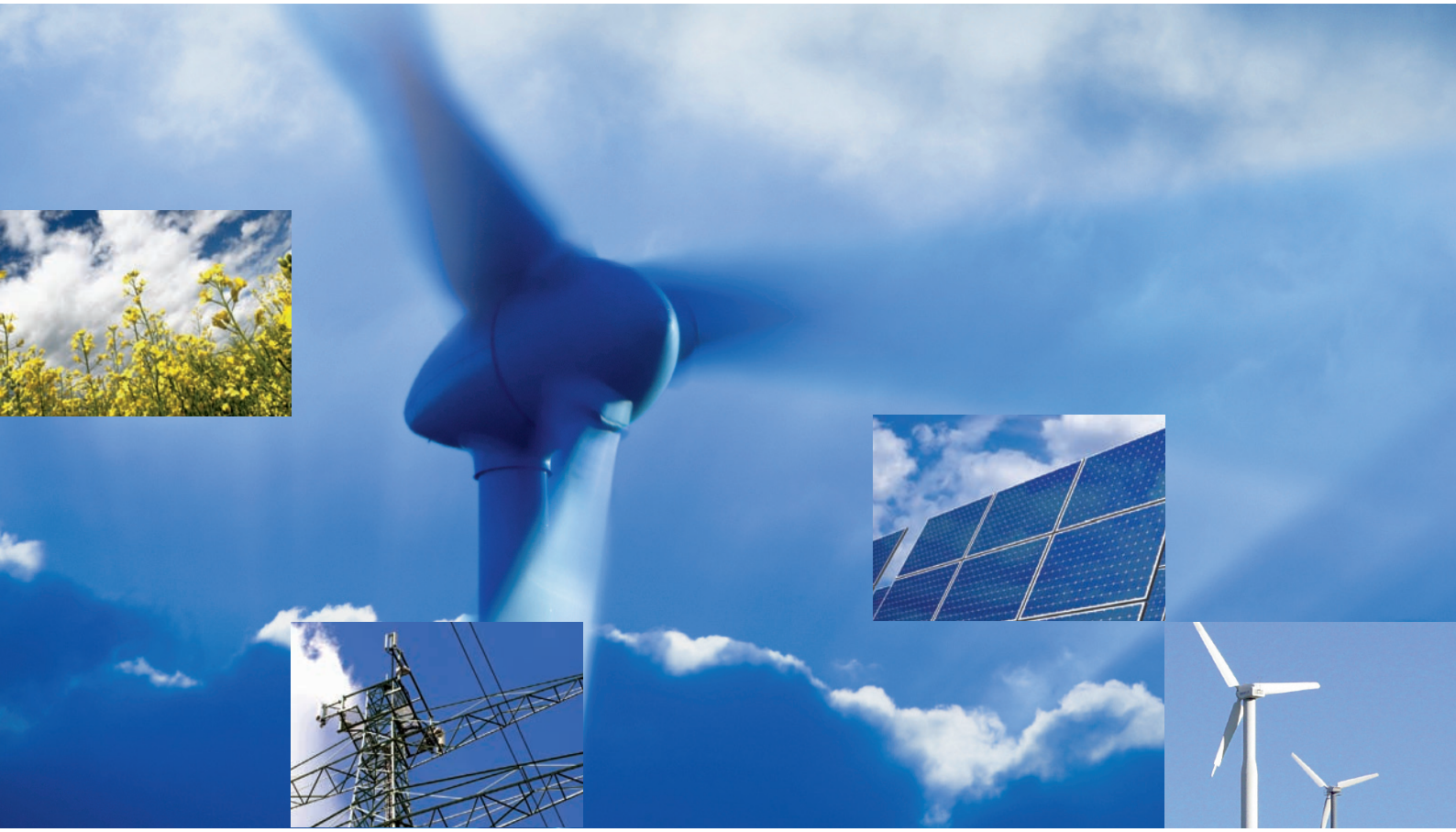
Division Water, Energy, Transport
TERNA Wind Energy Programme



Energy-policy Framework Conditions for Electricity Markets and Renewable Energies

16 Country Analyses

Eschborn, November 2009

Energy-policy Framework Papers,
Section »Energy and Transport«

gtz TERNA Wind Energy Programme

On behalf of
Federal Ministry
for Economic Cooperation
and Development

Energy-policy Framework Conditions for Electricity Markets and Renewable Energies

16 Country Analyses

Eschborn, November 2009

Energy-policy Framework Papers,
Section »Energy and Transport«

Published by:
Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH
Division Environment and Infrastructure
PO Box 5180
65726 Eschborn
Germany
Internet: http://www.gtz.de

Edited by:
Rolf Posorski and Daniel Werner
GTZ, TERNA Wind Energy Programme

Authors:
ECOFYS Germany GmbH

Layout:
Bosbach Kommunikation & Design GmbH,
Internet: www.bosbach.de

New Edition of the TERNA Country Survey

Since the first edition of the TERNA country survey appeared in 1999, there has been a distinct heightening of public and political awareness of the consequences of climate change and of energy provision as a key factor in sustainable development.

In Germany and other industrialised countries, a political tailwind, effective promotion mechanisms and rising energy prices have created the conditions for a dynamic market in which renewable forms of energy are exhibiting high growth rates within the energy mix. In 2008, renewable energy resisted the credit crunch more successfully than many other sectors for much of the year and new investment reached $120 billion, up 16 percent over 2007. However, by the end of the year, the impact of the crisis was beginning to show.

Economic development in many emerging countries has triggered rapidly rising demand for energy and competition on the international oil market. Against the background of the volatile cost of fossil fuels, supply risks and damage to the environment, the significance of renewable energy as a means of generating electricity is growing – also in developing and emerging countries. According to information released by the Renewable Energy Policy Network for the 21st Century (REN21), by early 2009, policy targets existed in at least 73 countries and at least 64 countries had policies to promote renewable power generation. Feed-in tariffs were adopted at the national level in at least five countries in 2008/early 2009, including Kenya, the Philippines and South Africa.

During 2008 the existing wind power capacity grew by 29 percent to reach 121 GW. The US and European market acted as the driving force for the wind energy industry and provide still an indispensable background of experience. However, growth in the industry is also increasingly apparent in developing and emerging countries: China doubled its wind power capacity for the fifth year in a row, ending 2008 at 12 GW, and breaching China's 2010 development target of 10 GW two years earlier. It is the successes in countries such as China, India and Egypt which encourage commitment beyond the borders of industrialised nations. In those countries there is a growing proportion of local content in the systems and equipment they produce – and not only for supply to their own domestic markets.

A number of other countries though, too, are erecting their first wind farms, thereby establishing the basis for gaining experience to be utilised in future markets. To help interested players gain access to the new markets, this survey provides detailed descriptions of the framework conditions for electricity markets and renewable energy in 16 developing and emerging countries.

This latest country survey and the previous editions are available on our homepage: www.gtz.de/wind. The publication is also available on CD-ROM. For information on how to obtain this, again, go to the homepage. Our grateful thanks go to a large number of GTZ staff members and other experts in the field for their help in putting this information together.

Eschborn, November 2009

THE COUNTRIES		
Latin America	Africa/Middle East	Asia
Argentina	Egypt	Indonesia
Brazil	Morocco	Pakistan
Caribbean States	Namibia	Viet Nam
Chile	Senegal	
Mexico	South Africa	
Panama	Tunisia	
Peru		

Legal Information

1.

The data used in this study is based on both publicly accessible sources of information (publications, specialist articles, internet sites, conference papers etc.) and non-public papers (for example internal expert reports from promoting institutions), as well as personal interviews with experts (for example officials at energy ministries in the investigated countries and project staff at promoting institutions). Although all information has been checked as far as possible, errors cannot be ruled out. Neither the GTZ nor the authors can therefore provide any guarantee of the accuracy of the data included in this study; no liability can be accepted for any loss or damage resulting from use of the data included in the study.

2.

The TERNA Wind Energy Programme

There is great potential for generating electricity from renewable energy sources in many developing and emerging countries. Obstacles to the exploitation of such sources include a lack of knowledge of framework conditions in the energy industry and insufficient transparency with regard to the prior experience and interests of national actors.

The purpose of the TERNA (Technical Expertise for Renewable Energy Application) wind energy programme, implemented by GTZ on behalf of the Federal German Ministry for Economic Cooperation and Development (BMZ), is to assist partners in developing and emerging countries in planning and developing wind power projects. Since 1988 the TERNA programme has pursued the goals of laying the foundations for sound investment decisions while at the same time enabling partners to assess wind energy potentials, plan wind energy projects and improve energy-policy frameworks for renewable forms of energy.

The TERNA wind energy programme's partners are institutions in developing and emerging countries that are interested in commercial exploitation of wind power. These include, for example, ministries or government institutions which have the mandate to develop BOT/BOO projects, state-owned or private energy supply companies (utilities) and private enterprises (independent power producers).

TERNA offers its partners expertise and experience. In order to initiate wind power projects, favourable sites must be identified and their wind energy potential ascertained. To do this, wind measurements are normally taken over a period of at least twelve months and wind reports are drawn up. If promising wind potentials are found, the next step is to conduct project studies investigating the technical design and economic feasibility. TERNA also provides advice to partners on matters of finance, thus closing the gap between potential investors and funding sources from national and international donors. If required, CDM baseline studies can be prepared. In order to ensure as much transfer of know-how as possible, efforts are made to ensure cooperation between international and local experts, for example when preparing the studies. In successful cases, TERNA initiates investment-ready wind farm projects by this method. TERNA itself is not involved in financing.

In addition to the activities that are tied to specific locations, TERNA advises its partners on how to establish suitable framework conditions for the promotion of renewable energy sources. Up until 2009, TERNA has been active in over ten countries around the world. Further information on GTZ's TERNA wind energy programme is available at www.gtz.de/wind or directly from:

Deutsche Gesellschaft für Technische
Zusammenarbeit (GTZ) GmbH
Postfach 5180
65726 Eschborn | Germany

Dr. Rolf Posorski
Tel.: +49 (0)6196 79-4205
Fax: +49 (0)6196 7980-4205
E-Mail: rolf.posorski@gtz.de

Daniel Werner
Tel.: +49 (0)6196 79-6203
Fax: +49 (0)6196 7980-6203
E-Mail: daniel.werner@gtz.de

Hans-Gerd Huehn
Tel.: +49 (0)6196 79-6243
Fax: +49 (0)6196 7980-6243
E-Mail: hans-gerd.huehn@gtz.de

List of abbreviations

ADB	Asian Development Bank
AFTA	ASEAN Free Trade Area
ASEAN	Association of Southeast Asian Nations
ASEM	Asia Europe Meeting
APEC	Asia-Pacific Economic Cooperation
ASTAE	Asia Sustainable and Alternative Energy Programme
BK-IDSE	Bach-Khoa Investment and Development of Solar Energy Co Ltd
BOT	Build-Operate-Transfer
BMU	Federal Environment Ministry
CNECB	CDM National Executive & Consultative Board
CDM	Clean Development Mechanism
CIA	Central Intelligence Agency
EB	Executive Board
EC-ASEAN	European Community and the Association of Southeast Asian Nations
DNA	Designated National Authority
EAEF	EC-ASEAN energy facility
EDF	Electricité de France
EIA	Energy Information Administration
ESRI	Environmental Systems Research Institute
EVN	Electricity of Vietnam
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GENI	Global Energy Network Institute
GTZ	Gesellschaft für Technische Zusammenarbeit
GWh	Gigawatt hour
ICD	International Cooperation Department
IE	Institute of Energy
IEA	International Energy Agency
IMF	International Monetary Found
IOC	International Oil Companies
IPP	Independent Power Producers
Ktoe	Kilotonne of oil equivalent
kV	Kilovolt
toe	tonne oil equivalent
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
MPI	Ministry of Planning and Investment
MVA	Mega Volt Ampere
MW	Mega Watt
MWh	Mega Watt Hour
ODA	Official Development Assistance
PCs	Power companies
PPCs	Provincial people's committees
PJ	Petra Joule
PV	Photovoltaic
PPA	Power Purchase Agreements
REAP	Renewable Energy Action Plan

RECIPES	Renewable Energy in emerging and developing countries
RECTERE	Research Centre for Thermal Equipment and Renewable Energy
REEEP	Renewable Energy & Energy Efficiency Partnership
RERD	Renewable Energy and Rural Development
SHS	Solar Home System
RES	Renewable Energy Standard
REVN	Renewable Energy of Vietnam Joint Stock Company
R&D	Research and Development
T&D	Transmission and Distribution
TPES	Total primary energy supply
TWh	Terawatt hour
USD	United State Dollar
V	Volt
VND	Vietnamese đồng
WTO	World Health Organization
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UPI	United Press International
USAID	United States Agency for International Development

16.1 Introduction

FIGURE 1:
MAP OF VIETNAM

Data Source: CGIAR (2004)

Vietnam is located in South-eastern Asia in the east of the Indochina Peninsula at the Gulf of Tonkin and the South China Sea. Neighbouring countries are China to the north; Laos and Cambodia to the west.

Vietnam's climate varies considerably due to the differences in latitude reaching from 9° to 23° north. It is tropical in the south and monsoonal in the north with a hot, rainy season (May to September) and a warm, dry season (October to March), with average humidity of 84 % throughout the year. Due to its long coast, Vietnam is exposed to winds from the sea to the east.

Vietnamese is the official national language. However, English is increasingly favoured as a second language, with French and Chinese also serving as business languages. Vietnam is a socialist republic governed by the communist party. The president of Vietnam is head of state and chair of the National Defence and Security Council. In June 2006, President Nguyễn Minh Triết was elected by the National Assembly of Vietnam with 464 votes (94.12 %).

Vietnam has diplomatic relations with 164 countries. In its foreign policy, Vietnam gives priority to enhancing relations with neighbouring countries such as Laos, Cambodia and China. Vietnam became official member of the Association of Southeast Asian Nations (ASEAN) in July 1995. Since then, Vietnam has been acting as an active member of the ASEAN Free Trade Area (AFTA) and the Asia Europe Meeting (ASEM). At present, Vietnam is a member of the Asia-Pacific Economic Cooperation (APEC) which is a forum for 21 Pacific Rim countries and cities located around the edge of the Pacific Ocean to cooperate on regional trade and investment liberalisation and facilitation. Furthermore, Vietnam is seeking admittance into the WTO, after having entered bilateral trade agreements with nearly 60 countries and territories.[1]

The major exports from Vietnam include crude oil, footwear, tea, coffee, electronic products and components, textiles, clothing, rubber and marine products. Major countries that import goods from Vietnam are USA, Germany, South Korea, Japan, China, Singapore, Hong

TABLE 1:
2008 KEY STATISTICS

Area	Population	GDP	GDP/capita	Export	Import
331 210 m²	86 967 Million	89 829 billion USD (60 798 billion Euro)	1 040.35 USD/capita (7 042 Euro/capita)	62.9 billion USD (42.6 billion Euro)	80.4 billion USD (54.4 billion Euro)

Source: U.S. Department of State 2009 and IMF 2009

[1] AusAID 2009

Kong and Taiwan. The major items imported by Vietnam include motorcycles, machinery and related products, steel goods, petroleum products, fertilizer, cement, grain and cotton. Major countries that export goods to Vietnam are France, Hong Kong, India, Taiwan, South Korea and Singapore.

10 % and hydro with 4 %. The split to the various sources can be seen in figure 2.[3]

The final energy consumption in 2006 added up to 46 108 ktoe (equal to 175 PJ). The distribution of this consumption to the various sectors is shown in table 3.

TABLE 2:
GDP OF VIETNAM 2004 - 2008

		2000	2002	2004	2006	2008
GDP (constant prices)	Annual percent change	6.7	7.0	7.7	8.2	6.1
GDP (current prices)	Billions VND	441 646	535 762	715 307	9 742 662	1 477 716
GDP (current prices)	Billions USD	31.1	35.1	45.4	60.0	89.8
GDP (current prices)	Billions Euro	21.04	23.75	30.72	40.60	60.77

Source: IMF

Table 2 shows the Vietnamese GDP which has grown constantly from 2000 to 2006 with a deceleration in 2008. In January 2009, the inflation rate was 17.48 % year-on-year. The poverty rate has been reduced from 58 % in 1993 to 13 % in 2008. The annual per capita income in Vietnam was 1 024 US $ in 2008.[2]

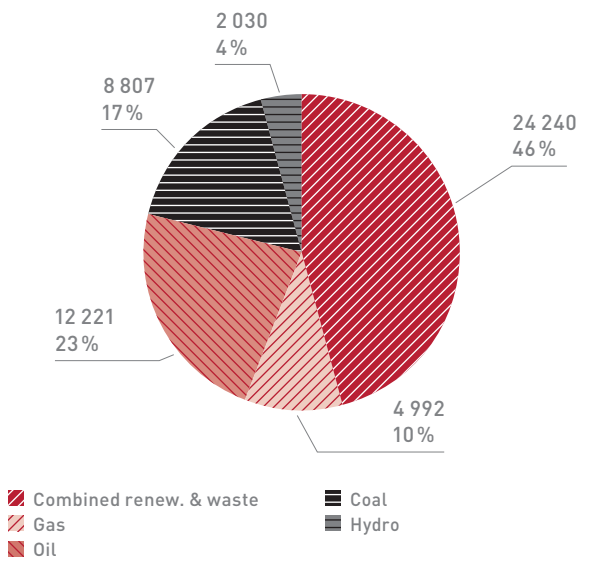
16.2 Energy Market

Overview Energy Market

The development of the total primary energy supply experienced a strong rise in the last years. Starting at 20 000 ktoe in 1970 of which more than 50 % were provided by combined renewables and waste. Over the last thirty years the share of coal and oil increased much more strongly than the other sources. The primary energy supply in Vietnam has been constantly rising and in 2006 reached 52 290 ktoe (equal to 113.4 PJ or GWh). Vietnam's primary energy supply is dominated by combined renewable and waste (46 %) (i.e. waste materials and biomass), followed by oil with 23 %, coal with 17 %, gas with

Vietnam's energy consumption has been increasing rapidly, in parallel with industrialisation.[4] Between 2000 and 2005, total primary energy consumption, besides

FIGURE 2:
SHARES OF TOTAL PRIMARY ENERGY SUPPLY IN VIETNAM IN 2006, IN KTOE



Source: IEA 2006

[2] World Bank 2009

[3] IEA 2008

[4] Omoteyama, 2009

TABLE 3:
FINAL ENERGY CONSUMPTION IN VIETNAM, 2006, IN KTOE AND PJ

Total Final Consumption				
		ktoe	PJ	%
Industry		9627	403.4	20.9
Transport		6933	290.5	15
Other sectors		29324	1228.7	63.6
of which	Residential	27057	1133.7	58.7
	Commercial and Public Services	1738	72.8	3.8
	Agriculture / Forestry	530	22.2	1.1
	Fishing	0	0	0
	Other Non-Specified	0	0	0
Non-Energy Use		224	9.4	0.5
Total		**46108**	**1931.9**	**100**

Source: IEA 2008

biomass, grew at an average annual rate of 10.6 %. The share of the industrial sector rose steadily whereas the shares of transportation and other sectors have decreased.

Although it is a significant net oil exporter, Vietnam relies on imports of petroleum products due to a lack of refining capacity. Additionally Vietnam is a net exporter of coal to Japan and China and may emerge as a significant natural gas exporter in the future.

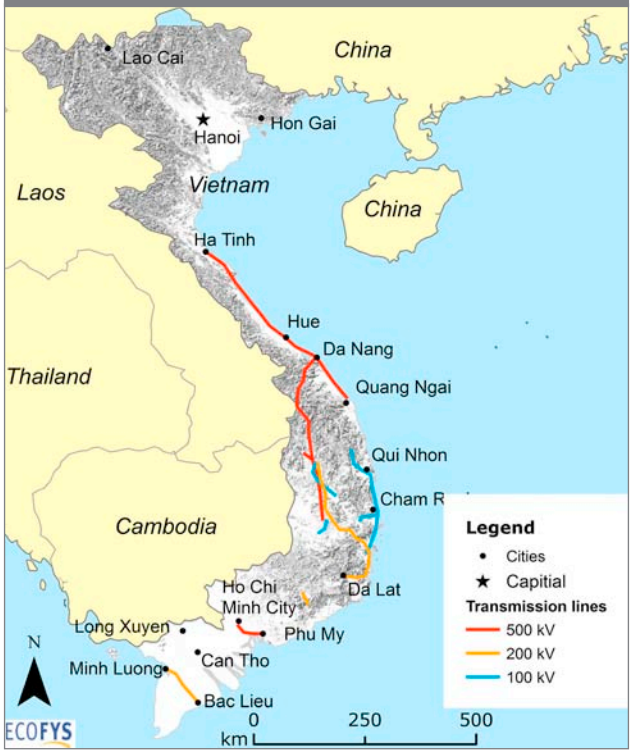
The Electricity Grid

Electricity of Vietnam (EVN) is a state owned enterprise with more than 50 subsidiaries under the Ministry of Industry and Trade (MOIT) and it holds a monopoly in electricity transmission and distribution.[5] EVN owns the electricity and also telecommunication industries. Internally, EVN is divided into a number of operating companies, including seven distribution entities known as the power companies (PCs), of which three are regional companies, and four supply the major urban areas of Hanoi, Haiphong, Ho Chi Minh City and Dong Nai.

In 2006, EVN operated a power transmission and distribution system of about 115 659 km of 6 kV, 10 kV, 15 kV, 22 kV and 35 kV lines with a total capacity of 3 662 MVA and 109 199 km of 220 kV lines with a total capacity of 32 061 MVA. The extent of the grid can be seen in figure 3.

Low voltage distribution in rural areas is primarily the responsibility of provincial authorities, and is undertaken by around 8 800 rural municipalities, of which only 19 % are supplied directly by the power companies of EVN.

FIGURE 3:
ELECTRICITY TRANSMISSION GRID OF VIETNAM



Data Source: CGIAR (2004)

[5] RECIPES 2006

TABLE 4:
INSTALLED ELECTRICITY CAPACITY: DEVELOPMENT IN VIETNAM, IN MW, 2000-2007

Fuel Type	2000	2001	2002	2003	2004	2005	2006	2007
Hydropower	3 100	4 050	4 050	4 050	4 050	4 050	4 200	4 200
Coal thermal	750	750	1 500	500	1 500	1 500	1 700	1 850
Oil-fired	200	200	200	200	200	200	200	200
Gas turbine (Oil/Gas)	1 000	1 900	2 100	2 250	3 000	3 000	3 000	3 000
Diesel	500	500	500	500	500	500	500	500
IPP/BOT	500	500	1 250	1 500	1 500	2 250	2 250	3 000
Import	0	0	0	0	100	250	300	500
Total	**6 050**	**7 900**	**9 600**	**10 000**	**10 850**	**11 750**	**12 150**	**13 250**

Source: Adb 2009

For its 5th Power Development Master Plan of Vietnam (2001-2010), EVN plans to construct and expand its transmission and distribution systems. The transmission expansion programme is based on the regional distribution of load and generation growth. Within the ten-year-period, EVN intends to build 2 416 km (500 kV), 4 414 km (220 kV), 7 757 km (110 kV), 92 600 km of medium voltage and 19 000 km of low voltage lines. The development of the T&D sector is expected to ensure safe and reliable operations, to meet customers demand with good quality, and to reduce electricity losses from 14 % in 2001 to 10 % in 2010.

In Vietnam the lack of power transmission lines linked to the national grid has become the biggest challenge and EVN will need VND 148 trillion (5 billion €) for its power transmission projects by 2015. A first step was taken in July 2009 when EVN started operating 11 new electricity grids and began construction of three others.[6]
In terms of international cooperation, EVN is encouraged by the Vietnamese government to cooperate with China in importing and exporting electricity through the existing 110 kV and 220 kV transmission lines. It is estimated that transfer between Vietnam and China via 500 kV power lines will begin after 2013. In addition, Vietnam collaborates with Laos through a Master Plan Interconnection and with the Kingdom of Cambodia where Vietnam supplies energy to some districts near the border.

Installed Capacity

In 2008 the installed electricity generating capacity in Vietnam was estimated at 15 764 MW[7] of which 5 486 MW (35 %) was hydropower plants, 9 300 MW (59 %) thermal power stations (oil, gas and coal), 332 MW (2 %) renewable energy (8.3 MW from wind, 1 MW from solar PV, 178 MW from biomass, 145 MW from small hydropower) (see Renewable Energies sub-chapter below for more details) and 646 MW (4 %) imports.
Table 4 shows the constant growth of the installed electricity capacity from 2000 to 2007.

EVN dominates generation and sales of electricity in Vietnam. EVN's facilities account for about 74 % of generation capacity and the remainder is under control of local or foreign Independent Power Producers (IPPs). Vietnam imports electricity from China in the north to avoid shortages, whereas plans existed to import electricity from Laos beginning in 2008 (IEA 2008). However, in July 2009 EVN is still not buying electricity from Laos.
The 5th Power Development Master Plan of Vietnam (2001-2010) and more recently the 6th Power Development Master Plan (2006-2015) urges the government to build new power plants to meet the high electricity demand. As Vietnam has significant energy resources including hydropower, coal, oil and gas, EVN gives high priority to the development of thermal power plants (mainly coal and gas) and hydropower plants. For in-

[6] VN business news 2009

[7] ADB 2009

stance Son La Hydropower (2 400 MW) has been completed in 2009. Further plans include Mong Duong Thermal Coal Power Complex (2 000 MW), O Mon Thermal Gas Power Complex (2 800 MW), Gannon Thermal Gas Power Plant (990 MW) and Nhon Trach Thermal Gas Power Complex (2 640 MW).

As part of this effort, EVN has outlined plans to build 74 new power stations to be completed by 2020. Of these, 48 are planned as hydroelectric facilities, which raised concerns about the country's high reliance on hydropower. To diversify the country's electricity supply, Vietnam is reportedly considering adding nuclear power to its generation mix.

Power Generation

The power generation of Vietnam was estimated at 77.2 MWh[8] in 2008 jointly produced by the state-owned power utility ENV and IPPs. There is a heavy reliance on hydroelectric power which accounts for 25 % of the output.

Table 5 depicts the strong development of the electricity generation by fuel types over the last 10 years. Electricity generation based on oil and hydro has risen constantly whereas coal and gas has grown exceptionally.

Although the generating capacity has expanded, the demand from residential and industrial customers is exceeding supply. Furthermore, since hydropower accounts for 38 % of total capacity, an imbalance in supply and demand occurs during wet and dry seasons. In the wet season, power supply is sufficient and sometimes redundant as hydro plants run at their full capacity. In the dry season, there are serious supply shortages when hydro plants are operating intermittently. This makes the use of wind energy a very interesting option: on the one hand, wind energy would save water thereby reducing the period of intermittent hydro power production, whereas on the other hand wind energy could easily be balanced by hydro power plants.

TABLE 5:
ELECTRICITY GENERATION IN VIETNAM, 1971-2006, IN GWh

Fuel type	1995	2000	2006
Coal/peat	2 000	2 100	9 691
Oil	1 500	4 200	2 289
Gas	750	4 000	20 915
Hydro	15 000	19 500	23 599
Total	19 250*	29 800*	56 494

* Value from this column has been estimated according to a graph
Source: IEA 2008

In 2007, EVN sold 58 GWh of electricity, an increase of 13.4 % compared to 2006.[9] Electricity sales brought in total revenues of 3.5 billion US$ in 2007, up 22 % compared with 2006.

In 2008, EVN had approximately 11 million clients directly purchase electricity[10]. Table 6 provides the electricity consumption of each economy sector in 2006. The industry and residential sectors are the two largest consumers.

TABLE 6:
ELECTRICITY CONSUMPTION BY ECONOMY SECTORS IN 2006

Economy sectors	GWh
Industry	22 975
Transport	434
Residential	20 569
Commerce & Public services	4 159
Agriculture/Forestry	607
Fishing	0
Others	0
Total	48 744

Source: IEA 2008

Since January until the end of July 2009 EVN has purchased nearly 2.2 TWh of power from China, a 13.2 % rise compared to the same period last year.[11] This is due to the fact that Vietnam is facing a severe shortage of about 1 400 MW or almost 10 % of total installed capacity in peak times resulting in many power cut-offs.

To cope with a rapidly increasing power demand of 15.8 % in 2007/08[12], the National Electricity Development Plan for 2006-2015 foresees to reach an electricity production

[8] Harvard 2008

[9] VNA 2008
[10] EVN 2008
[11] Vn business news 2009
[12] Nhat Lam 2008

of 93 000 GWh by 2010, 201 346 GWh by 2020 and 326 640 GWh by 2030. Electricity generation will increase at an average growth rate of 7.4 % per year.[13]

Renewable energies

Vietnam is rich in renewable energy sources.[14] The potential for small hydropower systems, for example, is 800 to 1 400 MW, while biomass-fuelled systems could provide an additional 250 to 400 MW. A feasibility study found that small mini-grids supplying hydroelectricity could meet the power needs of several hundred thousand households in the more mountainous north and central areas of Vietnam; improved micro-hydropower systems could have the same potential in the north. Studies have also shown that solar photovoltaic (PV) systems could serve about 50 000 households in southern and central parts of the country, although the technology is presently too expensive to be viable. ven though wind resources are still to be fully investigated, they could have a role in central coastal areas. A breakdown of the present and potential outputs of renewable energy sources in Viet Nam is provided in the following table 7.

TABLE 7:
POTENTIAL AND CURRENT USE OF RENEWABLE ENERGY IN VIETNAM

Resource	Current	Potential	Usage	Region
	MW	MW	Thousands households served	
Small Hydro	110 – 155	800 – 1 400	-	North and central
Micro-hydro	30 – 75	90 – 150	200-250	North and central
Off-grid solar PV	0.6	2	50	South and central
Biomass	0	250 – 400	Not available	South and central
Geothermal	0	50 – 200	Not available	Central
Wind power	8.3	To be determined	To be determined	Central/coastal

Source: Quyen 2003

Electricity Prices

The Ministry of Industry and Trade (MOIT) sets the electricity tariffs, except for isolated networks where they are set by electricity retailers.[15] By the end of 2009, the Vietnamese government plans to gradually remove subsidies on electricity as it moves to deregulate the sector which will lead to an increase of power prices.

Both average urban and rural residential rates are cross-subsidized by higher rates for industry, commerce, and foreign consumers.

The MOIT has released a document stipulating the retail electricity prices to be applied in March, 2009.[16] Electricity prices are different depending on time of consumption to encourage people to save electricity and to consume electricity in off-peak hours. From 2008 to 2009, this reform led to an average price increase of 8.92 % with an average retail power price of 862 dong (3.5 € cents) per kilowatt hour.

In peak hours, the retail price is 1 900 VND/kWh (7.5 € cents) and price for businesses is 3 100 VND/kWh (12 € cents). Meanwhile, the retail price for households will be calculated depending on the consumption volume. Under the new electricity price arrangement, the retail price for households and the wholesale electricity price to be applied in rural areas will have seven consumption levels instead of five as previously applied, and will not discriminate between rural and urban areas. The highest retail price for households is VND 1 790/kWh (7 € cents) (see table 8).

It is estimated that some 3 million families consume less than 50 kWh a month, including 2.4 million poor fami-

[13] APEC 2006
[14] Quyen 2003
[15] Freshfields Bruckhaus Deringer 2005
[16] Omoteyama 2009

lies. As the price level for the first 50 kWh of consumption will remain at a low level, poor families, which use less than 50 kWh a month, will have to pay no more than VND 21 000 (80 € cents) a month.

TABLE 8:
CURRENT RETAIL ELECTRICITY PRICES IN VIETNAM FOR HOUSEHOLDS FROM MARCH 2009

Consumption per month (kWh)	VND/kWh	€ cents/kWh
0-50	600	2.5
51-100	865	3.5
101-150	1 135	4.5
151-200	1 495 (up by VND20-25/kWh over the currently applied levels).	6
201-300	1 620	6.5
301-400	1 740	7
>400	1 790 (up by VND10/kWh).	7.3

Source: IEA 2008

Vietnam is planning to implement a price support mechanism which will be published for IPPs in the near future. Moreover, it expects to apply clean energy pricing regimes, including end-use green electricity tariffs and renewable power purchase agreements (PPA).

Liberalisation

EVN Vietnam's state-owned electricity utility, plays the central role in the Vietnamese power market. Since 1995 EVN holds a monopoly for electricity transmission and distribution. EVN's facilities accounts for about 78 % of the total electricity generation. The remainder is under the control of other local and foreign Independent Power Producers (IPPs). EVN operates as a single buyer of electricity from power plants.

Although private participation had existed previously via a Build-Operate-Transfer (BOT) concept, from 2002 on EVN was preparing for the post-liberalisation competition. The rapid urbanization and industrialization had been increasing the pressure on the power sector, resulting in a series of peak period outages in 2004 and 2005. The Electricity Law, which was passed in 2005, calls for the unbundling of the sector and for the creation of a competitive supply market, initially with EVN as a single buyer. In late 2009, a spot market will be set up, and an electricity regulator that reviews tariffs and reports to the Ministry of Industry will be established. Delays in preparing and issuing supporting regulations have so far hindered the implementation of this legislation.

To open competition, IPP projects have been developed and account for about 22 % of Vietnam's generating capacity. A large proportion of this capacity is derived from the ADB supported Phu My gas-fired power plants, which were the first projects constructed under Viet Nam's BOT Laws.[17]

The roadmap which has been approved by the Prime Minister in 2008 specifies that the power market in Vietnam will be transformed through three sequential developments: competitive generation market, competitive wholesale market and competitive retail power market. Phase I begins in 2009, phase II in 2017 and phase III in 2024.

Rural Electrification

In 2008, the Vietnamese rural electrification rate was 94.5 % compared to a mere 14 % in 1993.[18] Mainly the mountainous areas, islands and remote areas are still lacking electrification.

The Ministry of Industry and Trade (MOIT) implemented a rural electrification programme in 2000 and included it in its National Energy Policy (see Section 1.5).

The major driver for rural electrification remains the Renewable Energy Action Plan (REAP) promulgated by MOIT in 2001 with support from the World Bank and EVN. REAP is based on 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

[17] Quang 2003
[18] Van Tien Hung 2009

energy-based electrification for thousands of households not covered by EVN's grid expansion planning. It is a two-phase, 10-year programme with a Phase 1 target of adding 25-50 MW of renewable energy capacity, providing access to electricity for more than 35 000 households by 2010. Phase 2 targets a 3 % share for renewable energies in total installed capacity (475 MW).[19] This phase will be completed through two World Bank projects (Renewable Energy Development Project and Rural Energy Project) which have already been signed and will be implemented in 2010.
Many projects have been implemented in the wake of the REAP and some examples can be found in table 9.

In the coming years, the Rural Electrification Programme plans to implement renewable energy projects mainly based on Solar Home Systems (SHS)[20] supported by the World Bank Asia Alternative Energy Programme (ASTAE).[21]

16.3 Market Actors

Ministry of Industry and Trades (MOIT)
Ministry of Industry and Trades (MOIT) was formed after the merger between Ministry of Industry and Ministry of Trade and is in charge of activities related to the energy sector and other industries in accordance with the decree on 189/2007/ND-CP issued by the prime minister on 27 December 2007.
Related to the energy sector, the MOIT is responsible for the state management of all energy industries, namely electricity, new and renewable energy, coal, and the oil and gas industries. The MOIT is in charge of presiding over the formulation of laws policies, development strategies, master plans and annual plans with respect to these sectors, and submits them to the prime minister for issuance or approval. The MOIT is also responsible for directing and supervising development of the energy sector and reporting their findings to the prime minister.

TABLE 9:
EXAMPLES OF IMPLEMENTED RENEWABLE ENERGY PROJECTS UNDER THE RURAL ELECTRIFICATION PROGRAMME

Project	Power	Date of Implementation	Investors	Remark
Decentralized Rural Electrification – Vietnam	45 kWp + 40 kW micro hydro	2000 – 2004	Fondem - france Solarlab - Vietnam	Binh Phuuoc province, Can gio
Solar + Wind	10 kWp + 3 kW Wind		NEF - Japan EVN - Vietnam	Kon Tum province
Solar project with Germany	18 kWp	2002 – 2003	Germany - MOST- Vietnam	Bac giang, dak alk
Solar Project with Korea	3.3 kWp	2003 – 2005	KIER - Korea Solarlab - Vietnam	Binh Phuoc province
Solar Project with Finland	10 kWp	2000 – 2003	Fortum - Finland CEMMA - Vietnam	Bac can province
Wind Energy Project	850 kW	2004	EVN - Vietnam	Bach Long Vy

Source: RERD 2006

Provincial people's committees (PPCs) prepare investment plans and manage rural electrification programmes in their territories.
The Ministry of Planning and Investment (MPI) manages the overall economic planning and review of public investment in energy projects. MPI together with the Ministry of Finance (MOF) prepare annual investment

[19] Vu Van Thai 2006
[20] RERD 2006
[21] ASTAE 2008

plans (state budget, concessional credits and Official Development Assistance (ODA) funds). The MOF oversees all financial matters pertaining to the sector, including coordinating donor assistance.

Electricity of Vietnam (EVN)

Electricity of Vietnam (EVN) was founded on 17th December 2006, succeeding the former Electricity General Corporation of Vietnam.[22] EVN works in the areas of production, transmission, distribution and sales of electricity power with a charter capital of over 48 000 billion Vietnam dongs (approximately 2 billion €). EVN also operates a telecommunications subsidiary.

In 2005, EVN's gross turnover was 40 600 billion VND (more than 1.7 billion €), with a profit of 3 200 billion VND (136 million €). Currently, the total value of the corporation is 115 707 billion VND (approximately over 4.8 billion €). There are about 80 000 employees working in the area of electricity and telecommunications sales in all cities and provinces of Vietnam. Currently, EVN has 7 power companies and 5 consulting entities (including the Institute of Energy), owns 9 thermal and hydro power plants, 5 transmission entities, 2 companies producing power equipment and 3 power vocational schools. EVN Telecom is also an independent member of the corporation.

Institute of Energy (IE)

IE is a consulting organization of the Ministry of Industry and the EVN. It is responsible for high-level policy and technical consultation on energy and electricity.

Private companies:

Independent Power Producers (IPPs)

IPPs play an increasingly important role in the Vietnamese electricity market. There are two major foreign IPPs: Phu My 3 (716 MW, Gas, 412 million US$) and Phu My 2.2 (715 MW, Gas, 410 million US$). The most active IPP developers are EDF, Sumitomo, Sojitz, BP, Semcorp, Petrovietnam, and Vinacomin. Currently a large number of new IPP projects are being planned and developed. Power Purchase Agreements with EVN have been concluded for four of them.

Ministry of Natural Resources and Environment (MONRE)

In 2002, Ministry of Natural Resources and Environment (MONRE) was assigned by the Viet Nam Government to act as a national authority for implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, and to host the national focal agency for CDM. MONRE is the Designated National Authority for CDM (DNA). The CDM National Executive & Consultative Board (CNECB) was established in April 2003, chaired by Director General of ICD/MONRE.

16.4 Political Framework Conditions in the Energy Sector

National Energy Strategy

On 27th December 2007, the Prime Minister signed Decision No. 1855/QD-TTg approving Vietnam's National Energy Development Strategy until 2020 and the vision for 2050.[23]

The Strategy's specific objectives include finalisation of the energy programme in rural and mountainous areas; transformation of operations in the electricity sector, creation of a competitive power retail market after 2022; and connecting regional electricity networks between 2010 and 2015.

The Sixth Power Development Master Plan for the period 2006-2015 includes the following targets:

Target for grid-connected renewable energies: 3 % of primary commercial energy in 2010, 5 % by 2020, and 11 % by 2050;[24]

Target for off-grid renewable energy appliances: connect nearly 100 % households in rural areas by 2025;

Establishment of a framework for supporting renewable energies: Renewable Energy Office, Renewable Energy Fund;

Establishment of measures for implementation of RES (management, procedures etc.).

[22] EVN 2008

[23] Nguyen Tan Dung 2007

[24] MOIT 2008

Energy policies

Key legislation of the energy sector includes the Law on Environmental Protection (1993), Petroleum Law (1993) and its Implementing Decree (1996); and the new Electricity Law (2004), followed by Decrees 105 and 106 (2005), which deal with implementation of the Electricity Law. Table 10 gives an overview and shows what is regulated by the respective law.

The Decision No. 1885/QD-TTg dated 27 December 2007 by Prime Minister approving Strategy on Vietnam National Energy Development up to 2020, and outlook to 2050.

Main contents of the strategy on national energy development related to promotion of renewable energy development are:

TABLE 10:
MAJOR LAWS GOVERNING THE ENERGY SECTOR

Year	Title	Description
1993 Amended 2000	Petroleum Law	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 IOCs.
1993 Amended 2005	Law on Environment	Creates the statutory basis for regulating public and private activities to protect the environment and establishes the Ministry of Natural Resources and Environment
2004/2005	Electricity Law	Provides roadmap and assigns responsibilities for reform and liberalization of the power sector.

Source: EVN 2006

Investment Plans

EVN has reported that it is going to invest almost 50 trillion VND (1 900 million €) in electricity generation sources during 2009, including nuclear power plants. The State-run business revealed that it has raised 44.39 trillion VND (1 700 million €) so far and is actively seeking the remaining 5.6 trillion VND (214 million €).

16.5 Framework Conditions for Renewable Energies

Strategy and Support Schemes for Renewable Energies

As mentioned above, the promotion of renewable energies was included to a large extent in the national energy strategy. It is especially part of government decision No. 1885-2007 and 177-2007.[25]

- Diversification of renewable energy resources;
- Encouraging study and use of renewable energy sources, focusing on remote mountainous island areas;
- Strive to increase share of renewable energy to about 3 % of total commercial primary energy supply in 2010; 5 % in 2020 and 11 % in 2050 through the national energy policy issued in December 2007;
- By 2020, most rural population shall have access to electricity (based on both grid and off-grid decentralized power sources).

The Decision No. 177/2007/QD-TTg dated 20 November 2007, by the Prime Minister approving »Project on Biofuel Development for Period up to 2015, Outlook to 2025«.

The main objective of this project is to develop biofuels as a substitute for fossil fuels in order to ensure energy security and environmental protection.

[25] ADB 2009

The »Strategy and Master plan for Renewable Energy Development of Vietnam for the period up to the year 2015, with outlook to 2025« is a document which completes the status of renewable energies in Vietnam, the objectives and the roadmap.

Furthermore, a Decree on encouraging and supporting renewable development is under development of MOIT and is expected to be approved by the Prime Minister of Vietnam by end of 2010.

As a support instrument to achieve these targets the Vietnamese government will elaborate a price support mechanism law expected in 2010.[26] The Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) is involved in the establishment of a feed-in tariff via a project supported by the German Ministry of the Environment (BMU) and conducted in cooperation with the MOIT.[27]

Licensing procedure

The Government of Vietnam recognized the important role of renewable energies, in particular for rural off-grid areas. It welcomes worldwide investors for the cooperation and development of clean energy in Vietnam. To develop a renewable energy project in Vietnam, the project developer is required first of all to comply with the Vietnamese laws (see Section 1.4). In addition, it is necessary to request an investment license from the government.[28] To obtain the grid connection approval and the permission for producing energy, the developer needs to contact EVN.

Clean Development Mechanism

Vietnam signed the United Nations Framework Convention on Climate Change (UNFCCC) on 16 November 1994 and ratified it on 20 August 2002.

The Vietnamese Designated National Authority (DNA) was established in 2003 and is accommodated within the Ministry of Natural Resources and Environment (MONRE).

The national CDM market has made little progress to date. By July 2009, the Vietnamese DNA had 81 projects in its portfolio with 7 projects registered by the CDM Executive Board (EB) including one wind farm project (see table 11) and 62 projects in the process of validation. The remaining projects are under various phases (i.e. »under review«, »registration request«, »validation terminated« or »rejected«.

In addition, EVN has determined that the internal rate of return for investment into hydropower projects should be over 12 %.

TABLE 11:
REGISTERED AND PLANNED CDM-PROJECTS IN INDONESIA

Project	Location	Type	Installed capacity (MW)	IRR (%)	Annual savings [kt CO2eq]	Date of registration
Rang Dong oil field associated gas recovery and utilization (NM26)	Dong Nai	Fugitive		8-9	677	4-Feb-06
Song Muc Hydro Power Station Regeneration Project in Vietnam	Thanh Hoa	Hydro	2		4.3	26-Jun-06
Dong Thanh Landfill gas CDM Project in Ho Chi Minh City	Ho Chi Minh	Landfill gas	4.252		148	17-Jan-09
Wind Power Plant No.1 - Binh Thuan 30MW	Binh Thuan	Wind	30	13.72	58	6-Apr-09
Cao Phong Reforestation Project	Hoa Binh	Reforestation			2.7	28-Apr-09
Phu Mau hydropower project	Lao Cai	Hydro	5.6	11.70	14	5-Jun-09
Muong Sang hydropower project	Son La	Hydro	2.4	12.38	5.0	5-Jun-09

Source: UNDP Risø 2009

[26] DPA 2009
[27] GTZ 2009
[28] Dang Quoc Toan 2009

Further information on the CDM sector in Vietnam is available at the DNA website.[29] Support in local capacity building is provided by UNEP, the Asian Technology Institute and the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ).

International donor activities

International assistance in Vietnam is characterized by a large number of donors (49 bilateral and multilateral donors).[30]

Vietnam is an important German development cooperation partner. Since 1990, the German government has pledged Vietnam funding of over 900 million €.

In March 2009, the German Federal Ministry for the Environment (BMU) declared that it will provide the government of Vietnam with increased assistance for environmental and climate protection.[31] The Federal Environment Ministry is providing more than 2.8 million € for this purpose, inter alia for projects geared to promote wind energy utilization and the use of small biogas plants.

16.6 Market potential for wind energy

Wind energy potential

Vietnam's wind energy potential is considerably higher compared to Thailand, Laos or Cambodia[32]. A World Bank survey estimated the total potential of wind power at 513 360 MWequivalent to 200 times the output of Southeast Asia's largest power plant, the Son La Hydroelectric Plant in northern Vietnam and ten times the entire national capacity forecast for 2020. Vietnam's wind potential is significant in the central coastal region including Quang Binh, Quang Tri, Thua Thien-Hue and Binh Dinh and the south, including Ninh Thuan, Binh Thuan, Lam Dong, Tra Vinh and Soc Trang.[33]

Since the 1980s, the Institute of Energy (IE) was commissioned by the Ministry of Electricity (now Ministry of Industry and Trade) to review the erection of wind turbines on islands and in remote grid connected areas. Observations and calculations showed that around 28 000 square kilometres of Vietnam have average wind speeds of 7 m/s to 9 m/s at a height of 65 meters. For instance, the average speeds at 65 meters is 7.6 m/s in Bach Long Vi, 6.3 m/s in Spratley, 6.8 m/s in Phu Quy, 4.9 m/s in Hon Dau, 4.4 m/s in Co To.

3TIER[34] is a global leader in weather-driven renewable energy assessment and forecasting for wind projects of all sizes. It is able to provide high- level wind data including a wind energy potential map in Vietnam.

Framework Conditions for Wind Energy

Goal for the use of wind energy

The Ministry of Trade and Industry is developing a Strategy and Master plan for Renewable Energy Development of Vietnam for the period up to the year 2015, with outlook to 2025.[35] Under this plan, renewable energy will increase to 5 % of the total national energy output, with wind and solar power accounting for half of the amount. There is no dedicated strategy for wind energy.

Legal conditions and support instruments

Vietnam is lacking a legal framework for the implementation of wind energy projects. There is no support mechanism in place that gives investors the required security for their investment.[36] This explains why MOIT in cooperation with the German Technical Cooperation (GTZ) is carrying out a project entitled »Establishment of legal framework and technical assistance for grid-connected wind power development in Vietnam«.[37] One of the main goals of the project is to design a price-based support mechanism for wind energy that should come into effect by the end of 2010. The main incentive by the Vietnamese Government is a 100 % tax exemption for imported wind power technology and equipment. In addition, investors in wind energy projects have a land rent exemption over a certain period of time.

Permission procedures

The guidelines for potential foreign investors in wind power in Vietnam have been published by EC ASEAN Energy Facility.[38]

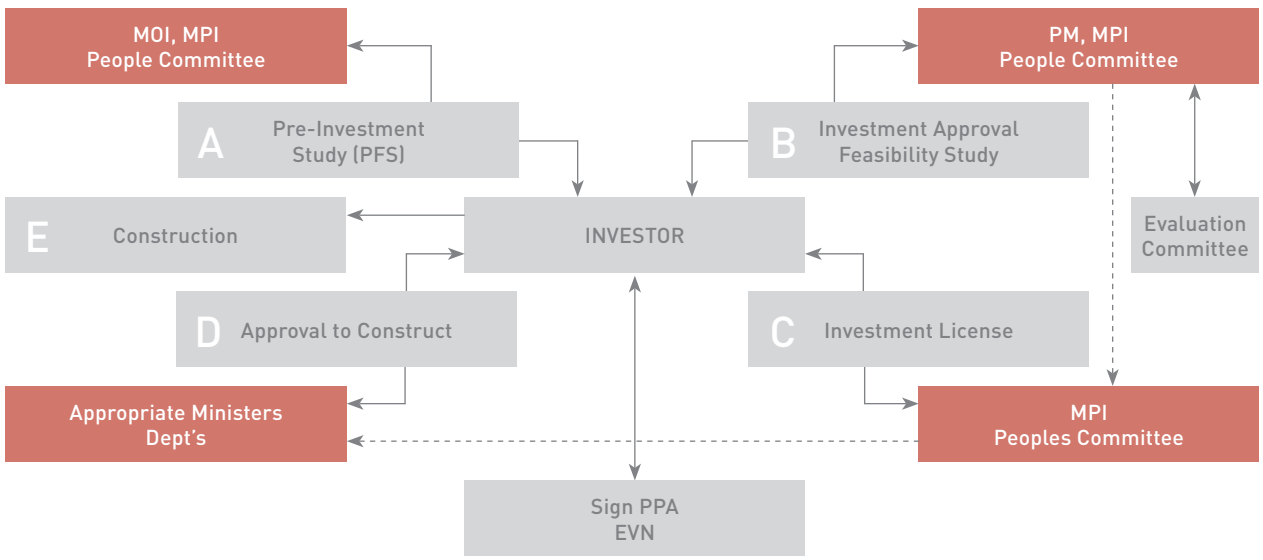
[29] www.noccop.org.vn
[30] France diplomatie 2008
[31] BMU 2009
[32] UPI Asia 2009
[33] Asian Energy 2009
[34] http://www.3tiergroup.com/
[35] *MOIT 2008*
[36] WEI 2009
[37] VOVNews 2009
[38] ASEAN energy 2006

The permitting procedures for energy projects are relatively complex and possibly act as a disincentive for potential investors. Figure 4 summarizes the process developers of private power projects have to follow in order to get approval to invest. Prospective IPPs must carry out detailed investigations and establish a business entity under which they can apply for investment approval followed by a construction permit.

Current Use of Wind Energy and Project Pipeline

Up to now more than 20 wind power projects are under way in Vietnam, with a capacity ranging from 6 MW to 150 MW. The most advanced project has been developed by the Vietnamese company REVN.[39] The first five 1.5 MW turbines from the German manufacturer Fuhrländer have been installed in Binh Thuan province. An extension of this project is already planned.

FIGURE 4:
EXISTING APPROVAL PROCESS FOR IPPS - FOREIGN INVESTORS



Source: ASEAN 2006

Grid connection conditions

To connect wind farms to the Vietnamese electricity grid, the project developer must contact EVN and negotiate for the unit price of electricity sold to EVN.

Actually, a PPA with EVN is one of the biggest obstacles for grid-connected wind power development as EVN will not buy electricity above 5.3 $ cents/kWh (3.56 € cents/kWh). However, no projects are financially viable under 8.4 $ cents/kWh (5.6 € cents/kWh). The government has subsidies in place for wind farm developers for example the project in Binh Thuan province.

Furthermore, around ten thousand 200-W battery charging wind turbines have been installed for household use, mainly in the central and southern regions. In addition a number of 150-W battery charging wind turbines have been installed at households in coastal areas of Quang Ninh and Hai Phong.

Wind energy projects in operation:

- The Bach Long Vy wind power plant with capacity of 800 kW has been in operation since the end of 2004;
- The first five turbines with a total capacity of 7.5 MW wind power project in Tuy Phong district, Binh Thuan province have been installed by Fuhrlaender Vietnam

[39] WWEA 2009

Joint Stock Company of Germany and joined the national grid in August 2009[40]. The project's investor Renewable Energy of Vietnam Joint Stock Company (REVN) will install seven additional turbines to reach a capacity of 18 MW in the first phase. The project to which 80 more turbines will be added to raise its total capacity to 120 MW, is expected to come into operation in 2011.

Wind energy projects under development in Vietnam include:

- The 55 MW Phuong Mai 3 wind power plant located in the central province of Binh Dinh province was stated to be constructed in September 2007. The investor of this project is Central Region Wind Power JS Company;
- The 30 MW Cau Dat Wind Power Plant located in Da Lat City, the Central Highlands province of Lam Dong is expected to be in operation in June 2011. The investor of this project is Cavico Transport Corporation;
- 2 MW wind power installation in Ly Son Island: The feasibility study has been completed by the Institute of Energy. EVN is the main project investor;
- 15 MW wind farm in Binh Dinh Province: The tender for equipment supply is currently open. The feasibility study was prepared by Phuong Mai Company;
- 84 MW Wind Power Project in Phuong Mai: The main investor is Grabowski Renewable Energy Company no. 1 Ltd;
- 2.5 MW wind project in Phu Quoc Island;
- 15 MW wind farm in Phu Yen Province. The project is owned by VINACONEX. IE prepared the feasibil ity study;
- 2.5 MW Wind Project in Co Dao Island: IE is currently undertaking the feasibility study.

Business Climate

Market players

Below is a list of companies involved in wind energy development in Vietnam.

Vietnam Wind Power Joint Stock Company[41] offers services including:

- Building wind measurement stations for collecting wind data at a height of 40 - 60m;
- Producing and trading electricity through investing, constructing and operating small and medium wind power plants;
- Producing, assembling and trading wind energy equipments;
- Providing advice on technology transference in the field of wind power;

Asia Petroleum Energy Corporation is a producer, wholesale supplier, exporter and importer of wind power equipment. Their services include construction, engineering and project development for clean energy.

Bach-Khoa Investment and Development of Solar Energy Co Ltd (BK-IDSE) is a manufacturer of small wind turbines for battery charging (from 200 W up to 3.2kW) and specialises in R&D. Moreover, BK-IDSE offers consultancy service for wind resource assessments.

GE - is investing in a factory for wind turbine generators.

Structural conditions

Vietnam has had experience with small scale wind technology through the Research Centre for Thermal Equipment and Renewable Energy (RECTERE) of Ho Chi Minh City Technical University. For twenty years, RECTERE has manufactured and installed household wind energy systems with a rated power of 100 W – 500 W.[42] The technical and investment requirements associated with these systems are extremely different to those associated with large scale grid connected wind farms.

[40] Solely wind energy project registered as a CDM project (see section 1.5): First sales of electricity from the wind farm will be from the 7.5MW first stage in January 2009, the 22.5MW second stage will commence sale of electricity in March of 2009.

[41] http://www.vwp-jsc.com/index.htm

[42] Nguyen 2007

The development of large scale grid connected wind farms is in the experimental phase, including the Wind Power Development in Vietnam Institutional, Policy and Market study and an EC-ASEAN Energy Facility (EAEF) project. The EAEF project aims to promote wind energy development and facilitate investments in wind energy projects in Vietnam through feasibility assessments and capacity building.[43]

There are currently no manufacturers of large scale wind turbines in Vietnam. However, CS Wind Vietnam Co[44], a Korean manufacturer of small scale wind turbines and towers, established its first wind tower factory in Vietnam and is now recognized as one of the leading wind tower manufacturers in the country.

Fuhrlaender is investigating the possibility to manufacture its 1.5 MW turbine in Viet Nam. Currently they are negotiating the conditions with the government.

Wind developers must import technology and gain expertise from abroad due to the limited technical expertise available in Vietnam and thereby assume significant risk in the development of wind farms. Thermal power and Hydro power generators do not face these barriers as Vietnam already has an established industry in these technologies.

Human resources conditions and education

Vietnam currently does not have the necessary skilled labour to adequately maintain the specialized equipment of which each wind generating unit is comprised. In order to fulfil the ongoing maintenance requirements of the equipment it is necessary for project developers to sign a maintenance agreement with the turbine suppliers. As a result, the project developers rely on the foreign manufacturer to provide quality maintenance services.

Financing possibilities

All important projects are supported by the state bank of Vietnam but financial support is also possible from the World Bank and the Asian Development Bank.

[43] EAEF 2007
[44] www.cswindcorp.com/eng

16.7 Contacts and Addresses

ASEAN Centre for Energy (ACE)
ASEAN Centre for Energy Building, 6th Floor
Jl. HR. Rasuna Said Blok X-2,
Kav. 07-08 Kuningan,
Jakarta - 12950
Tel.: +62 (21) 527 93 32
Fax: +62 (21) 527 93 50
Internet: www.aseanenergy.org

ASIA PETROLEUM ENERGY CORPORATION
Dang Quoc Toan, Managing Director
135/45 Nguyen Huu Canh, Ward 22,
Binh Thanh District, Ho Chi Minh City-Vietnam
Tel.: +84-8-54046976
Fax: +84-8-54046975
E-mail: toandtq@gmail.com
Internet: www.asiapetro.com.vn

CDM-Projects
International Cooperation Department (ICD)
Ministry of Natural Resources and Environment (MONRE)
83 Nguyen Chi Thanh Road, Hanoi, Viet Nam
Tel.: +84 (4) 773 61 03/822 89 74
Fax: +84 (4) 835 21 91/826 38 47
E-mail: vnccoffice@fpt.vn
Deputy Director General, ICD: Mr. Nguyen Khac Hieu
E-mail: hieu_monre@yahoo.com

Ministry of Industry
54 Hai Ba Trung Hoan Kiem District – Hanoi
Tel.: +84 (4) 826 78 70
Fax: +84 (4) 826 90 33
Internet: www.industry.gov.vn
Ministry of Planning and Investment
2 Hoang Van Thu Ba Dinh District – Hanoi
Tel.: +84 (4) 845 30 27
Fax: +84 (49 823 44 53
Internet: www.mpi.gov.vn

Electricity of Viet Nam – EVN
18 Tran Nguyen Han – Hanoi
Tel.: +84 (4) 82 49 508
Fax: +84 (4) 82 49 461
E-mail: vp@evn.com.vn
Internet: www.evn.com.vn

Institute of Energy – IE
6 Ton That Tung Dong Da – Hanoi
Tel.: +84 (4) 852 37 30
Fax: +84(4) 852 93 02
Internet: www.evn.com.vn/ioe/english/index_eng.html

National Load Dispatching Center (NLDC)
18 Tran Nguyen Han, Hoan Kiem District – Hanoi
Tel.: +84 (4) 824 37 45
Fax: +84 (4) 824 34 82
Internet: www.evn.com.vn/nldc/english/index_en.html

Renewable Energy Research Center
Hanoi University of Technology 1 Dai Co Viet Hai Ba Trung – Hanoi
Tel.: +84 (4) 869 26 56
Fax: +84 (4) 868 11 85
E-mail: ddthong@hn.vnn.vn

Research Center for Thermal Equipment and Renewable Energy – University of Technology
268 Ly Thuong Kiet, District 10 – Ho Chi Minh City
Tel.: +84 (8) 865 43 55
Fax: +84 (8) 865 43 55
E-mail: hcmbk.net@hcmut.edu.vn
Internet: www.hcmut.edu.vn

SELCO Viet Nam Company Limited
239 Tran Hung Dao
Dist. 1 – Ho Chi Minh City
Tel.: +84 (8) 836 82 62
Fax: +84 (8) 837 74 08
E-mail: selco-vn@hcm.vnn.vn
Internet: www.selco-intl.com

SOLARLAB – Viet Nam National Center for Science and Technology
Phan Vien Vat Ly, 1 Mac Dinh Chi,
Ho Chi Minh City
Tel.: +84 (8) 822 20 28
Fax: +84 (8) 829 59 05
E-mail: solarlab@hcm.netnam.vn
Internet: www.solarlab.org/

World Bank
63 Ly Thai To – Hanoi
Tel.: +84 (4) 934 66 00
Fax: +84 (4) 934 65 97
E-mail: webmaster.worldbank@fpt.vn
Internet: www.worldbank.org.vn/

German Embassy in Viet Nam
29 Tran Phu – Hanoi
Tel.: +84 (4) 845 38 36/7
Fax: +84 (4) 845 38 38
E-mail: germanemb.hanoi@fpt.vn
Internet: www.germanembhanoi.org.vn

Gesellschaft für Technische Zusammenarbeit (GTZ)
Viet Nam Office
6th Floor, Hanoi Towers, 49 Hai Ba Trung – Hanoi
Tel.: +84 (4) 934 49 51/2/3
Fax: +84 (4) 934 49 50
E-mail: gtz-vietnam@gtz.de
Internet: www.gtz.de/vietnam

Delegate of German Industry and Commerce
1303 Vietcombank Tower
198 Tran Quang Khai Street
Hoan Kiem District, Hanoi
E-mail: info@vietnam.ahk.de
Internet: www.vietnam.ahk.de

16.8 Information sources

ADB- Asian Development Bank:
Country Report Energy and Climate Change IN VIETNAM, Workshop, March 2009 (http://www.adb.org/documents/events/2009/Climate-Change-Energy-Workshop/VIE.pdf) Retrieved on 1st September 2009

APEC - Energy Demand and Supply Outlook 2006: Viet Nam, 2006

ASEAN centre for energy:
Vietnam, 2003 (http://www.aseanenergy.org/energy_sector/electricity/vietnam/current_organisational_structure_evn.htm#Transmission%20and%20Distribution%20Facilities) Retrieved on 1st September 2009

ASEAN energy:
Wind Power Development in Vietnam Institutional, Policy and Market study. Report, 2006 (http://www.risoe.dk/vea-ves/ASEAN%20web%20page/reports/Hanoi_Report%20minutes%20meeting.pdf)

Asian Energy:
Vietnam's high wind power potential, article, July 2009 (http://www.silobreaker.com/vietnams-high-wind-power-potential-5_2262493977309610008) Retrieved on 1st September 2009

ASTAE:
Annual status report, 2008 (http://siteresources.worldbank.org/EXTEAPASTAE/Resources/ASTAE_ASR_16_FY2008.pdf) Retrieved on 1st September 2009

AusAID - Australian Government:
Vietnam, July 2009 (http://www.ausaid.gov.au/country/country.cfm?CountryId=33) Retrieved on 1st September 2009

Auswaertiges Amt:
Vietnam, March 2009 (http://www.auswaertiges-amt.de/diplo/en/Laenderinformationen/01-Laender/Vietnam.html) Retrieved on 1st September 2009

BMU – Federal Environment Ministry:
Astrid Klug: Vietnam is an important partner in environmental protection, March 2009

CIA-Central Intelligence Agency:
The World Factbook, 2009 (https://www.cia.gov/library/publications/the-world-factbook/geos/vm.html) Retrieved on 1st September 2009

Dang Quoc Toan -
ASIA PETROLEUM ENERGY CORPORATION:
Wind energy questionnaire, Aug 2009

DPA, 2009: Experts:
Vietnam must raise electricity prices to lower emissions, Sept 2009 (http://www.earthtimes.org/articles/show/286126,experts-vietnam-must-raise-electricity-prices-to-lower-emissions.html) Retrieved on 1st September 2009

Dung, Nguyen Tan 2007:
Decision No. 1855/QD-TTg of December 27, 2007, approving Vietnam's National Energy Development Strategy up to 2020, with 2050 Vision (http://www.asiabiomass.jp/biofuelDB/vietnam/pdf/Decision%20No.%201855.pdf) Retrieved on 1st September 2009

EAEF – EC-ASEAN energy facility:
Summary of project implemented under EAEF co-financing, 2007

EC ESEAN:
Wind Energy Development in ASEAN 2005 (http://www.ec-asean-greenippnetwork.net/dsp_page.cfm?view=page&select=207) Retrieved on 1st September 2009

EIA - Energy Information Administration:
Country Analysis Briefs 2007 (http://tonto.eia.doe.gov/country/country_energy_data.cfm?fips=VM) Retrieved on 1st September 2009

Embassy of Vietnam, 2009
(www.vietnamembassy-usa.org)
Retrieved on 1st September 2009

ESRI- Environmental Systems Research Institute:
Map of Indonesia, 2008 (http://www.esri.com/)
Retrieved on 1st September 2009

EVN – Electricity of Vietnam:
Electricity & Energy Industry News, Article, January 2008
(htto://www.vfabric.com/Vietnews/e.htm) Retrieved on 1st September 2009

EVN:
Vietnam Electricity, Sept 2008 (http://www.investinvietnam.vn/Default.aspx?ctl=Article&tID=7&pID=323&aID=529) Retrieved on 1st September 2009

France diplomatie:
Framework partnership document France - Vietnam (2006-2010), 2008
(http://www.diplomatie.gouv.fr/en/country-files_156/vietnam_718/france-and-vietnam_5884/cultural-scientific-and-technical-cooperation_6083/framework-partnership-document-france-vietnam-2006-2010_11777.html) Retrieved on 1st September 2009

Freshfields Bruckhaus Deringer:
Vietnam New electricity Law, 2005
(http://www.mekongsources.com/doc/Briefing%20on%20Vietnam%27s%20Electricity%20Law%202005.pdf) Retrieved on 1st September 2009

GENI - Global Energy Network Institute:
Electricity transmission grid of Indonesia, 2007
http://www.geni.org/globalenergy/library/energy-issues/vietnam/index.shtml) Retrieved on 1st September 2009

Gtai, Vietnam CDM market, 2009
(http://www.gtai.de/DE/Content/__Shared-Docs/Anlagen/PDF/CDM/cdm-markt-vietnam-english,property=publicationFile.pdf?show=true)
Retrieved on 1st September 2009

GTZ - Gesellschaft für Technische Zusammenarbeit:
Vietnam Investment Review, July 2009 (http://gtz-windenergy.org.vn/index.php?mact=News,cntnt01,detail,0&cntnt01articleid=25&cntnt01detailtemplate=wind%20energy%20in%20vietnam&cntnt01dateformat=(%25d%2F%25m)&cntnt01returnid=53) Retrieved on 1st September 2009

Harvard Kennedy School:
Case study Vietnam Electrcity, 2008
(http://www.fetp.edu.vn/exed/2008/HaNoi/Docs/Readings/Day%202-1-Vietnam%20Electricity%20Case-E.pdf) Retrieved on 1st September 2009

IEA – International Energy Agency:
Beyond the OECD – Vietnam, 2006 (http://www.iea.org/Textbase/country/n_country.asp?COUNTRY_CODE=VN) Retrieved on 1st September 2009

IMF-International Monetary Found:
Report for Selected Countries and Subjects: Vietnam, 2009 (http://www.imf.org/) Retrieved on 1st September 2009

Khanh Q. Nguyen:
Impacts of a rise in electricity tariff on prices of other products in Vietnam 2008 (http://www.viet-studies.info/kinhte/Electricity_tariif_VN.pdf) Retrieved on 1st September 2009

Khanh, P:
Power Safety in Vietnam, 2007.
(ts.nist.gov/Standards/Global/upload/khanh.doc)
Retrieved on 1st September 2009

MOIT - Ministry of Industry and
Trade Viet Nam - Vu Van Thai:
Meeting rapid electricity demand growth,
September 2008
(http://www.mrcmekong.org/download/programmes/hydropower/presentations/2.4%20F.VVThai%20Presentation%20at%20Consultation%20on%20MRC%27s%20Hydropower%20Programme%20Lao%2025-26Sept.08.pdf) Retrieved on 1st September 2009

MOIT - Ministry of Industry and Trade Viet Nam:
Strategy and Masterplan for Renewable Energy Development of Vietnam for the period up to the year 2015, with outlook to 2025, October 2008

Nguyen:
Energy Policy 35, 2007, pg 1411

Nhat Lam (Reuters):
Vietnam 2008 power demand seen 16 pct – EVN,
Article, Feb 2008
(http://uk.reuters.com)
Retrieved on 1st September 2009

Omoteyama S. IEEJ:
Vietnam Energy report 2009 (http://eneken.ieej.or.jp/data/2588.pdf) Retrieved on 1st September 2009
Quang, Truong Nhat: BOT Project Financing in Vietnam, Asia Law, 2003 (http://www.ykvn-law.com/publications/botprojectfinancing.pdf), Retrieved on 1st September 2009

Quyen N.H.:
Chapter 13 - Renewable energy for rural areas: Viet Nam 2003

RERD – Center for Renewable Energy and Rural Development and Institute of Energy:
PROJECT Delta PRO RES; WORKSHOP IN PHNOM PENH, October 2006 (http://ftpnrj.free.fr/pdf_deltaprores/13_VIETNAM.pdf) Retrieved on 1st September 2009

RECIPES – Renewable Energy in emerging and developing countries: Country energy information – Vietnam, Sept 2006

REEEP - The Renewable Energy & Energy Efficiency Partnership:
Policy DB Details: Vietnam, 2009 (http://www.reeep.org/index.php?id=9353&text=policy-database&special=viewitem&cid=39) Retrieved on 1st September 2009

UNDP Risø :
CDM pipeline overview, Last visited 16/08/2009 (http://uneprisoe.org/)
Retrieved on 1st September 2009

UPI Asia - Energy Resources Vietnam's high wind power potential, Article, July 2009 (http://www.upiasia.com/Energy_Resources/2009/07/30/Vietnams-high-wind-power-potential/UPI-52881248999620/)
Retrieved on 1st September 2009

USAID:
Vietnam country report, 2007 (http://usaid.eco-asia.org/programs/cdcp/reports/Ideas-to-Action/annexes/Annex%206_Vietnam.pdf)
Retrieved on 1st September 2009

U.S. Commercial Service:
Market Brief – Vietnam, 2006 (http://www.nema.org/gov/trade/briefs/vtnmpower-gen.pdf) Retrieved on 1st September 2009

U.S. Department of State:
Background Note - Vietnam, 2009 (http://www.state.gov/r/pa/ei/bgn/4130.htm)
Retrieved on 1st September 2009

Van Tien Hung – WB:
VIETNAM RURAL ELECTRIFICATION PROGRAM, workshop, June 2009 (http://www.fema-africa.net/attachments/101_3.1%20Hung%20Van%20Tien-Vietnam-Rural%20Electrification.pdf) Retrieved on 1st September 2009

VietNamNet Bridge:
Wind power industry in Vietnam, article, July 2009 (http://english.vietnamnet.vn/reports/2009/07/860926/) Retrieved on 1st September 2009

VietNamNet/VnMedia:
Highest retail electricity price raised to VND3,100/kwh, March 2009 (http://www.lookatvietnam.com/2009/02/highest-retail-electricity-price-raised-to-vnd3100kwh.html) Retrieved on 1st September 2009

Vn business news:
EVN purchases 2.2 billion kWh of power from China, article, August 2009 (http://www.vnbusinessnews.com/2009/08/evn-purchases-22-billion-kwh-of-power.html) Retrieved on 1st September 2009

VNA:
EVN reports high revenues, dropping profits, 2008 (http://english.vietnamnet.vn/biz/2008/01/763885/) Retrieved on 1st September 2009

VOVNews:
Vietnam's first wind power plant to operate soon. Article, 2009 (http://english.vovnews.vn/Home/Vietnams-first-wind-power-plant-to-operate-soon/20097/105875.vov) Retrieved on 1st September 2009

Vu Van Thai, 2006:
Viet Nam Energy Policy: Energy Investment and Climate Change (http://www.unescap.org/esd/environment/climatechange/documents/Session%205/Mr.%20Thai_Viet%20Nam.pdf) Retrieved on 1st September 2009

WWEA - World Wind Energy Association:
Wind Energy International - Country report 2009, Indonesia. (http://www.wwindea.org/home/index.php) Retrieved on 1st September 2009

World Bank: Country Brief, 2008 (http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/VIETNAMEXTN/0,,contentMDK:20212080~menuPK:387573~pagePK:1497618~piPK:217854~theSitePK:387565,00.html) Retrieved on 1st September 2009

Xuan Thanh Nguyen, FETP, Case Study- ELECTRICITY POWER TRADING COMPANY (SINGLE BUYsER), workshop, 2008 (http://www.fetp.edu.vn/exed/2008/HaNoi/Docs/Readings/Day%202-2-Single%20Buyer-Case-E.pdf) Retrieved on 1st September 2009

Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH

Dag-Hammarskjöld-Weg 1–5
65760 Eschborn / Germany
T +49 61 96 79-13 03
F +49 61 96 79-13 03
E info@gtz.de
I www.gtz.de