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Case Study Report

Environment

TURNING THE LIGHTS ON Sustainable energy and development in Viet Nam

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Cover image: A utility pole supporting electrical wires in Bac Ha, Viet Nam.
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Contents

List of tables, figures and boxes

Tables

Figures

Quang Nam province in Central Vietnam. Photo: © Asian Development Bank

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Abbreviations

ADB	Asian Development Bank
AGECC	Advisory Group on Energy and Climate Change
APEC	Asia-Pacific Economic Cooperation
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DEG	District Electricity Group
ERAV	Electricity Regulatory Authority of Viet Nam
ESMAP	Energy Sector Management Assistance Programme
EVN	Electricity of Viet Nam
FDI	Foreign direct investment
GDP	Gross domestic product
GEF	Global Environment Facility
GFCF	Gross fixed capital formation
GHG	Greenhouse gas
GoVN	Government of Viet Nam
GSO	General Statistics Office
GW	Gigawatt
GWh	Gigawatt hour
HV	High voltage
IDA	International Development Association
IEA	International Energy Agency
kgoe	Kilogram of oil equivalent
ktoe	Kilotonne of oil equivalent
kV	Kilovolt
kWh	Kilowatt hour
LDU	Local distribution utility
LPG	Liquefied petroleum gas
LV	Low voltage
MOIT	Ministry of Industry and Trade
MV	Medium voltage
MW	Megawatt
ODA	Official development assistance
OECD	Organisation for Economic Co-operation and Development
PPP	Purchasing power parity
SE4ALL	Sustainable Energy for All
SOE	State-owned enterprise
TFEC	Total final energy consumption
TPES	Total primary energy supply
UN	United Nations Organisation
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VCP	Vietnamese Communist Party
VND	Vietnamese dong
WDI	World Development Indicators
WHO	World Health Organization

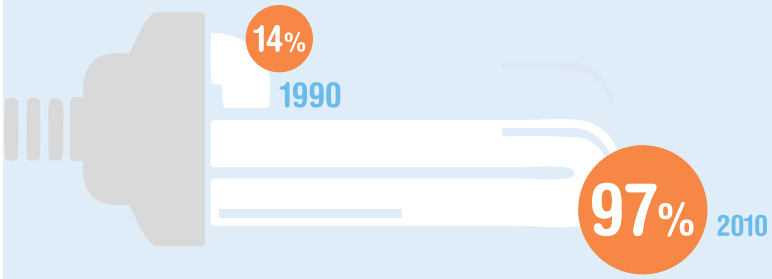
Abstract

Viet Nam has achieved impressive progress on both economic growth and poverty reduction over the past two decades. This progress has been accompanied by rapid increases in the production and consumption of energy, including a tenfold increase in electricity production between 1990 and 2010. Over the same period, Viet Nam outpaced other countries at a similar income level in providing access to electricity. Lighting and access to communications have improved the quality of life for the great majority of people. This case study highlights three key factors that have driven progress in energy: sustained policy commitment, which has adapted to changing conditions; local-level implementation and the mobilisation of local resources for rural electrification; and donors playing a supportive role to the Government to achieve national objectives.

While Viet Nam has made progress on energy for development, there are challenges to current and future progress. These include creating a sustainable energy mix, to stem the trend towards fossil fuels while meeting the growing demand for energy; achieving universal access to modern energy, as the poorest households are still lagging behind; ensuring a reliable supply; and reforming electricity subsidies while protecting access for the poorest. Viet Nam's experience holds lessons for policy-makers in other countries that need to balance economic growth and poverty reduction with growing demand for energy and its sustainability.

Electrical transmission towers in Sapa, Viet Nam. Photo: © UN Photo/Kibae Park

1. Introduction



INCREASED PROPORTION OF POPULATION WITH ACCESS TO ELECTRICITY

In some years, more than 2 million households were connected

Source: SE4ALL, 2013

1.1 Why Viet Nam?

Viet Nam has made impressive progress on economic growth, poverty reduction and access to energy since the introduction of its *Doi Moi* (renovation) policies in 1986 (Le Quang Binh, 2008; Vandemoortele with Bird, 2011; World Bank, 2012). At that time, Viet Nam was a low-income agrarian society where the poor, who comprised more than half of the population, relied on family and community support systems (World Bank, 2012).

The country achieved a fourfold increase in gross domestic product (GDP) between 1990 and 2010, and a threefold increase in GDP per capita,[1] and it now has middle-income country status. The population living below the official national poverty line fell by three-quarters between 1993 and 2010, from 58% to 14.2%[2] (Vandemoortele with Bird, 2011; World Bank, 2012).

In all, an estimated 30 million Vietnamese people have been lifted out of poverty in the past 20 years (World Bank, 2012). This general progress in poverty reduction in Viet Nam is described more fully in an earlier country case study from the Development Progress Project (Vandemoortele with Bird, 2011).

This progress on economic growth and poverty reduction was accompanied by rapid increases in the production and consumption of energy. Increases in the supply of energy fuelled economic activity, while demand for energy increased as output expanded. Access to adequate energy is essential for poverty reduction and the achievement of the Millennium Development Goals (Modi et al., 2005; Advisory Group on Energy and Climate Change, AGECC, 2010), and Viet Nam has also made impressive progress in improving access to electricity (Sustainable Energy for All, SE4ALL, 2013) – progress that has outstripped that of most countries at a similar income level. Between 1990 and 2010 the proportion of the population with access to electricity increased from about 14% to 97%. By 2010, all but 3%-4% of Viet Nam's population had access to electricity.

While access to energy expands livelihood opportunities and strengthens people's resilience in the face of climate change (Gaye, 2007), the production and consumption of energy can have serious consequences for the natural environment. Any assessment of energy's contribution to development progress in Viet Nam must, therefore, take account of its impact upon environmental sustainability. A comparatively high proportion of the energy that Viet Nam consumes is from renewable sources, and between 1990 and 2010 consumption of renewable energy increased fivefold. Over the same period, however, the composition of the primary energy supply changed from being mainly renewable to mainly fossil fuels.

Rapid economic growth and remarkable progress on poverty reduction and access to electricity, coupled with growing concerns about energy sustainability, the

1 GDP and per capita GDP measured in constant 2005 PPP US$, World Development Indicators.

2 Viet Nam's official poverty lines for urban and rural areas are revised every five years when a new Socio-Economic Development Plan is drawn up. The General Statistics Office uses a different poverty line in its Household Living Standards Survey and using this measure 20.7% of the population were below the poverty line in 2010.

'Rural electrification contributes power as the basic stuff of life for a civilized society' - Power generation company official

natural environment and inequities, point to Viet Nam as a suitable case study for the Sustainable Energy focus area of the Development Progress Project. How Viet Nam balanced the three energy policy objectives of security of supply, equitable access and reduced greenhouse-gas (GHG) emissions, whilst achieving rapid economic growth and poverty reduction, potentially offers lessons for the United Nations decade of Sustainable Energy for All (SE4ALL, 2014-2024) which is just beginning.

1.2 Country context

Viet Nam's remarkable development progress over the past two decades has its roots in the reconstruction that followed the American war in the 1970s and in the response to the socioeconomic crises of the 1980s. It has also been shaped by a strong sense of national independence and a culture of shared effort, reinforced by international political and trade embargoes that were not lifted until the mid-1990s. The adoption of *Doi Moi*[3] in 1986 formalised a more market-oriented development strategy, but liberalisation has been deliberately slow and the Government retains control of large parts of the economy. In the energy sector, for example, all of the main actors and service providers are state-owned enterprises (SOEs).

The country's constitution is clear: the Vietnamese Communist Party (VCP) leads both the state and society. The VCP has cells and members in nearly every village and neighbourhood, and its presence has expanded via mass organisations that also have a strong presence at the commune level. The VCP has provided political stability, seen as a real strength by investors (Le Quang Binh, 2008).

Although Viet Nam does not have multiparty democracy or national elections, there is some representation at all levels. Local government is composed of People's Committees at commune and district level, together with directly elected Provincial Councils (Hifab International, 2000). The 200-strong Central Committee, elected every five years at the Party Congresses, sets the overall direction and strategy for the country's development. The Political Bureau, elected from the Central Committee, oversees the executive government and makes all the important decisions (Le Quang Binh, 2008).

Rather than relying on ideological dogma and policy-reform blueprints, however, Viet Nam's policy-making process is characterised by a strong tradition of consensus-based decision-making, combined with a 'learning by doing' approach that allows policy experiments and the roll-out of what works (Rama, 2008; Le Quang Binh, 2008). The Government of Viet Nam (GoVN) emphasises poverty reduction and socially inclusive development in its policies and strategies, with a strong emphasis on equity and on ensuring that certain segments of the population are not left behind by economic progress (Vandemoortele with Bird, 2011).

The energy sector is dominated by three SOEs, under the direction of the Ministry of Industry and Trade (MOIT). The extraction, processing and export of fossil fuels are undertaken by PetroVietnam (oil and gas) and Vinacomin (coal), through their various subsidiaries. Electricity of Viet Nam (EVN) is the main power-generation company, owning 55% of the total generation capacity (Trinh Quoc Vu, 2013). Together, private sector companies and foreign investors in the power sector account for 12% of total generation capacity, while the other energy SOEs, PetroVietnam and Vinacomin, account for a total of 15% (Nguyen Anh Tuan, 2012).

Until recently, Viet Nam's overall energy mix has been characterised by the dominance of renewable energy.[4] However, this picture is changing – and fast – as renewables are overtaken by fossil fuels, despite significant growth in renewable energy production. At the same time, there are concerns that rapid economic transformation and growth have contributed to rising inequality in both income and opportunities, despite concerted efforts on the part of the Government to ensure equity. It appears that some groups – particularly those in remote rural areas, those in urban slums and those from ethnic minorities – are being left behind by overall economic and social progress and by the general increase in access to energy.

3 *Doi Moi* was a programme of economic renewal, which involved measures to move gradually from central planning to market mechanisms, including opening the economy to foreign trade and investment.

4 'Renewable energy' is energy that is derived from natural processes (e.g. sunlight) and is replenished faster than it is consumed. Solar, wind, hydro, geothermal and biomass (e.g. wood fuel) are common forms of renewable energy. In Viet Nam the term 'renewable energy' is used to refer to new renewable energy, i.e. micro- and small-hydropower, non-traditional biomass (including biogas), wind, solar and geothermal energy. In this study, renewable energy includes large-scale hydropower and traditional biomass.

1.3 About this case study report

This report describes key developments in the energy sector in Viet Nam and analyses their contribution to human and sustainable development over the past two decades. The report identifies the key factors that have driven the expansion of access to modern energy services,[5] increased energy consumption rates for economic growth and changed the environmental sustainability of Viet Nam's energy system. A perspective on progress in these three areas, including the synergies and trade-offs between them, reveals more general progress on sustainable energy.

The research for this report focused on five questions.

- To what extent did policy-makers seek to drive expansion of access to modern energy services and how effective were their policies?
- Has rapid growth in energy production and consumption, and the expansion of electrification, been achieved in a way that has improved the energy sector's environmental sustainability?
- How did national poverty-reduction programmes and other initiatives focused on disadvantaged groups affect progress on energy access and its development impact?
- How has access to electricity been financed and who were the main sources of investment finance?
- What role did bilateral and multilateral donor organisations play in achieving progress in access to sustainable energy?

The research team comprised researchers based in the UK, assisted by researchers in Viet Nam. All were involved in the analysis of available primary and secondary data and literature, and the UK-based team drafted the report. The team reviewed published and grey literature from the GoVN, donor and international organisations and academic sources. Information from government sources included policy statements and official statistics and reports, as well as presentations by officials available online that contained information not readily available elsewhere. The research team also conducted 13 interviews with key informants, including government officials and donor representatives in Viet Nam.

The report is structured as follows: Section 2 describes the progress that has been achieved in Viet Nam's energy sector since 1990, focusing on overall energy consumption, levels of access to energy and the contribution of renewable energy. Section 3 analyses the key drivers of this progress, while Section 4 looks at the barriers to continued progress. Section 5 provides some conclusions and lessons from Viet Nam's experience over the past two decades.

5 'Modern energy services' is the term that has been adopted by Sustainable Energy for All (SE4ALL) to describe the variety of different forms of energy use that people in all social groups need for domestic, productive and community services. Modern energy services can be provided through electricity and clean fuels. The cleanliness and safety of fuels is dependent on the technology used to transform fuel into useful energy.

2. What progress has been achieved?

'Well begun, not yet done' - World Bank (2012)

This section describes Viet Nam's progress in its energy sector over the past two decades, focusing on the expansion of energy consumption and production, household access to energy, the equity of energy distribution, energy for cooking, energy intensity, the changing contribution of renewables, and GHG emissions. The analysis reveals impressive economic growth and the rapid expansion of household access to electricity. It also reveals, however, concerns about both the equity of the country's energy system and its environmental sustainability.

2.1 Energy for economic growth

To understand how energy has contributed to economic growth in Viet Nam, we need to review two aspects of the energy sector: first, how energy production and consumption have expanded and, second, the overall effects of investment in the energy sector on economic growth.

2.1.1 Economic growth

Viet Nam's economic growth has been impressive and, in Asia, has been surpassed only by China. Its GDP growth averaged 7.3% per year over the period 1990-2010, while GDP per capita grew by 5.8% (World Development Indicators, WDI). The GDP annual growth rate peaked in 1995, at 9.5%, and fell to 4.8% in 1999 after the Asian financial crisis. The growth rate fell again after the global financial crisis in 2008, but not as dramatically.

From 1990 to 2010 the Government's policy was one of extensive growth across all sectors (Do Phu Tran Tinh, 2012), with the industrial and services sectors each contributing around 40% of output annually (Breu et al., 2012). In 2010, the Party Congress added a policy that gives greater attention to the quality, efficiency and sustainability of economic growth (Do Phu Tran Tinh, 2012).

There is debate on what has driven Viet Nam's growth. Some argue that it has been driven largely by investment in capital assets (Phan Minh Ngoc, 2008; Pham Lan Huong, 2013). Investment outstripped GDP growth between 1996 and 2011, growing by 11.4% each year (Pham Lan Huong, 2013), and accounted for an average of 30.5% of GDP between 1994 and 2011, peaking at 46.5% in 2007 (WDI; Pham Lan Huong, 2013). Growth during the 1990s has also been attributed to improvements in productivity (World Bank, 2012). Slower growth since 2010 has been attributed in part to adjustments following the Government's move away from capital formation as the main source of growth (Mishra and Viet Tuan Dinh, 2012). Another view is that growth has been export-led, with investment enabling production for export but not actually driving economic growth (Arkadie and Mallon, 2004). Growth from 2005 to 2010 has also been attributed to a structural shift from agriculture to manufacturing, the expansion of the labour force and productivity gains (Breu et al., 2012).

Although economic growth has been impressive it has favoured higher-income households more than the poorest. Especially in rural areas, the gap between the richest and poorest has widened: the ratio of the average income of the top 20% to the average income of the bottom 20% increased between 2004 and 2010 from about 7 to 8.5 (World Bank, 2012). The gap between ethnic minorities and the rest of the population has also widened, with the average income of the majority ethnic groups' bottom 20% increasing to more than double the average of the ethnic minorities' bottom 20% in 2010, from one and a half times higher in 2004 (World Bank, 2012).

2.1.2 Production and consumption of energy

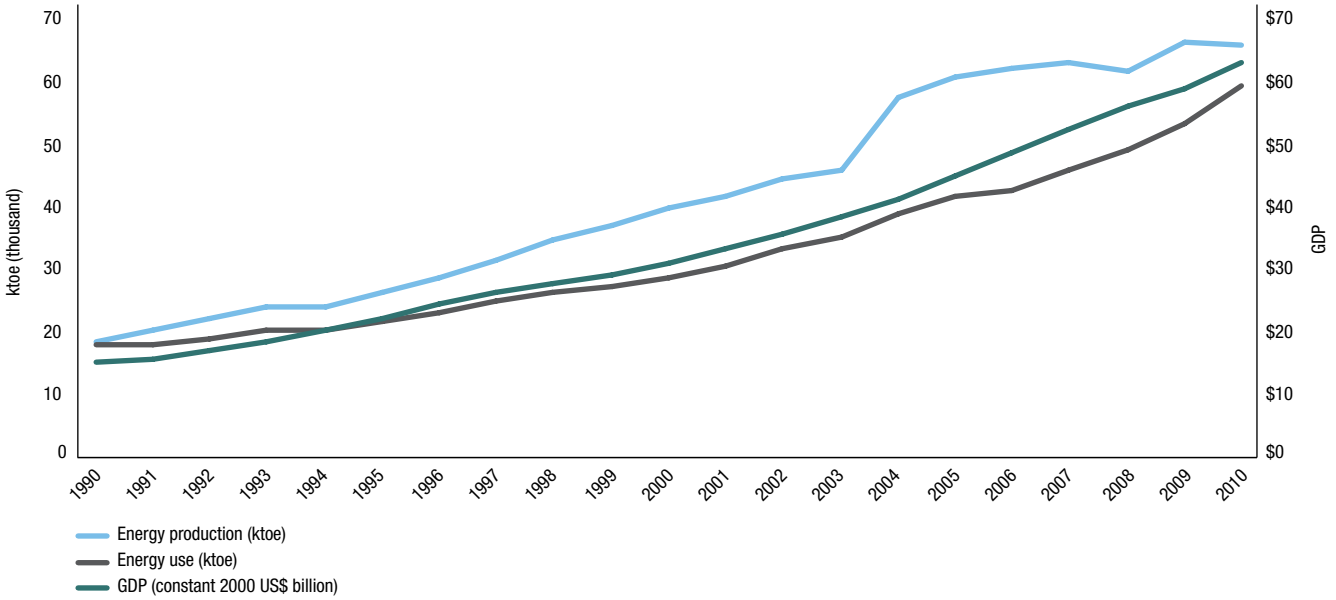
While there may be debate on what, exactly, has driven Viet Nam's rapid economic growth, one thing is clear: it has been accompanied by rapid increases in the production and consumption of energy (Figure 1), with overall energy production exceeding consumption throughout the period 1990-2010.

The largest consumer of energy in Viet Nam in 2010 was the industrial sector, which accounted for almost 40% of total final energy consumption (TFEC). The transport sector consumed 22%, while the commercial and agricultural sectors accounted for only small proportions, at 3% and 1% respectively (Le Thi Hanh, 2012). The residential sector, where the main source of energy is traditional biomass (i.e. wood fuel and agricultural residues, and classified in Viet Nam as non-commercial) accounted for one third of TFEC. A little over one-fifth (21%) of the total energy produced in 2010 was non-commercial energy[6] (Le Thi Hanh, 2012).

While total energy consumption has grown rapidly, Viet Nam's level of consumption is low when compared with

6 Non-commercial energy is a category comprising wood fuel, agricultural residues and other sources of energy that are not supplied through formal markets. This energy is largely for household consumption.

Figure 1: GDP and primary energy production and consumption 1990-2010



Source: WDI

global averages. In 2010, energy use per capita was just over 681 kilograms of oil equivalent (kgoe),[7] roughly one-third of the global average (1,852 kgoe/person) and of the averages seen in China (1,807 kgoe/person) and Thailand (1,768 kgoe/person). Final energy consumption per capita was 528.6 kgoe in 2010.[8]

Moreover, growth has been characterised by a marked shift away from renewables and towards fossil fuels. The energy picture in Viet Nam experienced a major shift between 1990 and 2010 (Figure 2, overleaf): in the space of just two decades, the composition of the country's primary energy supply changed from mainly renewable sources to mainly fossil fuels. While solid biomass as a proportion of the total was significantly lower in 2010, the overall quantity of biomass energy supplied had increased by 18%, and hydropower supply increased fivefold. This shift in primary energy supply is shown in Figure 2.

In 2010, Viet Nam produced a total of almost 70,000 kilotonnes oil equivalent (ktoe) of energy from all sources, imported almost 14,000 ktoe and exported around 21,000 ktoe. Total primary energy supply (TPES) amounted to just over 64,000 ktoe, and TFEC stood at around 50,500 ktoe.[9]

Viet Nam was a net exporter of energy in 2010 (Le Thi Hanh, 2012), and had been for most of the previous two decades. Viet Nam's main energy exports in 2010 were coal and crude oil, with 42.4% of coal production and 53.3% of oil production exported that year. By 2020, however, Viet Nam is expected to become a net importer of energy as a result of growing demand (MOIT, 2009; Pham Khanh Toan et al., 2011).

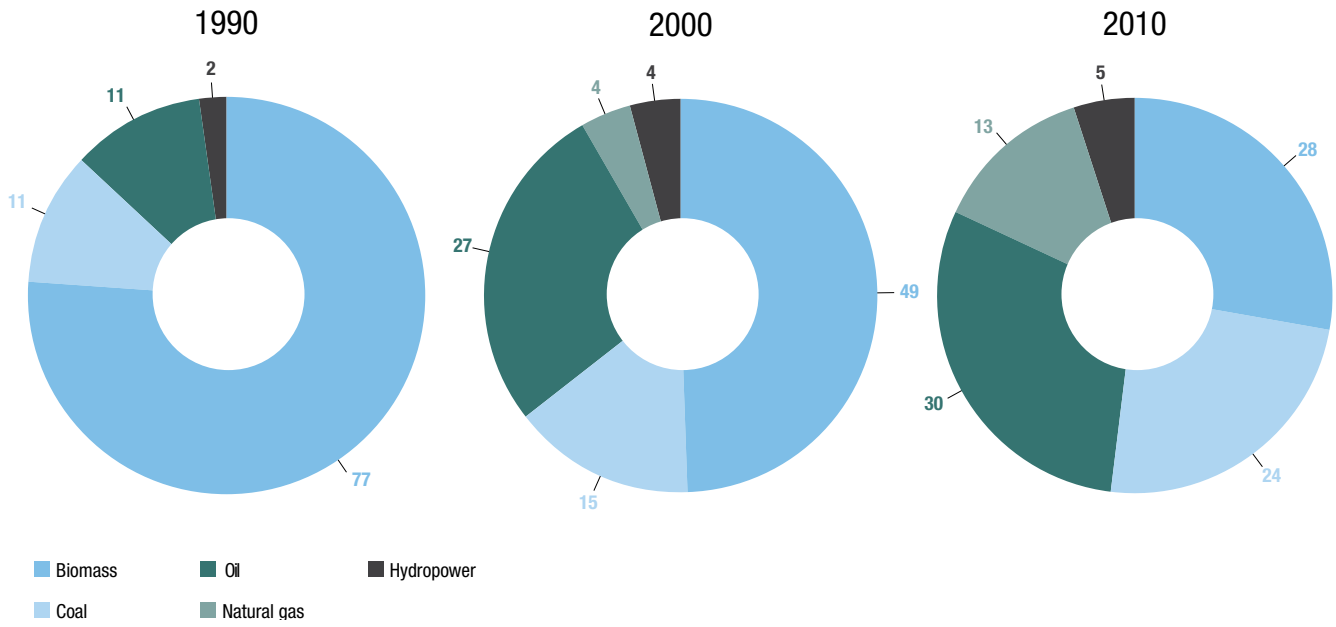
Oil production peaked in 2004 and has played a key role in the country's economic development, accounting in some years for 25% of exports and generating revenue equivalent to 25% of the government budget in the period 2000-2005 (WDI; General Statistics Office, GSO). By 2010 the contribution of oil revenues had fallen as a proportion of the budget to 12.4%, while increasing in terms of its value (in current prices) from 23,534 billion Vietnamese

7 Kgoe is a unit of energy equivalent to the amount of energy contained in a kilogram of crude oil. Energy use per capita 'refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport' (WDI).

8 Calculated from SE4ALL database figures, converting from joules to kgoe and using WDI population data. Final energy consumption covers all energy supplied to the final consumer for all energy uses, i.e. it excludes energy stock changes and energy consumed during the transformation of primary fuels (e.g. crude oil) to end-use fuels (e.g. diesel).

9 There is some variation between sources in the figures for TFEC. The International Energy Agency has 55,647 ktoe in 2009, the SE4ALL database has 49,950 ktoe in 2010 (calculated from their joules figure), and Le Thi Hanh (2012), for GoV, has 50,547 ktoe. The trend, however, is the same in all the datasets examined.

Figure 2: Composition of total primary energy supply in Viet Nam (%)



Sources: Asia Pacific Energy Research Centre (1990) and SE4ALL database (2000, 2010)

dong (VND) (approx. $1.48 billion) to VND 69,170 billion (approx. $3.55 billion).

Viet Nam's output of raw coal increased almost ten-fold between 1990 and 2010, from under 5 million tonnes to 47.5 million tonnes. A large proportion of this coal was exported: a total of 19 million tonnes in 2010, accounting for 40% of the raw output (Tran Xuan Hoa, 2011). In value terms, however, raw coal has accounted for only a small proportion of total exports.

Natural gas production began in 1995 and expanded to 290 billion cubic feet per day in 2010, double the output in 2005, with Viet Nam consuming almost all of the gas it has produced domestically.

TFEC increased from about 22,500 ktoe in 1990 to almost 55,647 ktoe in 2009, as shown in Figure 3 (International Energy Agency, IEA). Total consumption increased by an average of around 5% per year over this period, with the average rate higher in the second decade than in the first (6.3% compared with 4.5%), but there was noticeable variation between years (see Figure 4).

Per capita final energy consumption in 1990 stood at around 243 kgoe, less than half the level in China and Thailand and below the level in Laos. By 2010 this had more than doubled to 529 kgoe, though the rate of increase in per capita final energy consumption lagged slightly behind growth in GDP per capita (Figure 5, page 16). Per capita energy consumption in 2010 was still below the level of consumption in China 20 years earlier (see Figure 6, page 16), highlighting that Viet Nam's level of energy consumption is low by world standards. Viet Nam did, however, overtake neighbouring Laos in the mid-1990s.

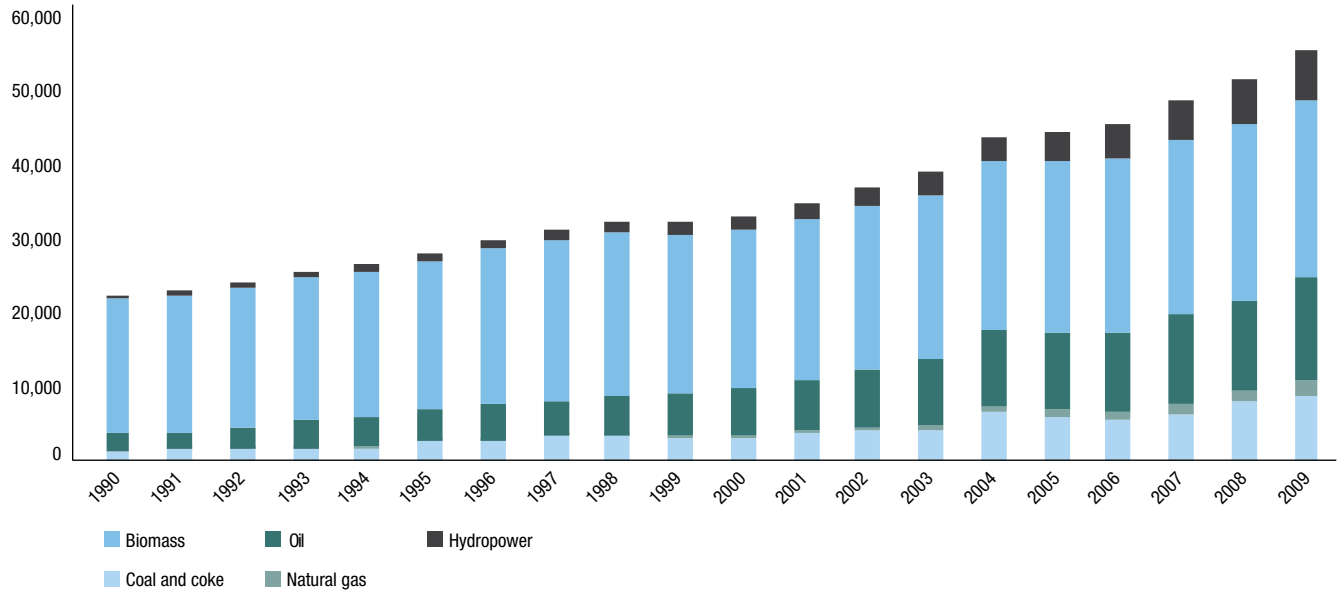
2.1.3 Investment in energy

Although economic growth in Viet Nam has been driven by investment, at least in part, and investment was necessary to expand energy production, it is reasonable to ask what investment in the energy sector contributed to overall growth. Unfortunately a lack of information about annual investment in primary energy production (in aggregate or by energy source) makes it impossible to answer this question. What we do know is that foreign direct investment (FDI) provided 21.7% of total investment between 1996 and 2011 (Pham Lan Huong, 2013), and a significant proportion of this investment went to the oil and gas industry, which accounted for around 20% of FDI in the period 1992-2000 (Arkadie and Mallon, 2004) and 41% in 2010 (Breu et al., 2012).[10]

Overall investment by the state, including investment financed from official development assistance (ODA), averaged 47.8% of total investment in the same period. Government policy was, however, to focus public investment on infrastructure to support the development of productive sectors (Arkadie and Mallon, 2004). In the energy sector, this included investment in power generation, transmission and distribution, leaving investment in oil and gas extraction to the domestic private sector and to FDI.

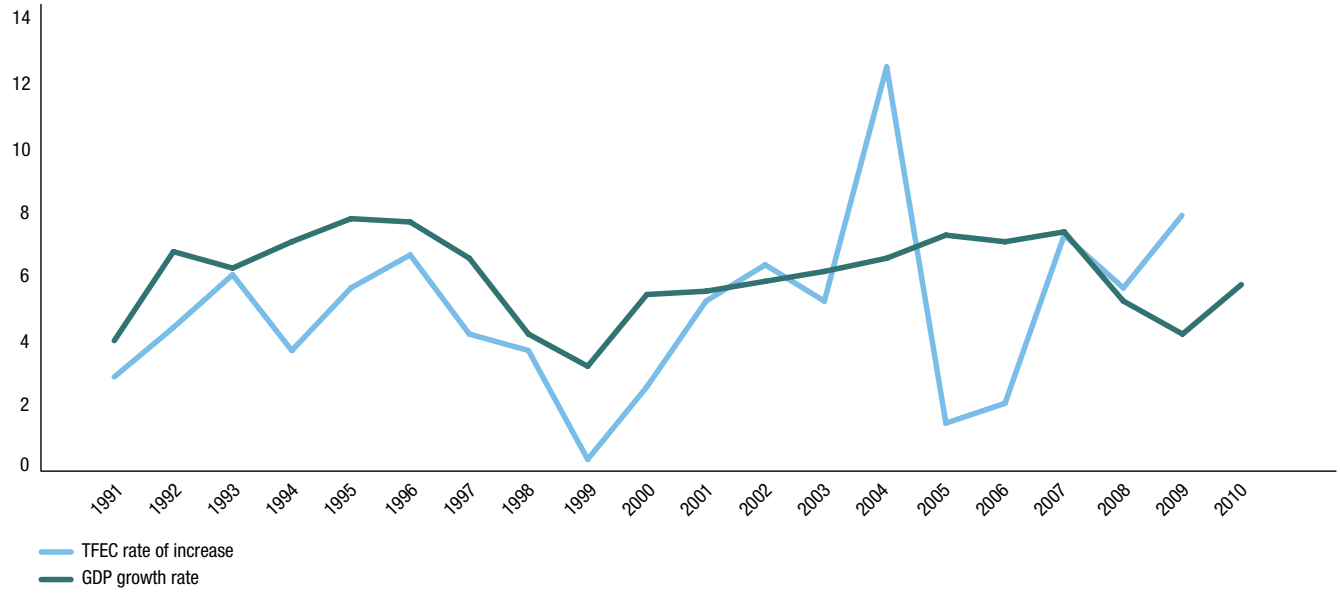
10 Total FDI grew from $295 million in 1992 (Arkadie and Mallon, 2004) to $21.5 billion in 2010 (Breu et al., 2012).

Figure 3: Total final energy consumption 1990-2009 (ktoe)



Source: IEA

Figure 4: Growth rates of TFEC and GDP (%)



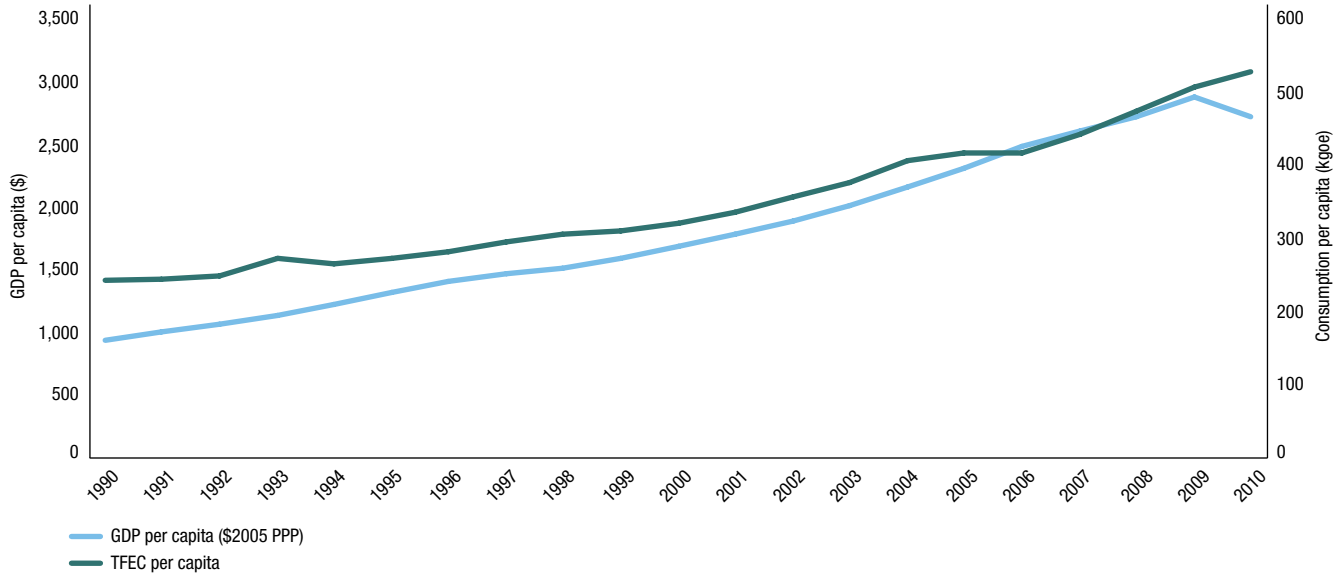
Source: IEA/SE4ALL (TEFC) and WDI (GDP)
Note: The 1999 dip in growth rates followed the Asian financial crisis. The 2004-2005 fluctuation shown in TFEC is largely due to changes in total final consumption of coal, according to IEA statistics.

2.1.4 A tenfold expansion of electricity production

The expansion of Viet Nam's electricity sector has been remarkable, with a tenfold increase in electricity production over the period 1990-2010, from around 8,700 GWh to almost 95,000 GWh – a far greater proportional increase than seen in TFEC (Figure 7, page 17). The average rate of increase over this period was 12.7% per year, with more rapid growth in the mid-1990s and the early 2000s. As shown in Figure 8 (page 17), per capita electricity consumption grew at about twice the rate of GDP per capita after 1993, increasing from around 98.1 kWh in 1990 to around 1,035 kWh in 2010.

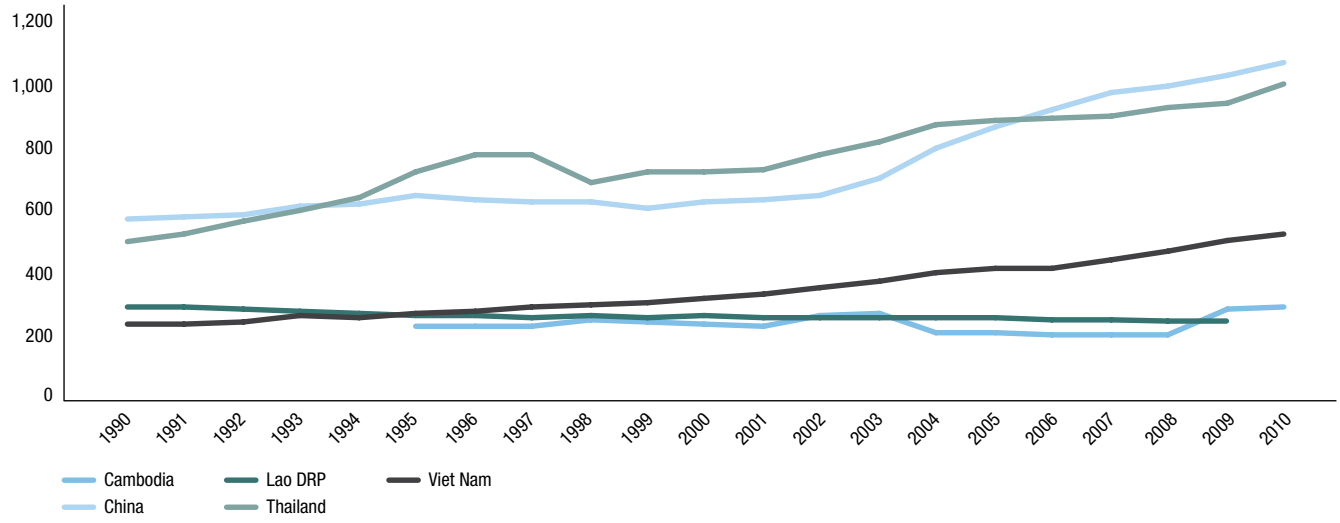
Electricity generation capacity ran ahead of demand, although the margin between peak demand and capacity

Figure 5: Final energy consumption per capita and GDP per capita



Source: SE4ALL database and WDI

Figure 6: Total final energy consumption per capita (kgoe) in South-East Asian countries



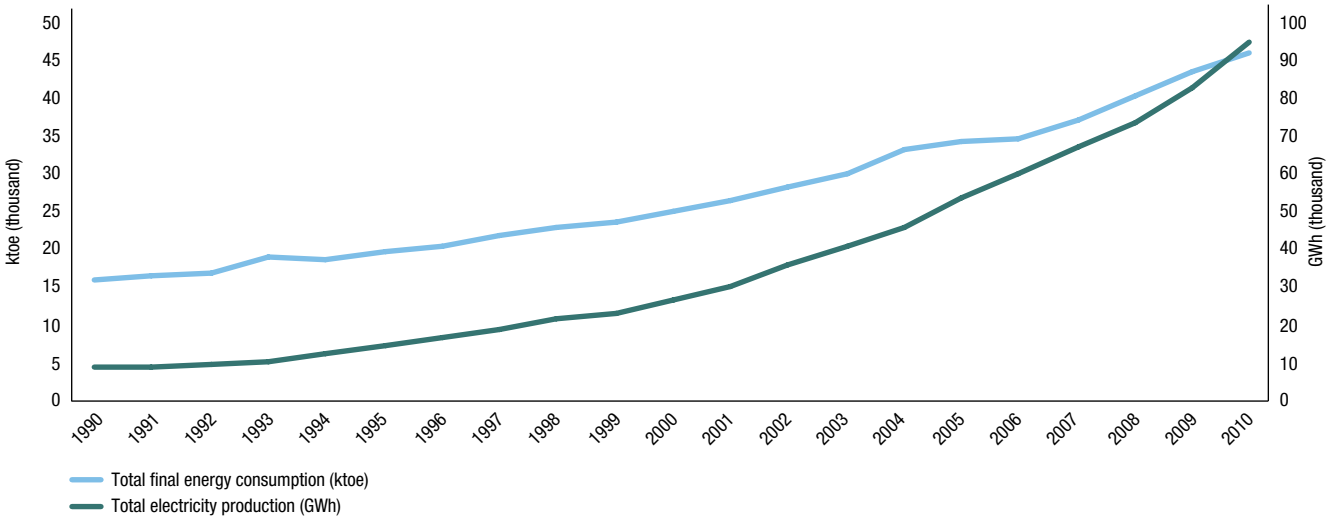
Source: SE4ALL database

was not enough to avoid load-shedding in some years. Excess supply in the north and the development of new hydropower plants in the mid-1990s helped to ensure a supply of electricity to rural areas (World Bank, 2011a). The total maximum capacity of Viet Nam's power stations increased from 2.5 GW in 1990 to just over 20.5 GW in 2010, another tenfold increase (Figure 9, page 18). By 2012, capacity had expanded even more, to around 26.5 GW (Trinh Quoc Vu, 2013).

This huge increase in total capacity was accompanied by a shift in the energy mix used for electricity generation. In 1990, 46% of generation capacity was hydropower and 36% coalfired, with 18% accounted for by oil and gas power stations. By 2009, the hydropower proportion was lower, at 37%, and gas-fired generation had increased to 38% of total capacity (Electricity Regulatory Authority of Viet Nam, ERAV, 2010). The share of coal had fallen, but is set to increase under current plans for the sector.

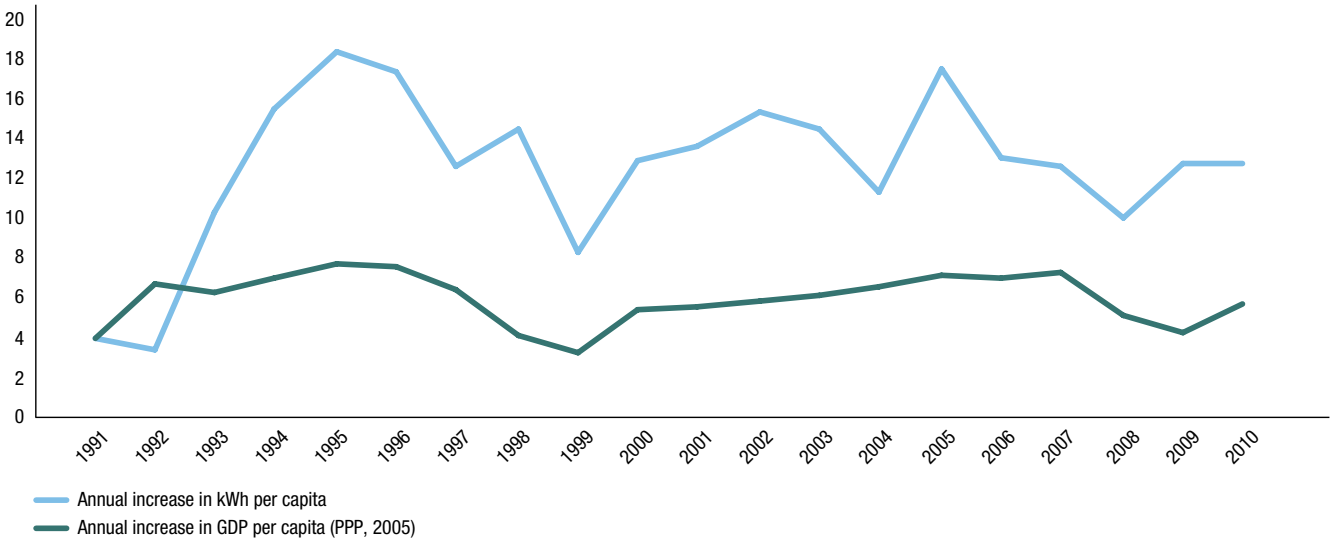
The extension of the transmission and distribution grid was just as important for access to electricity as adequate generation capacity. One critical development was the construction of a 500 kV transmission line, 1,490 km

Figure 7: Total final energy consumption and total electricity production 1990-2010



Source: SE4ALL database and WDI

Figure 8: Annual growth rates in per capita electricity consumption and GDP per capita (%)

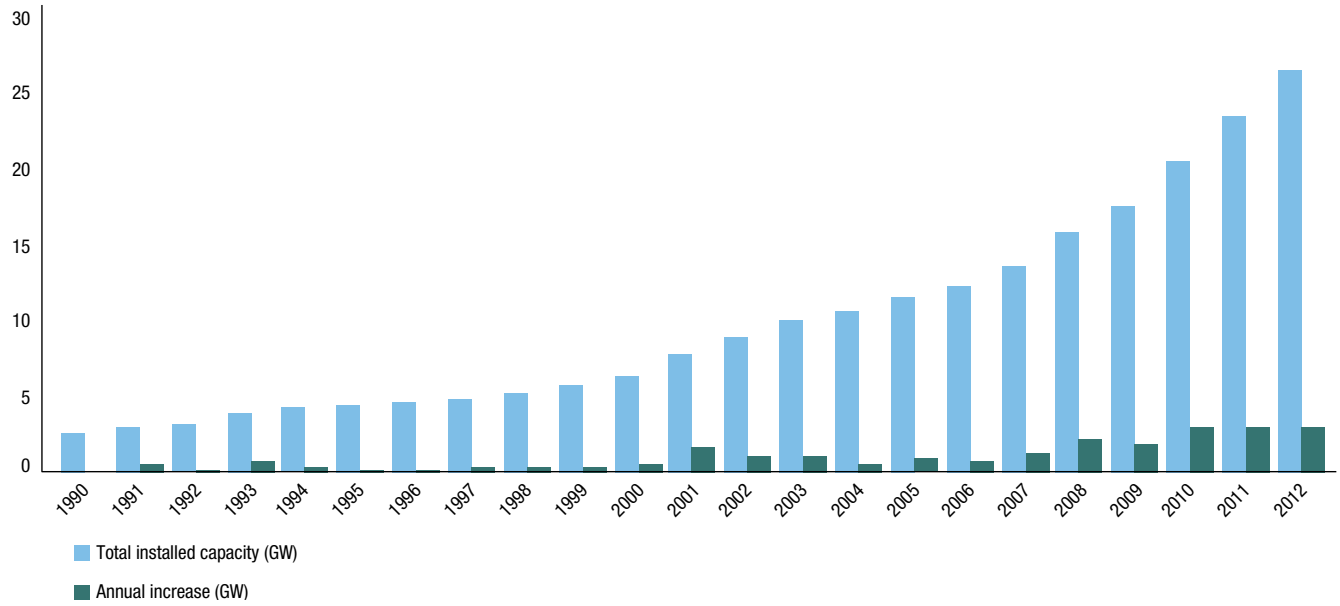


Source: WDI

long, in the early 1990s. This established a national grid and allowed the power produced by major hydropower plants to serve the whole country (Asian Development Bank, ADB, 2011). By 2010, there were almost 16,230 kilometres of high-voltage (HV) transmission lines (500 kV, 220 kV and 110 kV), while the medium-voltage (MV) network had expanded from around 17,140 km in 1998 to more than 135,370 km in 2010 (ERAV, 2010; World Bank, 2011a). Transmission and distribution losses were high during the early 1990s – over 25% in some years – but losses had been reduced to around 10% by the end of the period.

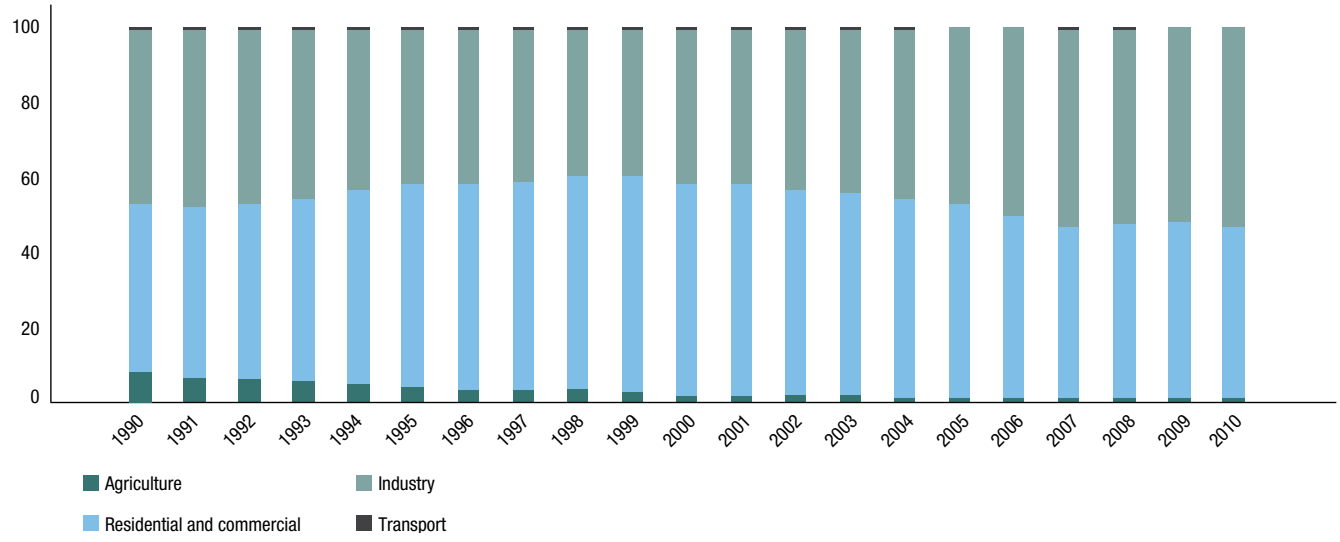
Industrial and residential consumers have accounted for most of the electricity consumed over the past two decades (Figure 10, overleaf). In 1990 the agriculture sector consumed about 10% of the total, reflecting the importance of agricultural production in the economy and the contribution of electricity to the sector. By 2000, that sector's proportion had fallen to less than 2% and by 2010 it had dropped to 1%, although the actual quantity of electricity consumed in agriculture had increased. The residential sector saw the greatest increase in electricity consumption, both in terms of kWh and as a proportion of the total consumed.

Figure 9: Total installed generation capacity 1990-2012 (GW)



Source: Asia Pacific Energy Research Centre (APERC) database and Trinh Quoc Vu (2013)

Figure 10: Proportion of electricity consumed by sector 1990-2010 (%)



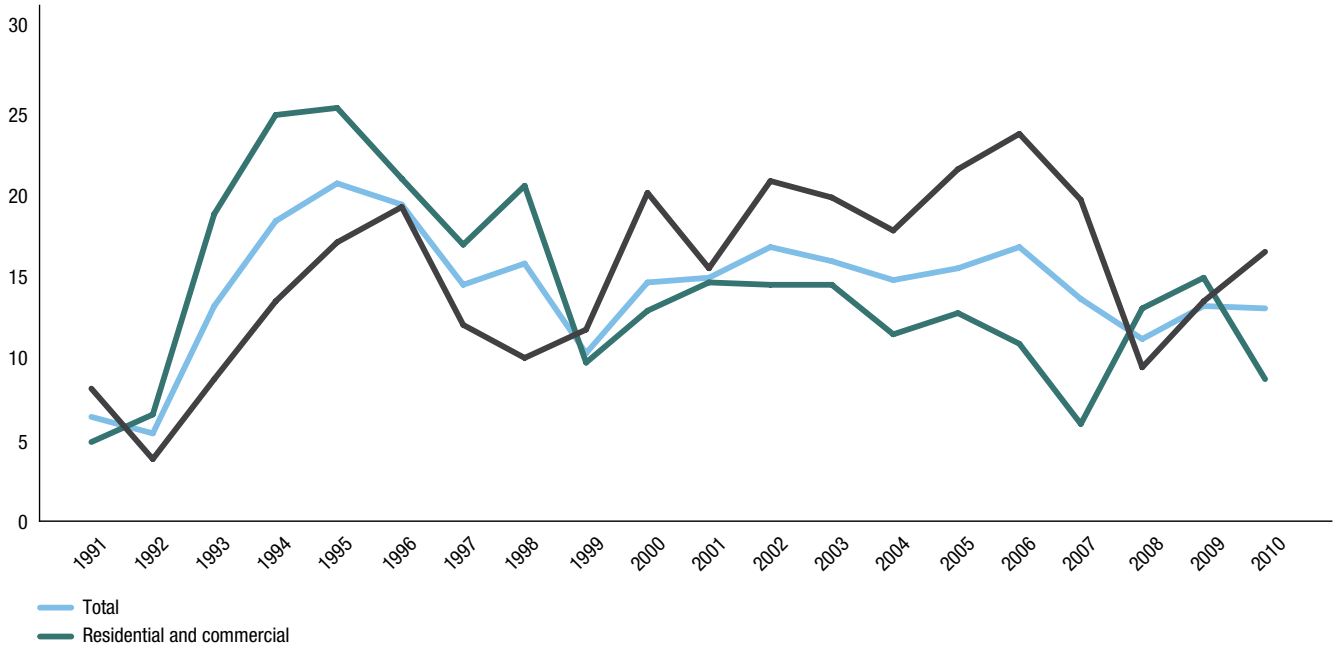
Source: Asia-Pacific Economic Cooperation (APEC) database

As shown in Figure 11, electricity consumption in the residential sector grew at a faster rate than in industry until 1999, while the industrial consumption of electricity grew at a faster rate than residential consumption until the financial crisis of 2008.

2.2 Household access to modern energy

Viet Nam's progress on household access to electricity has been much faster and has gone much further than that seen in most other countries at a similar income level. Between 1990 and 2010 the proportion of the population

Figure 11: Rate of increase in electricity consumption by key sector 1991-2010 (%)



Source: APEC database

with access to electricity increased from about 14% to 97% (Figure 12, overleaf).[11]

By 2010, all but 3%-4% of Viet Nam's people had access to electricity. The national census in 2009 recorded that 96.1% of households had electricity in their homes (GoV, 2010). The 2010 Viet Nam Household Living Standards Survey found that 97.2% of households used grid electricity as their main source of lighting, and a further 1.2% of households used batteries or generators (GSO, 2011).

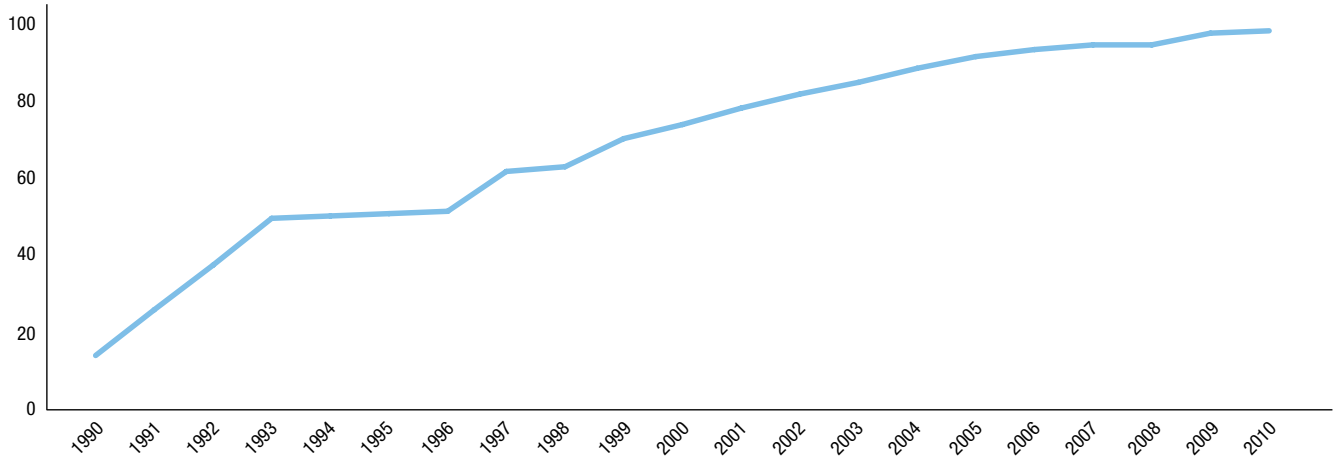
The main changes enabled by a supply of electricity are substitution of electric light for traditional lighting and the replacement of physical labour by mechanical agro-processing and water pumping. Electricity is used by rural households mostly for lighting, entertainment and communications, and for productive uses by only a small minority of better-off households (Khandker et al., 2009). This is consistent with findings in other countries, and it is these uses of electricity, therefore, that provide benefits to poor households (Pueyo, 2013). These benefits include improved education, comfort, safety, health and communications, as well as higher productivity in home-based economic and domestic activities.

There was particularly rapid growth in access to electricity during the 1990s (Table 1, overleaf). Between 1990 and 1996, over 6% of the population gained access each year on average and between 1990 and 1998, access levels increased from 14% to 61%. In some years, more than 2 million households were connected to an electricity supply. Growth in household electricity access has been higher than would have been expected, given the country's income levels (as shown in Figure 13, overleaf).

The foundations for rural electrification were laid during post-war reconstruction in the late 1970s and early 1980s, when the expansion of rice production was a key objective. Electricity for pumping irrigation water and post-harvest processing was seen as essential, leading to electrification in the rice-producing Red River Delta in the north and the Mekong Delta in the south (ADB, 2011). The expansion of hydropower-generation capacity in the 1980s was followed by investment in transmission and distribution infrastructure in the 1990s, including the 500 kV backbone connecting the north and south, and additional generation capacity. While the establishment of a national grid bore aspects of national unification and allowed nationwide power-sector planning, the priority

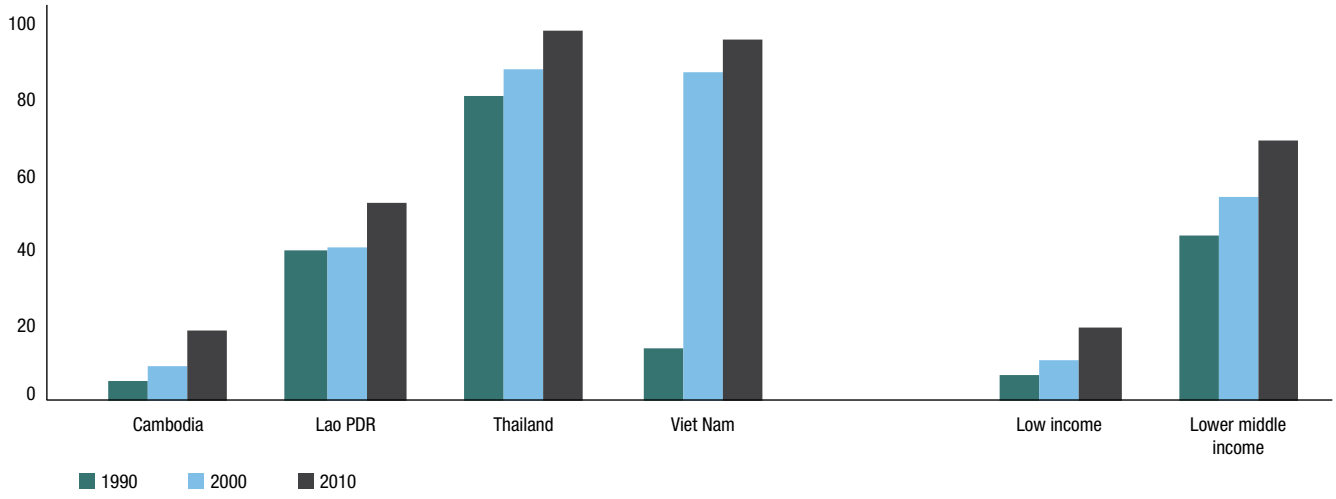
11 Estimates of the level of access to electricity in Viet Nam before 1995 vary widely and are sometimes inconsistent. According to GoVN figures, 14% of the population in 1993 had access (Van Tien Hung, 2009). The SE4ALL Global Tracking Framework (SE4ALL, 2013) erroneously suggests that 87.9% of the population had access to electricity in 1990. England and Kammen (1993) quote two different sources: one saying more than 50% of the rural population lacked access to the grid, c.1992, and one suggesting that 25% of the total population had access. Dollar et al. (1998), analysing household survey data, concluded that 49% of the total population used electricity for lighting, and that communes that accounted for 43.1% of the rural population had an electricity supply. Le Quang Binh (2008) cites a percentage of 43% having access in 1993. The World Bank's review of its experience in rural electrification in Viet Nam puts the figure at 13.9% in 1990, 49% in 1993 and 14% in 1993/4 (World Bank, 2011a). For this study, we are taking the level of access in 1990 to have been 14% of the population and, with less certainty, a level of 49% in 1993.

Figure 12: Population with access to electricity (%)



Source: SE4ALL database

Figure 13: Population with access to electricity in low-income, lower-middle-income and SE Asian countries, 1990, 2000 and 2010 (%)



Source: SE4ALL database (Viet Nam figures corrected)

Table 1: Population gaining access to electricity each year

	1990-1995	1996-1999	2000-2004	2005-2009	1996-2004	2000-2010
%	6.13	5.75	3.54	1.3	4.4	2.69
	4.047m	4.143m	0.987m	0.278m	3.889m	3.127m

Source: calculated by authors from SE4ALL database and World Bank, 2011a

for electricity continued to be to increase production for economic growth. The establishment of Electricity of Viet Nam (EVN) in 1995 introduced a clearer legal and regulatory framework and opened up the possibility of commercialisation and private sector investment in the power sector.[12]

In the 1990s, electrification extended out from the cities and towns. As generation capacity in the north began to exceed demand the Government was able to consider options for the use of this supply (World Bank, 2011a). Priorities for electrification to meet the needs of agricultural and industrial production began to

12 EVN is now responsible for HV transmission and MV distribution. EVN also undertakes low-voltage (LV) distribution in some places, including the main urban centres (World Bank, 2011a).

accommodate electrification for poor rural households (ADB, 2011). Nevertheless, rural electrification was seen as providing households the power to pump water for irrigation, as well as to supply lighting (United Nations Development Programme, UNDP, 2007).

In the 2000s, the Government increased its support for rural electrification, with an emphasis on remote areas and on household rather than commune connections. The national poverty-reduction programme, Program 135, targeted at disadvantaged communes in remote and mountainous areas, became one of the main vehicles providing government support for electrification. While the focus of rural electrification efforts transferred to remoter locations, planning for electrification continued to be based on extension of the national grid. Although electricity distribution to households was managed locally, only 51 of Viet Nam's 9,000 communes (56,000 households) relied on off-grid power in 2009 (ADB, 2011). In remote areas the costs of extending the grid to provide electricity can exceed the costs of off-grid options (World Bank, 2011a), though informants interviewed for this study tended to regard off-grid options as more costly and less reliable.

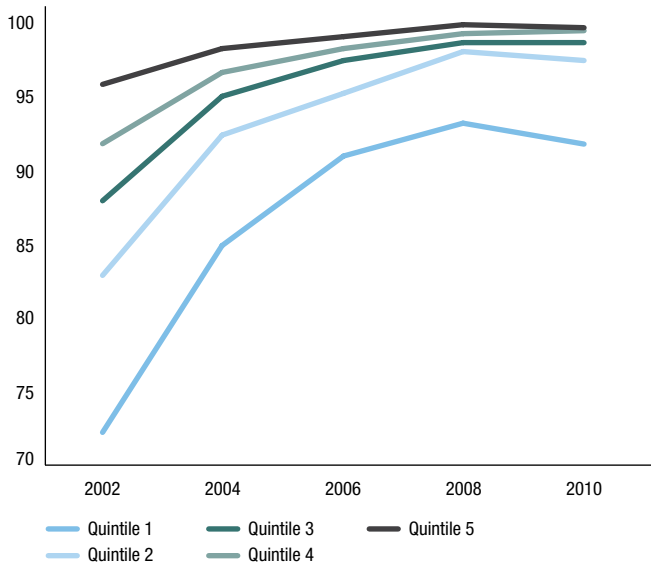
2.2.1 Equity in access to electricity

The Government's targets for access to electricity have been specified in terms of the number of communes and, more recently, the number of households connected to an electricity supply. As the SE4ALL Global Tracking Framework recognises, a more qualitative measure is necessary to assess the extent to which access translates into actually meeting people's energy needs (SE4ALL, 2013).

Viet Nam's 2010 Household Living Standards Survey found that 23.3% of households rated their electricity (over the previous 30 days) as 'not enough' to meet their needs, 72.3% said 'just enough' and 3% said 'more than enough' (GSO, 2011). The survey also revealed significant disparities by location, ethnicity and income.

A far higher proportion of urban households were more satisfied with their electricity supply: only 15.1% said that it was 'not enough', compared with 26.9% of rural households.[13] Geographically, more households (over 35%) in the north-east, north-west, and north-central coast regions were dissatisfied with their electricity supply. More ethnic-minority households (30.1%) said they did not have enough electricity to meet their needs than households from the majority Kinh and Chinese ethnic groups (22.3%). The difference between income levels is also significant, with 28.4% in the poorest quintile saying 'not enough' compared with 16.8% in the richest quintile (GSO, 2011).

Figure 14: Proportion of households with grid electricity as main source of lighting by income quintile (%)



Source: Viet Nam Household Living Standards Survey 2010

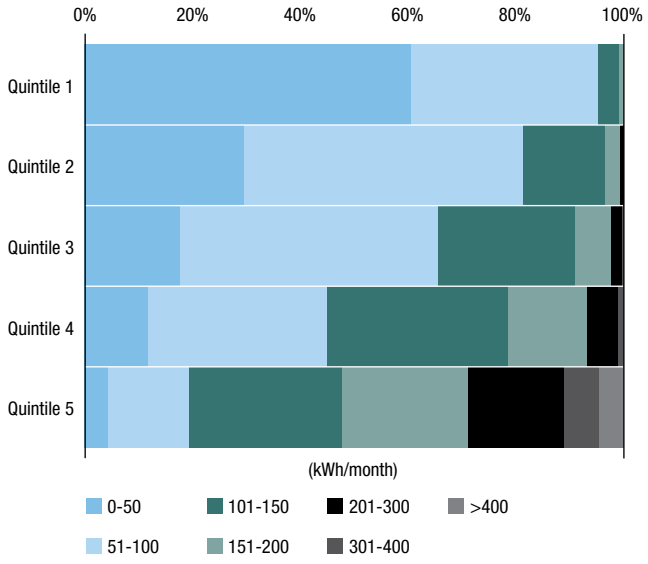
As might be expected, the proportion of poorest households (quintile 1 in Figure 14) with access to electricity is consistently lower than the proportion for other income groups. In 2010, 91.6% of households in the lowest income quintile had access, compared with 99.3% of those in the highest income group (GSO, 2011). This is supported by analysis of panel data from the Viet Nam component of the Young Lives study, which reveals that amongst households that remained out of poverty between 2006/07 and 2009, the proportion with access to electricity increased from 97.4% to 99%, while the proportion that remained below the poverty line increased from 88.7% to 91.6%.[14] In 2006/07, 59.2% of those without access to electricity indicated that this was because it was physically unavailable; 21.1% said it was because they could not afford it.

Figure 15 (overleaf), which shows the pattern of household electricity consumption across income groups in 2010, reveals the differences across income groups. Almost all of those in the lowest income quintile were consuming less than 100 kWh per month, and 60% were on the lifeline tariff (consuming less than 50 kWh per month), as were most of the households in the second and third income quintiles. Among the wealthiest households (quintile 5), only around 20% consumed less than 100 kWh, while around 25% consumed more than double that amount. Clearly, the amount of electricity used by

13 Dissatisfaction in urban areas may be related to the significant proportion who do not get their supply directly from the utility (10.1%) and the number who share a meter (8.7%) (UNDP, 2010).

14 The Young Lives study is conducting research on childhood poverty over a period of 15 years in four countries (www.younglives.org.uk). Analysis of the data from Viet Nam was originally undertaken by Lucy Scott for the Chronic Poverty Advisory Network in early 2013.

Figure 15: Electricity consumption by income quintile



Source: Thang (2012)

electrified households soars as they acquire more electrical appliances (World Bank, 2011a).

Expenditure on electricity by households that have a connection accounts for only a small proportion of total household expenditure and a minor proportion of their total expenditure on energy. The most recent analysis, for 2006, shows little variation across income groups in the proportion of household expenditure devoted to electricity (Table 2), averaging just 3%. This is consistent with the 3.5% share of total household expenditure spent on electricity according to a 2003 study, which also revealed significant differences between rural and urban households, which spent 2.9% and 5.6%, respectively, of their total expenditure on electricity (Heltberg, 2003).

A survey in northern Viet Nam in 1992 found that electricity accounted for between 4% and 13% of total household energy consumption (measured in terms of kgoe), with higher proportions among urban households (Nguyen and Lefevre, 1996). Expenditure on electricity was estimated to account for 12% of total household energy expenditure in 2003, 13% in 2005 and 10% in 2008 (World Bank, 2011a). Table 2 suggests that, on average, electricity consumption accounted for one-quarter of household energy expenditure.

Distinguishing between electricity for lighting and electricity for appliances, a study in the 1990s found that electric lighting accounted for between 2.3% and 4.4% of household energy consumption, depending on income and location, while electricity for appliances accounted for 0.7% to 16.7% of total energy consumption, with higher income groups in urban areas not surprisingly consuming the highest proportion (Nguyen and Lefevre, 1996). This suggests that higher expenditure on electricity consumption among households with higher incomes can be explained by their greater use of electrical appliances, including equipment for productive purposes. For most households, however, the use of electricity is limited to lighting, entertainment and communication.

Although most households in Viet Nam consume a small quantity of electricity, the impact on their lives is reported to be significant, but the empirical evidence for this impact is quite limited, as it is elsewhere (Pueyo, 2013). Improvements in education following electrification are commonly reported in the literature (Pueyo, 2013), and in Viet Nam one study found that in communes that were connected to the grid between 2002 and 2005, school enrolment increased by 17.1% for boys and 14.8% for girls (Khandker et al., 2009). Communes that had an electricity supply were generally better off than those without, and communes that had had a connection for more than 10 years were better off than the others (Khandker et al., 2009).

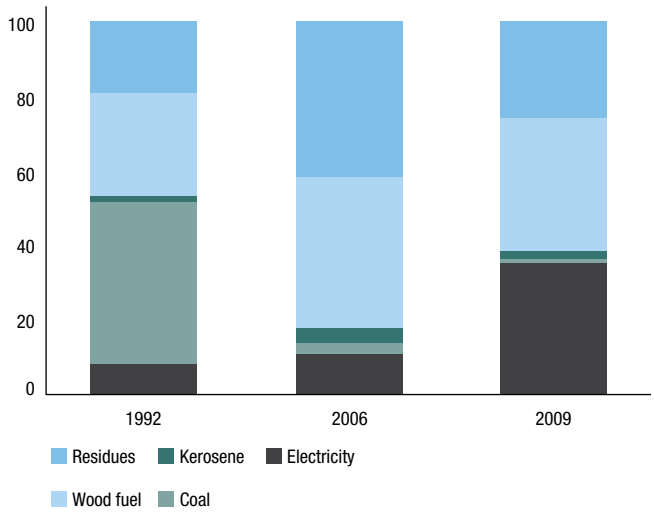
The ownership of durable goods is another indicator of the benefits that electricity brings. A survey in 1992 found that the most common household appliance is an electric fan, which increases comfort and indoor air quality, followed by a television set, which provides both entertainment and information (Nguyen and Lefevre, 1996). In 1997, 49.7% of households owned a television and 8.3%

Table 2: Share of household expenditure on various energy sources by quintile (%)

	Q1	Q2	Q3	Q4	Q5	All
Kerosene	0.4	0.3	0.3	0.3	0.1	0.3
LPG	0.3	0.9	2.2	4.0	4.7	2.6
Gasoline and diesel	1.2	2.0	2.9	3.9	4.7	3.1
Electricity	2.4	2.8	2.9	3.2	3.7	3.0
Biomass	5.3	4.4	3.3	2.2	0.9	3.1
Total	9.6	10.4	11.6	13.6	14.1	12.1

Source: Bacon et al. (2010)

Figure 16: Share of different fuels in household energy consumption



Sources: Nguyen Anh Tuan and Lefevre (1996); Bacon et al. (2010); Accenture (2012)

owned a fridge (United States Agency for International Development, USAID, 1999). By 2010, 85.9% owned a colour television and 39.7% had a fridge (GSO, 2011).

2.2.2 Energy for cooking

The most recent analysis of household access to non-solid fuels, prepared for the SE4ALL Global Tracking Framework (SE4ALL, 2013), suggests that between 1990 and 2010 the proportion of Viet Nam's population with access to modern energy for cooking increased from under 5% to 44%. Accenture (2012) estimated the proportion to be 46.4% in 2012.

In the early 1990s, all but a small urban minority used solid fuels, such as coal, for cooking and preparing pig feed (Figure 16). There were geographic differences: in the north, and especially in urban areas, coal was used by 40%-60% of households (Nguyen and Lefevre, 1996). In rural areas, however, and especially in the south, agricultural residues and leaves were the major source of fuel.

Just two decades later, the use of coal for cooking was almost non-existent. LPG (liquefied petroleum gas), first introduced in 1993, had become the fuel of choice for those who could afford it. By 2011, almost 81% of urban households and more than 38% of rural households were using LPG for cooking (Accenture, 2012). The number of people using non-solid fuels increased from less than 3.3 million to 38.2 million between 1990 and 2010, resulting in a reduction in the number of deaths attributable to indoor air pollution.

The main driver in the switch to non-solid fuels for cooking (i.e. LPG and electricity) has been increasing household income, which has made these fuels, and the appliances that use them, more affordable for more households.

Even so, more than half of Viet Nam's people still rely on solid fuels, wood fuel and agricultural residues for cooking, and the resulting indoor pollution is the cause of more than 10,000 premature deaths each year, especially among women and children. Yet there are few – if any – government initiatives to promote cleaner, safer cooking. The handful of programmes to promote improved cook stoves have been limited in scale and confined to the non-governmental organisation sector (Accenture, 2012). One factor behind the lack of government activity in this area is the lack of any single institution with clear responsibility (UNDP, 2007).

Solid biomass, mostly wood fuel and agricultural residues used for cooking, accounted for 73% of Viet Nam's TPES in 1990. By 2000, this share had fallen markedly to 54% (Nguyen Minh Bao and Nguyen Duc Cuong, 2010). In 2010, when the share had fallen to 23% of TPES (Le Thi Hanh, 2012), the amount of biomass being used for household cooking was still equivalent, in energy terms, to double the amount of oil and gas used for electricity generation. Yet it is often categorised as non-commercial energy, and neglected by policy-makers as a result.

As well as undermining health and wellbeing, the continued reliance of more than half the population on solid fuels for cooking is a barrier to the eradication of energy poverty.

2.3 Environmental sustainability

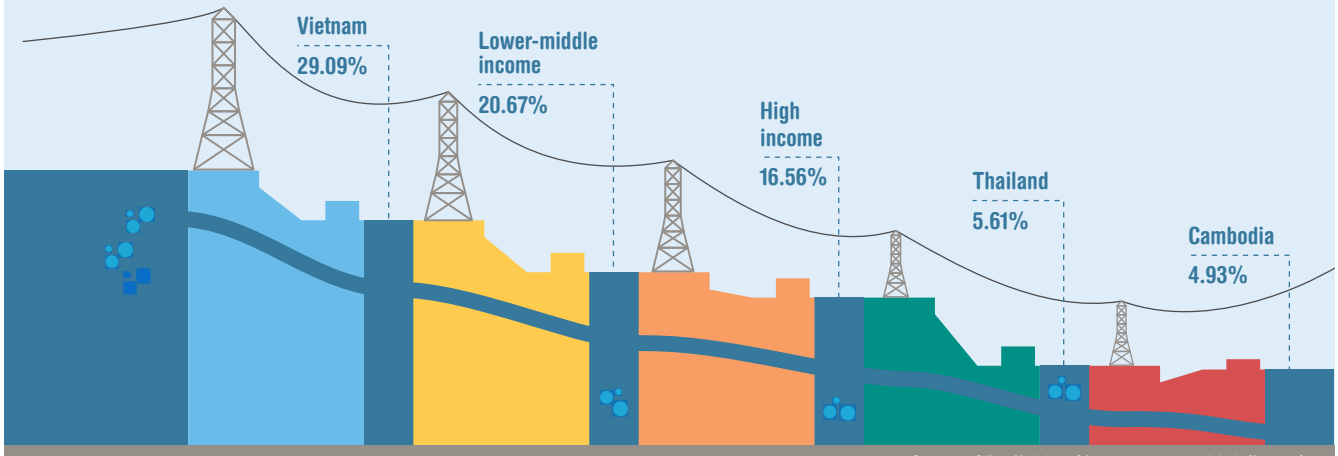
It is clear that Viet Nam's rapid economic growth and its huge progress on electrification have been accompanied by a relative deterioration in the environmental sustainability of its energy system. When looking at Viet Nam's impressive development progress story, we must also consider the resulting change in environmental sustainability and, in particular, the relative shift away from renewables and towards fossil fuels. The environmental impact of this shift is reflected mainly in GHG emissions. Emissions from the burning of wood fuel and agricultural residues, which account for most of the renewable primary energy supply, are surpassed by the removal of carbon dioxide (CO_2) from the atmosphere by crops and the expanding forested area (Ministry of Natural Resources and the Environment, 2010), and it is emissions from the consumption of fossil fuels that are the principal cause for concern.

Given the country's impressive progress on poverty reduction and rural electrification, we need to consider the environmental sustainability of electricity generation between 1990 and 2010. Given the impressive economic growth record, which has been based on the expanded use of fossil fuels, we need to examine how efficiently energy has been used to expand Viet Nam's output. And given the importance of energy for global environmental sustainability, coupled with Viet Nam's vulnerability to climate change, we need to review energy-related GHG

An access road to the Trung Son hydropower project construction site, Mai Chau district, Viet Nam. Photo: © Mai Ky / World Bank

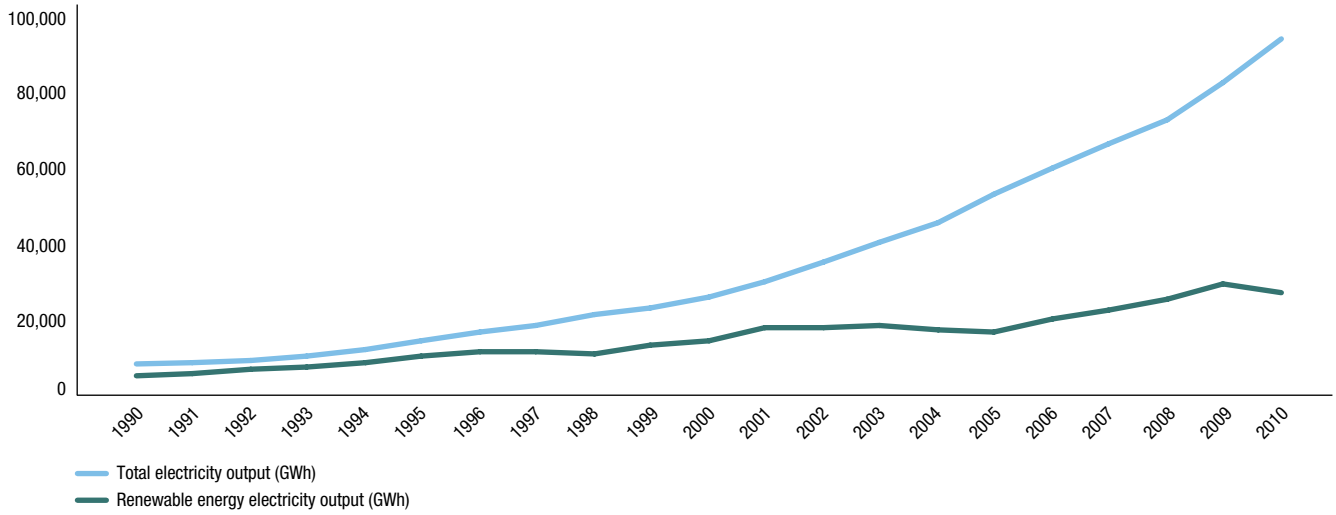
VIETNAM MAINTAINS A HIGH PROPORTION OF ELECTRICITY PRODUCTION FROM RENEWABLE SOURCES WHEN COMPARED WITH OTHER COUNTRIES

Power from renewable energy sources in Vietnam has increased by a factor of 5 between 1990 and 2010



Source: SE4all, 2013 (data represents 2010 figures)

Figure 17: Total electricity output and renewable electricity output 1990-2010 (GWh)



Source: SE4ALL database (accessed July 2013)

emissions. Together, these indicators provide a more nuanced picture of sustainable development progress.

2.3.1 The shift from renewables to fossil fuels

As a general rule, renewable energy accounts for a much larger proportion of final energy consumption in low-income countries – at 74.2% in 2010 – than it does in high-income countries: 9.3% (SE4ALL). In the world's lower-middle-income countries, the proportion of renewables tends to fall between these extremes, at 43.2% in 2010. This holds true for Viet Nam: in 1990, when it was a low-income country, 76.1% of its total final energy consumption came from renewable sources. By 2010, when Viet Nam was categorised by the World Bank as a lower-middle-income country, that proportion had fallen to 34.8% (SE4ALL). In the overall energy balance for 2010, 33% of TPES came from renewables – primarily biomass and hydropower – less than half the proportion seen in 1990 (Figure 2), though the renewable energy supply was more than three times greater in absolute terms (i.e. kgoe).

Coal, oil and gas together accounted for 67% of TPES in 2010 (Le Thi Hanh, 2012) and these fossil fuels were being consumed directly by industry and transport, as well as being used to generate electricity.[15] Over the same period, 1990-2010, the proportion of Viet Nam's electricity that came from renewable sources also halved, to 29% in 2010.

However, it should be noted that even though renewables declined as a proportion of total electricity supply between 1990 and 2010, the quantity of power they produced increased by a factor of five (Figure 17), from around 5,370 GWh in 1990 to more than 27,600 GWh in 2010 (SE4ALL, 2013). Compared with other countries in South-East Asia, Viet Nam still has a high proportion of its electricity coming from renewable sources (Figure 18, overleaf).

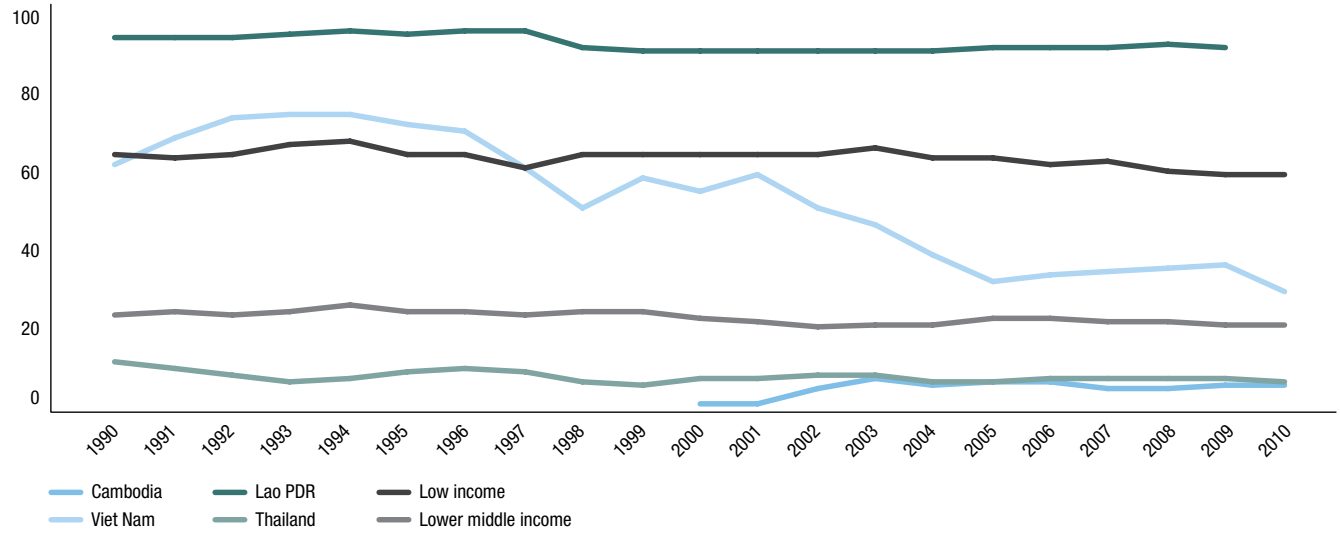
Viet Nam's installed hydropower-generation capacity increased from 675 MW in 1990 to more than 5,530 MW by 2010 and to more than 12,000 MW by 2012 (Trinh Quoc Vu, 2013) – almost all of it from large hydropower. Small hydropower capacity[16] accounted for 1,166 MW in 2010, while solar photo-voltaics generated around 2 MW and wind power about 37.5 MW (Nguyen Duc Cuong, 2012). The potential for renewable electricity generation is estimated to be an installed capacity of about 155,000 MW (Nhan Thanh Nguyen and Minh Ha-Duong, 2008), seven times higher than the total in 2010 and more than double the capacity planned for 2020.

Though large hydropower is regarded as a renewable in this study, and therefore as a contribution to the environmental sustainability of Viet Nam's energy system, its impact has not always been positive. The construction of dams displaced hundreds of thousands of people between 1990 and 2010 – many of them from already disadvantaged ethnic minorities (Dao, 2010; Pham Huu Ty et al., 2011). The construction of the recently commissioned Son La dam, for example, required the resettlement of 91,100 people from 248 villages, entailing the loss of assets valued at $116 million (Thi Minh Hang Bui et al., 2013). In general, compensation and resettlement programmes have not been able to ensure that displaced people regain their standard of living.

15 The IEA energy balance for Viet Nam in 2009 indicates that 28% of all fossil fuel supply (i.e. excluding exports) was consumed directly by industry and 27% by the transport sector. In the same year, 30% of the fossil fuel supply was used to generate electricity (IEA database).

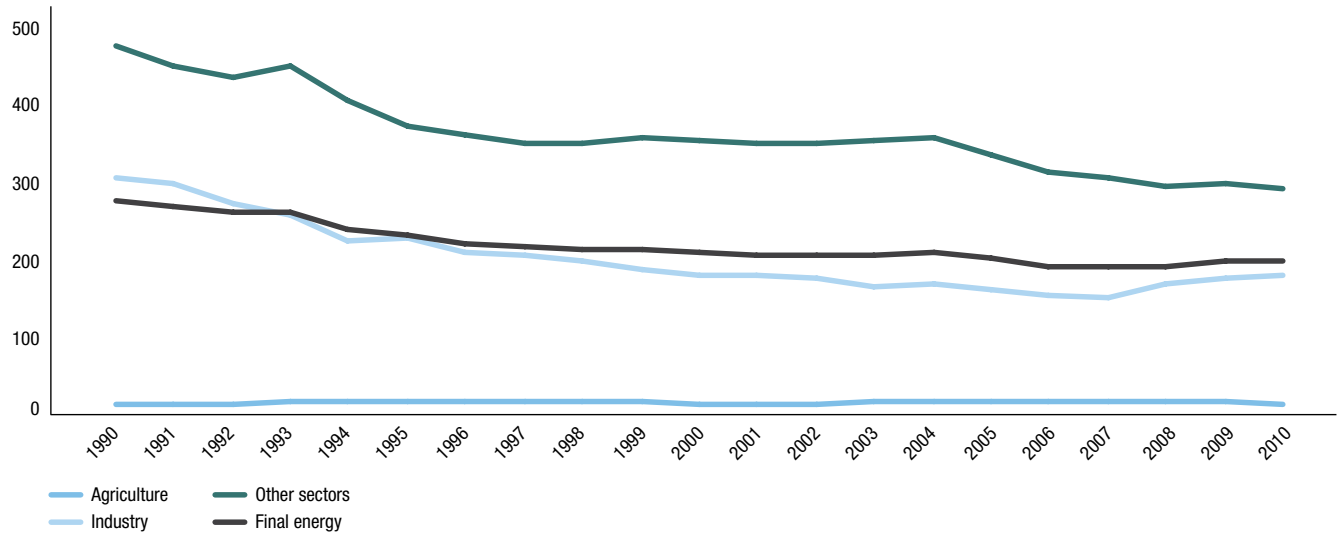
16 Defined as schemes of less than 30 MW in size.

Figure 18: Proportion of electricity production from renewable sources (%)



Source: SE4ALL database

Figure 19: Energy intensity in Viet Nam 1990-2010 (kgoe/$1000 GDP 2005 PPP)



Source: calculated from SE4ALL database

2.3.2 Energy intensity

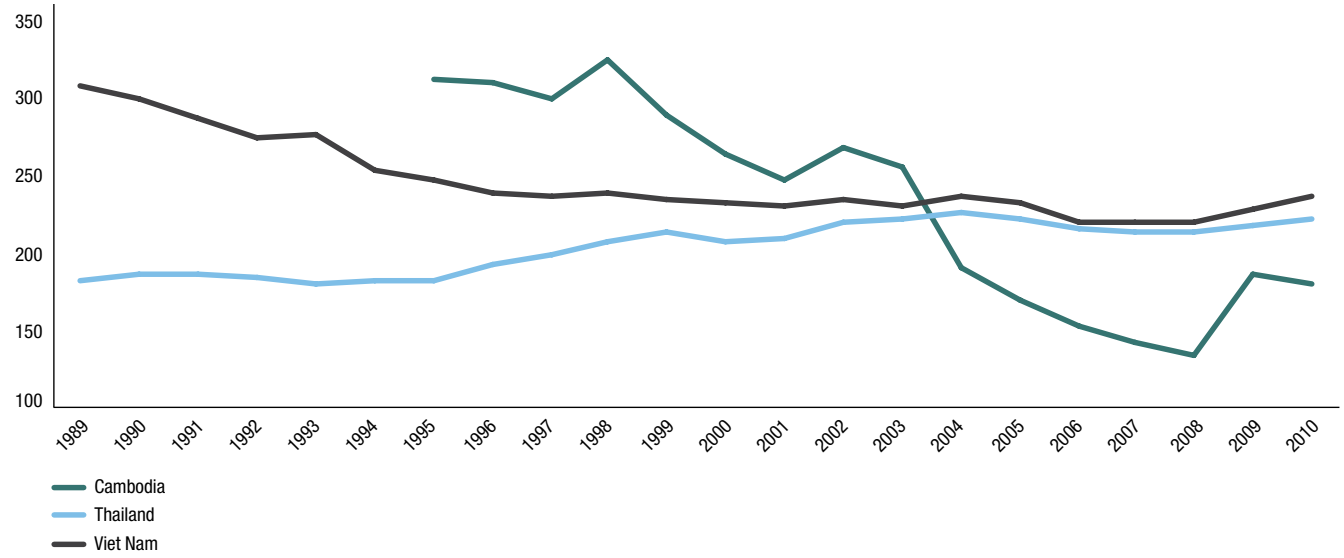
The quantity of GHG emissions is also affected by how efficiently energy is used, and improving energy efficiency can be a faster way to reduce emissions than investing in new power stations. Energy intensity (the quantity of energy required to produce one unit of output – kgoe/$1,000 GDP PPP) is the measure commonly used to reflect energy efficiency, and doubling the rate of improvement in energy intensity has been adopted as a global target under the SE4ALL initiative.

The energy intensity of the Vietnamese economy fell by more than 25% between 1990 and 2010 (according to SE4ALL data). In 1990, 268 kgoe of final energy produced $1,000 (2005 PPP). Improvements in the overall efficiency of energy use pushed this down to 194 kgoe/$1,000 (2005 PPP) by 2010 (Figure 19). Energy intensity in Viet Nam is higher than the average for middle-income countries (Figure 20), however, and while per capita energy consumption is relatively low, consumption is relatively inefficient (UNDP, 2012).

2.3.3 GHG emissions

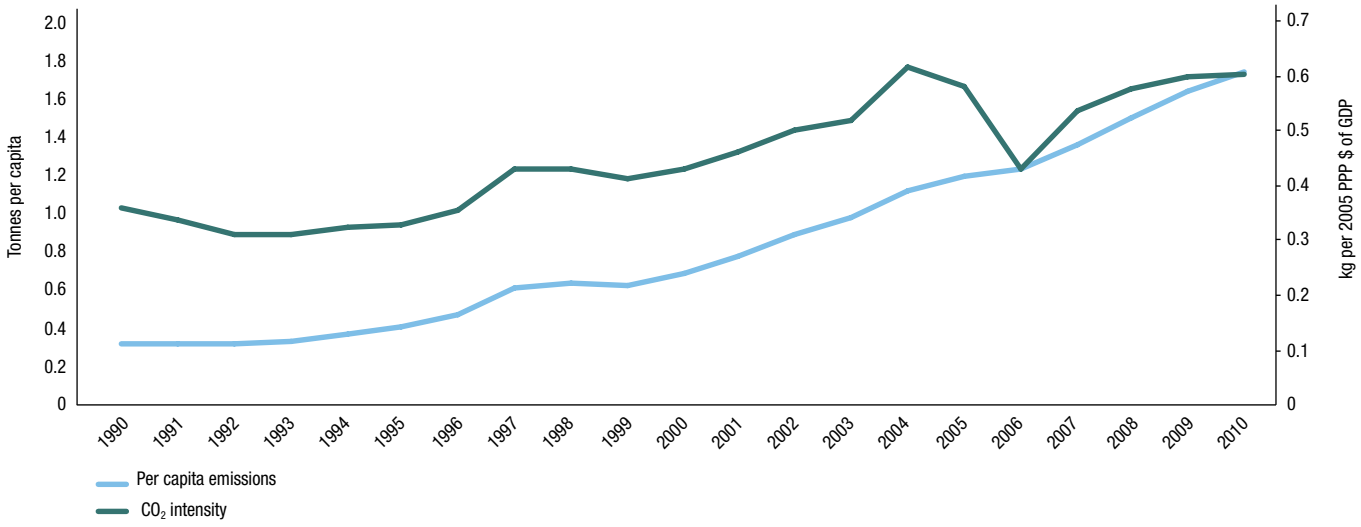
Viet Nam is particularly vulnerable to the effects of climate change. The country lies in the tropical cyclone belt and

Figure 20: Energy intensity in Viet Nam, Thailand and Cambodia 1990-2010 (kgoe/$1000 GDP 2005 PPP)



Source: SE4ALL database

Figure 21: Per capita CO_2 emissions and CO_2 intensity in Viet Nam 1990-2009



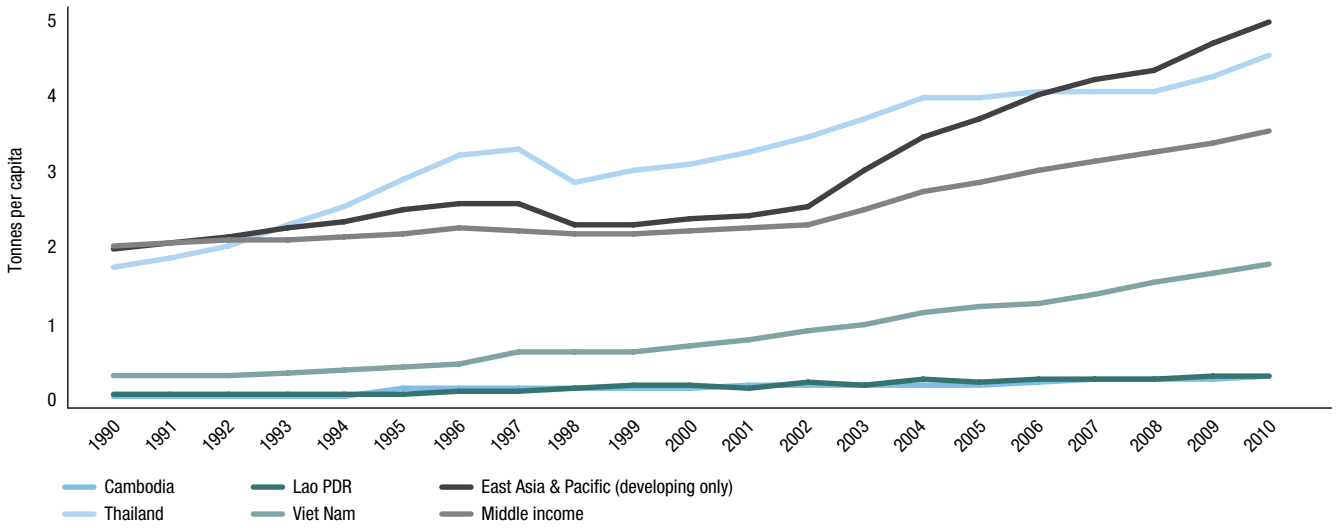
Source: WDI

its long coastline exposes it to such hazards as floods, saltwater intrusion and landslides. Between 2001 and 2010, weather-related disasters caused 9,500 deaths and an estimated 1.5% reduction in GDP. A one-metre rise in sea level would destroy 40% of the Mekong Delta and leave over 10% of the population affected by flooding (GoV, 2011). The importance of reducing its vulnerability to climate change and addressing Viet Nam's increasing share of global GHG emissions, from 0.1% in 1990 to 0.3% in 2004, have been recognised recently with the adoption of a Climate Change Strategy (2011) and a Green Growth Strategy (2012).

In 1994, the reference point for Viet Nam's first national inventory of GHG emissions, total emissions amounted to 103.9 million tonnes of carbon dioxide equivalent (CO_2e). By 2000, the figure had increased to 150.9 million tonnes CO_2e. Per capita emissions increased from 0.3 tonnes per person in 1990 to 1.6 tonnes in 2009 (Figure 21) (UN, 2013), a level that is still lower than the levels seen in most middle-income countries (Figure 22, overleaf).

Energy accounted for 24.7% of total emissions in 1994, and 35% of the higher total in 2000. While the agricultural sector continued to be the largest source of GHG emissions, energy-related emissions doubled in the

Figure 22: Comparison of per capita CO_2 emissions: selected countries 1990-2009

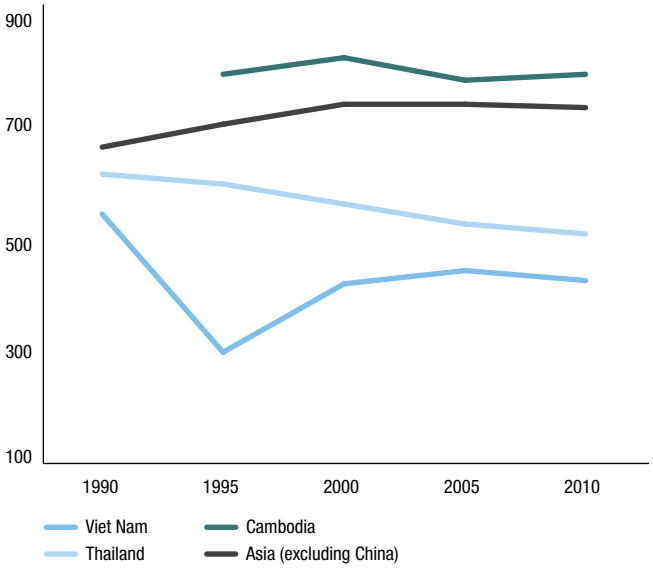


Source: WDI

six-year period of 1994-2000, to 52.8 million tonnes and, when the next inventory is made, are expected to have more than doubled again by 2010 (United Nations, 2013). This increase in energy-related emissions is the result of Viet Nam's rapid expansion of fossil-fuel consumption. In 2010, 28.1% of energy emissions were estimated to come from electricity generation, 27.6% from the consumption of energy in the industrial sector, 24.9% from transport and 12.4% from household energy use (UN, 2013).

The CO_2 intensity of Viet Nam's electricity declined in the mid-1990s with the expansion of hydropower generation, and increased again until 2000. Between 2000 and 2010 it was fairly steady, but did not return to the 1990 level (Figure 23). It remained significantly lower than the average CO_2 intensity of electricity seen in the rest of Asia (excluding China).

Figure 23: Comparison of CO_2 intensity of electricity in selected countries (gCO_2/kWh)



Source: WDI

3. What are the factors driving change?

Students at the University of Electricity in Hanoi, Viet Nam. Photo: © World Bank

This section reviews the factors that have driven progress in Viet Nam's energy sector. It looks at four key areas: policy commitment and direction, the demand for electricity, local-level implementation of rural electrification, and donor support. The analysis reveals how Viet Nam's early policy approach – driven by the quest for more energy to spur economic growth – has expanded to include a sharper focus on such issues as equity. It highlights the positive impact of cost-sharing, with local stakeholders contributing a major proportion of investment in rural electrification, backed by households that are eager to be connected and willing to pay for the service. Finally, it sets out the supportive role that has been played by donors, with an assertive government setting the agenda and directing resources.

3.1 Policy commitment and direction

The development of Viet Nam's energy sector has been guided by the priority placed on economic growth by the Government and its ambition to build a modern, industrialised economy (UNDP, 2007). An adequate electricity supply, spanning everything from generation capacity to distribution infrastructure, has been seen as vital for the achievement of these goals and has largely been achieved. This has underpinned Viet Nam's remarkable success in rural electrification. The key policies for the development of sustainable energy in Viet Nam include rural electrification, tariffs and environmental protection.

It was not until the Eighth Party Congress in 1996 that a specific target for rural electrification was introduced. Before this the Government had focused on construction of the core infrastructure for electrification, with production and economic growth in mind. This included substantial investment in the 1,490 km 500 kV transmission line,

which linked separate grids in the north and south of the country (World Bank, 2011a). This transmission line, completed in 1994 having taken only two years to build, was critical in enabling rural electrification.

The resolution of the Eighth Party Congress set clear targets – 100% electrification of districts, 80% of communes and 60% of households by the year 2000 – and the Rural Electrification Programme was launched in 1996 to reach them. In some ways they might be seen as not particularly ambitious, as 50% of households were already connected by 1996. The Congress resolution, however, marked recognition at the highest political level of rural electrification as a development objective. It was adopted in the light of the very rapid rate of electrification at the time and established the basis for the Government to increase support for it.

'State and people, central and local, working together' – Decree 45 (2001)

A new target, to connect 90% of households by 2010, was included in the fifth Power Development Master Plan (2000-2010). This was followed by a target of 95% of households with access to electricity by 2010 in the sixth Power Development Master Plan (2005-2015). The current target is near-universal access by 2020.

The Government has also issued a number of high-level policy statements that helped to drive progress in the energy sector. These include the 1997 Power Sector Policy Statement, which followed the Party Congress resolution, setting out the aim to provide electricity for the national economy and the entire population; Decision 22, the Prime Minister's Decision on the Rural Electrification Proposal, in 1999, which set out the responsibilities of the various actors in the sector; Decree 45, Electricity Activity and Uses, in 2001; the Electricity Law, passed in 2004; Decisions 27 and 32 of the Ministry of Industry, in 2006, which provided for the licensing of organisations and individuals; and Decision 21 in 2009, on tariffs.

Policy on rural electrification appears to have been joined up with other policies. National programmes for poverty reduction, such as Programme 135 introduced in 1998, provided funding to disadvantaged communes, some of which chose to use the funds to develop LV systems (World Bank, 2011a). There was also flexibility in government policy, which evolved in response to changing needs (e.g. focusing first on maximising access to energy, and later on inclusion and quality).

3.1.1 Regulation of electricity prices

Government commitment to providing access to electricity was manifested in the regulation of electricity prices. The Government introduced a ceiling price for rural-household electricity use (VND 700/kWh) in 1998, which remained in place until 2009. This was equivalent to $0.04/kWh, at 2009 exchange rates (World Bank, 2011a).

The local distribution utilities (LDUs) purchased electricity in bulk from the power companies at a subsidised rate of VND 390/kWh, plus VAT. This was intended to allow the subsidy to be passed on to rural consumers, but in practice many LDUs charged more than VND 700 per unit (World Bank, 2011a). Consumers who received their electricity directly from the power companies (i.e. 19% of communes in 2004) benefited from a lifeline tariff which put a lower price ceiling on the first 100 kWh consumed each month. This was set at VND 550/kWh ($0.03/kWh at 2009 exchange rates).

In 2009, Decision 21 changed the tariff structure, introducing a unified tariff for residential consumers throughout the country, to be determined by the Prime Minister. This was an incremental block tariff, with a lifeline block of 50 kWh per month set at VND 550/kWh ($0.03/kWh), approximately 30%-40% of the actual cost (World Bank, 2011a). This was lower than the VND 700/kWh ceiling, which was abolished by Decision 21. Tariffs for the next block, 51-100 kWh, were set at break-even cost (VND 1,104/kWh; $0.058/kWh), while higher blocks were set at above-average cost to subsidise those on the lifeline tariff. The highest tariff of all was VND 2,079/kWh ($0.11/kWh) for consumption of over 400 units a month. In effect, the new tariff structure meant that higher-income electricity consumers who used more electricity would subsidise lower-income consumers who used less, and urban consumers would subsidise rural consumers to balance out the higher costs of supplying electricity to rural areas.

Decision 21 also changed the bulk purchase tariffs paid by LDUs and the tariffs paid by EVN's transmission company to power generators, which marked the beginning of a transition to market prices within the sector. Decisions in 2010 and 2011 furthered the move towards the use of market mechanisms to determine electricity prices.

3.1.2 Environmental sustainability

The GoVN has a long history of seeking to promote environmental sustainability. The National Conservation Strategy developed in 1985 was the basis for a National Plan for Environment and Sustainable Development, formulated in 1991 (Quitzow et al., 2011). This stated that the country should rely on clean, renewable and decentralised sources of energy whenever feasible (England and Kammen, 1993). The National Law on Environmental Protection was passed in 1993, setting standards and rules for environmental protection. This was revised in 2005, and the Law on Environmental Protection Tax was passed in 2010 (Nguyen Chi Quoc, 2012). However, there were no specific or enforceable environmental standards for the energy sector (Nguyen Anh Tuan, 1997).

In 1998, the Political Bureau of the Communist Party recognised that the Law on Environmental Protection had

not been enforced and that existing laws and regulations on environmental protection were overlapping and inconsistent (Quitzow et al., 2011). Almost a decade later, Bass et al. (2010) concluded that development, poverty reduction and environmental institutional mandates were separate and uncoordinated at every level of government. While Viet Nam does now have policy documents that promote the integration of environmental considerations into plans for growth and poverty reduction, including a new 2005 Law on Environmental Protection and the Socio-Economic Development Strategy for 2011-2020, the practice has been constrained by limited capacity and lack of coordination across government (Bass et al., 2010).

The primacy given by Viet Nam's policy-makers to economic growth and poverty reduction has pushed environmental considerations into second place in policy implementation. Policy-makers are now, however, paying more attention to environmental challenges. Particulate and GHG emissions, both of which are related largely to energy, are now recognised as significant environmental problems. The National Target Programme in Response to Climate Change was approved in 2008, and the National Climate Change Strategy in 2011. A law on energy saving and efficiency was passed in 2010. In September 2012, the Viet Nam's Green Growth Strategy was approved. This aims to promote more resource-efficient production, reduce GHG emissions and promote sustainable consumption. The Green Growth Strategy also includes targets for 2020, 2030 and 2050.

3.2 The demand for electricity

Two decades ago, when only 14% of Viet Nam's people had access to electricity, most of them in urban areas, there was large and suppressed demand for electricity. For many people, the problem was the sheer unavailability of an electricity supply, rather than affordability. Analysis of data from the Young Lives survey suggests that in 2006, when only 8% of the population did not have household access to electricity, the main reason for continuing lack of access was unavailability (59%), while for 21% of those without access the reason was affordability.

There is a suggestion in the literature that the Vietnamese placed a particularly high premium on access to electricity. A household survey for the Asian Development Bank (ADB) found that electricity came top of the list of priorities when it came to the willingness of households to pay for essential services, above roads, schools and healthcare (ADB, 2011). During the early days of very rapid electrification (1994-1997), electrification was a topic of daily conversation (World Bank, 2011a). The World Bank also notes that 'even before the significant increases in their income, rural people had a rather high willingness to pay for electricity' (World Bank, 2011a: 59). Households were reportedly willing to spend amounts equal to one or two times their monthly incomes to pay for connection charges, and would be willing to pay a sum equivalent to one month's income to pay for the meter and service drop from the LV line to their house (World Bank, 2011a).

This desire for electricity was also expressed during pre-electrification consultation meetings in communes (ADB, 2011). When the construction work for a rural electricity network was set to begin in a commune, the ground-breaking ceremony would be accompanied by days of celebrations (World Bank, 2011a).

High demand for electricity in rural areas was the result, in part, of the higher incomes that resulted from expanded agricultural production following *Doi Moi*. Investment in rural electrification, roads, education and other programmes also contributed to higher incomes, more business opportunities and greater educational attainment, leading, in turn, to greater demand for electricity (World Bank, 2011a).

Viet Nam is reported to have a relatively high income elasticity of energy demand (i.e. the increase in energy use per unit increase in economic activity) of 1.46, and an even higher income elasticity of electricity demand, at 2.0 (Pham Khanh Toan et al., 2011). High income elasticity of demand for electricity suggests that small increases in income had a disproportionate impact on the demand for electricity. Increased rural incomes, improved affordability and electricity service extension and the availability of credit meant that households could borrow to pay for their share of new electricity connections (World Bank, 2011a). However, the growth rate of household access was higher than the growth rate in incomes, suggesting that it was not just impacts on incomes that led to accelerated progress.

The high priority placed on electrification seems to have stemmed, in part, from the use of electricity for productive purposes. A Hifab International study in 2000 of two districts in Dak Lak province found substantial willingness to pay for electricity among households who planned to use that electricity for productive purposes, e.g. water-pumping or agro-processing. Households were also willing to take on credit to fund electricity connections when they planned to use the electricity productively, while willingness to seek credit was much lower when electricity would not be put to productive uses (Hifab International, 2000).

3.3 Local-level implementation of rural electrification

The Government recognised from the very beginning, when electrification was first adopted as a policy priority, that implementation would require the combined efforts of actors at all levels. The resources available from the central government alone would not be enough to make rapid progress with rural electrification. This approach was articulated in 2001 in the principle of 'State and people, central and local, working together', which was part of Decree 45, Electricity Activity and Uses.

Power and telephone lines in Ho Chi Minh City, Viet Nam. Photo: © Jonas Hansel

The core infrastructure of power-generation capacity and HV and MV transmission lines, provided through government investment, was in place by the mid-1990s in much of the country. But local-level distribution infrastructure and service provision would be necessary to reach rural households. The demand for electricity was both high and unmet – a strong incentive for local actors to develop local LV distribution systems. Two inter-related factors contributed to the successful development of these systems: the evolution of local distribution organisations and cost-sharing between different stakeholders.

3.3.1 Local distribution organisations

In the early 1990s, electricity supplies in rural areas were provided through a variety of largely unregulated local initiatives that managed to take advantage of the extension of electricity infrastructure for productive uses. These initiatives, which were consistent with Viet Nam's 'fence-breaking' approach to innovation, unofficially permitted experimentation outside the boundaries set by government policy, and they were facilitated by rising agricultural incomes and the availability of credit (World Bank, 2011a). Communes or groups of households built MV and LV distribution systems, purchased power from the state-owned power companies at a subsidised price and sold it to users at an unregulated price.

Four models of operating electricity systems at the commune level emerged (World Bank, 2011a). First, the system could be managed directly by the local administrative authorities, at commune or district level. Second, a system owned and built by a commune could be leased to a private entrepreneur, who would purchase electricity from the power company and recover revenues from consumers. The third model, found in a small number of provinces, was the establishment of a separate company under the control of the People's Committee, to develop and manage the service. Finally, the power companies themselves developed and operated LV networks in some communes.

The most common model, found in 70%-80% of connected communes, was the District Electricity Group (DEG). The district authority would assign its own staff to operate the LV system in the district, contracting with the power company to purchase electricity at the regulated wholesale price and selling to consumers at a locally determined retail price.

By involving local authorities, which had links to People's Committees and the Party, these local-level institutions for the development and operation of rural electricity services were able to respond to local demand for electricity, mobilising funds from both the Government and consumers, and could extend access to large numbers of people at speed. The coordination of all infrastructure development by local authorities also helped to ensure that electrification accompanied the development of schools, clinics and roads (ADB, 2011).

ADB (2011) concluded that Viet Nam's rural electrification experience demonstrates the importance of community organisation and capacity-building for rural electrification. The DEGs, however, had limited technical and managerial capacity, which resulted in high distribution losses and, as a result, high consumer tariffs (World Bank, 2011a).

Regulatory oversight increased to some extent following the establishment of EVN in 1995. EVN experimented with rural electrification by directly operating distribution in eight communes (World Bank, 2011a). However, it was not until 1999 and Decision 22 that the local distribution organisations began to be brought under tighter regulation, with responsibilities clarified, EVN put in charge of all MV distribution, and the concept of LDUs introduced to manage LV systems (Van Tien Hung, 2009; World Bank, 2011a).

Decree 45, in 2001, required all LDUs to be licensed. The many existing local distribution organisations (Commune and District Electricity Groups) could become registered cooperatives or companies, or be taken over by EVN (Van Tien Hung, 2009). By 2009, LDUs operated services in over 5,600 of the country's 9,087 rural communes (World Bank, 2011a), purchasing power from EVN at a wholesale tariff and charging consumers a regulated consumer tariff (Van Tien Hung, 2009).

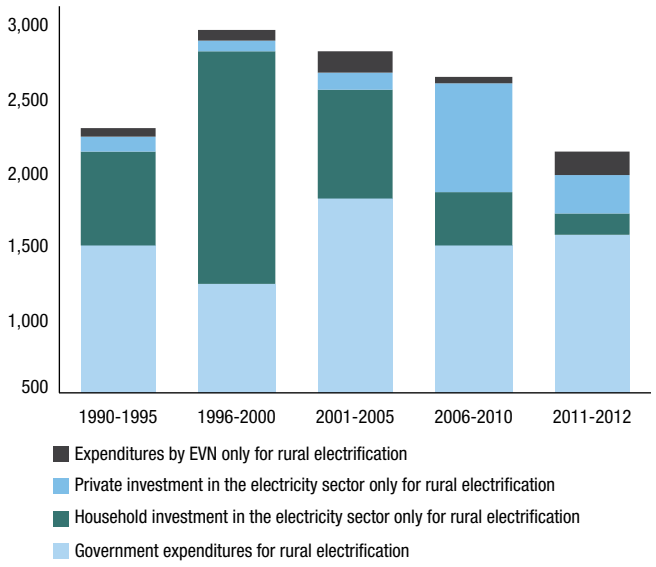
The transition from unplanned and unregulated local electricity-service initiatives to LDUs took place over a period of years, in line with Viet Nam's pragmatic approach to policy implementation, which allowed local and varied approaches to electrification, despite the centralised nature of government decision-making. The change was driven by the requirement for technical standardisation to improve the efficiency of the whole electricity network and the need to improve the management efficiency of the local service. Since the introduction of LDUs, technical losses have been reduced to 7%-10% and revenue collection now stands at 100% (Van Tien Hung, 2009). The greater regulation of local electricity services has also been facilitated by the policy of harmonisation of consumer tariffs across the country and the cross-subsidisation of rural electricity consumers by urban consumers.

3.3.2 Cost-sharing

The third factor in the local-level implementation of rural electrification has been the sharing of the costs across stakeholders, most notably the local stakeholders (local authorities and rural electricity consumers) and central government bodies (the Government and EVN). Investment in rural electrification totalled $10.3 billion over the period 1990 to 2012. Figure 24 (overleaf) shows how this was distributed over the two decades and how the investment was shared between the Government, the private sector, EVN and consumers (households).

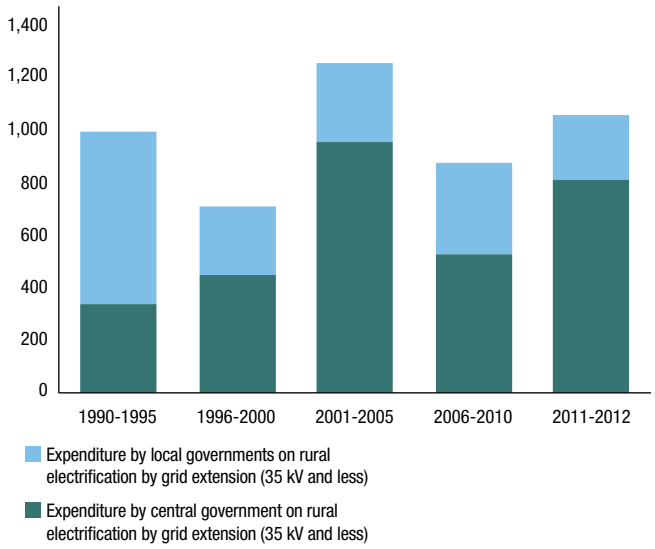
Government at all levels provided a total of $5 billion between 1990 and 2012 for investment in rural electrification. This accounted for approximately 50%

Figure 24: Sources of investment in rural electrification in Viet Nam 1990-2012 ($m)



Source: Government and EVN data sourced by Green ID

Figure 25: Central and local government investment in rural electrification 1990-2012 ($m)



Source: Government and EVN data sourced by Green ID

of the total cost, rising to more than 50% if EVN expenditure is seen as government spending. Figure 25 provides the breakdown between central and local government, showing that local government financing for rural electrification stood at about the same level as central government financing in the 1990s. While central government is the primary source of funding for local authorities, the spending decisions were made locally.

Households, i.e. electricity consumers, have been a major source of financing for rural electrification in Viet Nam, contributing some $3.4 billion between 1990 and 2012. In many cases, particularly in the early days of electricity expansion, customers paid 100% of the capital costs of the LV system and even the MV system. In almost all cases, customers paid for the connection to their house, plus the meter and wiring, as a minimum (GNESD Energy Access Knowledge Base, 2013). At the high point of electricity expansion (1996-2000), households were contributing 64% of the total cost of rural electrification, as shown in Figure 24. In later years, community contributions were often the deciding factor in bringing communes within the scope of EVN's rural electrification programme (ADB, 2011). The share of expenditure accounted for by households in the later periods was 17% in 2006-2010 and 9% in 2011-2012.

This level of household investment in rural electrification, and the tariffs households are prepared to pay for electricity once connected, reflect the high latent demand and high willingness to pay for electricity. In the early years of rapid electrification, Vietnamese households were willing to pay a high share of household income and to sell assets in order to meet connection costs. Without their enthusiasm, electrification efforts might have been constrained by low consumer revenues, low investment and poor service delivery and, in turn, a low willingness to pay.

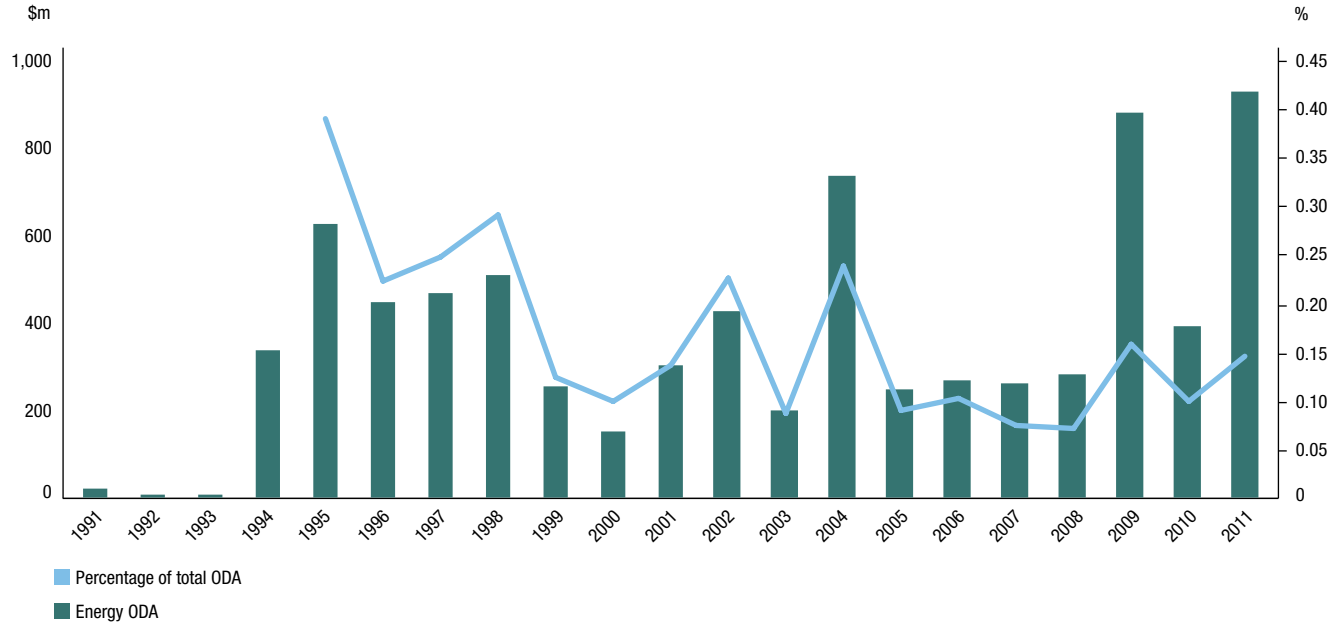
Combining the investment provided by local authorities and households as the share financed at the local level, it is clear that rural electrification in Viet Nam has been financed largely by local stakeholders. During the 1990s, when the number of households receiving a new connection was at its highest, these local stakeholders provided almost three-quarters of the total investment in rural electrification. The willingness of households to pay and the response of local authorities to popular demands enabled rural electrification to take off, even though consumer prices were very high in the early stages. Cost-sharing also contributed to the financial viability of local electricity providers and helped to ensure a sense of ownership and commitment across a range of stakeholders.

The high share of rural electrification costs paid for by households, particularly during the very rapid electrification in the 1990s, excluded some of the poorest households, who could not afford to pay connection costs. This was reinforced by the lack of financial control in those early days, which meant high consumer prices (World Bank, 2011a). In later periods, central government provided subsidies to support remote and lower-income households and, with donor support, undertook more of the investment from the centre, which included an objective to reach poorer groups.

3.4 Donor support

It is clear that ODA has made a significant contribution to the national economy over the past two decades,

Figure 26: ODA for energy in Viet Nam 1991-2011 ($m and % total ODA commitments)



Source: AidData and OECD Development Assistance Committee statistics

with the GoVN channelling external resources to support its successes in economic growth and overall poverty reduction (Le Quang Binh, 2008). Support from international donors is also reported to have been a significant factor in achieving progress in rural electrification. Most of the informants interviewed for this case study attributed support from donors, particularly the Japan International Cooperation Agency, the World Bank and the ADB, as a key driver for rural electrification. This support has taken two main forms, finance through grants and concessional loans, and technical assistance.

Before the mid-1990s, Viet Nam's international isolation meant that there was very little Western foreign private investment or ODA coming in. The main source of external finance had been the Soviet Union, which provided direct aid worth around $1 billion a year until 1986, with a further $1 billion in trade surpluses. ODA from Organisation for Economic Co-operation and Development (OECD) countries amounted to $500 million a year between 1986 and 1990 (England and Kammen, 1993).

Total ODA to Viet Nam increased from $1.6 billion in 1995 to $2 billion to $3 billion a year for the next decade (commitments at current prices). In 2011, ODA totalled $6.36 billion. In the 1990s, ODA accounted for an average of 17.5% of Viet Nam's annual addition to fixed capital (measured as gross fixed capital formation: GFCF), falling to 9.9% of annual GFCF in the 2000s (WDI).

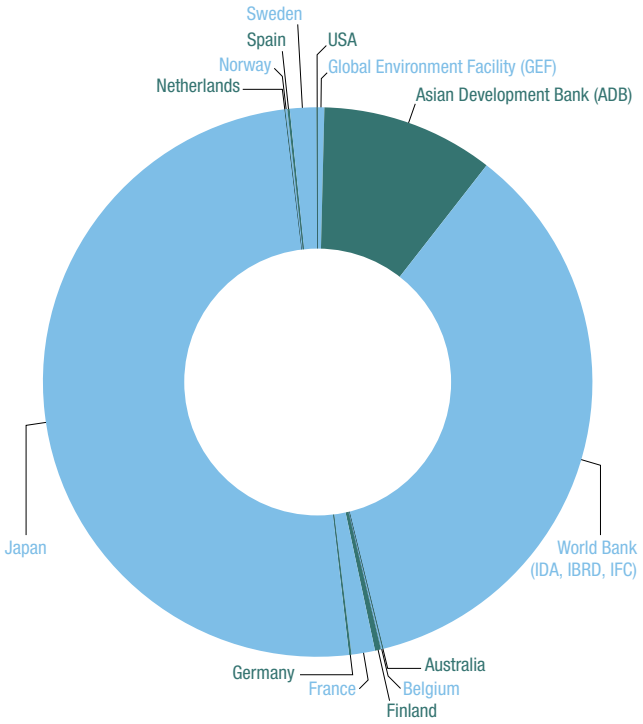
Donor commitments to Viet Nam's energy sector started after the US trade embargo was lifted in 1994, but beyond that there is no clear pattern in the volume of commitments, as shown in Figure 26. This may be because a lot of the expenditure for energy projects is fairly 'lumpy', with large commitments for investment projects in one year and none the next. The figure also shows that, as a proportion of total ODA, aid to the energy sector varied over the two decades. Between 1995 and 1998 the energy sector alone accounted for over 20% of total ODA, with a high of 39% in 1995. More recently, the proportion of ODA allocated to the energy sector has been between 10% and 15%.

In total, donors committed $7.8 billion to the Vietnamese energy sector between 1990 and 2011, with 96% of this coming from just three donors: Japan (50%), the World Bank (36%) and the ADB (10%). Sweden accounts for a further 2%, France 1%, and the balance comes from several bilateral donors and the Global Environment Facility (GEF, see Figure 27, overleaf).

Total ODA for the energy sector includes commitments to power generation and transmission and renewable energy projects (including hydropower), power-sector reform and capacity building, and rural electrification (Figure 28, overleaf). The last is not a category recognised in OECD statistics, so determining how much energy ODA was allocated to rural electrification calls for the interpretation of project figures. Assessing donor support for rural electrification is further complicated by the inclusion of support for energy services in broader rural-poverty programmes and, given Viet Nam's grid-based electrification, by the dependence of rural electricity services on the national power generation and transmission infrastructure.

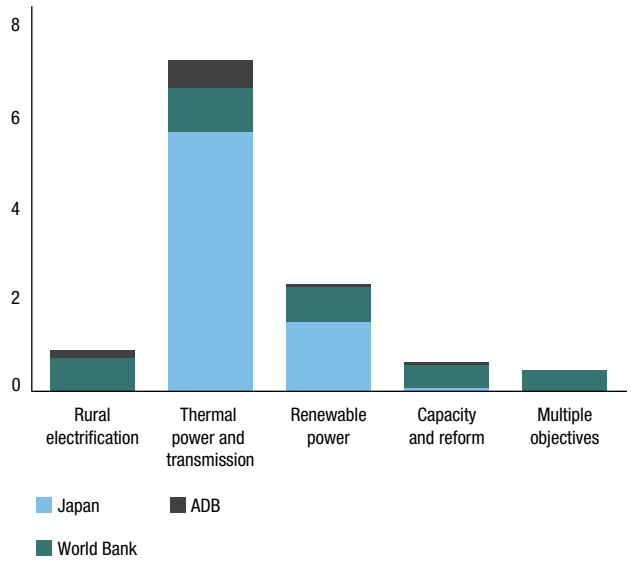
It is clear from analysis of donor figures that rural electrification, specifically, received a small proportion of

Figure 27: Share of aid commitments by donor in Viet Nam's energy sector 1990-2012



Source: AidData

Figure 28: Allocation of energy ODA from the principal donors 1990-2011 ($bn)



Source: interpreted from AidData project figures

total energy ODA between 1990 and 2010. Japan, the largest donor to the sector, did not provide any direct investment in rural electrification. The World Bank approved $720 million for rural electrification over the period, of which $615 million was actually disbursed, for four projects.

- The Rural Energy Project, approved in 2000 and financed by a $150 million credit from the International Development Association (IDA), to expand rural access in 671 communes through grid extension, where economically justified (World Bank, 2011a).
- The second Rural Energy Project, approved in 2004 and financed by a $220 million IDA credit and a $5.25 million grant from the GEF, which shifted the focus from new connections to the rehabilitation of existing systems.
- The Viet Nam Rural Distribution Project, approved in 2008 and financed by a $150 million IDA credit, to improve the reliability and quality of the MV networks bringing electricity to local distributors and to build up the capacity of regional power companies.
- An extension to the second Rural Energy Project, approved in 2009, and committing a further $200 million, to scale up the project given its good impacts.

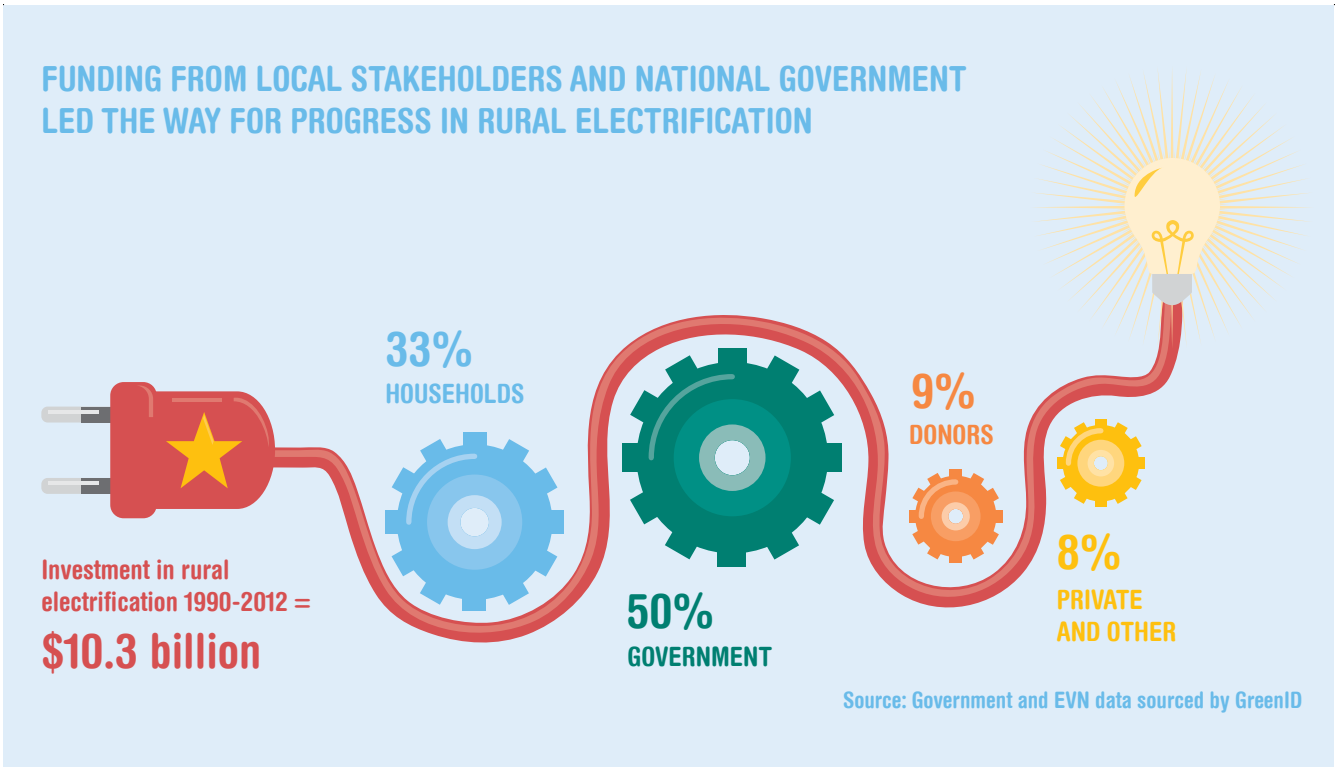
Before the year 2000, the ADB committed $180 million for the Central and Southern Viet Nam Power Distribution and the Power Distribution Rehabilitation projects. By 2010, the ADB had committed over $788 million to Viet Nam's power sector.

Counting only the World Bank and ADB contributions, this suggests that donor commitments to rural electrification totalled around $900 million between 1990 and 2010, with disbursements of roughly $100 million lower. Assuming that donor contributions are already included in the overall estimate of $10.3 billion investment in rural electrification, this suggests that donors financed around 8.7% of the total direct cost of rural electrification. Donor support for investment in power generation and transmission, which enable rural electrification, was more significant and reflected the priority given by the Government to economic growth.

Technical assistance for the power sector and for rural electrification was provided not only for specific projects, but also for project preparation activities. This form of support contributed to institutional development, policy formulation and planning for the sector in general and to rural electrification specifically. Donors, particularly the World Bank, contributed to the design of rural electrification programmes, and technical assistance may have been a more significant contribution to rural electrification than investment support. For example, the Rural Electrification Master Plan was completed with World Bank support, including technical assistance, through the Power System Development Project in 1996 (World Bank, 2011a). The World Bank Rural Energy Project in 2000 also helped to define and establish institutional mechanisms and the strategy for rural electrification in Viet Nam (World Bank, 2011a). The second phase of the Rural Energy Project supported capacity building of LDUs (World Bank, 2011a).

As far as ODA for investment in renewable energy is concerned, in financial terms this has been directed mostly to hydropower generation. Japan committed some $1.5 billion for renewables from 1994 to 2011. The World Bank committed a further $0.8 billion, while the ADB committed $2.12 million. Some of the broader investments in rural electrification have also included provisions for renewable energy. For example, the first World Bank Rural Energy Project, approved in 2000, included a provision to promote the application of renewable energy sources in areas inaccessible to the national grid and to supplement the grid power supply (World Bank, 2011a). An ADB loan of $151 million in 2009 included provision to help Viet Nam improve its electricity services through renewable energy in poor, remote communities with a high proportion of ethnic minority citizens.

It may be that Viet Nam's history makes it more assertive than some countries when negotiating with the main donors to the energy sector. As Rama (2008) notes, even following normalisation of relations with the international community, senior Vietnamese leaders viewed multilateral development banks with suspicion, seeing them as being controlled by the industrialised countries in general and by the US in particular. Gradually, this relationship matured, with a growing recognition of the value of donors' technical inputs and economic analyses. Le Quang Binh (2008) suggests that the evolution of mutual respect between the Government and donors allowed the latter to advocate changes to national policies. An example is the two-year dialogue between the Government and the World Bank that led to the Rural Electrification Master Plan. However, throughout the 1990s the Government stuck to its choices when donor recommendations were not deemed well-suited to Viet Nam's circumstances, warding off the rapid privatisation of state-owned-enterprises and reform of the power sector.



4. What are the challenges?

Photo: © Alexandre Nossovskoi

'The last households are the most difficult, so it will be very expensive as well as technically difficult' – Government Official

This section reviews the challenges to Viet Nam's progress on the provision of energy for development. First, an analysis of the environmental sustainability of Viet Nam's energy sector reveals that the proportion of renewables in Viet Nam's energy mix has halved since 1990, while GHG emissions from energy have increased more than fourfold. The challenge is to stem this trend while meeting the growing demand for energy. Second, the section assesses the 'unfinished business' of achieving universal access, with greater efforts needed to reach the poorest and most remote households. It suggests that access to electricity alone will not be enough to address Viet Nam's energy requirements for poverty reduction, citing the need to address the population's continued reliance on solid fuels for cooking – a threat to both family health and national development. Third, it considers the reliability of electricity, which is now a serious concern in rural and remote areas. Finally, this section outlines the need to reform the subsidies that keep electricity prices well below the actual cost, which is hampering investment, while ensuring that services to the poorest people are protected.

4.1 Environmental sustainability

Viet Nam has become increasingly dependent on non-renewable energy sources since 1990. The proportion of renewables in TFEC and in electricity consumption has halved, while GHG emissions from energy have increased more than fourfold.[17] It is clear that the environmental sustainability of the country's energy system has deteriorated. It will be a challenge to redress this while

17 In 1994, the baseline year for the national GHG inventory, emissions from energy were estimated to be 25.6 million tonnes CO_2e. Energy-related emissions were estimated to be 113.1 million tonnes in 2010 (Second National Communication).

Table 3: Key indicators for the sustainability of energy

	1990	2000	2010	2020	2030
	Estimated			Planned	
% renewable in TPES	79	53	33	-	-
% renewable in TFEC	85.06	71.84	56.31†	-	-
% renewable electricity generated	61.85	54.78	29.09	24.10	15.50
% renewable installed capacity	31.32	52.68	36.37	31.10	25.10
Energy intensity (kgoe/$1,000)	299.08	231.75	236.99	-	-
Energy CO_2 emissions (million tons CO_2)	25.6	52.8	113.1	251.0	470.8

Sources: UN (2013); 7th Master Plan for Power Development
† 2009

meeting rapid growth in the demand for energy, and under current plans the environmental sustainability of Viet Nam's energy system will continue to decline (Table 3).

Although the proportion of total energy supplied from renewable sources (i.e. hydropower and biomass) fell from 79% in 1990 to 33% in 2010 (Figure 19), the quantity of renewable energy produced and consumed increased. Between 1990 and 2010, electricity output from renewable sources grew fivefold and biomass consumption also increased. In 2010 the proportion of TFEC from renewables was higher than the average for South-East Asia (55.3% against 31.1%) and the proportion of electricity from renewables was twice the regional average[18] (29% against 14%) (SE4ALL database). The overall trend in Viet Nam, however, is towards an energy system that relies mainly on fossil fuels (Table 3).

As is the case in other countries, Viet Nam has two options for making its energy system more environmentally sustainable: improving the efficiency of energy use and switching to lower-carbon energy sources, including increasing the proportion of energy from renewable sources. Historically, regulated low energy prices have failed to encourage energy efficiency, but the challenge of meeting the country's rapidly growing demand and its increasing reliance on imported energy are driving a transition to higher prices. This can be expected, of itself, to lead to greater efficiency.

The potential for energy efficiency savings is estimated to be between 15% and 30% of demand, and is highest, in proportional terms, in the residential sector. Achieving these savings would reduce demand by up to 22,000 GWh a year by 2030, equivalent to the output of 16 planned coal-fired power stations, and would reduce CO_2 emissions by over 100 million tonnes a year (Soussan et al., n.d.). To achieve these savings, regulation and changes in enterprise management practices will be necessary, together with investment by the private sector and SOEs. Energy-efficiency investments, however, can often pay for themselves in cost savings.

Estimates of the full potential of renewable energy sources vary, which may suggest uncertainty about their role in the overall energy system and about their viability. Table 4 (overleaf) shows current, planned and potential capacity for renewable electricity (including large hydropower, but excluding nuclear). While there are differences in the estimates of the potential, except for large hydropower, it is clear that there is significant unexploited potential that could be addressed by alternative policies.

4.2 Achieving universal access

In the 1990s, Viet Nam achieved the rapid extension of access to electricity in rural areas across the country that previously had little or no supply. While the rate of rural electrification has slowed over the past decade, averaging about 490,000 connections a year since 2006, government targets have been exceeded. The current objective is to achieve near-universal access to electricity by 2020. With the access level standing at 97% in 2010, this target calls for around 500,000 new household connections over ten years. The challenge now is to reach the remotest and poorest households in the country: the investment costs per connection will be far higher than before and, even with a

18 There are wide differences between China and Thailand on the one hand, with a low proportion of renewables, and Cambodia and Laos on the other, with high proportions.

national lifeline tariff, the affordability of electricity could still be a problem for the households on the lowest incomes.

In 2010, six provinces had access rates lower than 85% (GSO, 2011). The two provinces with the lowest levels of access were Lai Chau and Son La, in the north-west region, where 30% and 20% of the population, respectively, had no access to electricity at all. These remote provinces are among the poorest in the country, have large ethnic minority populations, and together accounted for about 12% of the total population without access in 2010. Paradoxically, two of the largest hydropower plants in the country will be located in these two provinces by 2020.[19]

Electrification in Viet Nam has taken a centralised, grid-connection approach, but decentralised systems may be more economic in remote rural areas with relatively sparse populations. The seventh Master Plan for Power Development (2011-2020) suggests that an alternative approach is required in remote areas and proposes the use of new and renewable energy to supply electricity to these areas. The Master Plan aims to extend electrification by supplying 377,000 rural households with electricity from renewable sources (i.e. excluding large hydropower) by 2015, and a further 231,000 households by 2020.

The affordability of electricity for the poorest households, including those in areas where access is virtually universal (99.9%), remains a challenge for equitable access to services (World Bank, 2011a). The Government intends, over time, to bring the consumer price closer to the estimated long-run marginal cost (LRMC) of electricity, which is around $0.08-0.09/kWh[20] (Master Plan), equivalent to VND 1,687-1,898 (at 2013 exchange rates). This is double the current lifeline tariff of VND 933/kWh for consumption below 50 kWh a month. The poorest households will still need a subsidy for electricity consumption through a lifeline tariff or more direct and targeted cash transfers.

One of the informants interviewed for the study noted that: *'The good thing about electricity access in the rural area is that rural people now have light, more information and education, more entertainment, and pumped water. However, the economic impacts are limited. Electricity is not the driver for rural economic development yet.'* This observation reflects evidence that the quantity of electricity consumed by poor households remains very small, and is used mainly for lighting. If electricity is to contribute more directly to poverty reduction, and to help accelerate industrialisation and the modernisation of agriculture, as proposed in the Master Plan for Power Development 2011-2020, rural households need access to more than 50 kWh or 100 kWh a month. They also need access to appliances and equipment powered by electricity. Support could be provided through access to credit to purchase appliances and by linking electricity use to business and agricultural development programmes.

Access to electricity alone will not be enough to address energy requirements for poverty reduction. The single greatest energy demand is for cooking, but, as this case study has shown, electricity is rarely used for cooking in Viet Nam[21] (Accenture, 2012). The progress that has been achieved to date on access to non-solid fuels for cooking has been the result of rising incomes. This leaves most of the population, including those below the poverty line, without access to clean and safe fuels for cooking. Slower rates of economic growth, combined with higher fossil-fuel prices, suggest that relying on growing incomes to enable people to adopt safe and clean cooking fuels could delay

Table 4: Renewable energy potential in Viet Nam

	Currently installed	Planned for 2030	Potential
Large hydropower	12,009 MW	17,400 MW	20,000 MW
Pump storage hydro	-	5,700 MW	-
Small hydropower	1,166 MW	-	2,000-7,000 MW
Solar	2 MW	-	10 MW
Wind	37.5 MW	6,200 MW	500-1,400 MW
Biomass	150 MW	2,000 MW	400-2,900 MW
Geothermal	0 MW	0 MW	200-470 MW
Ocean (tidal/wave)	0 MW	0 MW	100-200 MW

Sources: USAID (2007); Tien Minh Do and Sharma (2011); Nguyen Duc Cuong (2012); Trinh Quoc Vu (2013)

19 Son La, with a capacity of 2,400 MW, was completed at the beginning of 2013, and the 1,200 MW Lai Chau plant is scheduled for completion in 2016.

20 IEA estimate the LRMC to be $0.95/kWh (IEA, 2011).

21 There is some evidence that electric rice cookers are common.

the achievement of the international objective of universal access to modern energy services in Viet Nam. At the rate of progress achieved in the decade from 2001 to 2010 it will be 2038 before all households use non-solid fuels.

The negative effects of solid-fuel use on health are well-documented (WHO, 2006), as are the effects of inefficient cook stoves on climate change (World Bank, 2011b). While Vietnamese policy-makers are not alone in neglecting energy for cooking, this neglect needs to be reversed to speed up progress on access to clean and safe fuels for cooking. Viet Nam's decision to join the Global Alliance on Clean Cookstoves at the end of 2011 suggests that policy-makers are now rising to this challenge.[22]

4.3 Reliability of electricity

The main indicator of access to electricity is the proportion of the population with access to an electricity supply. But the reliability of that supply also determines the contribution of electricity to people's living standards and their ability to use electricity for productive purposes. Viet Nam currently ranks 113 out of 144 countries in terms of the quality of its electricity supply in the Global Competitiveness Index 2012-13 (World Economic Forum).

Data on the reliability of the power supply in Viet Nam are limited, but there are signs that reliability is now a serious concern.[23] Unreliability is particularly acute in rural and remote areas where both the quality of the local LV distribution system and its connection through MV lines to the national transmission system need improvement (World Bank, 2009; World Bank, 2011a). In the World Bank Enterprise Survey of 2009, enterprises experiencing interruptions to their electricity supply estimated the resultant losses to be 3.6% of sales.[24]

The reliability of electricity is affected by two main factors: first, the margin between the capacity to supply power and actual demand, especially at peak times, and, second, the quality of the transmission and distribution infrastructure. Viet Nam has managed to keep a margin between peak demand and installed capacity over most of the past two decades, to allow for variations in supply (e.g. due to low water levels in reservoirs). The target has been to achieve a reserve margin of 25%-30%, reflecting the risk to hydropower from variable rainfall. This target was reached in the period before 2003, but between 2004 and 2009 the margin averaged 19.4%, putting pressure on the ability of EVN to meet demand. The margin has since increased, to almost 30% in 2012 (Trinh Quoc Vu, 2013), and is expected to remain relatively high under current plans.

The main challenge for reliability, and perhaps the most straightforward to address, is in the electricity transmission and distribution networks. Losses in the system averaged 8.08% in 2010 (UNDP, 2012), a considerable improvement on the 25% losses seen in 1990. This improvement is the result of investment in both transmission and distribution infrastructure and in improved management, including revenue collection. However, there is still a need to upgrade some of the local distribution networks that were built under local initiatives and with limited technical expertise.

4.4 Subsidy reform

Viet Nam has regulated energy consumer prices to facilitate economic growth and increase household access to energy. Domestic coal prices have been kept well below world market prices, to allow low-cost electricity generation from this domestic fuel resource, and electricity tariffs have been lower than in other countries. EVN has been able to purchase coal at 50%-60% of the export price (UNDP, 2012), and has, therefore, been encouraged to invest in coal-fired generation capacity. Electricity tariffs in 2010 averaged $0.07/kWh, which was 30% lower than the average in the Association of South-East Asian Nations region (UNDP, 2012). As shown in Table 5 (overleaf), these indirect subsidies totalled an estimated $2 billion to $4 billion a year between 2007 and 2010, equivalent to between 1% and 4% of GDP (IEA, 2011). Recent analysis suggests that GDP would be higher without these subsidies (UNDP, 2012).

These indirect subsidies to consumers result in financial losses for energy-sector SOEs that the Government then has to cover to ensure these SOEs can continue to operate. EVN's losses in 2010, for example, were estimated at $397 million (UNDP, 2012). The financial consequences of price controls also extend to transactions between SOEs, with EVN owing $485 million to Vinacomin and PetroVietnam, and industrial SOEs owing EVN. They also affect EVN's ability to pay independent power producers for electricity fed in to the grid. As a result, EVN has been unable to generate enough capital for investment (UNDP, 2012).

Regulated energy prices have encouraged inefficient energy consumption and have acted as a disincentive for investment in renewables. Although energy intensity has improved over the past two decades (Figure 19), in comparison with other countries in the region, Viet Nam has been, and continues to be, an inefficient user of energy (UNDP, 2012).

The 2004 Electricity Law provided for a transition to consumer prices for electricity that reflect the costs of production, but reform has been slow. According to one

22 http://vietnamembassy-usa.org/news/2012/01/vietnam-officially-joined-global-alliance-clean-cookstoves.

23 Several key informants interviewed for this study also stated that the quality of the supply in rural areas is poor, mainly because of the age and standard of LV systems.

24 http://www.enterprisesurveys.org/data.

Table 5: Fossil-fuel consumption subsidies ($bn)

	2007	2008	2009	2010	2011
Oil	0.32	1.09	0.00	0.00	1.02
Electricity	1.68	2.25	2.10	2.69	2.92
Natural gas	0.09	0.21	0.13	0.23	0.16
Coal	0.01	0.01	0.01	0.01	0.02
Total	2.10	3.57	2.23	2.93	4.12
% GDP	2.95	3.94	1.24	2.83	-

Source: IEA (2011)

estimate, electricity tariffs would need to be 15%-30% higher to ensure financial sustainability (UNDP, 2012). The Master Plan for Power Development 2011-2020[25] proposes that tariffs are adjusted gradually towards the long-term marginal cost of electricity in 2020, equivalent to $0.08-0.09/kWh. The Plan also suggests that the selling price of electricity should help create an environment that attracts investment and encourages competition in the production, transmission, distribution and use of electricity.

Regulated electricity tariffs have benefited consumers in all income groups by keeping prices below cost. The reform of pricing that is underway, to ensure tariffs are based on costs, will need to ensure that low-income groups are not affected adversely. This could mean retaining a lifeline tariff as part of an incremental block tariff structure, or a form of more direct subsidy. In 2011, for example, the Government provided direct transfers to the poorest electricity consumers when prices were increased (UNDP, 2012).

25 Prime Minister's Decision 1208/QD-TTg (21 July 2011).

5. What lessons can we learn?

Trung Son Hydropower Project construction site, Mai Chau, Viet Nam. Photo: © Mai Ky/World Bank

Viet Nam's impressive achievements on economic growth, poverty reduction and access to electricity have surpassed the progress made in many other countries at similar income levels. The evidence reviewed by this study, in response to the key questions identified in Section 1.3, indicates that policy leadership has made a difference, poverty-reduction programmes contributed to rural electrification, investment came from a range of stakeholders, and international cooperation made a significant contribution, particularly in strategy and planning. The study also suggests that Viet Nam's progress in delivering energy for development has come at a price, with a growing reliance on fossil fuels in the energy mix.

Policy-makers in other countries that aim to expand access to modern energy to boost economic growth and reduce poverty can learn from Viet Nam's experience over the past two decades. Three key lessons for policy-makers emerge from this case study:

Sustained and flexible policy direction is critical for progress in energy

Rapid expansion of rural electrification was achieved, in large part, because it was a clearly stated objective of the national Government. Local authorities, and later EVN, prepared local electrification plans and ensured implementation in response to successive government policy statements and the popular demand for electricity. The Government also reviewed progress and set more ambitious objectives when previous electrification targets were met. The provision of electricity in Viet Nam was seen as a public good and the state had a role to ensure its supply, through policies, targets, market regulation and investment in infrastructure.

In contrast, the absence of a policy and public expenditure on energy for cooking allowed all but a few actors to ignore the damage from inefficient and unsafe cooking fuels. Similarly, equivocal policy on environmental

sustainability, placing it secondary to economic growth, allowed the inefficient use of energy and rapid expansion of non-renewable power-generation capacity.

Based on this, policy-makers seeking to extend electrification rapidly in other countries should consider to what extent their energy policies provide clear and consistent direction over time and respond to changing conditions. Policy-makers should also consider whether their energy policies address all the energy needs of their citizens.

Local resources can be mobilised for rural electrification effectively

A major concern for governments and donors for the post-2015 development agenda is financing for the investment required to deliver universal services, such as energy. Globally, it is estimated that five times the current level of investment in access to energy will be required to achieve universal access by 2030 (IEA, 2011). Viet Nam's achievement of exceptionally rapid rural electrification during the 1990s, financed largely by consumers and domestic resources, demonstrates what can be done through the mobilisation of local resources. This may be particularly relevant where access to electricity is very low and there is a high level of unmet demand (e.g. in some sub-Saharan African countries). Progress in Viet Nam was undoubtedly determined by some context-specific factors, which mean this mobilisation of local resources may not be replicated easily elsewhere, a subject for further research.

Mobilising local resources for rapid electrification where the great majority of the population lack access to electricity could result in a lack of focus on the poorest and most marginalised families. Viet Nam's policies for equitable access to electricity were partly a response to the experience of relying on local resources for electrification. This highlights the importance of considering equitable access to electricity early on in electrification planning and implementation.

Policy-makers should consider the mobilisation of local resources for investment in expanding electrification in regions where access rates are low.

Achieving progress in energy for development can come at the cost of environmental sustainability

Viet Nam's experience of rapid economic growth, accompanied by rapid expansion of energy production and consumption, highlights a critical challenge for long-term sustainable development. Despite Viet Nam's early statements of commitment to sustainable development, before the first Rio conference on environment and development, and later policy statements on environmental sustainability, Viet Nam does not appear to have sought actively to balance the economic, social and environmental dimensions of sustainable development. Rather, the economic, and to some extent the social, dimensions of sustainable development have been given precedence. The distribution of responsibilities for natural resources and the environment across government departments, and limited capacity, contributed to the relative neglect of environmental sustainability.

Policy-makers should therefore consider the effects of a focus on growth in energy production on local and global long-term environmental sustainability.

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