

# Developing countries and access to energy

## Context

### Basis of the analysis

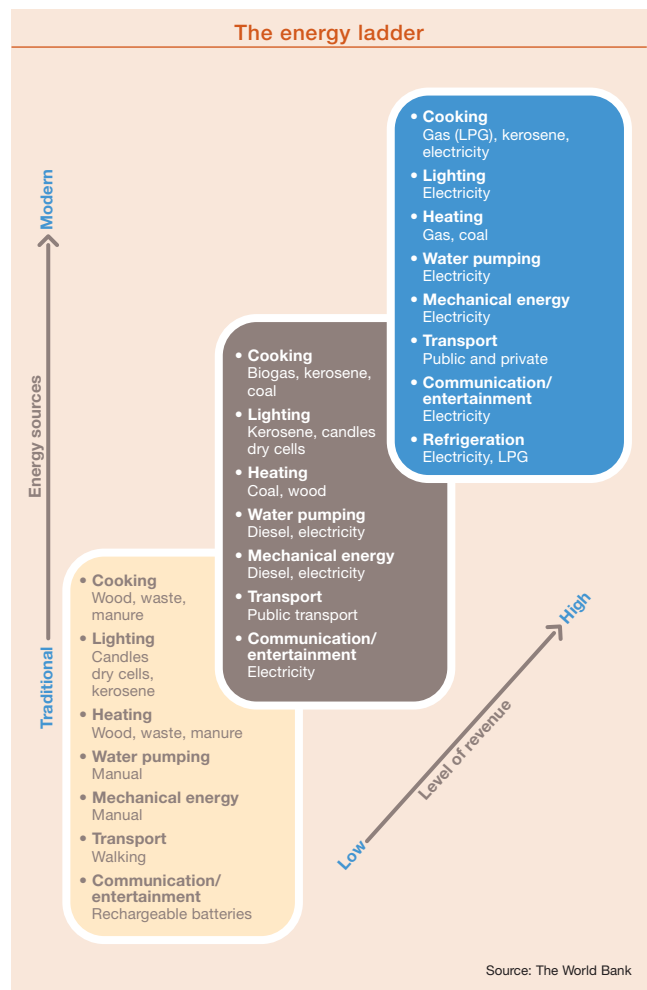
#### Energy, a fundamental of development

According to the World Energy Council, some 1.6 billion human beings, living mainly in rural and remote areas of developing countries, have no access to electricity or any other modern form of energy for cooking.

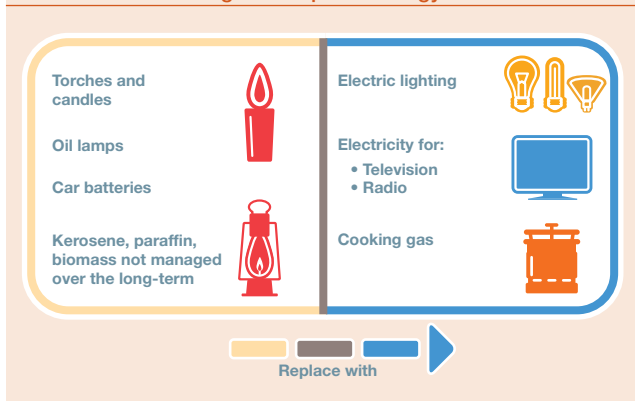
In some African countries, the combustion of wood, dung or crop residues accounts for more than 80% of primary energy supply<sup>1</sup>. In South Africa, nearly a dozen people are killed each day and thousands more are burned each year due to the widespread use of paraffin (or kerosene). According to World Bank estimates, two million deaths annually in developing countries can be attributed to indoor pollution from cooking fuels of poor quality.

Access to more efficient forms of energy not only has a decisive impact on health and safety, but is also a crucial factor in alleviating poverty. Better quality energy often goes hand in hand with convenient access to drinking water – something of which 17% of the world population remains deprived – and a release from some household burdens, particularly for women. Through its instrumental role in improving a population's general standard of living, modern energy helps to curb rural exodus, promote education and facilitate income-generating activities.

International organizations have now reached a consensus on the subject: none of the Millennium Development Goals (MDG) set out by the United Nations in 2000 can be attained without decisive measures to improve access to energy in the world's poorest countries. However, meeting this major challenge without aggravating the current environmental situation will demand a combination of policies to promote the use of renewable energies as well as energy conservation.



#### Switching fuels up the energy ladder



<sup>1</sup> Energy obtained directly from a raw fuel: wood, oil, coal, waterfalls, solar radiation, etc.



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# Challenges

## Technical solutions for each context

Several different options are available to meet people's needs with affordable, easy-to-operate, decentralized power systems fueled by fossil and/or renewable energy sources.

### Stand-alone photovoltaic systems

- **Application:** dispersed or clustered housing
- **Limitations:** meet limited energy needs (lighting and/or audiovisual equipment)
- **Advantage:** an energy solution for isolated or remote sites
- **Characteristics:** installed capacity of 50 to 200 Wp<sup>2</sup> per household
- **Cost:** on the order of €550 (delivered and installed) for a photovoltaic system consisting of a 55 Wp module, a battery, a charge controller, wiring and accessories

A solar panel in the KwaZulu-Natal province, South Africa



### Wind power

- **Application:** clustered housing
- **Limitations:** requires suitable wind conditions year-round
- **Advantages:** zero emissions; can be used as part of a hybrid system combining wind power with photovoltaics
- **Drawback:** substantial maintenance costs
- **Cost:** substantial investment: nearly €115,000 for a wind turbine with a capacity of 50 kW

### Micro-hydro

- **Application:** clustered housing
- **Limitations:** requires a watercourse with a steady and sufficiently strong flow; requires preliminary studies of the site over a two-year period
- **Advantages:** reliable, proven technology; an asset for the development of agro-industrial activities
- **Drawback:** requires regular maintenance
- **Characteristics:** capacity from 3 to 300 kW
- **Cost:** high investment: €100,000 for a power plant of 10 kW capacity

### Solar pumps

- **Application:** a solution for drinking water supply in villages of 500 to 5,000 inhabitants without electricity grid access
- **Advantages:** operate without batteries; minimal maintenance
- **Cost:** investment of approximately €35,000 for a daily per capita supply of 10 liters of water to 3,500 inhabitants

### Solar ovens

- **Application:** dispersed or clustered housing in sunny regions grappling with problems of deforestation and desertification
- **Advantages:** a good alternative to the combustion of wood or biomass as cooking fuels; can be manufactured locally using inexpensive, locally-available materials

### Diesel for electricity micro-grid

- **Application:** clustered housing in rural areas remote from national grids; a solution for the high energy requirements of production activities
- **Advantages:** limited capital expenditure on the order of €8,000 for a 20 kW diesel generator, excluding fuel costs; easy to install and hook up; can be used as part of a hybrid system combining solar energy and diesel generators to minimize the disadvantages of diesel alone
- **Drawback:** significant requirements for operation and maintenance (preventive and/or corrective)
- **Characteristics:** high capacity

### Bottled LPG

- **Application:** clustered housing
- **Advantages:** a clean, safe and efficient response to priority cooking fuel requirements; frees up time formerly spent gathering traditional fuels; helps to combat deforestation
- **Cost:** €22 for a 5-kg bottle + €6 per refill

LPG in small bottles



### Diesel multifunctional energy platforms

- **Application:** clustered housing
- **Advantages:** can supply power to several types of installation or apparatus simultaneously; stimulates the creation or development of income-generating activities, particularly for women; simple technology
- **Drawback:** fuel costs are high, but renewables can be used
- **Cost:** moderate investment of €4,000 for a unit equipped with a 10-kW motor

# Total's **commitment**

Many of Total's entities and employees are involved in projects whose common aim is to propose quality energy services to populations that are already devoting some of their budget to traditional forms of energy.

Drawing on its extensive experience in this area, Total is stepping up its support to its international subsidiaries and teams engaged in this field. Consistent with its primary objective of providing sustainable solutions for people's energy requirements, **the Group has set a target of giving one million more people access to energy by 2010.**

## **The starting point: an in-depth analysis of the local context**

Total teams often focus on the needs of people who live near its operating locations, thus embracing its corporate responsibility toward local communities. Other initiatives are taken within the framework of public-private partnerships promoted by host-country authorities. Some of these projects are deployed on a large scale and contribute to the additional goal of fostering sustainable, profitable activities in these countries.

Regardless of the context, the solution provided must guarantee the sustainability of the service, while improving the standard of living of target populations and preserving the environment. However, efficiency requires a combination of several factors, and local populations – many of whom have suffered the disappointment of dead-ended projects – do not always view renewable energies as a panacea. Intensive efforts to train and educate the public are often required.

### **Training in photovoltaic panel maintenance**



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## **A commitment honored by teams in the field**

Operational teams are in the best position to analyze key parameters such as local customs, demographic data, payment capacity, community organization, institutional framework of the energy sector, policy orientations, infrastructure projects, availability of renewable energies, site topography, skills and project funding potential. Where applicable, they seek additional support from the experts of the Total Gas & Power branch and/or outside consultants.

## **A more structured approach for lessons learned and assistance to subsidiaries**

As the first step in bringing its commitment to life, the Group in 2006 distributed "Access to Energy," a company guide giving practical advice and case studies designed to assist Group entities in arranging sustainable, viable and replicable projects.

At the Corporate level, a Sustainable Development coordinator is in charge of monitoring project implementation and organizing the sharing of lessons learned and the dissemination of best practices.

## **Mobilizing the right partners and appropriate types of financing**

At present, "Access to Energy" projects account for only a small share of the approximately €90 million that Total allocates each year to community and local development programs. For some projects, the Group is the sole source of funding – which can amount to €2 million as in the Venezuela example. More often, however, the cost of creating access to at least a minimum power supply (i.e., €1 million to equip 1,000 households), requires contributions from a number of different funding sources: governments, institutions, banks and international donors, cooperation agencies and contributions from the actual users of the service.

## **Sound organization and management, the key to sustainable projects**

To ensure the long-term availability of the service and encourage responsible behavior and empowerment on the part of local users, these aspects must be built into projects at the earliest possible stage to prevent any deterioration in the quality of the service and avoid perpetuating a "hand-out" situation. For example, the operation and maintenance of installations must be entrusted to clearly identified players with the capabilities to handle these roles.

In some cases, the establishment of public-private partnerships proves the most feasible option for helping public authorities to fully assume their role and for putting communities in charge of organizing their own services.

## **Developing the potential of micro-distribution networks**

Micro-distribution networks can be created to reach the populations of low-income markets that traditional business approaches often ignore.

Although the return on investment can be modest, micro-distribution must be cost-effective to ensure sustainability.

## **An experience in diesel-fueled power generation by Total Cambodia**

80% of Cambodia's population lives in rural areas and only 10% of those rural households have access to electricity, which is often supplied by diesel generators. Each of the country's Rural Electricity Enterprises (REEs) supplies power to between 200 and 400 households. The cost of this supply is quite high in comparison to the local purchasing power, notably due to line losses and management deficiencies.

In conjunction with the UNDP<sup>3</sup>, Total Cambodia conducted a pilot project from 2004 to 2006. Project aims were to train the REEs to improve the management of their activity, and work with them to develop sales of diesel fuel and lubricants. Despite the recurring problem of diesel fuel smuggling, the experience has had positive repercussions on the REEs and shows promise for replication in other countries.

<sup>3</sup> United Nations Development Programme

# Total's **commitment**

## The Totalgaz Shesha program in South Africa

In late 2004, Totalgaz South Africa introduced Shesha (short for "Safe Handy Economic Stable Healthy Affordable"), a 5-kg bottle of LPG fitted with a built-in cooker.

The initiative was developed in response to the government's desire to encourage people to abandon paraffin (or kerosene) in favor of clean, safe energy sources suitable for low-income households.

Totalgaz South Africa called on the help of local administrators in townships to set up a micro-distribution network run by women's associations. The early results have been promising (65,000 households have adopted the cooker), and the target is to sell 300,000 units by the end of 2009.

### A vehicle specially designed for micro-distribution



## Encouraging recourse to delegated management

The delegation of public services management in developing countries can entail various forms of public-private partnership. Whatever their differences, all forms of public-private partnerships involve a local entity (small company, municipal authority or villagers' association) which manages the infrastructure and provides a service in return for a fee, governed by a contract with end-users.

In this scenario, which is suitable for projects of modest scope (from a few dozen to a few hundred households), Total acts as a project facilitator. Group entities help put the system in place, sometimes contributing financing for the initial investments, then monitor the project, leaving day-to-day management of the service to the local parties in charge.

## The Orinoco Delta project in Venezuela (2005-2007)

Under a project initiated in 2005, Total has teamed up with the national oil company, PDVSA-CVP, to provide solar energy to the municipality of Antonio Diaz in the State of Delta Amacuro. Total is the sole source of financing for the project (€3 million) while PDVSA-CVP is handling the organizational and administrative aspects. The municipal government established the local energy service to handle management and maintenance of the infrastructure.

By late 2007, some 2,000 households, medical dispensaries and schools will be equipped with solar panels manufactured and installed by TeneSol, who is also training local managers to operate and maintain the project. Solar energy will also be provided to some manufacturing facilities by year-end 2007.

## Transposing the model of the Decentralized Service Provider

A Decentralized Service Provider is an entity owned and operated under local law, engaged in the business of selling power generated by infrastructure which it owns. Implemented by

French power utility EDF and the French environmental and energy management agency ADEME, the concept generally depends on the support of international donors, because it applies to projects benefiting several thousand or even tens of thousands of households. The efficiency of the concept is secured by a few basic rules: users of the service pay a fee; the initial infrastructure investments are subsidized; the service is managed locally; and priority is given to locally-generated, renewable energies.

Decentralized Service Provider entities are usually established in connection with bidding for decentralized rural electrification (DRE) programs.

Total and EDF have collaborated on the establishment of several Decentralized Service Providers in Africa. One such venture was supported by their jointly-owned subsidiary, TeneSol (world leader in the design, installation and operation of photovoltaic systems).

## KES in South Africa (Total 35%, EDF 65%)

KES, a Decentralized Service Provider set up in 2002, will ultimately supply electricity to 90,000 people in the KwaZulu-Natal province. Each household will be equipped with a 55-Wp photovoltaic panel. Users will pay in advance for the service: €8 per month plus a one-time €15 connection fee, but that charge covers only 2% of the actual cost of the program. KES is absorbing another 18% of the cost, with the South African government bearing the remainder (80%) thanks to a loan from the German aid bank, KfW<sup>4</sup>.

## Temasol in Morocco (Total 32.2%, EDF 32.2%, TeneSol 35.6%)

Between 2002 and 2005, the Decentralized Service Provider Temasol won three bids from Morocco's national electricity office (ONE) for contracts to provide a total of 400,000 people with electricity in the form of stand-alone photovoltaic kits. The program is part-financed by KfW and AFD<sup>5</sup>, with additional support from FFEM<sup>6</sup>. Temasol is providing a full 10-year guarantee of the service.

## A photovoltaic kit allows this isolated Moroccan household to have access to energy



## Koraye Kurumba in Mali (Total 30%, EDF 70%)

The Decentralized Service Provider Koraye Kurumba sells its services to the rural populations of western Mali as part of a program validated by the Malian authorities. A low-voltage micro-grid supplied by diesel generators provides five hours of electricity per day for 500 households, as well as public lighting. Although high at the inception of the project and covered by funds that migrant workers send to back to their home villages, the cost of the service is now in line with users' payment capacity, thanks to the reorganization of the institutional framework in order to promote rural electrification in Mali.

<sup>4</sup> Kreditanstalt für Wiederaufbau, the German aid bank

<sup>5</sup> Agence Française de Développement, *French Development Agency*

<sup>6</sup> Fonds Français pour l'Environnement Mondial, the bilateral French Global Environment facility