry of Foreign Affairs are being overseen by one agency, the new Japan International Cooperation Agency (JICA). One development scheme of JICA is the Private Sector Investment Finance program, which supports private enterprises with funds provided as either equity investments or loans. A feasibility study on a possible energy conservation loan under this program is underway. This is likely to include financing for the purchase of equipment from a specified "eligible high-efficiency equipment list." The design is patterned after a program being implemented in Japan in which government funds are made available to industrial enterprises. Preliminary plans call for the project to be implemented by the Vietnam Development Bank (VDB), which will lend to enterprises for their purchase of equipment.

JICA also has undertaken a development study entitled "Study on National Energy Master Plan in Vietnam." The project aims to (a) help establish the National Energy Master Plan up to 2025, including energy security, energy diversity, power import-export, rural electrification, promotion of renewable energy utilization, CO₂ emission issues, energy conservation, investment planning, socio-environmental impact analysis, and international cooperation; (b) develop a national database for socioeconomic and energy data covering electric power, coal, oil and gas, renewable energy, and so forth; and (c) build capacity

of the bodies under MOIT. JICA is currently working to develop a roadmap for the VNEEP to enhance program results and help MOIT meet its national targets.

The Energy Conservation Center, Japan (ECCJ), has also been actively conducting energy conservation training programs for developing countries, mainly in the Asian region and including Vietnam. ECCJ also has provided expert assistance for the development of energy conservation law, including the transfer of information on successful experiences in Japan. The ECCJ is developing a database for MOIT to facilitate the reporting and analysis of annual energy consumption data, which will likely be required for all large industrial and commercial customers under the proposed new law.

Swiss Development Cooperation

In the specific area of energy efficiency, the Swiss Development Cooperation (SDC) has been collaborating with UNIDO in the establishment of a national focal point for the promotion and implementation of eco-efficient industrial production through the Vietnam Cleaner Production Center (VNCPC) under the Hanoi University of Technology. The focus during Phase 1 (1998–2003) was on training, policy support, and dissemination of information on pilot demonstration projects. Phase 2 (2005–08) sought to operationalize VNCPC fully and make it financially sustainable. SDC has also implemented an energy-efficiency and environmental management project in the brick-making industry. The SDC assisted in the identification and promotion of economic and environmentally viable brick production processes within the framework of the Nam Dinh Urban Development Project. The project included the upgraded design and demonstration of a local tunnel kiln, which may be further replicated under the United Nations Development Programme's (UNDP's) SME Project.

The Swiss State Secretariat for Economic Affairs (SECO) established a trust fund with the VNCPC that provides partial credit guarantees and incentive grants for cleaner production (such as pollution prevention, energy efficiency, water and material recycling, and so forth). This Green Credit Line works with three commercial banks (Techcombank, Asia Commercial Bank, and Vietnam International Bank). The program targets SMEs (under US\$5 million of registered capital and 500 employees). VNCPC reviews applications and, if approved, provides a grant incentive based on the amount of environmental impact reduction (that is, reduced pollution and resource use). Applicants can also request up to a 50 percent guarantee for associated loans, if needed.

United Nations

The UNDP has been supporting Vietnam since 1977. Energy and environment is one of the focal areas for the UNDP's work in the country. One key initiative is a UNDP project entitled "Vietnam: Promoting Energy Conservation in Small and Medium-Scale Enterprises," with a program period from 2005 to 2010 and budget of US\$28.8 million, including US\$5.5 million of support from the Global Environment Facility (GEF). The project aims to address barriers blocking widespread adoption of energy-efficient management practices, operations, and technologies in SME. The project focuses on five SME production subsectors: bricks, ceramics, textiles, paper, and food processing. The project is composed of six integrated components: (a) policy and institutional support development; (b) communications and awareness; (c) technical capacity development; (d) energy-efficiency services provision support; (e) financing support; and (f) demonstrations.

Other ongoing activities or activities under advanced preparation include a US\$3.0 million UNDP-GEF public lighting efficiency project with the National Center for Natural Science and Technology (NCST) and the Institute of Material Science (IMS); a US\$4.5 million UNIDO national clean production program for Vietnam with Hanoi University of Technology (cofunded with SDC as noted previously); a proposed US\$6.8 million regional energy-efficiency appliance labeling and standards program, which includes Vietnam among other countries; and a proposed US\$3.0 million UNEP-GEF incandescent lamp phaseout program. Planned UNDP-UNIDO support from 2010 and beyond includes possible initiatives on energy-efficiency building codes, capacity building for implementation of the energy conservation law, promotion of Energy Management Standards via the proposed International Organization for Standardization (ISO) 50001 Management Standard, and assistance for the coordination of climate change adaptation and mitigation efforts.

The World Bank Group

The *International Development Association (IDA)* has been supporting energy-efficiency efforts in Vietnam since 1997. Its program began with a US\$3.6 million technical assistance grant provided by the Swedish International Development Agency (SIDA) administered by IDA, for: (a) DSM planning and pilots with EVN; (b) initiation of load management and research functions, also with EVN; (c) development of initial equipment standards with MOST; and (d) development of a commercial building code with the MOC. Based on the results of this

initial technical assistance work, IDA approved a follow-on Phase 2 project, the Vietnam Demand-Side Management and Energy-Efficiency Project (2003–09). This US\$20 million program, supported with both IDA and GEF funds, included support for (a) implementation of several larger DSM programs within EVN and its power companies (PCs) (including time-of-use metering, and CFL and FTL promotion); (b) development and implementation of a pilot commercial energy-efficiency program, which included training of service providers and audit-investment grants; and (c) development of some pilot market transformation programs with solar water heaters and air conditioners with MOIT's Energy-Efficiency and Conservation Office (EECO).

While the second phase is still under implementation, preliminary results have been substantial, including the following:

- Successful transformation of the CFL market in Vietnam from less than 1 million lamps a year in 2004 to more than 10 million by 2007
- Independent evaluation of EVN's programs reported almost 500 GWh in annual energy savings and ~91 MW in peak load reduction to date
- Approval and implementation of 100 commercial energy-efficiency projects (aggregate investment of US\$5.2 million) with expected energy savings of 34 GWh/year and training of more than 100 service providers (referred to as project agents).

IDA is now working with MOIT to conduct an independent evaluation of the commercial energy-efficiency pilot program and is considering options for a third-phase investment program in 2011.

The *International Finance Corporation (IFC)* has been developing investment projects with Saigon Thuong Tin Commercial Joint Stock Bank (Sacombank) and Technological and Commercial Joint Stock Bank (Techcombank). The investment project with Sacombank is a credit-linked guarantee, which will back a local currency loan to Sacombank of up to US\$50 million-equivalent. Funds may be provided through local life insurance companies or directly. Financing to support Techcombank's medium- and long-term lending activities to local SMEs is also being considered.

As part of its growing Environmental and Social Sustainability Program, the IFC recently approved Phase 1 of Vietnam Cleaner Production and Energy-Efficiency Program (VCPEEP). The project will span at least three years. Phase 1 includes US\$1.6 million of financing from the Mekong Private Sector Development Facility, a large multidonor trust fund managed by IFC. The objective of the VCPEEP is to promote investment in cleaner production and energy efficiency (CP-EE) projects by Vietnamese financial institutions. The program will include (a) advisory and investment services to selected financial institutions, (b) technical assistance to develop the consultancy market for CP-EE investments, and (c) promotion activities to increase awareness among local industries.

The World Bank Group considered options for new investment operations on energy efficiency in Vietnam, involving both IDA and the IFC as other possible donors, including the GEF, based in part on the findings of this report.

Options for Further Improving Energy Efficiency in Vietnam

Previous chapters reviewed energy demand trends in Vietnam, discussed the need to expand efforts to improve energy efficiency, and outlined Vietnam's current efforts to ramp up energy-efficiency initiatives. This chapter briefly discusses the overall challenge of implementing effective energy-efficiency initiatives and explores options and priorities for the future to overcome those barriers. The chapter then describes how a combination of regulation and market-based initiatives might be applied to realize improved energy efficiency in each of the four strategic sectors in Vietnam identified earlier. A final section provides recommendations for action during the next three years.

Making Energy-Efficiency Improvements Happen

Achieving greater energy efficiency has become a central tenet in the energy policy of many countries for a good reason: it helps enhance energy supply security, it is environmentally friendly, and it is substantially more cost effective than energy supply. In most cases, it also yields profitable life-cycle financial returns to energy users.

However, experience across the globe has shown that the huge potential for cost-effective, energy-efficiency investment is difficult to capture. Relying on market forces alone is insufficient. Even where market economies are very advanced, many energy-efficiency investments with strong life-cycle returns remain unimplemented. Although the use of market forces is important and critical for sustained progress on improving energy efficiency, strong government leadership is also

required. Government leadership is needed to put standards and regulations in place where there are market failures, to promote economic policies that encourage investment in operating cost savings as much as possible, to help provide information and raise awareness, to nurture the development of a domestic energy-efficiency service industry, to launch and nurture market transformation initiatives for key energy-using equipment or appliances, and to promote and foster the development of financing mechanisms and public-private alliances that can effectively help deliver increased energy-efficiency investment. The need for strong and sustained government leadership is especially evident in Vietnam, especially at the current time.

Barriers to Achieving Energy Efficiency

Lack of Information. Perhaps the most basic requirement for achieving greater energy efficiency is for energy users to be aware of potential energy savings and their financial benefit, and how to attain them. Although a good start has been made and the VNEEP recognizes its importance, Vietnam is still a long way from meeting this requirement. Many consumers, especially in commercial or industrial establishments, actually have little concrete idea of the potential for energy savings in their businesses, and how much money could be saved through improved management or modest investment. Despite some progress of late, there remains little reliable and comparable information on the actual energy-use patterns of different types of appliances or new equipment that consumers can readily see and properly consider. Business enterprises are typically not very knowledgeable about the types of retrofit projects that could save

them on energy costs, new and more efficient technologies, or even where they might find out more about these things. As VNEEP progresses in future years, consumers will also need more specific information on implementation and financing options.

Insufficient Readily Available Expertise. A related issue concerns the availability of expertise. Clients need to be able to tap appropriate expertise to advise on energy savings options, complete customized energy-use audits on site, identify projects and sources of financing, and assist in developing and implementing complex projects. Such expertise needs to be readily available locally and easy for clients to contact and engage. Clients also need some way to gauge whom they can trust. Experts with established track records in actually implementing projects are especially valuable for providing advice derived from actual experience rather than theoretical calculation. Expanding and improving the qualifications of local expertise is another area where Vietnam needs to make major improvements if a meaningful share of the potential for energy efficiency is to be captured. Vietnam's government has made this a priority, but it takes concerted effort over a sustained period to achieve real results.

Energy Pricing. In any market economy, higher energy prices are an exceptionally powerful force to attract attention to energy efficiency and to increase incentives for action. In Vietnam, prices paid for energy are low relative to those in most other countries. The actual level of electricity tariffs has fallen in real terms over the past several years, despite an increase in January 2007 of an average of 8 percent to VND 873/kWh and a further increase of an average of 9.1 percent to VND 948/kWh in 2009. Domestic coal prices are well below levels in other countries. Although solid returns on a wide range of energy-efficiency investments still exist, incentives and investment results could be sharply improved if energy prices better reflected international levels.

Cost-Consciousness. Even if price signals are strong, consumers need to be interested in reducing operating costs, although this is not always the case. Where enterprise operation culture in a planned economy remains strong, as in some state-owned enterprises, reducing operating costs, such as energy or water utility costs, may not be a priority to managers, even if quite profitable. In addition, when economic growth is robust, commercial and industrial establishments may naturally place greater emphasis on the expansion or introduction of new products to increase market share, and investments for long-term

payoff in operating cost savings may be assigned lower priority for the time being.

Lingering Generic Problems with Energy-Efficiency Projects.

Even if consumers are aware of opportunities, expertise is available, and the economic environment is supportive, problems inherent in these types of operating cost saving projects still remain and, unless addressed, continue to hinder realization of the available potential. Benefits in the form of calculated cost savings streams, as opposed to highly visible new production assets, appear nebulous and inherently risky to many. At micro decision-making levels, energy cost-saving characteristics of new equipment may be relatively insignificant compared to other concerns. When purchasing new refrigerators, for example, buyers are unlikely to push energy-efficiency demands on producers hard enough to cause market transformation, relative to other demands, such as refrigerator appearance, convenience items, layout, and so forth—the energy expenditures involved in operating one refrigerator are just not big enough (although the energy costs are large in the aggregate for the country). In some cases, for example, where office or living space is rented, one party may be responsible for purchasing equipment while the party responsible for paying energy bills is different, causing a problem of split incentives. Then there is the problem of transaction costs. Unless addressed, the efforts required by an energy user on his own to find good information, obtain advice, consider options, design projects, and then implement the measures may add up to too much effort and cost for the many small projects typical of the energy conservation business. If projects require substantial outside expertise or outside financing, the contractual hurdles involved increase transaction costs and implementation difficulties even more. Unless specific programs and packaging mechanisms are put in place, benefiting from scale economies in aggregation, these problems cause potential energy-efficiency investors to require exceptionally high implicit discount rates or to forgo the potential savings altogether.

Behavioral Inertia. There are also inherent behavioral issues associated with the acceptance of change. For some, there is comfort in doing what you know even if other ways may be better. Others perceive the adoption of new practices as having unforeseen risks. Engineers design in ways in which they are accustomed, procurement officers like to work with existing suppliers that understand their needs, and technicians prefer to work with equipment they know how to operate and maintain.

Overcoming Barriers to Energy Efficiency

All countries with mixed or fully market economies that have had some success in overcoming barriers to improving energy efficiency use a mix of government regulation combined with policies and programs to encourage improved uptake of energy-efficiency investment through the market. Some common regulations include requirements to provide monitorable information on energy use, requirements for standardized energy consumption labeling on energy-intensive equipment, enactment of mandatory energy-efficiency standards for certain equipment (such as refrigerators), implementation of programs for either voluntary or mandatory government-industry agreements on improving industrial plant energy efficiency, and outlawing of specified particularly energy inefficient equipment models or subscale industrial processes. Some common public programs to help spark greater market investment include public support for public-private partnership financing schemes, provision of targeted concessional finance or tax breaks, programs to develop and launch an energy-efficiency performance contracting industry by ESCOs, and more. In countries where information and expertise are basically available and economic environments are generally supportive, forceful and sustained government action on both regulation and promotion of market-based solutions is still needed to overcome the more generic energy-efficiency investment barriers described above.

Developing and Implementing Energy-Efficiency Regulations.

The most important measure that Vietnam can take in the short term to address current barriers to energy efficiency is enactment of the proposed Law on Energy Conservation and Efficient Use. The law is especially important because it can provide the foundation for the regulations that are needed to address specific problems undermining Vietnam's ability to achieve greater energy efficiency. The law can bring stronger legitimacy to organizations and their work, and provide for assignment of responsibilities and associated funding. Enactment of the law can send a clear message to society and the market on national intentions. The law can mandate new relationships among the government, industry, and large commercial enterprises to encourage more efficient use of energy, mandate improved systems to provide consumers with objective information, and lay a foundation for developing minimum energy-efficiency standards for key types of equipment. It is important to maintain flexibility for adjustments based on evolving experience, and hence leave many specifics for associated regulations. Based on China's experience with its first energy conservation

law in the 1990s; however, it is also useful for the law to provide clear authority for the enforcement of regulations and assessment of penalties for noncompliance.

Development and especially implementation of the first set of regulations based on the law, if enacted, will be a very large undertaking over the next three years. It is important for the design of specific regulations and their rollout to be carefully aligned with the government's capacity to assist in their implementation and to enforce them. Overambitious, all-encompassing regulations that cannot be practically implemented with existing staff and organizational capacity may undermine credibility and be counterproductive.

Unleashing Market Forces. While regulation is important for drawing attention to energy waste, ensuring unbiased information flow, and overcoming certain specific market failures, the use of market forces is critical for realizing large-scale, efficient, and sustainable investment in more efficient energy-use systems. For Vietnam, from an overall policy perspective, the review of consumer energy prices and adjustment to best reflect true costs, as well as continued state-owned enterprise reform, can make a major difference in helping bring market forces to bear, especially in the industrial sector. However, effort is also needed to foster development of effective investment project delivery systems. Experience elsewhere shows that effective delivery systems for energy-efficiency investment projects are not likely to develop without initial government encouragement, but once operational, investment can continue sustainably with more limited public involvement. Given the scale of investment needed, reliance on market-based mechanisms is essential to achieving long-term energy-efficiency goals. Some of the more common energy-efficiency investment delivery systems are outlined below.

Energy Service Companies. For the energy-efficiency investment market to function, entities that understand the technology and cost-saving potential are required to help identify opportunities, complete good feasibility studies, and assist in project implementation. Such companies or institutes may be called "third-party service providers," "project agents," or other terms. For Vietnam, continued development of a local industry of these types of companies will be critical if energy-efficiency investment is to increase sharply.

Many people reserve the term ESCO for energy service companies that engage in energy performance

contracting (EPC). EPC is a specific type of energy-efficiency investment model involving an ESCO and an energy-consuming client in which the ESCO provides technical service (for example, identifying, designing, and implementing projects in the client's facilities), finances or helps arrange financing for the capital cost, and is compensated from the resulting energy savings, based on a performance contract. This business proposition can be highly attractive to customers who might otherwise be unable or unwilling to concern themselves with the technical details or finance the project themselves. The model can be profitable for the ESCO if it is able to replicate projects without excessive transaction cost. However, it is a complex business, requiring an effective mix of financing, technical, and entrepreneurial skills on the part of the ESCOs, and familiarity on the part of clients. The business also relies on the effective execution of a unique type of commercial contract, which can be a particular challenge in an untried setting.

EPC is a promising business model for Vietnam, but its development is a long-term proposition, involving many challenges and a process of service company development, contract piloting, adjustment, increasing market sensitization, and gradual rollout. Steady government support is essential to get development off the ground and to gain traction.

Utility-Executed DSM. Utility DSM involves programs implemented by utilities to change the consumption patterns of their customers. For electric power, the focus includes both load management programs to foster shifts in power use away from costly peak demand times and programs to save electricity use by customers overall. Electric power DSM programs have a big advantage in that they can use the strong institutional platform of electric PCs for program implementation. However, a disadvantage is that some type of incentive system needs to be set up for utilities to implement programs that reduce customer electricity use. The main revenue of electricity companies is from the sale of electricity, and reductions in sales of electricity are lost revenue. While shifting electricity use from on-peak to off-peak can save utilities money (and improve electricity system efficiency), implementation of consumer electricity savings programs by commercially oriented PCs usually requires specific regulations and their enforcement, and/or compensation for costs and lost sales.

Electricity of Vietnam (EVN) has successfully implemented short-term DSM programs, especially for electric lighting, since about 2000, but the long-term future of DSM in Vietnam is uncertain. If the government wishes to pursue

this option aggressively, a major and fairly difficult regulatory scheme for requiring end-use efficiency DSM, with appropriate utility compensation and its financing, would need to be developed and enforced, especially given the ongoing power sector restructuring program. Barring that, a practical option would be to concentrate on utility implementation of several specific, relatively short-term programs, with the provision of funding external to EVN or the regional PCs, especially in cases where electricity use coincides heavily with peak load. Vietnam's MOIT also could contract one or more PCs for specific broader government program implementation functions, as it has done with the HCMC PC for solar water heaters under the World Bank-GEF Project.

Commercial Energy-Efficiency Loan Programs. One of the most common reasons cited by large energy users for the failure to invest in energy efficiency is the lack of access to financing. Because many energy-efficiency investments are actually quite profitable, energy-efficiency loan businesses also can be potentially attractive to banks. Commercial bank development of self-sustaining, market-based energy-efficiency lending operations is very much in the public interest. However, such energy-efficiency lending operations rarely develop without active encouragement. For most banks, energy-efficiency lending is at most a special, niche-type business. Loans to reduce operating costs are not common in most banks in most developing countries, with their seemingly less tangible assets and additional challenges in developing appropriate collateral. Provision of such loans for more than a one-year term also may be a challenge. Banks will need to develop partnerships with third-party energy-efficiency service entities for help in identifying, appraising, and monitoring projects. Developing efficient businesses that keep transaction costs down requires clever design, farsightedness, and good management.

A number of commercial banks in Vietnam have begun to explore energy-efficiency lending possibilities, with support from IFC and others. Again, achieving sizable investment results through this mechanism is a medium- or long-term proposition, but one that is important to launch and steadily support. In cases where Vietnamese banks are, in effect, being assigned and compensated as implementing agents for placement of international donor or other public energy-efficiency loan funds, the banks may gain some familiarity with the business. For lasting results, however, focus must be placed upfront on the development of customized lending businesses that meet the strategic objectives of the given bank, and program designs and implementation procedures that fit that bank's existing business models as much as possible.

Special Public Resource Funds. Some governments establish special-purpose funds, parastatal energy-efficiency investment companies, or other long-term special programs designed to catalyze energy investment in the market with the use of public funds. Two examples that involved the creation of new legal entities include India's Renewable Energy Development Agency (a national parastatal company that also engages in energy-efficiency loans) and the development of Energy-Efficiency Utilities by several state governments in the United States. Objectives best focus on maximum monitorable results in increased energy-efficiency investment per unit of public resources. While some programs have clearly been successful, there are many inherent challenges, including maintenance of program stability because of continuing financing uncertainties, complex and sometimes uneasy or unhealthy relations with the banking industry, and program management capacity requirements. If Vietnam chooses to consider such an option, it may be best to define upfront (a) very clear and narrow objectives, and a sophisticated system for how results will be measured; (b) specifics of program management and implementation, including the contracting of capacity from outside the government; and (c) medium-term dedicated financing sources.

Putting Regulation and Market-Based Programs Together in Key Sectors

Improving Energy Efficiency in Existing Industrial Plants

While many cost-effective energy-efficient technologies and process improvements are available and appropriate for existing Vietnamese industry, informing industry managers, incentivizing owners, packaging projects, and identifying and implementing them have been more problematic. On the regulatory side, some important and useful measures listed in recent drafts of the energy conservation law include new mandatory energy-use reporting systems, requirements for developing internal energy management programs in designated enterprises, requirements for designated enterprises to implement five-year energy-efficiency improvement plans agreed with and monitored by the government, and provisions allowing the government to ban particularly wasteful equipment and energy-use practices. The reporting, energy management, and energy-efficiency planning requirements can provide a critically needed platform for increasing information on the specific energy-efficiency opportunities, both in industrial enterprises and in government entities. They can also provide a powerful impetus

for organizing greater attention in enterprises to potentially profitable opportunities for energy-efficiency investments and operational modifications, and for instituting improved energy management practices that can have a big payoff over the medium term. However, implementation will be a major effort requiring focused attention at many levels for quite a few years. Countries with strong experience in recent years in these particular regulatory and monitoring areas include China, Japan, and a number of European Union countries. China also began to achieve good results in 2006–08 in its banning of particularly energy-wasting, subscale industrial technologies, but its experience has shown that rigorous enforcement at local levels is critical.

Regulatory measures can attract needed attention within industrial enterprises, but measures to help make it easier for them to implement money-making energy-efficiency projects in line with market forces are needed to then deliver concrete energy savings in existing plants (provided that the plants continue to operate). This requires additional information programs, steady and major capacity-building programs for energy managers and third-party service providers, and efforts to expand project financing channels and amounts. Programs to provide enterprises with information on opportunities—for example, through the dissemination of case studies, technical resources, and analytical tools; delivery of training courses; and so forth—often get the best results if the focus is on how enterprises can save money from energy conservation. Training and increasing hands-on experience is needed, especially among third-party service groups, to help efficiently identify and package financially attractive technology choices and renovations. Financing for energy-efficiency projects is typically difficult to arrange through standard channels. Although the business can be profitable for banks in due course, efforts are needed to help jump-start loan programs that can efficiently accommodate good energy conservation retrofit projects.

A number of international donors are working with the government to prepare new programs for preparing and/or financing industrial energy-efficiency retrofit projects, and such programs can be quite constructive. One suggestion is to try to focus exclusively on capturing a good share of the available financially attractive projects, avoiding less economic investments, and aiming to create and link project development and investment mechanisms that are inherently profitable for the financing and host entities and that can be sustained after donor financing is exhausted. Another suggestion is to ensure that technical assistance for project identification

and development is blended well together with financing programs. Stand-alone technical assistance projects often fail to achieve good energy savings results if they are not well associated to financing programs and if they do not meet the concrete needs of potential financiers. Similarly, programs that create financing without strong technical assistance to raise awareness and help identify and package projects tend to suffer from poor deal flow.

Encouraging More Energy-Efficient New Industrial Plant

As described earlier, the characteristics of new industrial plants will determine much of Vietnam's future energy-use and import needs. However, the policy and market-based tools available to influence this dynamic constructively are in many ways different from those for encouraging energy efficiency in existing industry.

Medium- and long-term national industrial development planning is essential to ensure that both industrial sub-sector growth trends and major new industry projects are aligned with plans and policies for national macro-economic balance, balance of trade, and infrastructure development, and are not shaped solely by local aspirations for specific new projects. Big future increases in industrial energy needs from new projects will shape much of the country's energy economy, and will impact the energy import bill. Now would be a good time to interject energy concerns more stringently into the broader industrial planning process. Especially important are policies concerning which subsectors to promote for growth and which to restrain, and efforts to tighten review processes for large new projects.

The main tool the government has for influencing industrial growth trends on the ground is regulation. This includes project permitting, environmental regulation, and approval of access to necessary infrastructure. Adoption of wasteful, backward, and highly polluting technology can and should be blocked. As in all countries, balance between national and local government regulation is an important concern, since interests and perspectives are not quite the same.

Improving access to financing for more energy-efficient and environmentally friendly new industrial processes, production lines, and equipment is another important means to impact new industrial development positively. Adoption of new, more efficient, and less resource-

intensive technology can pay off well over the long term in operating cost savings. It is more cost-effective to build efficient plants right the first time than to retrofit them later. Industrial plants that are designed inefficiently at the outset are more costly to operate. Typically, however, achievement of the operating cost savings requires a higher upfront investment, at least in terms of learning something new, but often also in terms of more upfront capital. Solving this problem is a banking function. The government can help by encouraging banks to adopt new programs to help their clients adopt "greener," operating cost-saving technology, which can pay off for both the banks and their customers. In general, other supportive measures include low-interest loans, tax incentives, and subsidies.

Transportation

Long-term planning and specific development policies also play a key role in determining energy efficiency in the transportation sector. Efficient energy use is only one of many concerns in transport sector planning, but many broad initiatives aimed at improving transportation efficiency in general (such as urban mass transit development, traffic planning, and promotion of intermodal balance, and so forth) also foster energy-efficiency gains.

One specific measure that has yielded energy savings in other countries is increasing fuel-efficiency standards for motor vehicles, and strict enforcement of these standards. Another set of measures includes vehicle inspection and maintenance programs (serving multiple objectives) and programs to promote earlier retirement of old, particularly inefficient vehicles. Promotion of vehicles using alternatives to liquid petroleum fuels (for example, hybrid electric vehicles and vehicles that use compressed natural gas or biofuels) have produced noticeable results in some countries, including programs to convert publicly owned or captive high-use fleets such as taxis, or programs to provide financial incentives.

The motor vehicle transport sector is also a sector where the level of energy prices really matters. Experience across the world has shown that increasing fuel prices has a marked effect on both the choices consumers make when purchasing vehicles and the efficiency of their vehicle use. Conversely, gasoline and motor diesel subsidies are particularly damaging for efforts to meet national energy-efficiency or interfuel substitution objectives.

Electrical Appliances

Electrical appliances in residences used 39 percent of all electricity consumed in Vietnam in 2007. The IEA estimates that electricity savings of some 25–38 percent in residential appliances could be achieved internationally.⁶ However, capturing the savings potential involves some different challenges from those in industry or transportation. In industry, energy-efficiency initiatives focus especially on helping enterprises identify and implement relatively customized solutions. With household electrical appliances, however, a limited number of appliance types dominate electricity use (for example, lamps, refrigerators, air conditioners, water heaters, and rice cookers), but a very dispersed supply and use chain that involves millions of customers, many retailers, and quite a few different product suppliers.

Because of the nature of the market, programs to improve efficiencies for electrical appliances are usually done on a national scale and often by individual appliance. Many countries aim to “transform existing markets,” that is, to guide the increasing penetration of more energy-efficient appliances into specific appliance markets through regulation and selective public intervention, yet they still rely on market forces for efficient and sustainable market operation. This involves (a) programs to provide customers with commonly available, credible, and correct but simple information about the efficiency characteristics of the choices in front of them; (b) government initiatives to work with suppliers to encourage expanded marketing of reputable and more efficient products, and discourage particularly wasteful or fraudulent market offerings; and (c) programs to help customers cope with the initial higher costs of some more efficient appliances until market transformation can take hold. Good results require careful planning, a mix of tools, and long-term dedication.

The main initiatives undertaken in the appliance market transformation arena in Vietnam so far are on the dissemination of CFLs and some initial activities on market labeling, establishment of appliance testing protocols, establishment of a local testing facility, and some development of several national standards (see Chapter 2). EVN’s program for bulk purchase and distribution of CFLs has been quite successful in terms of volumes achieved and increasing awareness. Now may be the time for the

government to establish promotional programs that can build on recent gains and be sustained over the long term through local retail outlets, and for renewed efforts on FTLs and electronic ballasts. It also is a good time to put more aggressive and comprehensive programs in place for larger household appliances. For the future, Vietnam needs to develop more consolidated and deliberate programs focused on ensuring long-term results.

Good market transformation programs require upfront public investment to gain understanding of the specific target markets before attempting to transform them. Consumer purchase behaviors and concerns when buying new appliances, the realities of retail systems and locations, consumer financing patterns, supplier chains and selling strategies, and the characteristics and prices of the main products currently on the market are all important to understand before embarking on major market transformation initiatives. Unless built on such specific understanding, program designs are likely to result in too much wasted effort.

Expansion and upgrading of programs to provide readily available and credible information to consumers about various appliance products on the market is especially important now. Many poor-quality products are on the market, and unsubstantiated claims about energy efficiency and critical product characteristics abound. It is difficult for consumers to know with confidence which claims are correct and which are bogus, and hence when payment of higher costs upfront will pay off. To solve this problem, however, will require greater public investment, planning, and time to develop and institute testing programs, to develop well-designed appliance labels and other information, and especially to increase the visibility of such information and consumer confidence that it is correct.

Development and implementation of either voluntary or mandatory energy-efficiency standards for key appliances has been effective in a number of countries and is being considered in Vietnam. However, standards must be strictly enforced or they lose their meaning. If compliance is voluntary, consumers must still have confidence from the compliance system that products claiming to meet voluntary standards actually do. Compliance monitoring systems also require public investment and time to develop and implement properly.

Energy-efficient appliances typically cost more than inefficient ones, even if they pay off through savings later, and the issue of higher upfront costs needs to be dealt

⁶ IEA. “Experience with Energy Efficiency Regulations for Electrical Equipment” IEA information paper, OECD/IEA, August 2007.

with as programs are launched. Government-supplier negotiations can often help to bring down costs, with technology transfer agreements, and/or bulk procurement or other discount deals in which suppliers offer lower prices for arrangements resulting in larger-scale sales. Still, consumer subsidies may be justified to jump-start market transformation to more efficient appliances, at least until the market penetration begins to see further economies of scale and/or consumers more clearly see the longer-term payoffs. Common subsidy mechanisms include partial rebates for the purchase of specified more efficient models, or the provision of low-cost financing for large appliances. Such subsidies are best designed from the beginning with plans for their gradual phaseout. Most countries rely on existing appliance retail systems for distribution, although electricity utilities may collaborate with the programs (for example, in marketing and distribution of rebate coupons and so forth) as part of DSM program agreements or under specific government contract. Because appliance markets are large and diffuse, government programs must be designed to minimize unintended distortions in the market, especially competition with and undermining of existing supply channels. Waste by providing incentives to those consumers already planning to purchase efficient equipment on the market also needs to be minimized.

Recommendations for Follow-Up Actions

With the new energy conservation law up for consideration by the National Assembly, growing experience through the implementation of the VNEEP, and a supportive donor community, the overall environment for scaling up the government's efforts to promote greater energy efficiency is very good. What is most important at this point is laying solid foundations for institutional systems and programs that can make major energy savings contributions over the long haul, and grow stronger and stronger over time. However, achievement of real and sizable energy-efficiency gains is not easy. While some "quick gains" may occasionally be achieved, the best and most lasting results usually stem from programs that are built with sufficient and growing local capacity for delivery. This requires good planning, upfront public investment, dedication, and time. Some countries have grabbed onto program ideas introduced from elsewhere, which sound simple and easy, and introduced them with high expectations without sufficient groundwork, adaptation to local circumstances, consideration of possible unintended consequences, or consideration of the need

for human resource investment in program delivery. Results then tend to be poor and fizzle out. It is certainly not the case that all programs must wait for complete, full-scale planning before anything can be started. Small-scale piloting and trial efforts are excellent ways to test ideas and begin to adapt them to realities on the ground. It is often useful, however, for pilots to have a strategic focus set in a broader, deliberate plan and, if evaluations show promise, for scale-up efforts to be designed with deliberate focus on long-term sustainable results.

Although donor funds may provide some large financing sources for a few years for some activities, the current public fund budget of US\$2 million per year for implementation of the VNEEP means that the government must prioritize its activities carefully. Increasing leverage is also critical—for example, to use public funds as seed money for ideas that can be scaled up by others, especially the private sector.

In prioritizing among competing program requests for public funds, the Bank study team strongly recommends greater attention to evaluation of the actual energy savings results that may be achieved. The success of the VNEEP should be assessed with respect to the specific, quantified role it has played in helping to meet the government's energy savings goals. It is true that many public investments in the early years may need to concentrate on human resource capacity building, although assessment of direct energy savings from capacity building investment is difficult. However, even in this case, greater rigor is possible. For example, what specific programs are staff to be trained for and expected to contribute to, and how much energy savings might evolve from a specific program if successful? After the training, did those staff really apply the skills they learned in the specific program? What other factors must be addressed for those skills to produce concerted, new energy savings, and have those factors been addressed?

With the new law moving forward and new implementation regulations in the preparatory phase, it would also appear to be a good time to review how government institutional responsibilities and the coordination between different parties can be further crafted to best serve the long-term needs. A common observation expressed by foreigners reviewing Vietnam's energy-efficiency program is that it is too fragmented institutionally, with overlapping or unclear responsibilities and insufficient coordination and direction. While there are many issues and factors to consider, the current juncture may provide a good opportunity for adjustments.

A variety of good, new energy-efficiency initiatives are now being launched in Vietnam. Comments and suggestions on some of these have been provided in previous sections. In addition, the Bank study team recommends consideration of a number of new or scaled-up initiatives, outlined below, many of which can be or already are being discussed as areas of future World Bank Group support.

Economic Studies

At least three strategic areas appear to warrant more extensive review and analysis, which should then lead to more specific policy recommendations:

- **Review of the Energy Implications of Industrial Development Policy.** The structure of Vietnam's industrial development over the next decade will have a major impact on the country's future energy imports and energy supply security. Countries in East Asia have followed different paths—with some such as the Republic of Korea in the 1970s investing strongly in the development of a heavy industry to capture a significant share of international markets, and others, such as Thailand, placing more emphasis on developing high value-added light industry. The implications for the energy needs of different industrial growth paths can be dramatic. An initial review could analyze the energy supply and import implications of different scenarios of industrial structural growth, and outline the government policy options that might best influence outcomes.
- **Consumer Energy Pricing Review.** Energy price levels clearly have a major impact on consumer attitudes toward saving energy and will be an important factor in determining the size of Vietnam's future energy import bill. Special focus needs to be devoted to how pricing policies for domestic coal, and then petroleum products, might be adjusted to best encourage improved energy efficiency without undermining industrial competitiveness or creating social hardship.
- **Review of the Energy Implications of Alternative Transportation Development Scenarios.** The transport sector is increasingly important in Vietnam's energy balance and central in determining net petroleum import requirements. A review of the energy-use implications of different scenarios of transportation planning and development would help to identify specifically where potential energy-efficiency gains may be most significant, and where energy-efficiency concerns overlap well with other key planning

considerations (such as quality of service and overall cost reduction).

Energy-Efficiency Promotion System Development

Three areas where well-targeted advisory assistance might be especially useful include advisory assistance for government efforts on the following:

- **Development of Vietnam's New Industrial Energy-use Supervision System.** Vietnam's draft new energy conservation law requires all designated enterprises to report on energy use, institute new energy management systems, and complete plans to achieve energy saving results. The government or its agents will need to provide detailed guidance; ensure compliance; compile, review, and analyze large amounts of information; help enhance the quality of submissions; and provide required approvals. This will require massive investment in human resource capacity and expanded institutional systems. Advice has been requested on how to undertake this in the most practical and realistic way. Piloting and gradual but steady rollout may produce the best results. Integration of evolving international enterprise energy management concepts and systems (for example, those relating to the proposed new ISO 50001) is also relevant. Proper application of an industrial energy management system has a strong linkage to compliance with the basic requirements under the energy conservation law to report on energy consumption, assign energy management teams within the enterprise, prepare and implement energy-efficiency improvement plans, and adhere to the equipment and process standards issued by the government. In Japan, strict enforcement of the energy conservation law—administered by the Ministry of Economy, Trade and Industry (METI), particularly the Energy Efficiency and Conservation Division—has been pivotal to the success of Japan's energy-efficiency programs. The ECCJ was established in 1978 with Japanese government and corporate support to assist with (a) research on and implementation of energy conservation programs, (b) accreditation or licensing of energy managers under the energy conservation law, and (c) dissemination of information on energy conservation.
- **Policy Development to Encourage Energy Efficiency in New Industrial Plants.** Although retrofitting current plants is important, the characteristics of equipment and processes installed in new industrial plants will

almost certainly have a greater bearing on energy-efficiency levels in industry over the next decade. The government should undertake a detailed stock-taking review of the energy-using technology and equipment adopted in new industry during the previous three years, as well as an assessment as to how energy-efficiency levels match up with the best technologies readily available. Results could then feed into a practical review of specific policy and regulation options to encourage efficient and more environmentally friendly technology choice and to limit the use of backward equipment.

- **Review of Fiscal Incentive Options to Promote Energy Efficiency.** Vietnam is considering what types of fiscal incentive options might be most appropriate to help promote energy efficiency, among the common menu of tax incentives, direct subsidies, border tariff adjustments, interest rate subsidies, and so forth. A review of the concrete experiences of other countries, including fiscal financing pitfalls, the extent of practical results from different options, and lessons learned—all with a focus on the main options that are actually relevant for Vietnam—could greatly help decision making on this complex topic.

Energy-Efficiency Investment Programs

In terms of the new, proposed energy-efficiency investment programs, the following provide indicative program ideas that the government may consider:

- **Clean Production and Energy-Efficiency Financing Program for New Industrial Capacity.** A program to help banks operating in Vietnam to offer and expand financing for upfront costs of enterprise investment in cleaner and more efficient technology, especially for new production facilities, could bring positive results far into the future. Donor assistance, including concessional finance, could support program start-up, help incentivize the use of new technology, and help mitigate banking risks. Government regulatory policy support, including renewed efforts to foster selection of environmentally sound and energy-efficient investment in new plants permitting (see recommendation 2 on *Energy-Efficiency Promotion System Development*).
- **Expand Commercial Financing for Energy-Efficiency Retrofit Projects.** Development and marketing of financing products for investments resulting primarily in operating cost savings is not a mainstream activity for local banks. To develop energy-efficiency lending into attractive business lines generally requires upfront, dedicated effort. Donor assistance and government support will be needed to jump-start programs, but if successful and developed on sound commercial principals, such programs could expand and yield sustainable results independently. Such an initiative could be combined with the program for new industrial capacity outlined above, or undertaken separately.
- **Expanded Development of the Third-Party Energy-Efficiency Service Sector.** Initial IDA, GEF, and government investments through the second IDA/GEF energy-efficiency projects for the development of third-party energy-efficiency service companies or project agents have yielded good results. Also building on IFC's current VCPEEP program, further investment and support are needed to help this new commercial industry to gain its footing and grow, since it will be essential for the future. In addition to creating explicit linkages with financing initiatives involving local banks that will need the assistance of this industry (for example, recommendations 1 and 2 on *Energy-Efficiency Investment Programs*), some possibilities include (a) support for more advanced training on energy technologies and systems, the use of more complex financial and contracting mechanisms, and more sophisticated use monitoring and verification systems and methodologies, and so forth; (b) an expanded financing program to project agents for audits and investments to include both electrical and thermal measures and allow for larger project sizes; and (c) creation of an energy-efficiency service company association that could help further organize the energy-efficiency market, train members, and discuss policy issues with the government.
- **Consolidate and Roll Out Appliance Market Transformation Efforts.** Residential electricity use plays a large role in the country's energy balance, and the efficiency of appliances can be substantially improved. Dedicated, multiyear, multitool programs are needed for the highest-priority appliances (for example, refrigerators and air conditioners, in addition to lighting, followed perhaps by pumps and hot water heaters). Provision of readily available and credible information on appliance energy-efficiency characteristics should be an important element. Market transformation initiatives for each product should consider existing supply chains, available technologies, customer classes, costs and benefits, and so forth, with market surveys and supplemental analyses, followed by development and implementation of appropriate strategies to encourage increased and sustained adoption of high-efficiency models.



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