



postnote

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ACCESS TO ENERGY IN DEVELOPING COUNTRIES

Increasing access to energy in developing countries has proved to be a challenging and contentious issue within the international development community. Agencies are now realising the limitations of past energy-related interventions and undertaking a widespread review of policy in this area. In the UK, the Department for International Development (DFID) is currently embarking on a new approach. This briefing outlines the current scale of energy needs in developing countries, the issues associated with meeting these needs and the role of the UK in adopting a new perspective.

Energy and development

Energy provides services to meet many basic human needs, particularly heat, motive power (e.g. water pumps and transport) and light. Business, industry, commerce and public services such as modern healthcare, education and communication are highly dependent on access to energy services. Indeed, there is a direct relationship between the absence of adequate energy services and many poverty indicators such as infant mortality, illiteracy, life expectancy and total fertility rate.¹ Inadequate access to energy also exacerbates rapid urbanisation in developing countries, by driving people to seek better living conditions.

Around 1.6 billion people in developing countries lack access to adequate energy services. 80% live in rural areas, predominantly in sub-Saharan Africa and South Asia. The table opposite illustrates the disparities in global energy consumption, where developed countries consume around six times as much energy per person as developing countries.

Increasing energy consumption has long been tied directly to economic growth and improvement in human welfare. However it is unclear whether increasing energy consumption is a necessary precondition for economic

Energy use in the developed and developing worlds¹

region	primary energy use (gigajoules/person)		
	1985	1990	1997
OECD countries	173	181	194
Developing countries	27	29	34

growth, or vice versa. Although developed countries are now beginning to decouple their energy consumption from economic growth (through structural changes and increases in energy efficiency), there remains a strong direct relationship between energy consumption and economic development in developing countries.

Sources of energy in developing countries

Around half of all people in developing countries are dependent for fuel on wood, dung and crop residue, collectively known as 'traditional biomass'. Three quarters of these live in China, India and sub-Saharan Africa. The International Energy Agency (IEA) has forecast that use of traditional biomass will decrease in many countries, but is likely to increase in South Asia and sub-Saharan Africa alongside population growth. Overall, the IEA forecasts that by 2030, the total number of people reliant on biomass will not have changed significantly.

While the use of traditional energy sources is not necessarily undesirable in itself, concerns have been raised over how they are currently being used. The box on the next page outlines the major questions about the current use of many traditional fuels.

Modern energy sources, such as electricity and petroleum-based fuels, generally provide only a small part of the energy use of poor rural people. This is mainly because they are too expensive and because it can prove difficult to achieve regular supplies to isolated rural communities.

Concerns over traditional biomass fuels

Efficiency - current utilisation practices tend to have low efficiencies (~10%)

Economic burden and gender disparities - time spent on collecting and using traditional fuels represents a significant burden, mainly for women - time that could be spent on productive tasks and education.

Environment - use of fuelwood for energy can exacerbate deforestation, which often has knock-on effects such as loss of wildlife, soil erosion and increased flooding.

Health - cooking on traditional stoves is a major source of concentrated air pollutants, including respirable particulate matter (in smoke) and gases such as carbon monoxide and nitrogen oxides. According to the World Health Organisation (WHO), long-term exposure to smoke can increase the risk of a child developing acute respiratory infection by between 2 and 4 times. The WHO estimates that 2.5 million women and young children in developing countries die prematurely each year as a result of breathing the fumes from indoor biomass stoves.

Projections of global primary energy demand to 2050 (Gigatonnes of oil equivalent)

	1990	2050		
		High growth	Middle course	Ecologically driven
OECD	4.2	6.7	5.6	3.0
Economies in Transition	1.7	3.7	2.4	1.7
Developing Countries	3.1	14.4	11.8	9.5
World Total	9.0	24.8	19.8	14.2

Source: World Energy Council

Energy forecasts in developing countries

As their economies develop over the next few decades, the demand for energy services in developing countries is expected to increase considerably, especially in rural areas. As well as meeting household needs for an adequate supply of energy, there is growing demand for rural services such as water supply, sanitation, health care and education, and for productive activities such as agriculture and small industries.

In 2000, the World Energy Council² (WEC) published updated long term projections for global energy demand for three scenarios up to the year 2050: high economic growth; ecologically driven growth; and a "middle-course" scenario. As is evident from the table above, even under the least energy intensive "ecologically driven" scenario, primary energy demand in developing countries is expected to triple and form up to two thirds of total global demand by 2050.

Options for delivering energy

Meeting energy demand in developing countries thus presents a significant challenge. The box opposite outlines a number of the technological options available to provide the energy required.

The optimum choice of technology will be specific to each location and depends on a number of factors including resource availability, affordability, ease of access and local capacity to absorb, use and maintain the technology. It will also depend on the services and

Options for energy supply in developing countries

Electricity grid extensions – while clean and efficient at the point of use, extending electricity grids is capital intensive and requires on-going maintenance

Small scale hydropower systems – these tend to have high capital costs but relatively low maintenance costs, a long service life, high operational reliability (given water availability) and low environmental impact

Solar energy systems (photovoltaic and solar thermal) – these have few environmental impacts, but initial costs can be high. Maintenance and replacement may be difficult in isolated communities.

Small scale wind energy systems – these tend to have high capital costs but low running costs. Supply is intermittent and so energy storage is necessary for reliability

Biogas and liquid biofuels (alcohols and vegetable oils) – these tend to have low capital costs and beneficial by-products

Improved biomass – this is focused on enhancing the use of biomass through technologies such as improved cooking stoves, aimed at increasing efficiency and reducing air pollution.

Hybrid systems – these provide a mix of energy sources for electricity generation and can frequently reduce costs, and ensure a reliable supply (e.g. wind and grid extensions).

end uses desired in each locality, as not all technologies are adaptable and cost effective for particular end uses. However, technology is not the only consideration, and other factors include:

- the impact on those whose livelihoods depend on the processing and sale of traditional fuels
- local preferences, attitudes and perceptions
- knock-on benefits, such as the creation of jobs associated with supporting industries.

Issues

The effectiveness of international aid

The box on the next page outlines the key features of energy-related aid in the last 20 years. There is now a growing consensus among international development agencies that many of these attempts have not been entirely successful and that a new perspective is needed. This has resulted in a widespread review of policy by multilateral and bilateral agencies alike.

Energy financing

The availability of adequate finance is one of the main challenges in meeting current and future demand for energy in developing countries. Current energy investments total US\$290-430 billion per year and the WEC has estimated that a total of US\$30 trillion over thirty years will be required to meet a 70% increase in global energy demand. The WEC's scenarios suggest growth in total world energy demand of between 58% and 175% by 2050 (see box above).

Current sources of energy finance in developing countries include governments, multilateral institutions, private investors (local and international) and overseas development assistance (ODA). Given the scale of the challenge, it has been generally acknowledged that the public sector in many developing countries will not be able to finance all the investment needed to satisfy

growing energy demand requirements. Increasingly, the task of ensuring adequate energy supplies is seen as one for the private sector. Here, key drivers have included structural adjustment and energy sector reform programmes, central to which has been the privatisation of publicly owned utilities and the removal of subsidies.

Despite the involvement of the private sector in such programmes, recent international energy reports have pointed out that securing the amount of investment required has proved to be difficult. The WEC suggests that this is due to a combination of barriers, including unfavourable conditions faced by private and foreign investors in many developing countries (particularly corruption and fragile governments) coupled with the fairly low rates of return associated with typical energy investments.

Furthermore, the World Bank points out that although energy investment increased almost 4-fold in the early 1990s, it later declined significantly as a result of a global financial downturn in 1997. This has led development organisations to press for policies to encourage private investment, and the setting up of institutional structures such as local co-operatives, which would work to improve local energy provision in rural areas.

Affordability

Where modern energy services exist, a major barrier still remaining is affordability. In India for instance, although electricity networks are technically within reach of 90% of the population, only 43% are actually connected, as many remain unable to afford the cost of connection. Where extension of electricity networks is not viable (in remote rural areas), many of the technologies that are best suited to provide energy services to those areas (e.g. solar or wind energy), have high initial capital costs as well as maintenance and replacement costs.

One approach to financing is to pay subsidies to those on low incomes. Many developing country governments actively promote this approach to replace traditional biomass with modern energy sources, particularly electricity. However, evidence points to subsidised energy services being diverted to unintended uses and disproportionately benefiting those otherwise able to afford the true market costs of supply (such as commercial businesses and the more affluent).

Alternative approaches to financing have recently emerged focusing on improved access to micro-credit and lending to purchase energy supply technologies and energy services. Evidence has shown that poor people in developing countries are willing to pay for energy services if they are able to do so. This has led the United Nations Development Program (UNDP) to suggest that poor rural households represent a large potential market. Here, UNDP argues, the private sector and banking institutions can play a role by providing micro-credit financing.

Key features of international aid efforts to date

Large scale power generation projects

Much of the early international aid interventions were carried out through the development of large-scale energy projects (mostly hydropower), often led by commercial interests. Although these proved to be effective in providing energy to large numbers of people, widespread criticism of their consequences (including displacement of people and undesirable environmental effects); as well as their focus on providing energy for urban centres led to a substantial decrease in their numbers.

Rural electrification:

Most interventions aimed at increasing energy services in rural areas have focused on grid extensions and distribution of electricity from large-scale generation facilities. Experience has revealed that successful electrification depends on:

- the ability to recognise that some areas are more viably served through locally generated (decentralised) electricity (such as when grid extension costs are too high or demand is intermittent)
- the availability and affordability of the conversion technologies and electrical appliances needed
- the presence of complementary social and economic infrastructure such as microcredit lending schemes, rural water supply, healthcare and schools.

Power sector reform

In the 1990's, energy related development aid projects were replaced by efforts aimed at reforming the energy sector in developing countries, primarily existing electricity and gas networks. According to the World Bank, limited study on their effectiveness reveals that despite financial and institutional innovations in providing energy to low income areas, the reforms have made little impact on improving energy services to the poor.

The World Summit on Sustainable Development (WSSD)

Energy was identified as one of the five thematic areas to be covered in advance of WSSD (along with water, health, agriculture and biodiversity) and featured strongly in the Draft Plan of Implementation. Although several specific targets for action were proposed, these were not adopted by the international community and WSSD achieved very little in this area.

Improved biomass

A considerable amount of development aid has been targeted towards improving the current use of biomass, based on the adaptation of traditional stoves to increase efficiency and limit adverse effects (as illustrated in the box on page 2). Development organisations such as the Intermediate Technology Development Group regard such efforts as being largely successful.

Technology barriers

Although various energy technologies are available in the global market, they remain beyond the reach of many developing countries. Recognising this, many in the development community have called for increased efforts to transfer these technologies from the developed to the developing world. However, simply having access to the technology will not guarantee that people in need will receive the energy services. It is also necessary to ensure that there is adequate capacity in developing countries for suitable people to obtain and enhance technological skills and capability to acquire, select and absorb that knowledge into local settings. Hence many agree that technology transfer and capacity building must come hand in hand.

It is widely known that the proliferation of new technologies to developing countries is constrained by an unwillingness of some technology owners to transfer their intellectual property (e.g. through unfavourable terms in patents and licensing agreements). This arises primarily where intellectual property holders perceive an absence of adequate regulations within developing countries to ensure the protection of their property rights. In this context, the Department of Trade and Industry (DTI) is leading the UK's efforts to begin a new round of negotiations under the World Trade Organisation. The question remains whether the new round will tackle how international property rights might affect development.

The UK role

Technological transfer and capacity building

The UK is currently involved in a number of initiatives and partnerships that involve the transfer of energy technologies and knowledge to developing countries (see box opposite). However, there is no oversight of the range of initiatives. Indeed, many are aimed primarily at promoting and aiding UK business in exporting new and innovative technologies, while development objectives appear secondary to this. Thus, some have called for closer coordination between these initiatives and a clear statement of their goals, ensuring that the development agenda is taken fully into account.

Private Sector Engagement

The UK is also taking steps to facilitate energy investments by the private sector through the Export Credit Guarantee Department (ECGD) of the Department of Trade and Industry (DTI). The ECGD aims to provide guarantees, insurance and reinsurance against loss for exporters of UK goods to developing countries. The Government has recently announced that beginning in April 2003, the ECGD will aim to provide developing countries with improved access to renewable energy technologies by making at least £50 million worth of credit guarantees available each year for exports in the sector. ECGD will also be working with DTI, Trade Partners UK's Export Promoters and Renewable UK to help them identify opportunities for exporters and investors in the renewables sector.

Furthermore, the Kyoto Protocol's Clean Development Mechanism³ provides an opportunity for UK business to transfer efficient, clean and appropriate energy technologies to developing countries, while contributing towards UK greenhouse gas reduction targets. However, although interest has been expressed by larger multinational organisations, CDM projects may be unattractive due to high transaction costs. DTI has recently set up a Climate Change Projects Office, to provide advice and support to UK business in pursuing these types of projects. DFID has also recently commissioned research aimed at facilitating investments in small, rural, poverty focused projects.

A new approach to energy related development aid

The limitations of previous development assistance aimed at increasing energy access have been widely

UK technology transfer programs

New and Renewable Energy Programme - encourages the commercialisation of renewable energy technologies and other novel energy sources. A major part of the programme is devoted to technology transfer and export promotion.

Technology Partnership Initiative (TPI) - encourages the transfer of environmental technologies, mainly by providing access to information about UK suppliers. (£500K per year)

Commonwealth Partnership for Technology Management (CPTM) - partnerships between governments of British Commonwealth countries and the private sector, established as part of the UK Government's aim to encourage the formation of global technology transfer networks and partnerships. (£60K per year)

Asia-Europe Environmental Technology Centre (AEETC) - aims to encourage partnership between EU and Asian organisations in the transfer of environmental technology and R&D activities. (£80K per year)

Centre for the Analysis and Dissemination of Demonstrated Energy Technologies (CADET) - aims to provide information on proven technologies to help accelerate their adoption in the market both nationally and internationally

Hands on Training Scheme (HOTS) - geared towards helping companies establish overseas contacts by helping business meet the cost of a short-term training in the UK for individuals or groups to learn about sector specific technology or practice. (£120K per year)

Centres of Excellence for Technology Innovation for Sustainability in Africa (CETISA). The Royal Institute of International Affairs, with support from the UK government launched this Type 2 partnership at WSSD. The initiative is bringing together partners from governments in Africa and other countries, along with intergovernmental organisations, businesses and civil society groups to design and establish a network of centres of excellence. The partnership aims to build science and technology capacity to enable the development and implementation of the technological solutions needed for sustainable development.

acknowledged among development agencies. In 2002 DFID published an issues paper outlining a new approach to energy assistance⁴. This addresses many of the issues highlighted above, including: developing local capacity; attracting private investment in energy services and providing access to finance and reducing costs. The question remains as to how this new strategy for energy assistance will be implemented.

Endnotes

- 1 International Energy Agency: *World Energy Outlook 2000*.
- 2 The World Energy Council (WEC) is a UN- accredited, non governmental organisation renowned for its research and analysis of energy issues on a global level. It is a UK based charity. (www.worldenergy.org)
- 3 For further information on the Clean Development Mechanism, see POSTnote 176 *Ratifying Kyoto*.
- 4 Available at: envpov.aeat.com/ENPOV/

POST is an office of both Houses of Parliament, charged with providing independent and balanced analysis of public policy issues that have a basis in science and technology. POST is grateful to Roon Osman and Imperial College for Energy Policy and Technology for the research undertaken in the preparation of this briefing note. A longer report is available on the POST website.

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