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ANNEX 6

# VIETNAM COUNTRY REPORT

FROM IDEAS TO ACTION: CLEAN ENERGY SOLUTIONS  
FOR ASIA TO ADDRESS CLIMATE CHANGE

**June 2007**

This report was produced for the United States Agency for International Development (USAID). The authors' views expressed in this report do not necessarily reflect the views of USAID or the United States Government. International Resources Group (IRG) prepared this report for USAID under the ECO-Asia Clean Development and Climate Program; Contract No. EPP-I-00-03-00013-00 Task Order 9.

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## LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AFOC	ASEAN Forum on Coal
APERC	Asia-Pacific Energy Research Centre
ASEAN	Association of Southeast Asian Nations
ASTAE	Asia Alternative Energy Program
CD4CDM	Capacity Development for CDM
CFB	Circulating Fluidized Bed (combustion technology)
CFL	Compact Fluorescent Lamp
CNECB	CDM National Executive and Consultative Board
DANIDA	Danish International Development Agency
DEM	Danish Energy Management
DONRE	Department of Natural Resources and Environment
DNA	Designated National Authority
DSM	Demand Side Management
ERAV	Electricity Regulatory Authority of Vietnam
ESCOs	Energy Service Companies
ESMAP	Energy Sector Management Assistance Program
EVN	Electricity of Vietnam
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
HAPUA	Heads of ASEAN Power Utilities and Authorities
HCMC	Ho Chi Minh City
IE	Institute of Energy
IOCs	International Oil Companies
IPPs	Independent Power Producers
JBIC	Japan Bank for International Cooperation
JICA	Japanese International Cooperation Agency
MOARD	Ministry of Agriculture and Rural Development
MOC	Ministry of Construction
MOF	Ministry of Finance
MOFA	Ministry of Foreign Affairs

MOI	Ministry of Industry
MONRE	Ministry of Natural Resources and Environment
MOST	Ministry of Science and Technology
MOTE	Ministry of Training and Education
MOU	Memorandum of Understanding
MPI	Ministry of Planning and Investment
MSW	Municipal Solid Wastes
Mt	Million Metric Tons
MW	Megawatt
NEA	National Environment Agency
NOCCOP	National Office for Climate Change and Ozone Protection
PDD	Project Design Document
PETROVIETNAM	Vietnam Oil and Gas Corporation
PHRD	Policy and Human Resources Development
PM10	Particulate Matter < 10 microns, unit mg/m <sup>3</sup>
PV	Photovoltaic
RCEE	Research Center on Energy and Environment
REAP	Renewable Energy Action Plan
SIDA	Swedish International Development Agency
SME	Small and Medium-sized Enterprise
TOU	Time-of-Use
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
VEPPL	Vietnam Energy Efficiency Public Lighting Project
VINACOAL	Vietnam Coal Corporation
VSRE	Vietnam Swede Rural Electrification Program
VUSTA	Vietnam Union of Science and Technology Associations
WHO	World Health Organization

# I. VIETNAM’S CLEAN ENERGY CHALLENGE

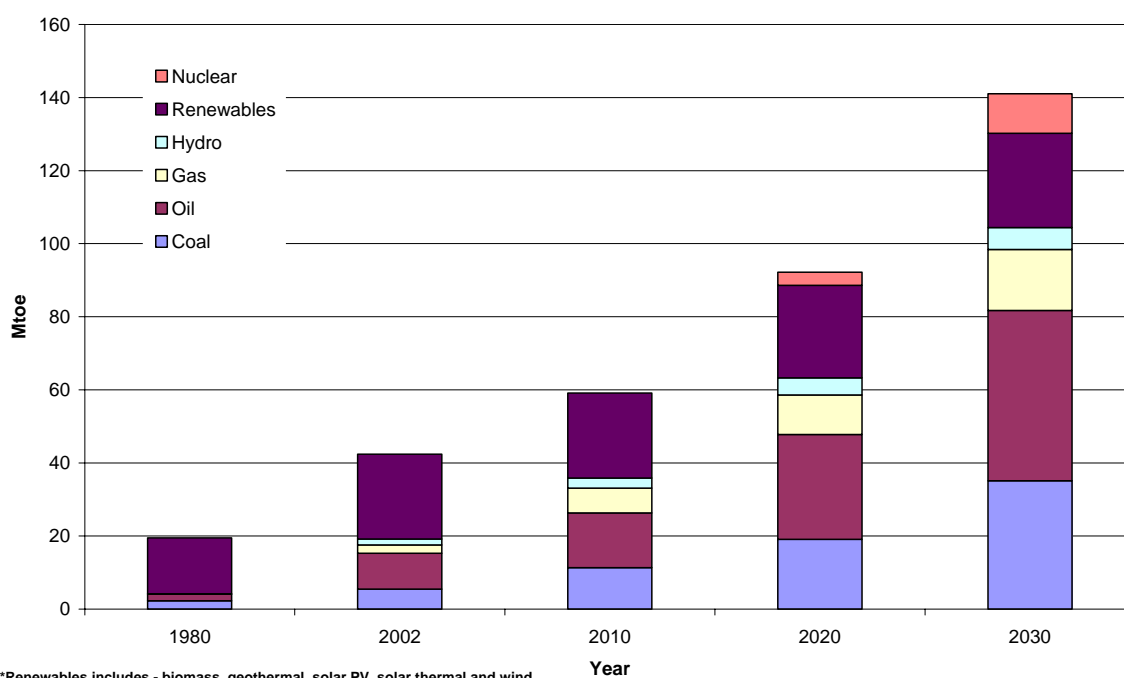
Energy has been a key component of Vietnam’s solid and strong growth during the last decade and will remain so if high growth continues through 2010. However, like many countries of similar demographics, Vietnam is facing the difficult challenge of maintaining this growth in a sustainable manner, with no or minimal adverse impacts on society and the environment. This country profile presents an overview of Vietnam’s energy sector, focusing on clean energy issues and institutions. It also explores the potential for USAID’s ECO-Asia program activities to help Vietnam achieve clean development.

## I.1 TRENDS IN ENERGY RESOURCES AND USE

Vietnam will increasingly become dependent on fossil fuels. As can be calculated from **Figure I**, the share of fossil fuels – coal, oil, and natural gas – in the total primary energy supply will rise from 42 percent in 2002 to 69 percent in 2030. However, it is expected that domestic energy production will meet most if not all the projected requirements as Vietnam has large oil, natural gas, and coal reserves. In fact, Vietnam has been a net energy exporter and is expected to remain so in the foreseeable future.

Biomass, mainly wood residues, which now accounts for the bulk of renewable supply, will decline in importance, both in relative and absolute terms, as modern energy becomes universally accessible and available, incomes rise, and urbanization spreads. The combined contribution of renewables, including large hydro and geothermal plants, in the total primary energy supply will fall from 58 percent in 2002 to 22 percent in 2030. Despite this, energy supply from renewables other than biomass (wind, solar PV, geothermal, waste-to-energy, and hydropower) is expected to increase. Hydropower production, in particular, is projected to grow by 4.9 percent per annum from 2002 to 2030. Moreover, it is also likely that nuclear power will have a certain share by 2030.

**FIGURE I: PRIMARY ENERGY SUPPLY BY SOURCE**



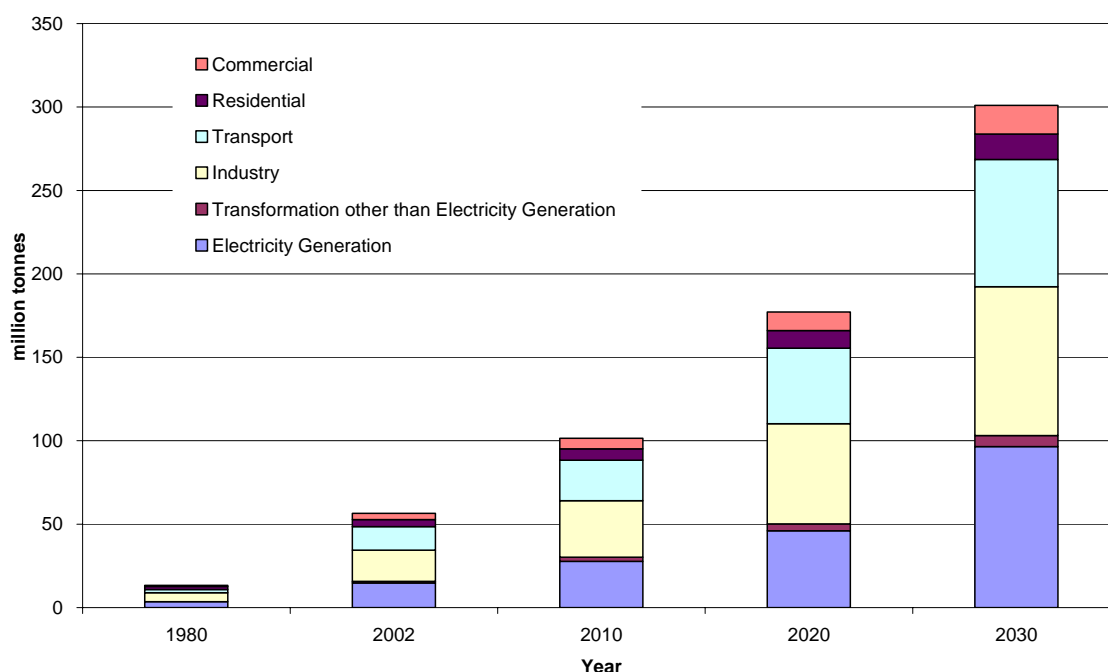
Source: APERC, 2006.

Figure 1 also reflects the rapid growth in consumption of these energy resources. Coal and natural gas consumption, driven by the rapid development of industry and the electricity sector, will grow by 6.9 percent and 7.3 percent, respectively, between 2002 and 2030. Meanwhile, the annual growth in oil consumption, driven by transportation sector demand, will be 5.7 percent during the same period.

## 1.2 IMPACTS OF ENERGY USE

Rapid development of commercial fossil fuel supplies together with expansion of the power sector will result in 6.2 percent growth in CO<sub>2</sub> emissions from energy use over the outlook period, reaching about 301 million tons (MT) of CO<sub>2</sub> in 2030 (Figure 2). Emissions are expected to increase rapidly as Vietnam industrializes and the economy utilizes more carbon intensive fuels (APERC, 2006). In fact, more recent estimates from the Ministry of Natural Resources and Environment (MONRE), which is also the CDM Designated National Authority (DNA), project CO<sub>2</sub> emissions will already have reached 268 million tonnes by 2020.

**FIGURE 2: CO<sub>2</sub> EMISSIONS BY SECTOR**



Source: APERC, 2006.

The burning of fossil fuels is also responsible for emissions that cause air pollution and therefore the deterioration of air quality, particularly in major cities like Hanoi and Ho Chi Minh City. Among these pollutants, the levels of particulate matter (PM10), though decreasing in some areas, are still alarming (Table 1 and Table 2). The rapid increase in vehicle population<sup>1</sup> that outpaces available road space and poor specifications of fuels used in vehicles both contribute to worsening air quality, especially in urban areas. Although the concentration of other air pollutants – particularly sulfur dioxide (SO<sub>2</sub>), carbon monoxide (CO), and nitrogen oxides (NO<sub>x</sub>) – are generally below national standards, increasing vehicle

1. For example, in 2000 alone, a 14.2 percent increase in the number of motorcycles occurred in Vietnam. In Hanoi, the number of vehicles increased by 384 percent during the decade 1991-2001; in Ho Chi Minh City, the number of motorcycles doubled between 1997 and 2002.

ownership is expected to test these limits in the near future. In fact, in specific locations (at certain times of the day) the concentrations of these pollutants seem to be increasing and exceed national standards.<sup>2</sup>

**TABLE 1: CONCENTRATION OF AIR POLLUTANTS IN HANOI, 1997-2000 (MG/CUBIC METER)**

Pollutant	Locations							Standard*
	Nga Tu Vong			Nga Tu So				
	1997	1998	2000	1997	1998	1999	2000	
CO	5.822	5.478	4.333	5.32	5.713	5.44	4.933	5
SO <sub>2</sub>	0.792	0.839	0.723	0.752	0.742	0.801	0.723	0.3
NO <sub>2</sub>	0.239	0.221	0.073	0.145	0.205	0.210	0.063	0.1
PM	1.239	1.237	0.567	1.121	1.151	1.191	0.633	0.2

Source: Centre for Environmental Engineering of Town and Industrial Areas. \*Standard = (TCVN 5937-1995) (24 hour average)

**TABLE 2: CONCENTRATION OF AIR POLLUTANTS IN HO CHI MINH CITY, 1998-2002**

Pollutant	Average concentration (mg/m <sup>3</sup> )					Standard*
	1998	1999	2000	2001	2002	
SO <sub>2</sub>	0.093	0.149	0.146	0.155	0.160	0.3
NO <sub>2</sub>	0.061	0.077	0.088	0.120	0.130	0.1
PM	0.39	0.51	0.51	0.45	0.52	0.2

Source: Centre for Environmental Engineering of Town and Industrial Areas. \*Standard = (TCVN 5937-1995) (24 hour average)

Even if the air pollution problem in urban areas of Vietnam is less serious than in other Asian cities experiencing rapid economic growth (e.g., New Delhi or several Chinese cities), there is still cause for concern. According to a WHO research, air pollution causes over one-third of respiratory inflammation and 22 percent of chronic pneumonia cases in Vietnam. Moreover, research in residential neighborhoods located near industrial zones suggests a connection between stationary source air pollution in Vietnam and respiratory inflammation (MONRE, 2005a). For example, 4,908 children under 15 years old were treated in the pediatric ward of Thanh Nhan Hospital (Hanoi) during 2001-2003 because of diseases connected with air pollution. In Bach Mai Hospital (Hanoi) in 2001, the percentage of respiratory inflammation was 2.1 times higher than the average during 1991-1995 and 1.9 times higher than the average during 1996-2000 (MONRE, 2005a).

## 2. CLEAN ENERGY POLICY AND REGULATORY FRAMEWORK

### 2.1 KEY LAWS, DECREES, AND POLICIES

A National Energy Policy has been submitted to the Government of Vietnam. It contains the following key elements:

2. However, it is difficult to interpret these results because of the degree of inconsistency and different measurement basis (e.g. monthly averages, maximum daily readings, etc.) across the data sets. Hence, one of the priorities in Vietnam is to upgrade and standardize air quality monitoring. The National Standard TCVN 5939-1995 has been upgraded to TCVN-2005 for the Maximum Allowable Emission Limits of inorganic and particulate matters in the Industrial flue gas.

1. Developing energy infrastructure and ensuring adequate, stable and long-term energy supplies for development;
2. Developing energy, taking into account environmental considerations and sustainable development;
3. Encouraging the economical and efficient use of energy by: (i) taking steps to replace low-efficient equipment and facilities, (ii) encouraging domestic manufacture of end-use equipment and facilities that meet energy efficiency standards, (iii) carrying out measures to improve energy conservation in large buildings, and (iv) applying the principles of demand side and energy supply management;
4. Developing new and renewable energy resources, such as small hydro, wind power, solar energy, and geothermal;
5. Promoting rural energy policy by ensuring adequate energy supply for the sustainable development of remote populations, achieving rural access for all by 2010;
6. Enhancing international cooperation in energy<sup>3</sup>; and
7. Improving legal frameworks and market-oriented reforms, especially in the power sector (APEREC, 2005).

The major energy laws that serve to promote these policies are summarized in **Table 3** and described briefly below.

**TABLE 3: MAJOR LAWS GOVERNING THE ENERGY SECTOR**

Year	Title	Thrust
2004/2005	<b>Electricity Law</b>	Provides roadmap and assigns responsibilities for reform and liberalization of the power sector.
1993 (Amended 2000)	<b>Petroleum Law</b>	Sets the overall framework for exploration and development of on-shore and off-shore oil and gas resources, including the nature of FDI allowed and types of contracts to be entered into with IOCs.
1993 Amended 2005	<b>Law on Environmental Protection</b>	Creates the statutory basis for regulating public and private activities to protect the environment and establishes the Ministry of Natural Resources and Environment.

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

3. Vietnam is already engaged in various forms of international energy cooperation. In terms of trans-border project development Vietnam is developing the following projects via bilateral or multilateral cooperation:
  - The Vietnamese and Malaysian governments have authorized PetroVietnam and Petronas to sign a commercial agreement to jointly develop petroleum from overlapping areas between the two countries.
  - Vietnam has joined the other ASEAN economies in signing an MOU to build a trans-ASEAN gas pipeline project.
  - Vietnam and Lao PDR have undertaken an energy cooperation program under which Vietnam will import about 2000 MW of hydropower from Lao PDR.
  - Vietnam will supply power to Cambodia via a 220 kV transmission line beginning 2007. In the future, after Cambodia builds hydropower plants, Vietnam will buy electricity from Cambodia using the same interconnection.
  - Vietnam has joined the Power Trade Agreement among the Greater Mekong Sub-region (GMS) members, which comprise Vietnam, Laos, Cambodia, Thailand, Myanmar, and Yunnan province in China.
  - Vietnam and Japan will cooperate to explore deep underground coal deposits in Quang Ninh province.
  - Vietnam is also an active participant in both the ASEAN energy cooperation and the APEC Energy Working Group, primarily through MOI and EVN's Institute of Energy. Vietnam participates in several working groups organized under the HAPUA (Heads of ASEAN Power Utilities and Authorities), including those on transmission, generation, databases, financial, and renewable energy/environment. The Working Group on Renewable Energy/Environment has numerous sub-groups on biomass, MSW, solar, wind, mini-hydro, which are just getting organized, in line with the Senior Officials' Meeting on Energy agreement to sponsor an Action Plan to increase the amount of renewable energy in the region to 10 percent by 2010. The other ASEAN forums in which Vietnam is active include the ASEAN Forum on Coal and the ASEAN Sub-Sector Networks on Energy Efficiency and Conservation and Renewable Energy.

### 2.1.1 Overarching Laws

**The Electricity Law:** The Electricity Law was approved by the National Assembly in November 2004 and took effect in July 2005. The Law provides regulations on electric power sector planning and investment, electricity savings, power market development, the rights and obligations of organizations participating in providing and consuming electricity, protection of electrical equipment, and power safety. The Law provides the general scheme for developing wholesale and retail electricity competition. It establishes the Electricity Regulatory Authority of Vietnam (ERAV) under the auspices of the Ministry of Industry (MOI) and requires power prices be set appropriately to encourage market development, facilitate investors in achieving a reasonable profit, encourage energy savings, and protect the rights and benefits of electricity providers as well as consumers. The Law also establishes a special regime for subsidizing or otherwise encouraging local energy development in rural, mountainous and island regions, including energy derived from new sources and renewable energy.

**The Petroleum Law:** Vietnam's Petroleum Law was introduced in July 1993. It contains the legislative provisions granting petroleum rights, establishing royalty and participation rights, and regulating activities in the petroleum sector. It also proposes the existence of decrees and model contracts that contain details regarding the exploration and production of petroleum. Vietnam passed a Petroleum Decree in December 1996 that implements provisions of the Petroleum Law of 1993. However, no model contract has been established yet, although a number of drafts exist. Finally, some aspects of Vietnam's petroleum regime are contained in Decision 216 of the Prime Minister, 7 November 1998, which establishes fiscal and commercial terms for certain incentive blocks.

**The Environmental Law:** The Law on Environmental Protection was amended by the National Assembly on 12 December 2005. The Law provides regulations and resources for environmental protection, policy formulation and measurement. It also details the rights and obligations of organizations, households, and individuals in environmental protection. Article 33 stipulates that development of clean energy and renewable energy is one measure for environmental protection. More specifically, the Article states that organizations and individuals investing in the development and use of clean energy and renewable energy shall be granted preferential taxes, funding support, and land for building production facilities. It also obliges the Government of Vietnam to formulate and implement a strategy to integrate clean and renewable energy development into programs for hunger eradication and poverty reduction, as well as the development of islands and rural, mountainous, and coastal areas.

### 2.1.2 Energy Efficiency

The government decrees, circulars and decisions that address energy efficiency and conservation are listed in Table 4.

**TABLE 4: ENERGY EFFICIENCY DECREES, DECISIONS, AND CIRCULARS**

Legislation (type)	Promulgator	Issuance date	Date Effective
Energy Saving and Efficient Use of Energy (Decree)	National Government	3 September 2003	September 2003
Guiding the Saving and Efficient Use of Energy by Production Establishments (Circular)	Ministry of Industry	2 July 2004	July 2004
Approving the 2006-2010 Electricity Saving Program (Decision)	Prime Minister	14 April 2006	May 2006

**TABLE 4: ENERGY EFFICIENCY DECREES, DECISIONS, AND CIRCULARS**

Legislation (type)	Promulgator	Issuance date	Date Effective
Approving the National Target Program on Saving and Efficient Use of Energy (Decision)	Prime Minister	14 April 2006	May 2006
Establishing the Energy Efficiency and Conservation Office at the Ministry of Industry (Decision)	Ministry of Industry	7 April 2006	7 April 2006
Establishing the Steering Committee of the National Target Program on Savings and Efficient Use of Energy (Decision)	Ministry of Industry	18 May 2006	18 May 2006
Promulgating the Regulations on Selection of the Organizations, Individuals to Preside over the Implementation of National Target Program on Saving and Efficient Use of Energy projects (Decision)	Steering Committee of the National Target Program	20 September 2006	20 September 2006
Guiding the Order and Procedures for Energy Efficiency Labeling for Energy Consuming Products (Decision)	Ministry of Industry	16 November 2006	December 2006

Source: EVN, 2006c.

Perhaps the most important is the Decree on Energy Saving and Efficient Use of Energy (102/2003/ND-CP) issued on 3 September 2003. The Decree sets forth the roles and responsibilities for all actors in government and society with respect to energy efficiency and conservation through the following key clauses:

- Clause 5 on Special Large Enterprises requires large electricity users to submit annual reports on their energy consumption and energy intensity.
- Clause 6 on Designated Enterprises requires large energy users with total annual fuel consumption greater than 1,000 TOE and/or electricity consumption greater than 3 million kWh to report annually on their energy use, including installation of energy-efficient equipment.
- Clause 8 on Designated Buildings requires all new buildings with projected consumption of over 2.8 million kWh to include a description of the energy efficiency and conservation measures in the building as part of their construction permit application.
- Clause 11 on Designated Equipment affords the State the authority to designate high-consuming equipment categories and work with the Ministry of Finance to provide incentives or subsidies for manufacturers to improve their energy efficiency.
- Clause 12 on Energy Efficiency Labeling calls for suppliers of energy consuming equipment and facilities to declare equipment energy consumption in the user instructions and on the labels of such equipment and facilities. It also provides for a voluntary energy efficiency certification activity.
- Clause 15 on Loans for Suppliers of Energy Efficient Products allows companies who put forward projects for producing energy efficient products or who invest in energy efficiency and conservation technology to borrow medium and long-term funds from the Development Assistant Fund.
- Clause 18 provides for MOI to set a program of national targets for energy efficiency and conservation, which includes: research and development; establishing medium and long-term plans; and educating, training, and information dissemination on energy efficiency.
- Clause 19 assigns to the State several roles with regard to energy efficiency and conservation including: issuing regulations and requirements for energy efficiency consultations, energy audits,

and verifying energy efficiency labeling and certification; establishing policies on the import of machinery and equipment; implementing programs to increase awareness of energy efficiency; carrying out international cooperation in energy efficiency; and developing human resources in the field of energy efficiency.

- Clause 20 on Roles of State Institutions assigns MOI, the Ministry of Science and Technology, the Ministry of Construction, the Ministry of Transport, and the Ministry of Finance their respective responsibilities for implementing the energy efficiency program.
- Clause 22 on Violations and Penalties sets penalties for failure to comply with the requirements of the Decree (EVN, 2006c).

The subsequent Circular, *Guiding the Saving and Efficient Use of Energy by Production Establishments*, issued by the Ministry of Industry on 2 July 2004 further guided energy efficiency in industrial facilities by requesting that large industrial customers use energy more efficiently, and report their energy consumption and progress in performing energy audits and efficiency improvements.

*Approving of the National Strategic Program on Energy Saving and Effective Use* lays out a plan for achieving very ambitious energy saving targets in the Vietnamese economy, including saving from 3 percent to 5 percent in total energy consumption in 2006-2010 and from 5 percent to 8 percent in 2011-2015, against the existing forecast on energy development and socio-economic development. These targets are in line with the long-term objective of reducing the elasticity factor (growth rate of energy demand/growth rate of GDP) from the historical level of 1.46 to 1.0 by 2015, and further to 0.9 by 2020 and 0.8 in subsequent years.

A new Law on Energy Conservation and Efficiency is being drafted. This Law will help clarify the roles and responsibilities of agencies and ministries in carrying-out the several decrees and policies now in place. MOI's Department of Science and Technology/Office of Energy Efficiency and Conservation is developing the draft law and will soon circulate it for comment and discussion. The draft will then be submitted to the National Assembly in December 2007. It is expected to take effect in 2009.

Besides the above-mentioned regulations that focus on demand-side energy efficiency, the Power Sector Development Master Plan targets supply-side efficiency improvement. It calls for a shift towards higher-efficiency coal-fired base load units. The Institute of Energy is supporting EVN in studying the technologies required to meet the move from 300 MW sub-critical coal steam electric power plants to 600 MW supercritical coal steam electric power plants.

### 2.1.3 Renewable Energy

The major renewable energy policy document remains the Renewable Energy Action Plan (REAP) promulgated by MOI in 2001 with support from the World Bank and EVN. REAP is grounded in various Government documents, including the 2001-2010 Master Plan of Power Development. REAP focuses on rural electrification of remote areas as a near-term opportunity to scale-up renewable energy technologies, including micro-hydro, wind, biomass, and solar PV. It establishes goals for renewable energy-based electrification for the hundreds of thousand of households not covered by EVN's grid expansion planning.<sup>4</sup>

REAP comprises five components: (i) individual renewable energy systems for households and institutions; (ii) off-grid village hydro schemes; (iii) grid-based renewable energy schemes; (iv) policy and institutional capacity building; and (v) technology improvement and resource assessment. It is a two-

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4. The major implementing vehicle for REAP was the World Bank project System Efficiency Improvement, Equitization and Renewables (SEIER). A follow-on to SEIER, the Renewable Energy Development Project, is under development by the World Bank.

phase, 10-year program with a Phase I target of adding 25-50 MW of renewable energy capacity, providing access to more than 35,000 households (MOI, 2001).

Other than REAP, the only other mention of special encouragement for renewable energy is in the Electricity Law, which states that: (i) investment incentives, preferential pricing, and preferential taxes are to be provided through MOF for development of new and renewable energy resources; and (ii) individuals and organizations are encouraged to utilize renewable energy when providing electricity access to rural and mountainous areas.

There is also an effort to develop a Master Plan for Renewable Energy Development that would seek to increase the amount of renewable energy developed according to certain long-term targets. MOI and the Institute of Energy are working on the background analysis with an eye towards floating a draft decree in 2007 (Institute of Energy, 2006). MOI is also developing a Law on Renewable Energy, with a draft expected in 2007 as well.

### 2.1.4 Clean Transport

Clean energy in transport is not yet a priority in Vietnam, owing to the intensive need for basic transport infrastructure investment throughout the economy and the greater urgency of other issues.<sup>5</sup>

Nonetheless, several steps have been initiated by the government to deal with the problem of vehicular and stationary source emissions. Most significant was the switch to unleaded fuel undertaken nationally in July 2001 (World Bank, 2002). Moreover, the National and Local Clean Air Act have been drafted by NEA and DONRE. The Action Plan on Reducing Vehicle Emissions is also under preparation.

## 3. INSTITUTIONAL ANALYSIS

### 3.1 ORGANIZATIONAL OVERVIEW

The key institutions involved in managing the energy sector and undertaking clean energy activities are listed in Table 5.

**TABLE 5: SUMMARY OF CLEAN ENERGY INSTITUTIONS AND ORGANIZATIONS**

Key Governmental Energy Institutions	Main Function
<b>Ministry of Industry (MOI)</b>	Overall responsibility for the energy sector
<ul style="list-style-type: none"> <li>Office of Energy Efficiency and Conservation</li> </ul>	Responsible for the Energy Efficiency Agenda in Vietnam, including the National Energy Conservation Plan and the Electricity Savings Program 2006-2010
<ul style="list-style-type: none"> <li>Institute of Energy</li> </ul>	Focal point for high-level policy and technical consultation on energy and electricity. EVN's in-house consultant
<ul style="list-style-type: none"> <li>Vietnam National Coal Corporation (VINACOAL)</li> </ul>	State enterprise responsible for all aspects of coal production and marketing
<ul style="list-style-type: none"> <li>Vietnam Oil and Gas Corporation (PETROVIETNAM)</li> </ul>	State enterprise responsible for upstream and downstream management of oil and gas
<ul style="list-style-type: none"> <li>Electricity of Vietnam (EVN)</li> </ul>	State-owned enterprise responsible for operating and managing the integrated power sector
<ul style="list-style-type: none"> <li>Electricity Regulatory Authority of Vietnam (ERAV)</li> </ul>	Assists MOI in managing the power sector, including planning and regulating electricity tariffs
<b>Ministry of Planning and Investment (MPI)</b>	Overall economic planning and review of public investment in energy projects
<b>Ministry of Finance (MOF)</b>	Oversees all financial matters pertaining to the sector, including coordinating donor assistance

5. Notably basic rural road access, inadequate facilities for urban pedestrians, traffic management, and road safety.

**TABLE 5: SUMMARY OF CLEAN ENERGY INSTITUTIONS AND ORGANIZATIONS**

<b>Key Governmental Energy Institutions</b>	<b>Main Function</b>
<b>Ministry of Natural Resources and Environment (MONRE)</b>	Responsible for environmental oversight and the Government of Vietnam's participation in UNFCCC
<ul style="list-style-type: none"> <li>National Office for Climate Change and Ozone Protection (NOCCOP)</li> </ul>	Designated National Authority for Vietnam's participation in CDM
<b>Ministry of Science and Technology (MOST)</b>	Responsible for national standards for end-use devices and appliances
<b>Ministry of Construction (MOC)</b>	Responsible for national standards, and buildings and construction materials
<b>State Bank of Vietnam</b>	Domestic counterpart for donor lending
<b>Provincial People's Committees</b>	Responsible for integrated governance at the sub-national level

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

**Ministry of Industry (MOI):** In line with its overall responsibility for managing the industrialization of the Vietnamese economy, MOI has overall responsibility for managing the energy sector, including overseeing the state-owned energy companies Electricity of Vietnam (EVN), Vietnam Coal Corporation (VINACOAL), and Vietnam Oil and Gas Corporation (PETROVIETNAM). MOI is responsible for sector reform initiatives, review and submission to the Prime Minister of master investment plans, and approval of all major investment projects. It also reviews and recommends retail price adjustments for approval by the Prime Minister, especially in the electric power sub-sector.

MOI has overall responsibility for the energy efficiency agenda in Vietnam. Through its Energy Efficiency and Conservation Office, it provides overall direction to the National Energy Conservation Plan and the Electricity Savings Program 2006-2010. The Office also provides the link from the Central Government to the provinces through five provincial offices (Hanoi, HCMC, Hai Phong, etc.) for running energy efficiency and conservation training programs, as well as promotion and awareness campaigns.

The Electricity Law of 2004 also designates MOI as responsible for administering overall electricity activities and use, with the Provincial People's Committees managing electricity activities within their jurisdiction.

**Institute of Energy (IE):** The Institute of Energy serves as a consultant and think-tank for the Government of Vietnam and the power sector in the formulation of national strategies and policies on energy and electricity. It carries out research, development, analysis, and design on a wide variety of issues and technologies, and acts as EVN's in-house consultant on many development projects. IE prepares and updates the Master Plan on Electric Power Development; provides forecasts on energy demand growth; prepares project and conducts feasibility studies; manages research into new technologies (nuclear, wind, DSM); and undertakes international cooperation with donors, other ASEAN utilities, and regional groupings.<sup>6</sup>

IE is also drafting with ERAV the Renewable Energy Decree and the Master Plan for Renewable Energy Development, which is due for submission to the National Assembly in 2007. These documents will chart how to reach the 10 percent renewable energy target (excluding large hydro) by 2020. The Master Plan will include recommendations for legal frameworks and financing mechanisms for scaling-up renewable energy.

6. For example, IE is heavily involved in ASEAN regional energy cooperation.

Another unit within IE is focused on commercial and industrial energy efficiency. This energy audit group includes 10 people.

**Vietnam National Coal Corporation (VINACOAL):** VINACOAL explores, produces, processes, distributes, and exports coal through several subsidiaries. In 2005, VINACOAL was corporatized as the Vietnam National Coal Group. Under MOI guidance it is now drafting the Study on National Coal Development Master Plan, which focuses on promoting sustainable growth for the coal sector.

**Vietnam Oil and Gas Corporation (PETROVIETNAM):** Established in 1975, PETROVIETNAM has responsibility for all oil and gas resources in Vietnam. PETROVIETNAM is responsible for developing and adding value to these resources, including oil and gas exploration and production, storage, processing, transportation, distribution, and services.

**Electricity of Vietnam (EVN):** EVN is a state-owned utility engaged in the generation, transmission, and distribution of electricity, and thus it is responsible for ensuring adequate electricity supply throughout Vietnam. EVN is organized as a management holding company with a number of wholly owned subsidiaries, including seven regional Power Companies in charge of power transmission and distribution from 110 KV downwards.<sup>7</sup> The other key entities under the EVN umbrella include four Power Transmission Companies, four Power Engineering Consulting Companies, the National Load Dispatch Center, several manufacturing companies, and the Institute of Energy.

**Electricity Regulatory Authority of Vietnam (ERAV):** In November 2005 the Government of Vietnam established ERAV to assist MOI in undertaking regulatory activities. A key area ERAV is responsible for under the Electricity Law is developing an avoided cost basis for the pricing of IPP and SPP energy projects submitted to EVN.

On 1 November 2006 ERAV submitted the DSM National Program Design to MOI for review. It focuses on improving the national load curve through energy efficiency programs targeting commercial buildings and industries. ERAV is also the project manager of MOI's Commercial Energy Efficiency Program, a World Bank-executed, GEF-supported project setting up the foundations for a commercial energy services industry in Vietnam. ERAV is also drafting the Renewable Energy Decree, which should be ready in 2007.

**Ministry of Natural Resources and Environment (MONRE):** MONRE is responsible for environmental regulation and contains both the GEF focal point and the CDM Designated National Authority (DNA) for administering the sovereign responsibilities of Vietnam under the UNFCCC.

**Ministry of Science and Technology (MOST):** Under the Energy Conservation Decree the responsibilities of the Ministry of Science and Technology are: (i) issue National Standards on energy consumption rates for commonly used energy equipment and facilities that could apply energy efficiency measures to benefit society; (ii) ensure that the National Standards on energy consumption rates of energy equipment and facilities are technologically advanced, economically reasonable, socially adaptable, continuously improved, and gradually integrated into Regional and Global Standards; and (iii) issue regulations to verify that equipment and devices meet or are compatible with National Standards on energy consumption rates.

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7. The three largest Power Companies are PC1 (northern Vietnam), PC2 (southern Vietnam), and PC3 (central Vietnam), while the other four manage the power distribution systems in Hanoi, Ho Chi Minh City, Hai Phong, and Dong Nai.

### 3.2 INSTITUTIONAL NEEDS ASSESSMENT

ERAV and certain departments of MOI appear to have overlapping responsibilities for key functions related to clean energy development on both the supply and demand side. A proper working relationship and division of labor will determine how quickly and how far the clean energy agenda contained in the Electricity Law can be achieved.

Between the numerous energy and electricity laws and decrees now in place there are far more policies and targets than capacity or resources to carry them out. Therefore, a key institutional need is technical assistance and capacity-building in support of the institutions charged with sector reform, capacity expansion, and clean energy scaling-up. Capacity building is needed across the board, but the key areas are as follows:

- Feasibility study and preparation of clean energy projects
- Policy frameworks for encouraging renewable energy project development
- Renewable energy resource mapping
- Clean energy action planning
- Technology transfer of energy efficiency technologies and equipment
- Appliance and equipment codes, standards, labeling, and testing regimes
- Market development of clean energy equipment and manufacturers
- Clean energy pricing regimes, including end-use green electricity tariffs and renewable energy-friendly power purchase agreements
- Analytic tools and methods for calculating baseline energy intensity by consuming sector and setting goals for improvement
- Statistical methods and systems for collecting and analyzing end-use energy data
- Clean energy regulation
- Financial remediation for clean energy projects
- Development of provincial clean energy practitioner base
- Best practice for energy conservation laws

## 4. CURRENT STATUS AND POTENTIAL OF CLEAN ENERGY

### 4.1 OVERVIEW OF FUELS AND RESOURCES

#### 4.1.1 Fossil Energy and Nuclear Power

**Coal:** Vietnam produced 25 million tons (Mt) of coal in 2004, and VINACOAL planned to progressively expand production to 30 Mt in 2005 in line with forecast growth in demand of over 40 Mt by 2010. In order to keep pace with increased mining activities, VINACOAL is preparing a National Coal Development Master Plan to be submitted to the government. This plan will include construction of several new railroads as well as specialized port facilities for transporting and handling coal (APERC, 2005). Notwithstanding, MOI expects that Vietnam will have to import 5.9 Mt of coal in 2015, 15.4 Mt in 2020, and 54.4 Mt in 2025 (*Vietnam Economic Times*, February 2007). MOI projects total coal consumption to reach 29-32 Mt t in 2010, 47-50 Mt in 2015, 69-72 Mt in 2020, and 112-115 Mt in 2025.

**Oil and Gas:** Between 1998 and 2005, Vietnam signed more than 50 petroleum contracts with international oil companies. Exploration is focused on the shallow water areas of southern Vietnam,

especially the Cuu Long and Nam Con Son basins. Nine major oil and gas fields are under development: Bach Ho, Rong, Dai Hung, Rang Dong, Ruby, Lan Tay-Lan Do, Emerald, Su Tu Den, and Bunga Kekwa. As of end-2004, Vietnam's proven oil reserves were 500 million cubic meters (MCM), with proven gas reserves totaling 400 MCM. Vietnam has invested and completed two gas pipelines with total capacity of 9 billion cubic meters (BCM) per year and has constructed dedicated gas-fired power plants totaling 4,300 MW at Phu My and a 0.8 Mt per year state-of-the-art fertilizer plant at Ca Mau. Up to 2010, Vietnam plans to construct more gas pipelines in the south, including one from Phu My to HCMC. The other major downstream development is the construction of a refinery capable of handling 6.5 Mt of crude oil at Dung Quat in central Vietnam. It will start producing petroleum products by 2009 (APEREC, 2005).

**Nuclear Power:** Nuclear power will have a certain role by 2030. At present, the Institute of Energy in collaboration with the Vietnam Nuclear Energy Commission has conducted a pre-feasibility study for a nuclear power plant with the capacity of 3,000 MW in Ninh Thuan province in central Vietnam. The study is part of the approval process. According to the Electricity Master Plan 2006, the first units (three 1,000 MW units) will appear by 2017, and the next units (eight 1,000 MW units) will be commissioned in 2025.

#### 4.1.2 Renewable Energy and Distributed Generation

**Hydropower:** Vietnam is rich in hydropower resources, mostly in the north and central regions near Lao PDR and China. The total hydropower potential is estimated at 80,000 GWh/year. Around 20 percent of this total (16,000 GWh/year) is small hydro (under 10 MW). The National Master Plan on Small Hydropower identifies 408 potential sites ranging from 1 to 30 MW capable of generating 13.5 billion kWh/year for a total capacity of 2,887 MW (PECCI, 2004).

A major deterrent to renewable energy small power development is the current method of price determination by EVN, the single-buyer. Many private sector developers view the 12 to 13 percent internal rate of return (IRR) for small renewable energy projects as too low. Nevertheless, many of these small, medium and large hydroelectric projects cost less than new thermal power supplies, and are thus being rapidly developed.

**Wind:** Vietnam has more than 3,000 kilometers of coastline and thousands of islands and mountainous areas, thus, the potential for wind energy is substantial. The average wind speed can reach 5.6 meters per second (m/s) in coastal areas and more than 8.0 m/s on islands.

The installation of small wind power generators with capacity from 100 to 700 W<sub>p</sub> started in Vietnam in the 1980s. These systems were usually installed in remote areas and islands for powering water pumping systems, especially in salt extraction sites along the coast. As for large wind power generators, around 10 sites with potential for wind power development have been investigated. The average wind speeds measured at these sites vary from 6.1 to 11.2 m/s. The total installed capacity of wind power plants could reach 200 to 400 MW (RCEE, 2003).<sup>8</sup>

Yet, wind is not currently given any preferential pricing advantage by MOI or EVN, and thus is at a disadvantage compared to other less-expensive renewable energy sources such as hydropower and biomass.

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8. There are some wind power plants in operation or under development. The Bach Long Vy wind power plant with capacity of 850 kW has been in operation since the end of 2004. The 15 MW Phuong Mai wind power plant is under development. The development of three other wind power projects (3.5 MW in central Khanh Hoa province, 50 MW in central Binh Dinh province, and 2 MW in southern Kien Giang province) is underway.

**Solar:** The potential for development of solar photovoltaic (PV) energy is quite large in the central and southern provinces of Vietnam, which have solar radiation of up to 5 kWh/m<sup>2</sup>/day. Solar PV systems are already used for a variety of off-grid applications (household lighting, rural community cultural services, powering of schools and health clinics, and telecommunications) and have been installed under several government and donor projects since 1988. According to SOLARLAB, Vietnam had installed approximately 537 kWp, or about 5,600 solar PV systems, by the end of 2000.

**Biomass:** Vietnam possesses abundant biomass resources, including wood residues, municipal wastes, and crop residues. The annual output of major biomass residues is around 92.8 Mt, which is equivalent to 1,250 terajoules (TJ) of primary energy (ENERTEAM, 2003).

Wood residues as well as firewood still make up more than half of the primary energy use in rural areas of Vietnam. Fuel wood is also the preferred type of fuel in many commercial and industrial activities. Any new application of these biomass fuels must consider the impact of their withdrawal from existing markets and uses. Furthermore, the diffuse nature of the supply of this fuel makes collection costs high when it is utilized as feedstock for power generation or other commercial and industrial uses.

Rice husk and bagasse are the biomass resources with the greatest economic potential, estimated at 50 MW and 150 MW respectively (ENERTEAM, 2003).<sup>9</sup>

**Biogas:** Biogas technology was introduced to Vietnam in the early 1960s. It is estimated that more than 25,000 household biogas digesters, rated 1 to 50 m<sup>3</sup>, have been installed in rural areas.<sup>10</sup> The Dutch-funded Biogas Program operated by SNV Vietnam constructed some 18,000 biogas facilities in 12 provinces between 2003 and 2005, with a second phase (2007-2010) target of 150,000 biogas tanks in both rural and peri-urban settings.

The biogas potential in Vietnam is large given a livestock population of 30 million, mostly pigs, cattle, and water buffalo. Although most livestock dung already is used in feeding fish and fertilizing fields and gardens, there is potential for higher-value utilization through biogas production. However, a major barrier to biogas uptake is the lack of large-scale poultry or pig farms. The livestock sector is largely made up of household farms with stocks of 5 to 20 head, making necessary economies of scale difficult to achieve.

**Geothermal:** There is very little information available about the geothermal resource potential in Vietnam. One developer (ORMAT, USA) estimated 200 MW of geothermal potential in central Vietnam. This developer is preparing a pre-feasibility study for a 50 MW plant and has identified six possible sites.

### 4.1.3 Energy Efficiency

In 1997, EVN with World Bank assistance commissioned a demand side management (DSM) potential assessment study for Vietnam. This study identified important opportunities for cost-effective electricity savings in a number of sectors and end-use applications (Hagler Bailly, 1997). It recommended a long-term and phased DSM program that could save as much as 700 MW of capacity and more than 3,550

9. More than 40 cogeneration systems with a total electric capacity of around 150 MW have been installed in the sugar sector. However, most of these cogeneration systems are old and inefficient due to the use of low-pressure boilers (18-25 bar @ 300-400°C). If these systems could be replaced by modern and efficient equipment using high steam pressure boilers (60-70 bar @ 480-500°C), the total electric capacity of bagasse-fired power plants could be increased to 500-700 MW. Meanwhile, a 50 kW rice husk-fired cogeneration system has been installed as a demonstration plant in Long An province. Also, the Nippon Mining Research and Technology Group, one of the five biggest petroleum groups in Japan, has announced it will invest around US\$15 million in the construction of a 10 MW rice husk-fired power plant in Can Tho City (*Liberated Saigon Newspaper*, 23 Apr 2004).

10. International Workshop on Research and Development of Use of Bio-digesters in South East Asia, March 2002

GWh/yr over 12 years. Based on this assessment, a Phase I DSM effort, supported by a US\$3 million grant from SIDA, undertook capacity building within EVN, MOI, and MOC, along with a multi-year DSM program plan and implementation of “enabling” activities including load research and DSM pilot projects. SIDA also supported efforts at MOC and MOST to develop building codes and efficiency standards for lighting and industrial motors. As a result of these early efforts EVN has accepted the importance and role of DSM options as a complement to large-scale supply-side investments, even including a DSM Chapter in the latest Power Development Master Plan (EVN, 2006).

The World Bank project Vietnam DSM and Energy Efficiency represents Phase II of this long-term energy efficiency commitment. The integrated Phase II effort has two parts: a utility DSM component implemented by EVN and a commercial energy efficiency component implemented by MOI. The EVN component focuses on “strategic” energy efficiency measures, notably efficient lighting for the residential sector, which can shave peak loads and reduce new investment in peaking capacity, as well as load management measures, such as time-of-use (TOU) metering and load control. The commercially oriented energy efficiency effort provides support to start-up companies in any and all aspects of energy efficiency project development and implementation. Because the industrial sector in Vietnam is still largely state-owned and marginally creditworthy, the program has targeted those portions of the buildings sector – retail hotels and office buildings – that can access financing on their own.<sup>11</sup>

The EVN component of the Vietnam DSM and Energy Efficiency project has progressed past its mid-point and some results are presented in

**TABLE 6: MID-TERM RESULTS OF THE DSM AND ENERGY EFFICIENCY PROJECT**

Mid-Term Performance Goal	Actual Results	Project Outcomes
Peak load reduction of 70 MW and energy savings of 153 GWH	CFL - 14 MW TOU - 45 MW Total - 59 MW	EVN has installed TOU meters for 60,000 customers and distributed 300,000 CFLs. No formal measurement and verification (M&V) is available.
1 million CFLs sold	Almost 300,000 sold to date	An additional 700,000 CFLs have been procured and are expected to be sold by early 2007.

Sources: World Bank, 2006c and d.

Meanwhile, the implementation of the MOI component has focused mostly on training and the establishment of project infrastructure. Training has been completed for 40 Project Agents (PAs), Project Proponents (PPs), and Financial Service Providers (FSPs). The Project Office within MOI (now ERAV) has been established, and a very detailed Operations and Procedures Manual has been prepared incorporating the experience from the training sessions. However, only three projects have been proposed so far and no project has been implemented. The inception of marketing efforts focused on targeted facilities and building owners should accelerate the pace of energy audits and project proposals (World Bank, 2006b).

The other major ongoing energy efficiency and conservation program is housed in the Ministry of Industry’s Department of Science and Technology/Office of Conservation and Energy Efficiency. This Office is responsible for a comprehensive program of activities associated with the Electricity Savings Program 2006-2010, a government-funded activity that responds to the energy efficiency provisions

11. The strategy is to first create core competencies among project agents, namely ESCOs, in basic and highly-replicable renovation categories and then develop (in subsequent phases) more complex business models, renovation and improvement designs, and financing schemes.

contained in the Electricity Law. This program was approved through the Prime Ministerial Decision of 14 April 2006 and is intended to mobilize action at all levels of Vietnam's society – consumers, government, and business – to take dramatic steps to use energy more efficiently.

With respect to supply-side efficiency, EVN has progressed substantially in its ongoing efforts to improve power sector operational performance. Transmission and distribution losses in EVN's system have fallen steadily over the last decade to 12.2 percent in 2004. This is acceptable for a system such as Vietnam's, with a large number of highly-dispersed low-voltage residential consumers. And EVN intends to go further. It has adopted the goal of a 0.6 percent improvement per year to the ultimate target of 9 percent by 2008. The modalities being adopted by EVN to reach this goal are medium voltage rehabilitation, increased transmission capacity, modern technical tools for dispatch (e.g., SCADA), and improved management. The tricky part is to sustain these improvements, which the WB-supported Rural Energy II project seeks to do (EVN, 2006).

EVN also has a strong program to improve thermal efficiency in power generation. The program had been focused on high-cost thermal units, especially fuel oil-fired plants, and has yielded a 20 percent improvement in operating efficiency. However, fuel efficiency in thermal power generation is highly plant specific. Existing coal-fired power plant efficiencies are poor, as the facilities and technology are relatively old, and units are relatively small. In 2004, the average heat rate for coal-fired units was 458 grams of standard coal equivalent per gross kWh (but with two plants in the 500-700 gm CE/kWh range) (World Bank, 2006).

Two 100 MW coal power plants at Cao Ngam and Na Duong being built by VINACOAL will use circulating fluidized bed (CFB) combustion technology and are expected to have much higher efficiencies and lower emissions than equivalent sub-critical steam power plants.

#### **4.1.4 Clean Transport**

Even though clean energy in transport is not yet a priority for Vietnam, the government is supporting the development of this sector. In 2006, MOI submitted to the Prime Minister a program for bio-fuels development in Vietnam (ASEAN, 2006). The program proposes a roadmap for bio-fuels development that consists of three phases:

- Short term (until 2010): Develop a public awareness campaign on bio-fuels benefits; undertake technology research and development; create a bio-fuels infrastructure; build technical capacity for bio-fuels development; and undertake raw materials research and production.
- Medium term (2011-2015): Expand bio-fuels production facilities and distribution infrastructure; introduce new, fast-growing bio-fuels varieties; diversify raw materials; and improve technology.
- Long term (By 2020): Bio-fuels production will reach 5 billion liters per year for bio-ethanol (E10) and another 500 million liters per year for bio-diesel (B10).

Efforts are also underway to improve the air quality monitoring network, including installation of 10 automatic air-monitoring stations, two mobile air-monitoring stations, and two environmental analytic laboratories in urban and industrial areas (MONRE, 2006).

## **4.2 COMPARISON OF ECONOMIC POTENTIAL AND COST EFFECTIVENESS**

### **4.2.1 Renewable Energy**

Several studies have provided estimates of the potential for all types of renewable energy in Vietnam. An in-depth catalogue of existing renewable capacity and market potential of renewable energy

resources was undertaken as part of REAP; its estimates are shown in **Table 7**. Of the renewable power sources in current operation, grid-connected mini-hydro is operated by municipalities and provincial power companies, and industrial biomass cogeneration is operated by non-utility generators and independent power producers. Their capacity and production is included in national figures. REAP estimates have not been updated since 2001, but the existence of large amounts of economical renewable energy, especially hydro and biomass, is shown by the number of SMEs developing renewable energy projects (MOI, 2004).

**TABLE 7: POTENTIAL AND CURRENT USE OF RENEWABLE ENERGY (EXCLUDING LARGE HYDRO) IN VIETNAM**

Renewable Resource	Resource Potential		Current Use		Total REAP Program (Phase I+II) Goals <sup>12,27</sup>	
	MW	1000s HHs	MW	1000s HHs	MW	1000s HHs
Off-grid (HH) pico hydro	90-150	200-250	30-75	100	N.A.	85-150
Off-grid (HH) PV	2	50	.6	N.A.		
Isolated mini-grid hydro	300-600	300	20	N.A.		90-150
Wind power			.2	1		
On-grid small/mini hydro	400-600	N.A.	60	N.A.	175-251	N.A.
Biomass	250-400	N.A.	40	N.A.		
Refurbished on-grid hydro						
Geothermal	50-200	N.A.	0	N.A.		
<b>Total</b>	<b>1,100-1,900</b>	<b>500-600</b>	<b>160-215</b>	<b>106</b>	<b>41-66</b>	<b>175-300</b>

Source: Renewable Energy Action Plan (REAP).

REAP analysis also concluded that a grid-connected small hydro, wind, and industrial biomass goal of 25 MW over five years and 150 MW over 10 years is possible with proper capacity building and technical assistance to both government and the private sector. This is the recommended objective of a two-phase, 10-year lending and capacity building program (see the last column in **Table 7**).

#### 4.2.2 Energy Efficiency

The first formal analysis of Vietnam's energy efficiency and DSM potential was conducted as part of the World Bank's ASTAE-funded 1997 study *Demand Side Management Assessment for Vietnam*. This study was the basis for the design of the IDA-financed Vietnam Demand Side Management and Energy Efficiency Project (GE-P071019). The 1997 DSM assessment was updated in 2006 by Danish Energy Management as part of the planning process for EVN's Phase 2 (2005-2007) DSM program. The original potential study (see) estimated 3,600 GWh of electricity savings (5 percent of forecast 2010 total sales) and 690 MW of peak demand reduction (7 percent of forecast EVN peak demand).

**TABLE 8: BREAKDOWN OF 1997 DSM POTENTIAL ESTIMATE BY SUBSECTOR**

Program	Year 2010 Program Impacts		Benefit/Cost Ratio
	Annual GWh Savings	Peak Demand Reduction	
<b>Load management</b>	1,549	422	29.6
<b>Industrial audits</b>	150	17	14.2

12. The REAP has two phases. Phase I, which is underway, is being implemented via the *SEIER*. Phase II will be implemented via a Renewable Energy Development Project now under preparation by the World Bank and MOI. Together the two phases constitute a 10-year program of renewable energy investment.

**TABLE 8: BREAKDOWN OF 1997 DSM POTENTIAL ESTIMATE BY SUBSECTOR**

Program	Year 2010 Program Impacts		Benefit/Cost Ratio
	Annual GWh Savings	Peak Demand Reduction	
<b>Motor standards</b>	322	36	35.5
<b>Commercial building codes</b>	1,051	109	1.9
<b>Residential lighting standards</b>	272	91	6.7
<b>Industrial lighting standards</b>	70	9	1.7
<b>Public lighting</b>	145	2	5.3
<b>TOTAL IMPACTS</b>	3,559	686	7.2

Source: Hagler-Bailly, 1997.

The 1997 economy-wide assessment has not been systematically updated to reflect the changing energy efficiency opportunities due to structural change and industrialization in the Vietnamese economy over the past decade. However, a partial update of opportunities in the household and commercial/industrial sectors was recently done by EVN as part of planning its Phase 2 DSM programs (EVN, 2006b). This update estimated a technical potential of 24,600 GWh of energy efficiency from these sectors. When the cost and difficulty in achieving this energy efficient potential is factored in, the likely near-term market potential is close to 4,500 GWh – not too far from the original 1997 estimate – but the peak demand reduction rises to five times the initial estimate (Table 9) (EVN, 2006b).

**TABLE 9: TECHNICAL POTENTIAL FOR END-USE EFFICIENCY SAVINGS IN VIETNAM**

	GWh at evening peak	Peak Reduction (MW)
<b>LCDs for TVs</b>	348	238
<b>LCDs for computers</b>	393	269
<b>Refrigerators</b>	142	97
<b>Rice cookers</b>	58	40
<b>CFLs</b>	571	391
<b>FTLs</b>	152	104
<b>Electric fans</b>	56	38
<b>Air conditioners</b>	276	189
<b>Electric pumps</b>	49	34
<b>Solar water heaters</b>	942	645
<b>Industrial audits</b>	1384	948
<b>Commercial audits</b>	73	50
<b>Total</b>	<b>4,444</b>	<b>3,044</b>

Source: EVN, 2006b.

## 5. CARBON AND GREENHOUSE GAS ABATEMENT

### 5.1 STATUS OF ACTIVITIES IN THE CARBON MARKETS

Vietnam signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 16 November 1994 and ratified it on 20 August 2002. MONRE has been designated by the government as the National Focal Agency (NFA) for taking part in and implementing UNFCCC and the Kyoto Protocol.

In 2002-2003 Vietnam conducted the National Strategy Study to assess the country's GHG emission reduction potentials and costs. Several climate change projects were identified and studied. National

GHG inventories were also carried out for 1990, 1993, 1994, and 1998, covering the energy sector, industrial processes, land use change, agriculture, forestry, and waste. The total GHG emissions calculated for 1994 was 103.8 Mt of CO<sub>2</sub> (1.4 ton per capita) and for 1998 it was 120.8 Mt of CO<sub>2</sub> (1.54 ton per capita) (MONRE, 2005b).

The Clean Development Mechanism (CDM) National Executive and Consultative Board were established on 29 April 2003. It is responsible for approving project activities eligible for CDM and setting criteria for the eligibility of CDM projects. It comprises representatives from MONRE, the Ministry of Planning and Investment, Ministry of Science and Technology, Ministry of Finance, Ministry of Foreign Affairs, Ministry of Industry, Ministry of Agriculture and Rural Development, Ministry of Trade, Ministry of Training and Education, and the Vietnam Union of Science and Technology Associations. It is chaired by the Director General of MONRE's International Cooperation Department (ICD).

Vietnam's Designated National Authority (DNA) has been established within the ICD's National Office for Climate Change and Ozone Protection. The DNA is responsible for managing the development, validation, implementation, monitoring, verification, and certification of CDM project activities. Its functions include building national assessment criteria, regulations, and guidelines on Clean Development Mechanism (CDM); submitting potential CDM projects to the CDM National Executive and Consultative Board for evaluation; and receiving, assessing and submitting project idea note (PIN) or project design documents (PDD) of CDM projects to MONRE for formal letters of endorsement or approval.

Just nine PDDs have been approved, while there are another 30 projects in the stage of PIN preparation and PDD processing. There are five EE and 26 RE projects under review by DNA.

**TABLE 10: CDM PROJECTS IN THE PIPELINE**

Type of project	Number(s)			Annual reduction tCO <sub>2</sub>
	Small scale	Normal scale	Total	
1. Forestry	0	1	1	28,000
2. Fuel switching	-	1	1	58,000
3. CH <sub>4</sub> capture	1	4	5	1,540,000
4. Energy efficiency	3	1	4	300,000
5. Renewable	12	7	19	1,680,000
<b>Total</b>	<b>16</b>	<b>14</b>	<b>30</b>	<b>3,606,000</b>

Source: Research Centre on Energy and Environment.

## 5.2 INSTITUTIONAL CAPACITY FOR MEASURING AND REPORTING GREENHOUSE GAS ABATEMENT

GHG measurement and reporting on emission reductions in Vietnam will be conducted by Energy Efficiency Centers. There are currently five: in Hanoi, Hai Phong, Da Nang, HCMC and Dong Nai. The strongest center is in HCMC. The others are under development. These centers were formed and are controlled by the Ministry of Science and Technology's Standards and Measurement Center of Vietnam.

Vietnam has been a recipient of international programs for institutional capacity building on CDM. For example, Vietnam is one of the 12 countries that participated in the three-year project Capacity Development for CDM, or CD4CDM, funded largely by the Dutch government and implemented by UNEP Risoe. In addition to generating broad understanding of the opportunities offered by CDM, the project sought to develop the capacity of policy-makers, NGOs, and the private sector to formulate and implement CDM projects.

However, this project did not include capacity building for measuring and reporting GHG abatement. The beneficiaries of the training on GHG measurement and reporting should be the above-mentioned centers and technical staff of CDM projects.

## 6. DONOR ACTIVITY IN CLEAN ENERGY

Donors have been active in all aspects of clean energy development in Vietnam since the early 1990s. A number of activities supported by multi-lateral development banks and bilateral agencies have contributed to the development of renewable energy plans and policies as well as DSM and energy efficiency programs. However, in general there has been less activity in clean fuels and transport.

The lending and technical assistance projects listed on **Table II** have been funded by DANIDA, UNDP, SIDA, JICA as well as Trust Funds including ASTAE, ESMAP, and PHRD.

There is considerable cooperation among donors, and between donors and government agencies. For example, World Bank and UNDP support on DSM and energy efficiency are designed to be complementary, with each donor focusing on different approaches for improving overall energy efficiency in the Vietnamese economy.<sup>13</sup> The World Bank and UNDP have been very successful as well in mobilizing assistance from the Global Environmental Facility (GEF). The UNDP-GEF Vietnam Energy Efficiency Public Lighting Project seeks to remove barriers to EE lighting systems in the public sector by helping local governments promote and implement new and efficient lighting systems. The UNDP-GEF Promotion of Energy Conservation in Small and Medium Enterprises Project promotes energy conservation in SMEs, largely through publicly funded provincial energy conservation centers in Vietnam, and supports information dissemination, market development, and access to financing.

**TABLE II: RECENT OFFICIAL DEVELOPMENT ASSISTANCE IN SUPPORT OF CLEAN ENERGY**

Project and Timeframe (when available)	Donor or Funding Agency	Counterpart	Approx. Budget
<b>Renewable Energy Action Plan</b>	ESMAP, ASTAE	EVN MOI	US\$100,000 US\$383,000
<b>DSM Potential Assessment for Vietnam (1997)</b>	ASTAE, PHRD	EVN	US\$100,000 US\$400,000
<b>Phase I DSM Program (1999-2003)</b>	SIDA	MOI, EVN, MOSTE, MOC	US\$2,800,000
<b>Vietnam Energy Conservation Program (1995-2002)</b>	Dutch and German TFs	MOSTE, DOSTE	US\$1,000,000
<b>Vietnam Energy Efficiency Public Lighting Project (2006-2008)</b>	UNDP-GEF	MOST	US\$380,000 (GEF) US\$8 million (Local)
<b>Promoting Energy Conservation in Small and Medium Enterprises (2005-2009)</b>	UNDP-GEF	MOI	US\$5.5 million (GEF) US\$28.8 million (Local)
<b>System Energy, Equitization and Renewables (2003-2007)</b>	IDA-GEF	EVN, MOI	US\$13.5 million (IDA) US\$4.5 million (GEF)

13. The World Bank focuses on market-based EE development for industry and large buildings, while UNDP targets public policy/public sector EE programs and SMEs.

**TABLE II: RECENT OFFICIAL DEVELOPMENT ASSISTANCE IN SUPPORT OF CLEAN ENERGY**

Project and Timeframe (when available)	Donor or Funding Agency	Counterpart	Approx. Budget
<b>Second Rural Energy Project (2005-2011)</b>	IDA-GEF	EVN PCs	US\$220 million (IDA) US\$5.25 million (GEF) US\$105 million (Local)
<b>DSM and Energy Efficiency (2003-2007)</b>	IDA-GEF	EVN	US\$18.6 million (IDA) US\$5.4 million (GEF)
<b>Vietnam Sweden Rural Energy Program</b>	SIDA	MOI	US\$3 million
<b>Various Thermal and Hydro Power Plants</b>	JBIC	EVN	
<b>Mong Duong AFBC Coal-fired Thermal Power Project (2006)</b>	ADB	EVN	US\$180 million
<b>Song Bung 4 Hydropower (2007)Hdr</b>	ADB	EVN	US\$180 million

Source: Various documents; World Bank, JICA, ADB.

The World Bank, Asian Development Bank (ADB), and the Japanese Bank for International Cooperation (JBIC) are all actively lending to energy projects in Vietnam, especially in the power sector. Since 1996, the World Bank has focused on financing the improvement of transmission systems and rehabilitation of distribution networks via a series of transmission and distribution and rural energy projects. Another focal area is projects that focus on providing rural access, improving system efficiency, promoting DSM and renewable energy, and mobilizing private finance through sector regulation and provision of guarantees. ADB is financing the first-ever atmospheric fluidized-bed coal-fired thermal power plant in Vietnam at Mong Duong, comprising four, 250 MW CFB generating units, and the common facilities for another 1,000 to 1,200 MW of installed generating capacity utilizing domestic coal as fuel. The Northern Power Transmission Project, also funded by ADB, will expand and strengthen EVN's transmission system in the north to improve system reliability and quality and improve the efficiency of the power sector by supporting the restructuring and commercialization of EVN. Meanwhile, JBIC continues to finance EVN's power generation expansion through both a generic Power Sector Loan and financing of specific power plants.

## 7. BARRIERS AND NEEDS ASSESSMENT IN CLEAN ENERGY

The barriers to scaling-up renewable energy in Vietnam are not very different from those elsewhere in the region. They include:

- Policy development, in particular a Small Power Purchase Agreement (SPPA) that meets the needs of on-grid project developers
- Pricing reflective of clean energy's extra benefits, as the single-buyer EVN is not required to treat renewable energy projects differently from fossil-fired projects
- Awareness, as insufficient information is available about technologies, costs, and effectiveness
- Lack of any stimulus to early development of renewable electricity markets, such as is provided by Renewable Portfolio Standards (PRS) and Green Electricity Tariffs

- Lack of a dedicated or specialized agency or ministry charged with looking after early development of a renewable energy industry
- Commercial and industrial capability, with few renewable energy businesses now in Vietnam
- Financing, as long-term financing is essential to renewable projects with high initial costs
- High-quality technology, as there is a considerable quality disparity between certain key components, such as controls and turbines, manufactured domestically versus those imported
- Sufficient local capability to maintain networks of small specialized renewable energy plants
- Lack of detailed resource data, especially on wind regimes, geothermal resource availability, and agricultural biomass potential

Yet, the No. 1 obstacle to a more diverse renewable energy project pipeline is the lack of streamlined, standardized, pro-renewable energy project preparation and power purchase arrangement. EVN, as the single-buyer and de facto price-setter, has exercised its monopoly power to minimize its power purchase outlays, but at the expense of renewable energy projects. For example, the Phuong Mai wind power project is prepared and approved by DNA for carbon financing, but it is not yet bankable because of the disagreement between EVN and its developer on delivered price and indexing.

Other needs include improved resource maps and resource assessment techniques, improved and standardized procedures for pre-feasibility and feasibility studies to reduce transaction costs, and improved procedures for safeguards and resettlement issues associated with even small-scale renewable energy projects, especially hydropower.

Meanwhile, scaling-up investment in energy efficiency in Vietnam (or elsewhere) requires overcoming several categories of barriers – market, price, institutional, financial, and technical.<sup>14</sup> Most of these barriers are in play in Vietnam and overcoming them requires active interventions by government or NGOs.<sup>15</sup>

## 8. CONCLUSIONS

The Renewable Energy Small Power Producers Program feasibility study contains specific recommendations that should be taken up by MOI and its subsidiary regulator ERAV at the earliest possible opportunity. These recommendations include: (i) simplify and standardize project development

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14. Market barriers include: *limited information*, as energy efficiency is an invisible product attribute unless energy performance labeling or promotion is undertaken; *perceived risk or unfamiliarity*, as customers may be unfamiliar with more-energy-efficient appliances (e.g., compact fluorescent lamps), and; *awareness*, as customers may not place particular importance on energy savings relative to other factors influencing purchase or investment decisions. Price barriers arise when there are *subsidies or price distortions*, a particular obstacle in developing economies when some end-users avoid or are shielded from the full avoided cost of consuming electricity. Institutional barriers arise when the end-user and the implementing agency do not share a similar agenda, or when customers do not pay the full cost of energy or receive the full benefits of the efficiency investment. The major financial barriers are *transaction costs*, as the scale of energy efficiency projects and complicated deal structures increases the amount of preparation time relative to other investments; and *access to financing*, as financial institutions may also be unfamiliar or risk averse as regards energy efficiency investments. Technical barriers arise when there is a lack of *availability* of either energy efficiency goods or services, especially when the technology is imported or no distributor or energy services provider network exists.

15. Interventions can be broadly divided into six categories: *regulation and reform*, in which governments impose mandatory requirements for energy intensity or at least require auditing or inspection of equipment or factories or undertake reform policies (such as introduction of individual metering for heat or electricity) which stimulates more energy-efficient behavior; *fiscal or tax policies*, in which governments provide inducements (e.g., tax credits) for investment in energy efficiency or jump-start markets by direct procurement for the government's own use; *efficiency promotion and market transformation programs*, in which governments or energy providers, in conjunction with the private sector, attempt to influence the terms of consumer purchase decisions through product improvement, labeling and standards programs, building codes, and customer education; *technology development*, where the government, energy provider or NGO subsidizes development and early use of energy efficient technologies; *ESCO and market development*, where the government or energy provider works with the private sector to enable start-up of new businesses (manufacturers or commercial energy services companies) focused on energy efficiency improvements; and *financial remediation*, where public or private sector entities including municipalities, financial institutions, energy providers, or even commercial entities access financing directly or indirectly via a wide variety of instruments.

procedures; (ii) reduce developer and purchaser risk and transaction costs by setting the price up-front and in a transparent manner; (iii) post and disseminate the ground rules and procedures to all interested parties, with no preferences to any market participant and based on a transparent regulatory process in which all can participate; (iv) level the playing field for all participants, including buyers, sellers, bankers, and beneficiaries; and (v) establish and demonstrate best practices (MOI, 2004).

## 8.1 RECOMMENDATIONS ON CLEAN ENERGY STRATEGY

With respect to energy efficiency, while concrete steps have been taken by the government through MOI and EVN (see earlier section) to address the aforementioned barriers, there is a pressing need to improve the level of sophistication and analytical capacity throughout EVN, MOI, and ERAV to integrate demand-side programs, including load management and energy efficiency, into the overall resource planning process. Promising developments – such as the development of a DSM chapter in the Sixth Power Development Master Plan and EVN's successful household CFL program – need to be built upon and further mainstreamed within the overall effort to meet future power needs in a least-cost and sustainable fashion. Further initiatives already suggested by the World Bank and others include establishing a formal DSM Center within EVN, dramatically scaling-up EVN's energy efficient lighting programs, accelerating efforts by MOI to catalyze a new energy efficiency business industry in Vietnam, and urgently implementing the several unfunded energy efficiency initiatives already proclaimed via decrees and laws that could drastically scale-up demand-side contributions to power sector expansion needs. The integration of demand-side resources into overall generation expansion planning and power sector reform is another area that could benefit from a regional program of activities supported by USAID ECO-Asia activity. In particular, a program of capacity building in diverse specialties such as DSM screening, load research, tariff design, and dynamic pricing could be delivered from a regional platform but have significant national benefits in the Vietnamese context.

There are also numerous areas where MOI's EE&C Office could collaborate with the regional ECO-Asia activity, including: (i) dialogue on bridging the gap between Audit and Investment in EE projects; (ii) regional program on energy consumption data collection and benchmarking, including standard procedures and formats, benchmarking and base-lining procedures, setting of targets for improvement, best practice in energy intensity regulation, and development of low-carbon development trajectories; (iii) functional assessment of Energy Center best practices (e.g., What makes a good energy center?); (iv) regional clean energy regulatory framework linked to pilot programs or case studies in each country which are in turn discussed and analyzed in the regional forum; and (v) best practice on energy conservation laws.

## 8.2 RECOMMENDED INTERVENTIONS AND ACTIVITIES

Based on discussions with key energy institutions active in clean energy development in Vietnam, the following list of priority activities (Table 12) was identified where a regional program could be expected to lead to a strengthening of Vietnam's clean development agenda. These activities allow engagement across a broad spectrum of organizations involved in clean energy development in Vietnam, and relate to renewable energy SPPs, DSM, and energy efficiency.

**TABLE 12: RECOMMENDED AREAS OF CLEAN ENERGY ACTIVITIES IN VIETNAM**

Activities	Lead Agency and Potential Partners
<b>Regional cooperation in off-grid renewable energy-based rural electrification</b>	VSRE, PCs, EVN, IE, IPPs, SPPs
<b>Regional clean energy project planning and preparation facility</b>	IE, MOI, MOF
<b>Regional SME energy efficiency end-use facility</b>	MOST, MOI, MOF
<b>Regional market development activities</b>	MOI, IE
<b>Regional clean energy market development strategies</b>	ERAV, MOI, IE
<b>Regional forum on supply-side efficiency improvement</b>	EVN, VINACOAL, PETROVIETNAM, IPPs, SPPs
<b>Regional forum on clean energy regulation</b>	ERAV, MOI, MOF
<b>Regional dialogue on project finance</b>	MPI, MOF, MOI, EVN
<b>Regional cooperation in energy data collection, statistics, and analysis</b>	IE, RCEE, ENERTEAM

Source: USAID ECO-Asia Clean Development and Climate Program, 2006.

**Regional cooperation in off-grid renewable energy-based rural electrification:** Many of the countries in South and Southeast Asia are facing similar problems in providing modern energy access to remote rural populations. These populations are often marginalized and among the most in need of livelihood improvement and income-generating opportunities that modern energy access can bring. Often, the most economical solution to provide electricity access to these isolated populations is through an off-grid, renewable energy-based application. Under this activity, donor assistance would support a regional facility to consider cooperation in implementing technical and institutional models for off-grid rural electrification using renewable energy. A logical Vietnamese anchor for this activity would be VSRE.

**Regional clean energy project planning and preparation facility:** Several respondents mentioned the need for increased capacity in preparing clean energy projects in a streamlined and standardized manner that would be acceptable to both donors and commercial bankers, as well as the local distributors that would be purchasing the power. In this activity we would use the HAPUA WG # 4 umbrella to undertake a variety of activities, including:

- Policy frameworks for encouraging renewable energy project development;
- Regional consortium for RE resource mapping; and
- Regional preparation facility for renewable energy action plans.

The logical Vietnamese anchor for such an activity would be the Institute of Energy.

**Regional SME Energy Efficiency End-Use Facility:** The SME sector is particularly tough to target for energy efficiency improvements. It is diverse, often cash-strapped, with managers who are often too busy to look for ways to improve their energy efficiency. At the same time there are many opportunities for improvement in this sector as new technologies emerge, energy prices go up, and global competitiveness makes every opportunity to find a business edge important. Furthermore, the electricity consumption of an SME in a given industrial sector in Vietnam is probably similar to that of a similar SME in Indonesia. Therefore, there are likely to be economies of scale and advantages of replication in

addressing this sector with a regional platform. This activity would use a regional approach to engage this difficult to reach sector by creating a community of practice and packaging technologies for easy delivery, monitoring and verification. Such an effort could attract the involvement of energy efficiency equipment suppliers. A logical anchor for this activity in Vietnam would be the Ministry of Science and Technology's Promoting Energy Conservation in Small and Medium Enterprises Project.

**Regional Market Development Activities:** Clean energy development depends on the growth of strong private sector energy efficiency and renewable energy goods and services providers. Under this activity a regional approach to market development and private sector capacity building would be taken. Activities include:

- Accelerated development of CFL quality assurance (QA) standards and testing regime for the region;
- Regional association of lighting manufacturers to pursue certification, control on smuggling of products, and technology transfer for manufacturing;
- Regional forum on creating enabling conditions for renewable energy project development, including Green Electricity Tariffs and SPPAs;
- Assistance in accessing regional financing sources for development of and investment in clean and renewable energy projects; and
- Supporting all aspects of national bio-fuels development programs, including policy, regulation, technologies, and market development.

**Regional Clean Energy Market Development Strategies:** Under this activity, a regional platform would be used to conduct a regional study on how to stimulate market development of renewable energy. The effort would consider both clean energy market stimulation frameworks such as pricing and tariffs as well as regulatory approaches such as renewable energy portfolio standards. The objective would be to share expertise among countries that are faced with making policy choices about how best to stimulate clean energy markets without creating undue distortions or secondary effects. A good anchor for this activity in Vietnam would be ERAV.

**Regional Forum on Supply-Side Efficiency Improvement:** Any GHG emission strategy must take on inefficiencies in supply and delivery as well as inefficiencies in end-use consumption. There is also considerable potential for a regional approach to this issue, as all utilities in the region are looking for ways to optimize their investment in system loss reduction, power plant heat rate improvement, and construction of new generation capacities, etc. This activity would support exchange of ideas among utility managers, perhaps under the HAPUA umbrella, with EVN being the anchor for Vietnam's participation.

**Regional Forum on Clean Energy Regulation:** Regulators have an important but not well understood role to play in reducing the GHG emissions of economic activities. Under this activity, a regional platform would be used to support existing activities, such as the World Bank's East Asia and Pacific Infrastructure Regulatory Forum. This forum commenced just last year and is funded by WB's Public-Private Infrastructure Advisory Facility. It is partly focused on how to encourage clean development through regulation. This activity would also consider regional clean energy regulatory frameworks linked to pilot programs or case studies in each country, which in turn would be discussed and analyzed in the regional forum.

**Regional Dialogue on Project Finance:** A long standing dilemma for energy efficiency practitioners is how to bridge the gap between performing an energy audit and successfully banking an energy

efficiency investment. This is a problem whenever energy efficiency policies and decrees require audits but do not include enough incentives to encourage actual investment based on audit results. This activity would convene a regional forum of bankers and ESCOs to better understand the reasons for this gap and how to bridge them. The activity will in part build on the famous “three-country study” supported by the World Bank.

**Regional Cooperation in energy data collection, statistics and analysis:** This activity would comprise regional cooperation in energy consumption data collection and benchmarking. It would include standard procedures and formats, benchmarking and base-lining procedures, setting of targets for improvement, best practice in energy intensity regulation, and development of low-carbon development trajectories on a disaggregate basis. One specific platform that could be extended to the region is the IEA/UNDP/World Bank work on G5 energy indicators.

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