

# **Achieving Energy Security in Developing Countries**



This publication may be reproduced in whole or in part and in any form for educational and non-profit purposes without special permission from the copyright holder, provided acknowledgment of the sources is made. GNESD would appreciate receiving a copy of any publication that uses this publication as a source. No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from GNESD. The opinions and recommendations set forth in this publication are the responsibility of the authors and should not be considered as reflecting the views or carrying the endorsement of UNEP.

This publication and other publications from GNESD can be downloaded from [www.gnesd.org](http://www.gnesd.org)

### **GNESD Developing centres are:**

#### **Africa:**

ENDA-TM, Environnement et Développement du Tiers Monde, Senegal.

AFREPREN/FWD, The African Energy Policy Research Network/Foundation for Woodstove Dissemination, Kenya.

ERC, The Energy Research Centre, South Africa.

MEDREC Mediterranean Renewable Energy Centre, Tunisia.

#### **Latin America:**

Fundación Bariloche (IDEE/FB), Argentina.

CentroClima at the Federal Uni. of Rio de Janeiro

CENBIO at the Uni. of São Paulo, Brazil. in conjunction

#### **Middle East and Asia:**

AIT, The Asian Institute of Technology, Thailand.

TERI, The Energy and Resources Institute, India.

ERG/AUB, The Energy Research Group at The American University of Beirut, Lebanon.

ERI, The Energy Research Institute of the National Development and Reform Commission (NDRC), China.

### **GNESD**

The Global Network on Energy for Sustainable Development (GNESD) is UNEP facilitated knowledge network of Centres of Excellence and Network Partners, renowned for their work on energy, development, and environment issues. The main objective of GNESD is to work for reaching the Millennium Development Goals (MDG) by:

- Strengthening the Members Centres' ability to acquire, assimilate, and apply existing knowledge and experiences.
- Working for a better understanding of the links between sustainable energy and other development and environment priorities, and technology and policy options, leading to better articulation of practical policies that can be adopted so as to promote and highlight the crucial role of energy for sustainable development.
- Working to provide research findings to the Governments to be considered in formulating their policies and programmes, and the private sector to attract investments in the energy sector, so that these favour energy sector growth for sustainable development, especially for the poor in the developing countries.
- Promoting a communication infrastructure that provides a means for Members to share experiences and draw on each other's strengths, expertise, and skills, and
- Strengthened South-South and North-South exchange of knowledge and collaboration on energy issues of common interest.

GNESD is one of several Type II partnerships in the field of Energy that were launched at the World Summit on Sustainable Development (WSSD) in Johannesburg, September, 2002.

#### **Photocredits**

<http://knowledge.allianz.com>

Andreas Flensburg

UNEP Risø 2010



# Achieving Energy Security in Developing Countries

**GNESD studies find that a twin-track approach of prioritising renewable energy and energy efficiency can be the quickest and most effective means to achieve energy security in developing countries**

## Background

This energy policy briefing is based upon country reports on energy security and efficiency produced by member centres of the Global Network on Energy for Sustainable development (GNESD) in 2010. This policy brief is a summary of key issues and recommendations emerging from the GNESD study that investigated the energy security threats facing developing countries, and measures to mitigate them. Experiences from eight case-study countries considered in this policy briefing are Argentina, Brazil, India, Kenya, Senegal, South Africa, Thailand and Tunisia.

## Introduction

In recent years, the issue of energy security has topped the agendas of governments around the world. However the term 'energy security' can mean many things. From a developed-world perspective, policies to improve energy security normally focus on the means to secure low cost and reliable supplies of fossil-fuels for electricity generation and transport. For most OECD countries that are increasingly reliant on imported oil, natural gas, and coal, the key question is how to diversify these supplies of imported energy in order to reduce the risk of shortage.

While this is also a concern for many developing countries, energy security is also about meeting basic human needs at the household level, where per-capita consumption levels and the quality of energy supplies are often far lower than in OECD countries. As such, this policy briefing focuses on the connections between energy security at the household and national levels, from the perspective developing countries. Key policy recommendations focus on the need to expand the supply of renewable energy, while seeking to manage demand growth through energy efficiency measures.

## Linking national and household energy security: identifying the problem

At the national-level, seven out of the eight countries studied by GNESD are major net energy importers. In fact, energy import dependency (net energy imports as a percent-

age of total energy consumption) is over 40% in Senegal, Thailand and Tunisia, whereas in India, Kenya and South Africa, it is around 20%. In addition, the amount of energy imported in absolute terms has increased in all the countries during last few years. At the same time, most of the low income developing countries with high import dependency also show a high vulnerability to energy price volatility. For example, Kenya and Senegal spend more than half of their export earnings for importing energy, while India spends over 45%. In terms of final energy consumption, the share of the transportation sector in total oil consumption exceeds 40% in all the countries in the study, except India.

However, an overriding concern for energy policy makers in developing countries is the need to secure affordable, clean and reliable energy sources at the household level. In fact, domestic energy consumption tends to make up a far larger proportion of total energy demand in developing countries than in OECD nations. For example, 45% of India's total primary energy consumption takes place at the household level. However, households in many developing countries face the threat of insecure energy supplies due to a lack of access to electricity and clean cooking fuels. For example, less than 8% of the Kenyan population has access to electricity, with 42% and 56% in Senegal and India respectively. Even in areas where households are connected to the grid, supply interruptions are a common occurrence in many developing countries.

The cost of energy also imposes a heavy financial burden on the majority of low-income households in developing countries. In Kenya, low income families spend more than 20% of their total income on energy commodities. In Brazil higher income households that depend entirely on electricity typically spend 3-5% of their income on energy, whereas low income households spend 10-20% of their income on energy. As such, rising international petroleum prices have a disproportionate impact on the poorest households in low income countries, and pose a challenge for countries aiming to increase access to cleaner modern fuels for low-income households, such as liquid petroleum gas (LPG).

Indeed, there is already evidence of rising fossil fuel price having forced households down the energy ladder in Senegal and Brazil, thus highlighting the direct connection between macro and micro-level energy security in many developing countries. If rising imported fuel prices are not managed then there is a risk that lower-income households will be forced into using more biomass sources, which in turn in-



creases the risk of health problems and local environmental stress. Where these economic impacts are successfully managed, many developing countries face the challenge of ensuring sufficient and reliable energy supplies, especially of electricity, given that per-capita consumption is often very low but rapidly rising.

The quality of the energy supply is also an issue. Most countries face problems of frequent energy supply disruptions and/or peak time electricity supply shortages. Interruptions of varying frequencies in the electricity sector are mostly due to a heavy reliance on a single resource (e.g., hydro in Kenya and Brazil), inadequate supply capacity and the lack of investment in infrastructure development to meet increasing demand (e.g., inadequate installed capacity in India and South Africa, insufficient oil refining and storage facilities in Senegal).

## **Policies and programs to address the energy security challenge**

In order to enhance energy security it is necessary to consider policies that reduce risks from both the supply and demand-side. To this end, governments of developing countries are advised to diversify their sources of imported energy, while seeking to reduce a reliance on imported energy (especially oil) over the longer term. On the demand side, policies aimed at increasing energy efficiency are often the easiest and lowest-cost means to achieve greater energy security.

This is particularly the case in countries with diminishing marginal reserve capacities in the electricity generation sectors, where short term demand-side management is often quicker and cheaper than building new supply capacity.

## **The importance of renewable energy**

In countries that have high net energy imports, there is a greater need and justification for expanding the role of domestic renewable energy sources. The barriers to expanding the supply of renewable energy are often the same across countries, principally a lack of financial subsidisation or incentives and limited access to appropriate technologies. In order to encourage large scale and sustained private investment in renewable energy, a combination of R&D-push and demand-pull measures are crucial in order to achieve cost competitiveness.

Examples from the GNESD country studies show that it is desirable for governments to establish dedicated and authorised agencies responsible for promoting, initiating and financing renewable energy projects and programs. Clearly set government targets are fundamental in giving confidence to private investors seeking to develop renewable energy projects. The success of the Brazilian bio-fuel programme was mainly due to clear and consistent policies and targets, as well as government subsidies, set at an early stage.

## Key policies for promoting renewable energy technologies and markets

Tried and tested means to promote investment in renewable energy include the introduction of feed-in tariffs, net-metering, and tax credits, while governments must lead efforts to support necessary R&D. The 'adder' program, which was introduced to small-scale power producers in Thailand, has also been successful. This is where the price of electricity generated from renewable energy is decided by a public competitive bidding system, with the government providing additional revenue to energy suppliers depending on the energy source. After a renewable technology becomes mature, it is left to compete on the open market.

The promotion of solar cookers in India is an example of a renewable energy technology that was initially promoted through several incentives, including government subsidies, but which later became competitive in the open market. Thus, governments can intervene with market creation policies at an early stage of technology development, without having to commit to long-term subsidies. Similarly, in the Brazilian bio-fuel program the government offered a variety of incentives including low-interest loans to build distilleries, ethanol purchase guarantees and favourable pricing relative to gasoline, as well as retail tax breaks until bio-fuels were able to compete without subsidies in 2005. In Thailand, 'conventional' policies such as financial incentives and tax exemptions have also attracted private sector investment in bio-fuel development programs. However the government actively promotes the consumption of bio-fuels through mandatory consumption policies and attractive pricing structures.

## Renewable energy at the household level

The household sector can also benefit from the renewable energy projects and the development of infrastructure facilities such as extended grid networks and storage facilities, so that the citizens can access improved energy services. Following positive experiences in Brazil and Tunisia, it is evident that the promotion of renewable energy technologies at the household level, such as solar hot water systems, can help in reducing peak demand in the national grid. Such

initiatives, which can make use of renewable energy at peak periods (when prices are highest), are recommended since countries can operate with a lower capacity margin at peak hours, which would otherwise adversely affect the quality of energy and possible load shedding.

Small-scale biogas technologies are being promoted, with some success, in India and Kenya, as well as solar cookers in India, Argentina and Kenya and solar water heater program in Argentina, Brazil, Kenya, South Africa and Tunisia. Increasing access to electricity and other grid-based energy networks is recommended wherever possible. Several countries have initiated a number of programs to expand energy access, especially among rural and low income groups. South Africa, India and Brazil have initiated programs aimed at providing universal access to modern energy services, mainly through electrification which opens the door to an array of grid-connected renewable energy technologies, from large-scale wind farms to household level solar-PV.

## Affordability

Affordability of sustainable energy is a major concern, especially among low income households, in developing countries. As indicated, low income households spend a significantly higher share of their total expenditure on energy (about 18% in Argentina and Thailand, and over 20% in Kenya) than their higher income counterparts. They are therefore particularly vulnerable to increases in energy prices, underlining the need for properly designed energy subsidies – at least in the early stages of introducing cleaner fuels. Here, it is crucial that subsidies should be properly targeted to cover only the poor. Subsidised natural gas in Argentina and LPG in India provided benefits which were too often received by higher-income households. However, if successful, subsidies should be removed at an appropriate time, such as during a period of low energy prices, or, ideally, when income levels have increased among the target households.

## What about biomass?

With regard to fuels for cooking and heating, households in developing countries continue to depend heavily on biomass, thus occupying a position at the bottom of the energy



ladder: in Senegal, India and Kenya, the share of biomass in household energy consumption exceeds 70%. The heavy dependence on biomass energy is due to either a lack of access to clean energy sources or the inability to pay for them where they exist, reflecting a need to address wider development goals. However, energy security at the household level can be achieved by promoting the efficient use of biomass energy on one hand, and increasing its availability and its substitutes on the other hand. Here, a number of insights can be gained from the GNESD studies. Technologies such as efficient cook stoves can radically reduce indoor air pollution and the heavy burden on forest resources. India provides the best example of promoting energy efficient cook stoves: 35 million household units were installed between 1987 and 2003, saving an estimated 10 million tons of fuel wood per year. Renewable energy sources can also substitute biomass as a cooking fuel. In India the government provided initial support for the market in household solar cookers which now competes with conventional technologies.

## Energy efficiency: the other side of the coin

The introduction of demand management programs can help to reduce total energy demand growth, and thus help achieve energy security at both the national and household level. Key policies include energy consumption reduction targets, taxation, flexible financing mechanisms, energy labelling, performance standards, and awareness raising campaigns. Among the GNESD country studies, Argentina, India, South Africa, Thailand and Tunisia are promoting compact fluorescent lamps, while India and Kenya are also promoting improved cook stoves at the household sector.

One of the best examples of government commitment to improving energy efficiency is the Thai government's support through the ENCON fund, which is generated from a tax imposed on petroleum products. The ENCON fund provides low interest loans to private investors to finance energy efficient installations and programs. Elsewhere, experience suggests that consumer awareness campaigns can make a significant impact in improving energy efficiency, at a low cost.

Secretariat  
Global Network on Energy for Sustainable Development  
Risoe - DTU  
Frederiksborgvej 399, Bldg. 142  
DK-4000 Roskilde  
Denmark  
Tel: +45 46775189  
[gned@risoe.dtu.dk](mailto:gned@risoe.dtu.dk)  
[www.gned.org](http://www.gned.org)