



Development  
Progress

## TURNING THE LIGHTS ON Sustainable energy and development in Viet Nam

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A utility pole supporting electrical wires in Bac Ha, Viet Nam. Photo: © Kibae Park for UN Photo

### Case Study Summary

*Environment*

- In two decades, between 1990 and 2010, access to electricity in Viet Nam increased from around 14% to a staggering 97% of the population. In twenty years, 19 million households were newly connected to an electricity supply.
- \$10.3 billion was invested specifically in rural electrification between 1990 and 2012, financed largely from domestic sources. Vietnamese households contributed 64% of these costs between 1996 and 2000.
- The electricity tariff structure ensured that higher-income consumers who used more electricity would subsidise lower-income consumers who used less, and urban consumers would subsidise poorer rural consumers.
- The supply of renewable electricity increased by a factor of five between 1990 and 2010, from 5,370 GWh to more than 27,600 GWh, though it halved as a proportion of Viet Nam's total electricity supply.

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## Why explore energy and development in Viet Nam?

Policy-makers in all developing countries face three challenges when it comes to the development of their energy sector: providing enough energy to meet rapidly growing business and citizen demand, extending electricity and clean fuels to those who currently lack access to them and developing the energy sector in a way that does not harm the natural environment.

In Viet Nam, rapid economic growth and remarkable progress on poverty reduction over the previous two decades was accompanied by rapid expansion in electricity generation and rural electrification. Concerns about equitability of access to electricity and the sustainability of the energy sector highlight the challenges the country has faced in developing the sector, making Viet Nam a suitable case study for the Development Progress project.

The case study identifies the key factors driving the expansion of access to electricity, the overall increase in energy consumption and changes to the environmental sustainability of Viet Nam's energy system. It provides a perspective on the progress achieved by Viet Nam in these three areas and how synergies and trade-offs between the energy policy objectives of security of supply, access and sustainability were managed. Lessons from Viet Nam's experience will have relevance to actions being taken in other countries during the UN Decade for Sustainable Energy for All (2014-2024).

## What progress has been achieved?

Viet Nam's impressive progress on both economic growth and poverty reduction over the past two decades was outstripped in Asia only by China. GDP growth averaged 7.3% a year over the period 1990-2010, while GDP per capita grew by 5.8% (World Development Indicators). Economic growth favoured higher-income households over the poorest but widened the gaps between the richest and poorest, along with ethnic minorities and the rest of the population.

### 1. Energy and economic growth

Viet Nam's rapid economic growth was accompanied by rapid increases in the production and consumption of energy. Oil production played a key role in the country's economic development, generating export earnings and government revenue, while overall energy production exceeded consumption throughout the period 1990-2010. In 2010, total final energy consumption (TFEC) stood at around 50,500 thousand tons oil equivalent (ktoe). By 2020, Viet Nam is expected to become a net importer of energy as a result of growing demand (MOIT, 2009; Pham et al., 2011).

Although total energy consumption has grown rapidly, Viet Nam's level of consumption is still comparatively low. In 2010, energy use per capita was just over 681 kilogrammes of oil equivalent (kgoe), roughly one third of the global average (1,852 kgoe/person) and below the level in neighbouring China twenty years earlier.

The expansion of Viet Nam's electricity sector has been remarkable. Electricity production increased ten-fold over the period 1990-2010, from around 8,700 gigawatt hours (GWh) to almost 95,000 GWh – a far greater proportional increase than seen in final energy consumption. The average rate of increase over this period was 12.7% a year and the largest increase in consumption was in the residential sector.

The total maximum capacity of Viet Nam's power stations increased ten-fold, from 2.5 GW in 1990 to just over 20.5 GW in 2010. This huge gain 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% coal-fired, with 18% accounted for by oil and gas power stations. By 2009, the hydropower proportion was 37%, while gas-fired generation had increased to 38% of total capacity (ERAV, 2010).

### 2. Household access to modern energy

Viet Nam's progress on household access to electricity has been fast (Figure 1). Between 1990 and 2010 the proportion of the population with access to electricity increased from an estimated 14% to 97% (Van Tien Hung, 2009; World Bank, 2011; SE4All, 2013).

The foundations for rural electrification were laid during post-war reconstruction in the late 1970s and early 1980s, but there was particularly rapid growth in access to electricity during the 1990s following investment in new power stations and transmission infrastructure. In a decade, more than 11 million households were connected to an electricity supply.

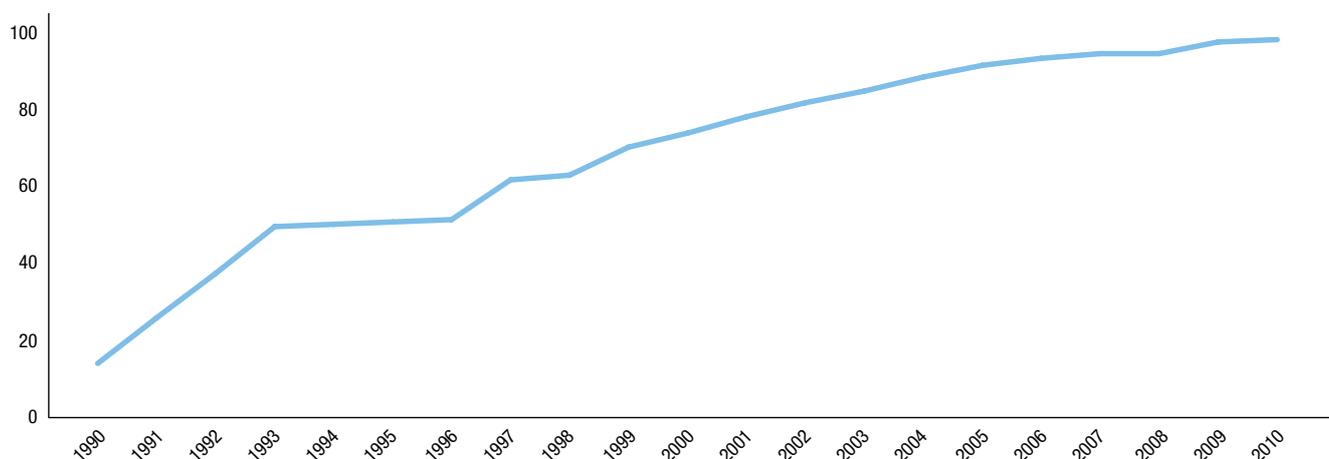
In the 2000s, the Government increased its support for rural electrification, with the national poverty reduction programme, Program 135, becoming one of the main vehicles providing this support. By 2010, 91.6% of households in the lowest income quintile had access to electricity, compared with 99.3% in the highest income group (GSO, 2011). Almost all those in the lowest income quartile were consuming less than 100 kWh per month, with 60% consuming less than 50 kWh per month. In most poor households, the use of electricity was limited to lighting, entertainment and communication.

Between 1990 and 2010 the number of Viet Nam's citizens with access to modern energy for cooking increased from 3.3 million people to 38.2 million. By 2011, almost 81% of urban households and more than 38% of rural households were using liquid petroleum gas (LPG) for cooking (Accenture, 2012). The main driver in the switch to non-solid fuels for cooking (i.e. LPG and electricity) was increasing household income.

### 3. Environmental sustainability

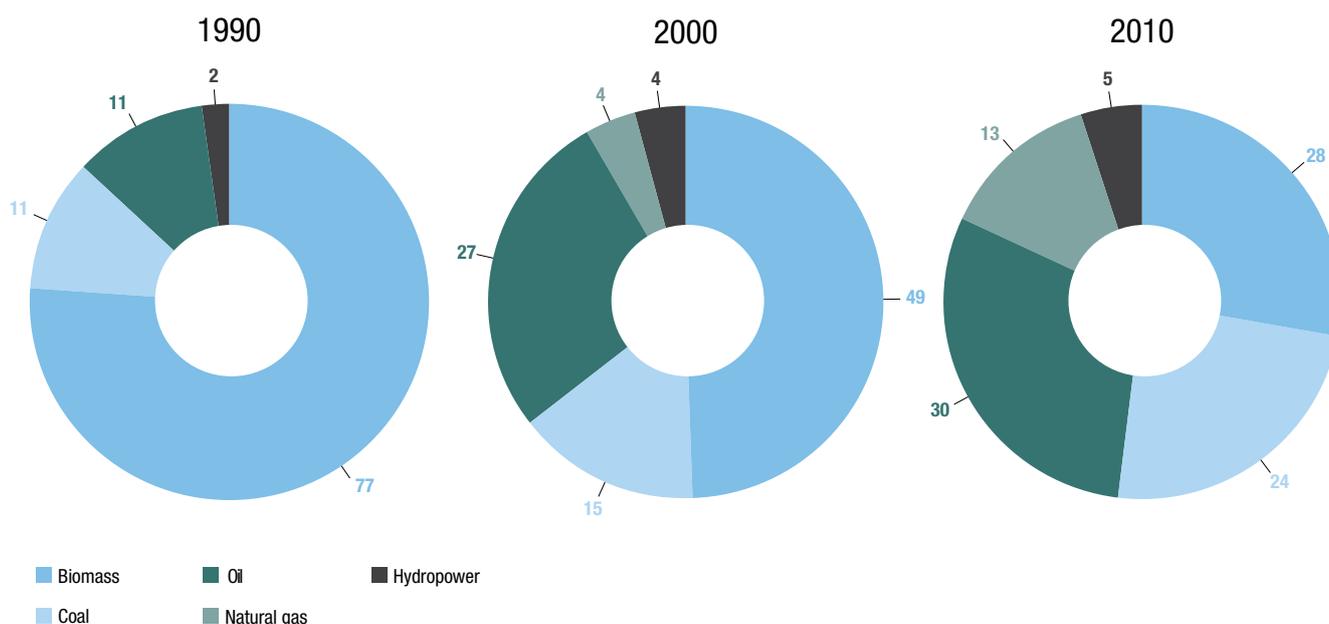
Viet Nam's rapid economic growth and its huge progress on electrification have been accompanied by expansion in the production of renewable energy. The quantity of electricity produced from renewables (including large-scale hydropower) increased from around 5,370 GWh in 1990 to more than 27,600 GWh in 2010 (SE4All, 2013). Although the proportion of Viet Nam's electricity from renewable sources halved, to 29% in 2010, compared with

**Figure 1: Population with access to electricity (%)**



Source: Sustainable Energy for All database; World Bank, 2011

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



Sources: Asia Pacific Energy Research Centre (1990) and SE4All database (2000, 2010)

other countries in south-east Asia, a high proportion of Viet Nam’s electricity still comes from renewable sources.

About one third of total primary energy supply (TPES) came from renewables (primarily biomass and hydropower) in 2010, less than half the proportion seen in 1990. Hydropower accounted for 5% of the country’s TPES in 2010, an increase from 2% in 1990. However, as depicted in Figure 2, TPES changed from mainly renewable sources to mainly fossil fuels over the period 1990-2010. Consequently, energy consumption accounted for 35% of Viet Nam’s total greenhouse gas emissions in 2000,

compared with 24.7% in 1994. Per capita emissions increased from 0.3 tons per person in 1990 to 1.6 tons in 2009, a level that is still lower than those seen in most middle-income countries (United Nations, 2013).

The energy intensity of the Vietnamese economy is higher than the average for middle-income, but fell by more than 25% between 1990 and 2010, from 268 kgoe of final energy per \$1000 (2005 PPP) to 194 kgoe/\$1000 (2005 PPP). Further efficiency gains remain possible (UNDP, 2012).

## What are the factors driving change?

### 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. An adequate electricity supply, spanning generation capacity to distribution infrastructure, is vital for the achievement of these aims and has largely been achieved.

A specific target for rural electrification was first introduced in 1996: 100% electrification of districts, 80% of communes and 60% of households by the year 2000. This was achieved and later revised upwards in successive Power Development Master Plans. The current target is near universal access by 2020.

A number of high level policy statements helped to drive progress in the energy sector, with policy on rural electrification appearing to have been joined up with other policies, including the national poverty reduction programme. There was also flexibility in government policy, which evolved in response to changing needs – focusing first on maximising access to energy and, later, on inclusion and quality.

Government commitment to providing access was manifested in the regulation of electricity prices as well as investment in infrastructure. In 1998, the Government introduced a ceiling price for rural household electricity use (equivalent to \$0.04/kWh), which remained in place until 2009, when a unified tariff for residential consumers was introduced throughout the country. This was an incremental block tariff, with a tariff of \$0.03/kWh for the first block of 50 kWh per month, which is approximately 30-40% of the actual cost (World Bank, 2011). 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 poorer rural consumers.

However, over this time, the primacy given by Viet Nam's policy-makers to economic growth and poverty reduction pushed environmental considerations into second place in policy implementation. The integration of environmental considerations into plans for growth and poverty reduction has also been constrained by limited capacity and lack of coordination across government. Environmental challenges are increasingly recognised in Viet Nam, with policy-makers now paying more attention to them.

### 2. The demand for electricity

Two decades ago, when only 14% of Viet Nam's people had access to electricity, there was a large and suppressed demand for it, partly the result of the higher incomes that resulted from expanded agricultural production. For many people, the problem was simply the unavailability of an electricity supply, rather than its affordability.



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

There is a suggestion in the literature that the Vietnamese placed a particularly high premium on access to electricity and there is some evidence that small increases in income had a disproportionate impact on the demand for electricity. Households were reportedly willing to spend amounts equal to one or two times their monthly incomes to pay for connection charges (World Bank, 2011). However, the growth rate of household access was higher than the growth rate in incomes, suggesting that it was not just higher incomes that led to accelerated progress.

### 3. Local-level implementation of rural electrification

In the early 1990s, electricity supplies in rural areas were provided through a variety of largely unregulated local initiatives that took advantage of the extension of electricity infrastructure for productive uses. In the most common model, found in 70% to 80% of connected communes, the district authority would assign its own staff to operate the low voltage distribution system in the district, purchasing electricity from the Power Company at the regulated wholesale price and selling it to consumers at a locally determined retail price.

By involving local authorities, 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 rapidly extend access to large numbers of people. The coordination of all infrastructure development by local authorities helped ensure that electrification accompanied the development of schools, clinics and roads (ADB, 2011). However, district electricity services had limited technical and managerial capacity, resulting in high distribution losses and, as a result, high consumer tariffs (World Bank, 2011).

It was not until 1999 that the local distribution organisations began to be brought under tighter regulation and local distribution utilities (LDUs) were introduced. By 2009, LDUs operated services in over 5,600 of the country's 9,087 rural communes, purchasing power from the national utility, Electricity of Viet Nam (EVN), at a wholesale tariff

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

and charging consumers a regulated consumer tariff (Van Tien Hung, 2009). The transition from unplanned and unregulated local electricity services was driven by the need for technical standardisation to improve the efficiency of the whole electricity network and the need to improve the management efficiency of the local service.

Rural electrification in Viet Nam has also been financed largely by local stakeholders. Investment in rural electrification totalled an estimated \$10.3 billion over the period 1990 to 2012. Government at all levels provided approximately 50% of this. Households (i.e. electricity consumers) contributed around \$3.4 billion; at the high point of electricity expansion (1996-2000), they were contributing 64% of the total cost of rural electrification.

The high share of rural electrification costs paid for by households excluded some of the poorest, who could not afford to pay connection costs. 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.

#### 4. Donor support

Donors committed \$7.8 billion to the Vietnamese energy sector between 1990 and 2011, the main donors being Japan, the World Bank and the Asian Development Bank. The energy sector accounted for over 20% of total official development assistance (ODA) between 1995 and 1998 but, more recently, the proportion of ODA allocated to the energy sector has been between 10% and 15%.

ODA is generally regarded as having been significant for rural electrification, though only a small proportion of total energy ODA was specifically targeted at it (shown in Figure 3). In all, donors financed around 8.7% of the total direct costs 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.

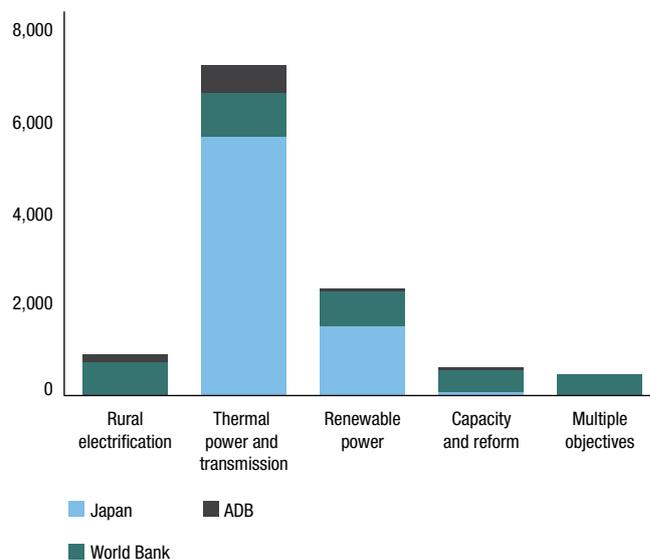
Technical assistance may have been a more significant contribution to rural electrification than investment support, which was largely provided by donors – the World Bank in particular – for specific projects and project preparation activities.

### What are the challenges?

#### 1. Environmental sustainability

The supply of renewable electricity increased substantially, overall. However, the environmental sustainability of the country's energy system has deteriorated – the proportion of total energy supplied from renewable sources falling from 79% in 1990 to 33% in 2010 – and redressing this while meeting rapid growth in the demand for energy will be a challenge. Under current plans, the environmental sustainability of Viet Nam's energy system will continue to decline. As in other countries, Viet Nam has two options to make its energy system more environmentally sustainable: improve the efficiency of energy use and/or switch to lower carbon energy sources, including

**Figure 3: Allocation of energy ODA from the principal donors 1990-2011 (\$'000)**



Source: interpreted from AidData project figures.

increasing the proportion of energy from renewable sources.

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-powered power stations, and would reduce CO<sub>2</sub> emissions by over 100 million tons a year (Soussan et al., nd). To achieve these savings, regulation and changes in enterprise management practices will be necessary, together with investment by the private sector and state-owned enterprises.

The potential for renewable electricity generation is estimated to be about 155,000 MW, seven times higher than the total installed capacity in 2010. Though there are differences in the estimates of this potential, it is clear that there is significant unexploited potential that could be addressed by alternative policies.

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

#### 2. Achieving universal access

The current Government objective is to achieve near universal access to electricity by 2020. This calls for around 500,000 new household connections over ten years, with the challenge now to reach the remotest and poorest households in the country. The investment costs per connection will be far higher and the seventh Master



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

Plan for Power Development (2011-2020) proposes the use of new and renewable energy to supply electricity to these areas.

The Government intends, over time, to bring the consumer price closer to the estimated long-run marginal cost of electricity (around \$0.08-0.09/kWh), which is double the tariff paid by most low-income households. To ensure universal access, the poorest households will still need a subsidy for electricity consumption through a lifeline tariff or more direct and targeted cash transfers.

Rural households will need to consume more than the 50 kWh a month, available on a subsidised tariff, if electricity is to contribute more directly to poverty reduction and help accelerate industrialisation and the modernisation of agriculture, as proposed in the Master Plan for Power Development 2011-2020. To achieve this, support could be provided to enable poor households to access credit for the purchase of appliances and by linking electricity use to business and agricultural development programmes.

### 3. Reliability of electricity

Viet Nam ranked 113 out of 144 countries in terms of the reliability of its electricity supply in 2012 (World Economic Forum, 2013). Unreliability of supply is particularly

acute in rural and remote areas where both the quality of the local distribution system and its connection to the national transmission system need improvement. Losses in the system averaged 8.08% in 2010 (UNDP, 2012), a considerable improvement on the 25% losses seen in 1990, but 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. Subsidy reform

Viet Nam has regulated energy consumer prices to facilitate economic growth and increase household access to energy. These indirect subsidies to consumers result in financial losses for state-owned energy enterprises, which the Government has to cover. They affect EVN's ability to invest and to pay independent power producers for electricity fed in to the grid (UNDP, 2012). This has encouraged inefficient energy consumption and acted as a disincentive for investment in renewables.

Decisions in 2010 and 2011 furthered a move towards the use of market mechanisms to determine electricity prices. According to one estimate, electricity tariffs would need to be 15-30% higher to ensure financial sustainability (UNDP, 2012). The reform of pricing underway will need to ensure that low-income groups are not affected adversely.

## Lessons learned

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. This case study indicates that:

- clear policy objectives made a difference
- poverty reduction programmes contributed to rural electrification
- investment came from a range of stakeholders, including consumers and
- international cooperation made a significant contribution.

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. Three key lessons for policy-makers emerge:

- **Sustained and flexible policy direction is critical for progress in energy.** Rapid expansion of rural electrification was achieved, largely because it was a clearly stated objective of the national Government and it responded to 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 service 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, plus equivocal policy on environmental sustainability placing it secondary to economic growth, allowed inefficient use of energy and rapid expansion of non-renewable power generation capacity. Based on this, policy-makers seeking to rapidly extend electrification in other countries should consider to what extent their energy policies provide clear and consistent direction over time and respond to changing conditions, along with whether their energy policies address all the energy needs of citizens.

- **Local resources can be effectively mobilised for rural electrification.** Viet Nam's achievement of exceptionally rapid rural electrification during the 1990s 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 context-specific factors, which means this mobilisation of local resources may not be easily replicated elsewhere. Viet Nam's policies for equitable access to electricity were partly a response to the experience of relying on local resources for electrification, which does not necessarily lead to a focus on providing access for the poorest. This experience highlights the importance of considering equitable access to electricity early on in electrification planning and implementation. Policy-makers should also 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.** Despite early policy statements on a commitment to sustainable development, and later ones on environmental sustainability, Viet Nam does not appear to have actively sought 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 has 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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This summary is an abridged version of a research report and one of a series of Development Progress case studies being released at [developmentprogress.org](http://developmentprogress.org)

Development Progress is a four-year research project which aims to better understand, measure and communicate progress in development. Building on an initial phase of research across 24 case studies, this second phase continues to examine progress across countries and within sectors, to provide evidence for what's worked and why over the past two decades.

This publication is based on research funded by the Bill & Melinda Gates Foundation. The findings and conclusions contained within are those of the authors and do not necessarily reflect positions or policies of the Bill & Melinda Gates Foundation.

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