

# ENERGY AND POVERTY IN CAMBODIA



Challenges and the Way Forward



United Nations Development Programme



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IN CAMBODIA**  
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Way Forward**

Regional Energy Programme for Poverty Reduction  
UNDP Regional Centre in Bangkok

Design and layout: Keen Media (Thailand) Co., Ltd.  
Cover images: UNDP-Cambodia

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ISBN-13: 978-92-1-126178-3  
Assigned Sales #: E.06.III.B.7

More than a billion people in the Asia-Pacific region do not have access to electricity and 1.7 billion are dependent on traditional biomass fuels for their cooking and heating needs. Access to affordable modern energy services can improve their productivity and enhance living standards.

Even so, there are no specific targets for the energy sector in the Millennium Declaration, a historic document signed seven years ago by the world's leaders. Affordable and sustainable modern energy services are a necessity for countries to meet their Millennium Development Goals (MDGs). Efforts of countries in the Asia-Pacific region to meet these aims will be hindered unless adequate attention is given to the crucial role energy services play in the development process. This is particularly true for the economic, environmental and social well-being of the poor.

With fluctuating energy prices, the poor in many of the countries in the Asia and Pacific region face a daunting future. For them, access to affordable and essential modern energy services that could improve their living conditions and ensure a means to earn a living, will fall outside their reach.

Recognizing the urgency for countries to factor in access to modern energy services, particularly when shaping national poverty reduction initiatives, the United Nations Development Programme (UNDP) provided technical and financial support for national-level rapid energy assessments. The primary aim of this work, carried out through UNDP's Regional Energy Programme for Poverty Reduction (REP-PoR) and completed in 2006, was to identify gaps and priority needs in linking energy services provision with poverty reduction.

The framework for rapid gap assessments linking energy and poverty was developed as a joint effort of the UNDP Regional Centre in Bangkok (RCB) and UNDP country offices in the region, with the support of experts from the region. The draft framework was discussed at two sub-regional meetings, one held in Bangkok, Thailand (August 2005) and the other in Apia, Samoa (September 2005). The meetings were helpful in customizing the framework to suit specific needs and circumstances of the participating countries.

Subsequently, UNDP country offices held national-level stakeholder consultations to consolidate the findings and recommendations of the assessments. This work benefited immensely from the support of government

officials and representatives of civil society. Documented in individual country reports, this work serves as resource and reference material for programming and planning for access to modern energy services for the underserved, particularly, the poor.

This document is a summary of the Country Report on Cambodia and is part of a series of REP-PoR's Asia-Pacific publications. It draws on the key findings of the Country Report, summarizes the challenges faced at the national level, and provides priority recommendations. Specifically, critical issues related to energy policy, including institutional structures, regulatory frameworks, priority programmes, financing measures, gender concerns, as well as monitoring and evaluation support are highlighted. It offers a way forward, outlining issues and options for the country.

Our hope is that this document will be of relevance to national policy makers, development partners, energy service providers, civil society organizations and academia in implementing various measures to promote access to modern energy services for the poor.



**Marcia V.J. Kran**

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This report sets out to examine the ways and means to providing affordable, accessible and reliable energy services in support of achievement of the Millennium Development Goals (MDGs) and poverty reduction in Cambodia. The underlying premise of this study is that access to affordable and sustainable sources of energy has strong links to poverty reduction. This is particularly the case in terms of energy and its effects on household income, health, education, gender and the environment. The report also offers options for the country to overcome its energy sector challenges.

This study is particularly valid in the context of Cambodia, where income poverty is among the highest in South-East Asia. In fact, more than one-third of the population lives below the poverty line. Access to modern energy services is limited mainly to urban and peri-urban areas. A mere 15 percent of the total population has access to grid-electricity in Cambodia. Of the 85 percent of Cambodians who live in rural areas, only 7.9 percent have access to grid electricity. Cost of electricity can vary between US\$0.18 and US\$1 per kWh and is rather high for rural areas. In urban areas, about 40 percent and in rural areas, about 94 percent of energy needs are met by fuelwood. The need for improved cook stoves (ICSs) and sustainable charcoal production is very important as the total amount of fuelwood used in Cambodia is estimated at 4.5 million tonnes of wood per year. Cambodia has also been burdened with the development of basic infrastructure that was severely damaged by years of war, and this includes the energy sector too.

This study examines critical energy issues in Cambodia related to the institutional structure of the energy sector, policy and regulatory framework and sectoral programmes. It analyses reasons for the limited reach of energy services to rural provinces; unsustainable dependence on traditional fuels and inefficient technologies; the restricted supply of energy by rural energy enterprises; and inadequate financing for energy. Gender concerns are also examined in rural energy projects and programmes. It highlights the urgent need for key data and indicators to support monitoring and evaluation of energy access for areas that are least served.

This report concludes that deficient capacities, inadequate funds and limited synergy in the planning and implementation of various policies and programmes at the national and provincial levels are the main factors impeding the targeted provision of energy services for poor communities in Cambodia. Even though many international development agencies have supported the Government with relevant policy studies and capacity development interventions for technology and entrepreneurship development, long-term planning and implementation and technical capacities have remained weak in the energy sector. In addition, poverty reduction is not often an explicit objective of the energy sector institutions. The report proposes that a centralized responsible agency with close interaction with provincial and municipal bodies, with sufficient capacities, focusing on energy services planning, delivery and coordination can succeed in bringing together relevant line ministries, departments, rural electricity enterprises (REEs) and technical working groups to address cross-sectoral issues linking energy and poverty concerns. A dialogue mechanism can be created that enables inputs from rural stakeholders. Expanded capacity-building, targeted at provincial and local energy sector stakeholders, is imperative for the vertical as well as cross-sectoral coordination mechanism to work.

Promising energy initiatives can and do exist in Cambodia. A community forestry project has been successful in increasing sustainable access to wood energy for rural households in Takeo province. The Cambodia Fuel Saving Project (CFSP) has also developed replicable practices for the design and dissemination of improved ICSs. Currently about 30 percent of urban households have started using ICSs. Government support, possibly with donor assistance, for up-scaling of these highly positive efforts can start with a provision of incentives to manufacturers to stop producing the traditional inefficient stoves. Legal frameworks encouraging new standards, fuelwood policy to govern the production, distribution, sale and utilization of fuelwood and biomass wastes can increase market penetration. Likewise, regulations for tree plantations can enable promotion of certification systems for sustainable firewood and charcoal production. Experiments with promising local gasifier technology, using agricultural waste as a fuel, can replace existing diesel generators and conventional cook stoves once proven to be economically viable.

The commitment of the Government of Cambodia to achieve 70 percent rural electrification by 2030, stated in the Cambodian Energy Sector Strategy, is highly commendable. A Government initiative, the Rural Electrification Fund, is also an important step towards boosting private entrepreneurship in the energy sector in the long run, with specific focus



on rural areas, renewable energy and income generation. Yet, only an equal emphasis on reforming the pricing frameworks can make electricity affordable for the rural poor. Development of the renewable energy law is yet another very positive effort that needs to be concluded. Existing and new renewable energy technology (RET) pilots can be up-scaled faster if a strong regulatory framework is in place. Especially important is the design of well targeted pro-poor subsidy and tax policies. For example, lowering an import tax on RETs can create a supportive environment for private investments. Among others, these efforts can benefit especially remote rural communities who are not served by Electricité du Cambodge or REEs. Such policies can have a major impact on the capital costs, both for rural grid electrification and the development of off-grid solutions – such as micro-hydro, biogas and solar home systems, wind turbines and pumps, and other such technologies. These efforts must be complemented with strong efforts towards improving schemes for the provision of micro-finance for micro-scale enterprises and different income-generating activities.

We trust that the report is unique in terms of its insights into bridging the gaps between access to energy and poverty reduction in Cambodia. Our aim is to provide country-specific information on institutional structures, energy resources, policy recommendations, and capacity and financial gaps that can point the way towards improving access to modern energy services, particularly for the poor.



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## ACKNOWLEDGEMENTS

*Energy and Poverty in Cambodia: Challenges and the Way Forward* is the result of a partnership initiative of the United Nations Development Programme (UNDP) Asia-Pacific Regional Energy Programme for Poverty Reduction (REP-PoR). It benefits from collaboration between the UNDP Regional Centre in Bangkok (RCB), UNDP-Cambodia Country Office, key national stakeholders and regional experts.

This report is the sixth in the series of nine country reports for Asia and a synthesis report on similar lines for the Pacific Island countries. Like any multi-stakeholder work, this report reflects the efforts of many people over the last two years. We would like to express our appreciation for the inputs, suggestions and support provided by them.

Our appreciation goes to the excellent support of the Energy and Environment Team of UNDP-Cambodia in the entire process of the gap assessment and the preparation of the original Country Report. The UNDP Country Office focal point in Cambodia, Eeva Härmä, provided strong support through many rounds of review and comments, in addition to providing critical data and information to complete this report. We would like to acknowledge the Assistant Resident Representative, Lay Khim, and the former Country Office focal point, Miho Hayashi, for the valuable support in initiating the country gap assessment. We convey our profound gratitude to the Ministry of Industry Mines and Energy (MIME), especially to the Secretary of State, HE Khlaut Randy, for his expert reviews and fruitful comments and also thank all the participants at the national consultations of the gap assessment that preceded the preparation of this report.

We would like to acknowledge the national expert, Rogier van Mansvelt, who was responsible for preparing the original Country Report and going the extra mile in capturing, consolidating and processing all gathered inputs from an elaborate country consultative process. Our appreciation also goes to the excellent support of GERES-Cambodia who organized a team of experts to prepare the original Country Report. The other team members were Yohanes Iwan Baskoro, Minh Cuong LeQuan, Andrew Williamson and Erik Middelink, who participated in the process of the gap assessment and the preparation of the original Country Report. Ibrahim

Hafeezur Rehman provided overall technical backstopping and guidance in the preparation of the original report to the country team.

The analytical structure and conceptualization of the gap assessment report went through many rounds of reviews and revisions by the core REP-PoR team in RCB, namely Nandita Mongia, Thiyagarajan Velumail, Thomas Jensen and Bhava Dhungana during the last two years. We appreciate the inputs from Kamal Rijal, Abu Sadat Moniruzzam Khan, Sooksiri Chamsuk and Sanna Salmela-Eckstein, who contributed at different stages of finalizing the country report.

We appreciate and acknowledge Keen Media for editing and doing the layout of this report. All of the above-mentioned efforts have made the writing of this report possible.

## ACRONYMS/ABBREVIATIONS

ACLEDA	Association of Cambodian Local Economic Development Agency
ASEAN	Association of South East Asian Nations
BCS	battery-charging station
CDM	clean development mechanism
CEC	Community Energy Cooperative
CER	certified emission reduction
CESS	Cambodian Energy Sector Strategy
CFSP	Cambodian Fuelwood Saving Project
CKN	Centre Kram Ngoy
CNPA	Cambodian National Petroleum Authority
DATe	Development and Appropriate Technology
DET	Department of Energy Technique
DIME	Department of Industry, Mines and Energy
DNA	designated national authority
EAC	Electricity Authority of Cambodia
EdC	Electricité du Cambodge
EEO	Energy Efficiency Office
GDP	gross domestic product
GERES	Groupe Energies Renouvelables Environnement et Solidarités
GHG	greenhouse gas
GVEP	Global Village Energy Partnership
ICS	improved cook stove
IPP	independent power producer
ITC	Institut de Technologie du Cambodge (Institute of Technology of Cambodia)
JICA	Japan International Cooperation Agency
kWh	kilowatt-hour
LA	lead-acid
LPG	liquefied petroleum gas
MAFF	Ministry of Agriculture, Forestry and Fisheries
MDG	Millennium Development Goal
M&E	monitoring and evaluation
MEF	Ministry of Economy and Finance
MIME	Ministry of Industry, Mines and Energy

MW	megawatt
NBP	National Biogas Programme
NEDO	New Energy and Industrial Technology Development Organization
NGO	non-governmental organization
NIS	National Institute of Statistics
NPRS	National Poverty Reduction Strategy
NTTI	National Technical Training Institute
R&D	research and development
RDI	Research Development International
REAP	Renewable Energy Action Plan
REE	Rural Electricity Enterprise
REF	Rural Electrification Fund
RET	renewable energy technology
SME	small and medium enterprise
SNV	Dutch Development Organisation
TWG	Technical Working Group
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
VER	verified emission reduction
WENetCam	Wood Energy Network Cambodia

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<b>Capital</b>	Phnom Penh
<b>Area</b>	181,035 square kilometres
<b>Population (2006)</b>	14.4 million
<b>Gross domestic product (GDP)(2005)</b>	5.4 billion current US\$
<b>Poverty (most recent year available during 1990-2004)</b>	34.1% (Population below income poverty line US\$1)
<b>Electricity consumption/Population (2003)</b>	9 kW/capita
<b>Lighting energy consumption by type (2004)</b>	<ul style="list-style-type: none"> <li>• Kerosene 64.5%</li> <li>• Battery power 16.1%</li> <li>• Generator power 1.8%</li> <li>• Grid power 14%</li> </ul>
<b>Cooking energy consumption by type (2004)</b>	<ul style="list-style-type: none"> <li>• Fuelwood 84%</li> <li>• Charcoal 5.5%</li> <li>• LPG 5.9%</li> <li>• Others 4.2%</li> </ul>

Sources UNFPA (2006); World Bank (2006); UNDP (2006); and NIS (2005)

# ENERGY AND POVERTY IN CAMBODIA

## Challenges and the Way Forward

The Kingdom of Cambodia scores low on the human development index, ranking 129th of all countries. Thirty-four percent of its population lives on less than US\$1 a day (UNDP 2006), and a mere 15 percent has access to grid electricity.<sup>1</sup>

Decades of war have significantly hampered the development of institutional capacities and related infrastructure that could have otherwise addressed significant matters, particularly concerning the nation's poverty and its energy needs. To address these twin issues, the stakeholders in Cambodia's development should explore poverty reduction through the energy sector by introducing modern technology into the existing inefficient supply modes. This strategy must be

### BACKGROUND

<sup>1</sup> Grid electricity in Cambodia is decentralized and does not refer to a national grid. Urban centres have separate grids that are operated by independent power producer (IPPs).

THE  
CHALLENGES

considered in order to align with and meet the objectives envisaged as part of Cambodia's Millennium Development Goals (MDGs) and the National Poverty Reduction Strategy (NPRS) (Government of Cambodia 2006).

An assessment of Cambodia's energy sector highlights a number of challenges to be faced in terms of linking the concerns of energy provision and poverty reduction. Some of these concerns and challenges are detailed below.

### *Poor synergy within institutional arrangements*

In Cambodia, access to modern energy services is limited mostly to urban and semi-urban areas. Electricity grids exist only in the biggest cities and are not connected to each other. The existing situation makes a compelling case to examine the effectiveness of institutional arrangements at the macro level in tackling the issues at hand. Nationally, the energy sector involves five key players: (1) the Ministry of Industry, Mines and Energy (MIME), (2) the Ministry of Economy and Finance (MEF), (3) the Electricity Authority of Cambodia (EAC), (4) the Cambodian National Petroleum Authority (CNPA) and (5) the Ministry of Agriculture, Forestry and Fisheries (MAFF).

Within these macrolevel institutions, there are departments with specific responsibilities. MIME's General Department of Energy, for example, is responsible for the development and standardization of renewable and hydroelectric energy. CNPA is responsible for import, trade and use of petroleum products as well as the exploration of oil and gas deposits. Under MAFF, the Forestry Administration is involved in tree planting for biomass energy generation, and the National Biogas Programme falls under the purview of MAFF's Department of Animal Health and Production. Collectively, these ministries and agencies represent the spectrum of official energy development, management and policy-making in Cambodia.

The primary institutions that hold a mandate for energy efficiency are the Department of Energy Technique (DET) and the Energy Efficiency Office (EEO), part of and established by MIME, respectively. The mandate of EEO is to prepare, implement and control standards of energy use and guide programmes to achieve energy efficiency. The focus of these institutions has largely been limited to urban areas where, despite efforts, they have not been able to infuse efficient technologies into the energy sector.

The major factors impeding energy service delivery are (1) inadequate funds, (2) deficient capacities and (3) limited synergy in the planning and implementation of various programmes. Moreover, the policies and

programmes related to poverty, in general, and energy, in particular, are often formulated through partnerships with bilateral and multilateral agencies.

Non-governmental organizations (NGOs) such as the Cambodian Research Centre for Development, Groupe Energies Renouvelables Environnement et Solidarités (GERES), the Centre Kram Ngoy (CKN) and Small and Medium Enterprises-Cambodia (SME-Cambodia) have worked closely with bilateral and multilateral agencies such as the United Nations Development Programme (UNDP), the Japan International Cooperation Agency (JICA), the New Energy and Industrial Technology Development Organization (NEDO-Japan), the Dutch Development Organisation (SNV), the European Union, the World Bank and the Governments of Japan and USA. All these players work closely with the Government of Cambodia to develop low-cost, high-efficiency energy applications and to build the capacities of the energy sector, particularly regarding research and development (R&D) and entrepreneurship skills.

Often, the financial incentives provided by donors for participation become the primary motivation for officials to support the donor-proposed programmes/projects in the country. Besides, poverty reduction is often not an explicit objective stated in the mandates of a majority of central institutions in the energy sector, and their programmes and policies have only indirect linkages to poverty (Table 1). Local-level institutions, like commune councils, which are best suited to provide the necessary grassroots or community interface, do not have energy access or energy services provision as an area of focus.

At the decentralized level, private institutions in the energy sector encompass medium-to-large independent power producers (IPPs), rural electricity enterprises (REEs), battery-charging stations (BCSs), solar home lighting system companies, charcoal producers and cook stove manufacturers. While IPPs have an installed capacity of over 88 megawatts (MW), they focus on providing electricity to the Electricité du Cambodge (EdC).

At the rural level, REEs have emerged as important energy suppliers, with close to 700 active REEs throughout the country. However, only about 130 REEs are licensed with EAC, which leaves most private energy entrepreneurship outside the regulatory framework. Moreover, most centralized regulatory institutions do not have branches outside the capital or provincial urban centres to allow any interface with REEs.

Even in villages with mini grids, one or more BCSs are often seen to operate. Although no authoritative figures are to be found, there are more than 14,000 villages in Cambodia where BCSs provide the basic energy

*Local-level institutions do not focus on energy access or energy services provision.*

needs of many households. The BCSs operate like cottage industries and are therefore managed by unskilled villagers. The inefficiencies in the supply and use of batteries by households make the energy consumed rather expensive.

### Box 1: KEY CHALLENGES IN INSTITUTIONAL ARRANGEMENTS

- The notion of linking energy strategies to poverty concerns has not yet taken root in Cambodia. Even bodies mandated to direct energy initiatives towards socio-economic development, such as the Technical Working Group (TWG) on Energy and Infrastructure, have not been able to look beyond the power sector. Only the MEF has incorporated the poverty agenda into its mandate, as it is also the lead organization for the NPRS.

**TABLE 1**  
**MAJOR**  
**INSTITUTIONS IN**  
**CAMBODIA WITH**  
**LINKAGES**  
**BETWEEN**  
**ENERGY AND**  
**POVERTY**

Major institutions	Mandate	Linkages between energy and poverty (existing and potential)
MIME, DET, Department of Hydroelectricity, and Department of Energy Development	Focus on energy and industry (excluding petroleum), energy policy planning and technical capacity building	Seek to reduce the cost of electricity and extend electricity services to rural areas
MEF	Focus on energy and poverty; control EdC along with MIME	Formulates NPRS at the policy level
EAC	Regulate the electricity sector	Aims to improve affordability of power services through tariff setting and regulation
EdC	Focus on electricity generation, transmission and distribution	As the biggest supplier of electricity, has considerable potential to expand electricity access in rural and remote areas
CNPA	Focus on import, trade and use of petroleum products	Regulates oil import and exploration of oil and gas deposit
REEs	Provide energy services in rural areas	Can stimulate rural industrial growth and income generation
NGOs and international donors	Assist in the development and diversification of the energy sector	Seek cost-effective alternatives to commercial energy sources in order to boost energy access for the poor

## Weak policy and regulatory framework

The importance of energy services in Cambodia's broad-based poverty reduction policies has been downgraded, such as in the Cambodian MDGs. Following the same pattern, energy policies aimed at developing the power sector have failed to understand the proper place of poverty reduction within their strategies. As a result, poverty reduction and energy development programmes have largely followed mutually exclusive policy paths.

Of late, the Government has committed to boost rural access to electricity through various policy initiatives (Table 2). The Rural Electrification Fund (REF) and the Cambodian Energy Sector Strategy (CESS) are welcome steps that promise delivery in the long run. However, they mainly focus on electricity and exclude fuelwood and biomass. Like REF and CESS, most policies have not adequately considered the energy needs and realities of poor communities that need basic energy for cooking and lighting.

Strategy/Policy/Programme	Implementing agency	Goal
Energy Sector Development Policy 1994	MIME, EdC, EAC	Establish principles and framework for an energy sector that would satisfy Cambodia's goals for development and growth, while meeting social and environmental needs
Power Sector Strategy 1999	MIME	Contains broad objectives (investment and so on) and a preliminary schedule for the implementation of electricity generation, transmission distribution and renewable energy projects. No specific goals
Draft CESS 2005*	MIME	Contains various goals, including electrification of 70% of rural households by 2030 and energy balance
Renewable Energy Action Plan 2004**	MIME	Achieve the following targets: five percent of all energy, about 6 MW, supplied by renewable energy technologies; 100,000 households with access to power from renewable energy sources; 10,000 households served by micro photovoltaic sets
JICA Technical Power Standards	MIME, EAC	Establish a basis for improving the safety, reliability and efficiency of power systems in Cambodia

**TABLE 2**  
MAJOR ENERGY  
SECTOR STRATEGIES/  
POLICIES/  
PROGRAMMES IN  
CAMBODIA

**TABLE 2  
(CONT'D)**  
**MAJOR ENERGY  
SECTOR STRATEGIES/  
POLICIES/  
PROGRAMMES IN  
CAMBODIA**

Strategy/Policy/ Programme	Implementing agency	Goal
JICA Master Plan for Rural Electrification by Renewable Energy	MIME	Establish guidance for rural electrification, plus a series of specific feasibility studies and projects
REF	MIME	Achieve the following: 45,000 new REE connections to rural grids; 6 MW of new micro-hydro; 12,000 new solar home lighting systems
National biogas digester programme	MAFF, Department of Animal Health and Production; SNV	Install concrete biogas digesters by rural cattle and pig breeders
Preparatory Activities for a Rural Energy Development Programme	MIME, with support from UNDP and GERES	Create a rural energy balance for Kampong Speu and Prey Veng and formulate a full scale Rural Energy Development Programme

\* The Government approved CESS on 17 January 2007

\*\*Has not yet been endorsed by the Government

*The absence of a comprehensive renewable energy development policy and law hinders the successful initiatives.*

Policies in the electricity sector too have been unable to resolve tariff barriers. For instance, CESS set up a national objective to achieve 70 percent rural electrification by 2030 but does not place equal emphasis on reforming the pricing frameworks to make electricity affordable for the rural poor. An accompanying strategy to show how this will be achieved will be necessary.

The absence of an approved, comprehensive renewable energy development policy and law hinders the success of private and donor-led investments and interventions. Other initiatives such as the Renewable Energy Policy and Strategy – assisted by the World Bank – and the Renewable Energy Action Plan (REAP), presented in March 2003, have been slow to translate into action. Further, REAP 2004 sought to generate 6 MW of energy through renewable energy sources by 2007, but has yet to be officially adopted. REAP as well as the REF initiative, which aims to enable a 5 percent solar and small-hydro contribution to the national installed capacity, will be more effective if the Government approves the related laws and policies.

Policies formulated through donor support are now awaiting approval by the Council of Ministers. Many of these initiatives provide constructive strategies for Cambodia's future. For example, the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)-supported CESS and JICA draft entitled 'Master Plan Study on Rural Electrification by Renewable Energy in the Kingdom of Cambodia', provides promising strategies. Also hopeful, the World Bank drafted the

'Energy Sector Strategy Review' policy paper to promote electricity investments (World Bank 2005). The Australian Business Council for Sustainable Energy drafted an overview of the energy systems, renewable energy options, initiatives, actors and opportunities in Cambodia for renewable energy with recommendations, listing a summary of other reports (BCSE 2005). Moreover, the Asian Institute of Technology drafted 'The Role of Renewable Energy for Poverty Reduction in Cambodia' (Martin 2006), exploring all possibilities for renewable energy in Cambodia. The EC-ASEAN Energy Facility presented options for the promotion of and investment in renewable energy projects in its draft. Unfortunately, many of these project plans/strategies are not likely to be implemented (CRCD 2006).

Also, the draft Renewable Energy Law is yet to be guided through different government agencies before approval by the Government. On 17 January 2007, the Government approved CESS, creating a supportive environment for renewable energy technology (RET) programmes. The formulation of the energy strategy was supported by UNESCAP (MIME 2007a).

### Box 2: KEY CHALLENGES IN THE POLICY AND REGULATORY FRAMEWORK

- An inefficient legal environment, with many laws still in the process of being drafted or awaiting approval, makes for a weak regulatory framework in Cambodia. With regard to the rural electricity sector, there is little or no regulation at present.
- Donor-driven institutional reforms, even though agencies such as EdC and EAC need several reforms.
- No attempt to reduce high import duties even while the Sub-Decree on Private Sector Participation commits to facilitate private investment in RETs. Import tax on renewable energy equipment is 35 percent.
- As EAC tries to implement regulations, oversight, tariff fixation and training of REEs, REEs face high grid losses and often use very old and inefficient generators. With increasing diesel prices, they often charge more than US\$0.5 per kilowatt-hour (kWh) in more remote areas. Many REEs are currently loss-making ventures.
- Many development agencies are focused on supporting the Government with analytical/review reports and policy writing, rather than with long-term support to design programmes and support implementation. Government agencies are often busy helping development partners and donors, leaving little time for coherent policy development and planning.

***The continued lack of institutional capacity and funding is preventing a well-planned and coordinated introduction of RETs.***

### ***Inadequate institutional capacities***

Most planning, policy formulation and implementation in the energy sector is executed with international technical assistance. Capacity enhancement activities are largely concentrated at the central level, with most based in Phnom Penh. This does not help provincial stakeholders as they struggle to manage their energy issues.

Due to low technical and managerial capacities, REEs, diesel generator operators, charcoal producers and BCSs are unable to provide professional and quality services. EAC and EdC do have training and capacity-building programmes for registered REEs, however, many REEs are still not registered. The BCSs, in particular, receive limited support from the Government and international agencies.

### ***Weak applied research and development of renewable energy technologies***

The tasks entailed in the research, development and dissemination of RETs are spread over many different NGOs and companies. The Institut de Technologie du Cambodge (ITC) and various vocational training institutes are also involved. To cite an example, the improved cook stove (ICS) programme involved local institutions, such as the Don Bosko School, in the project's execution. The French ADEME works with CKN Electrical Training School, and the NBP biogas programme has aligned itself with a technical training school for masons in order to construct the dome model digester. Interestingly, some staff members of the energy department at the National Technical Training Institute (NTTI) have their students conduct surveys and enter data since government funds are limited. Though this is an innovative effort to get some work done, the continued lack of institutional capacity and funding is preventing a well-planned and coordinated introduction of RETs targeted at rural development and poverty reduction. Research institutions and the Government – both at the national and local level – need to find continuous funding to also help create more jobs.



### Box 3: KEY CHALLENGES IN BUILDING INSTITUTIONAL CAPACITIES

- Insufficient sources of finance (internal and external) to execute the government programmes and policy directives.
- Inadequate institutional capacities, including (1) organizational and managerial support, (2) conceptual integration of energy and related fields and (3) rural energy supply with appropriate technology at the household and SME levels.
- Low involvement amongst the provincial departments of industry, mines and energy (DIMEs). Need for greater funds for upgrading skill sets and capacities for implementation of energy policies in the provinces.
- Weak coordination between NGOs and R&D institutions. Better synchronization will help promote new applied research for appropriate RETs in rural development and poverty reduction efforts.
- The National Technical Training Institute initiated an Energy Park for the promotion of RETs but operates with poor financial support and low capacity.

#### *A programme framework partial to grid electricity*

Lack of a pro-poor energy development framework decreases the effectiveness of the ongoing energy programmes in meeting overall socio-economic development goals. Although 94 percent of rural energy needs are met by fuelwood and 2.6 percent by charcoal (NIS 2005), the main energy programmes focus only on electricity grid extension that mainly benefits urban areas and some rural rich and middle class families. The poor who have no ability to pay for grid electricity are left aside by these programmes. Two good examples of programmes that are cross-sectoral and have a rural orientation are the Cambodia Fuel Saving Project (CFSP)<sup>2</sup> and SEILA<sup>3</sup>. The focus of SEILA, however, is on democracy, decentralization, health and education – energy is not part of its agenda.

The formulation of energy policies has typically been the focus of international development agencies and donors; for example, UNESCAP's support of CESS (MIME 2007a), the World Bank's support of REAP, and the REF's aid in implementing REAP. Even though this is a good strategy, the Government will also need a renewable energy law and policy. The limited

<sup>2</sup> CFSP is a project of GERES.

<sup>3</sup> SEILA in Khmer language means 'foundation stone'.

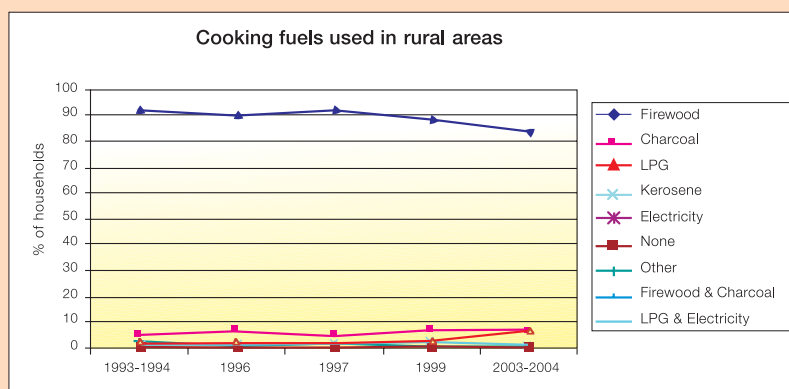
institutional capacities in the country, however, impede and delay the development and even the approval process of any new policy or law.

### *Dependence on inefficient energy sources*

The most prevalent fuel options in Cambodia are the following: diesel, for electricity generation, industry, agriculture and transport; fuelwood, for domestic cooking and SMEs; and kerosene, for domestic lighting. While the use of fuelwood for cooking has declined significantly in urban areas to about 40 percent, rural Cambodia still relies on it as its primary source for cooking. Historically, the type of fuel source used for home cooking has corresponded to the household income. The trend shows more people have started using convenient fuel sources such as charcoal and liquefied petroleum gas (LPG), reflecting the growth within the middle- and upper middle-income demographics (Figures 1, 2 and 3) (MIME 2007b).

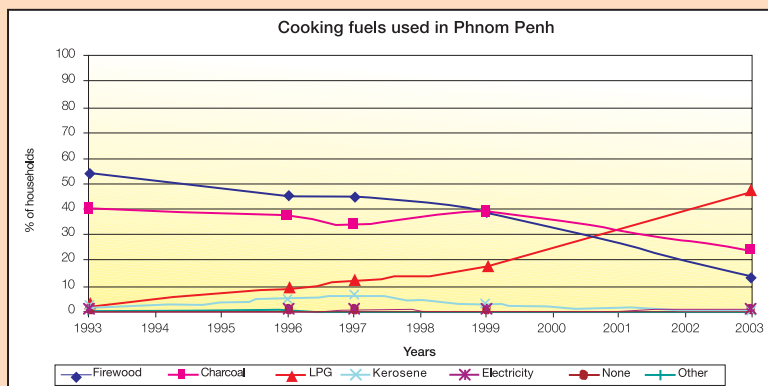
As the demand for charcoal increases, exploitation of the resource grows. Cambodia now has a huge informal industry built around charcoal production, despite the fact that the supply of wood is restricted in many areas and the making of charcoal is officially illegal. Mainly concentrated near the Aural Wildlife Sanctuary, charcoal production generates a significant income for the poor families who sell it or transport it towards Phnom Penh at an estimated rate of 90,000 tonnes per year (Mansvelt 2006a). For many rural families, the charcoal business is a good income substitute to failed rice farming, earning them between US\$275 and US\$385 a year.

**FIGURE 1**  
**HOUSEHOLDS**  
**AND THEIR**  
**COOKING**  
**FUELS**



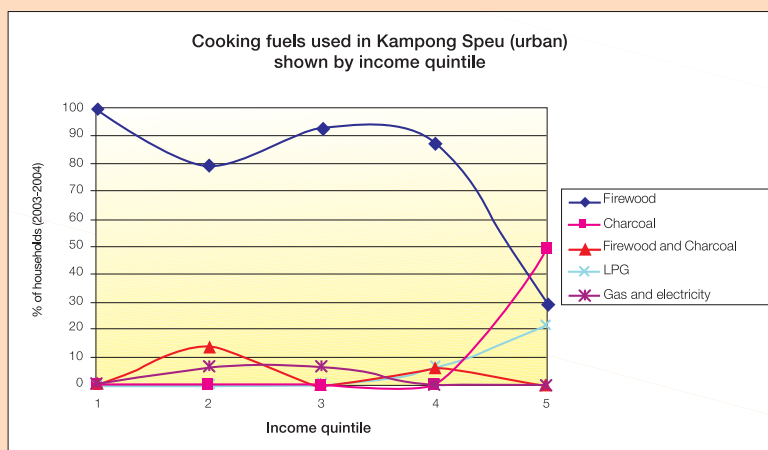
Sources MIME (2007a) and MIME (2007b)

**FIGURE 2**  
HOUSEHOLDS  
AND THEIR  
COOKING FUELS



Source MIME (2007b)

**FIGURE 3**  
HOUSEHOLDS  
AND THEIR  
COOKING FUELS



Source MIME (2007b)

Note Income quintile: 1=\$64.56; 2=\$139.14; 3=\$238.77; 4=\$441.47; 5=\$1,982.53 (average income per month in Cambodia).

The fluctuations in Figure 3 reveal the complexities that are part of the fuel change scenario as it progresses through various income quintiles. Many reasons might influence the household's choice of fuel. During interviews, poor families did not seem to understand the difference in caloric values of the fuel sources, and often use small bottles of gas thinking they are the cheapest fuel source. The graph also shows clearly that as income increases, the use of firewood decreases. Simultaneously, the usage of charcoal rises and, eventually, there is a steady growth in the use of LPG. Otherwise the cooking fuel patterns in the highest income quintile are not very distinct from the poorer income quintiles. Combined

*Both the public utility and private entrepreneurs focus on commercially viable urban and peri-urban areas.*

use of firewood and charcoal, as well as gas and electricity, fluctuate between the different income quintiles, however, there are no distinct patterns. The future rural and urban energy demand could be predicted by analysing the switch in fuel choice during the progression in income quintiles as also by looking at other historical data from Phnom Penh. MIME is now analysing existing data and gathering new field data to formulate a rural energy balance. The result will indicate the total rural energy demand for cooking and lighting in Kampong Speu and Prey Veng provinces.

#### **Box 4: KEY CHALLENGES TO PROVIDING ACCESS TO EFFICIENT ENERGY SOURCES**

- Modern energy services that are renewable, efficient and affordable face numerous barriers.
- Rural families are particularly disadvantaged in their access to such modern alternatives in the energy ladder.
- The energy sources in common use are sub-optimal. The Cambodian Research Centre for Development recently concluded that the country's rural energy sector is environmentally, socially and economically unsustainable.

#### **Poor access to modern energy**

Both the public utility and private entrepreneurs concentrate their power supply towards commercially viable urban and peri-urban areas, leaving vast tracts of rural, low-income Cambodia without access to grid electricity. Consequently, of the 85 percent of Cambodians who live in rural areas, only 7.9 percent have access to grid electricity. Of the rest, 17.4 percent use lead-acid (LA) batteries, and 69.5 percent rely on kerosene for lighting. The remainder of the rural population uses a combination of grid electricity and generator power, generator power only, candles or other sources for lighting (NIS 2005).

Studies indicate that even the most aggressive electrification drives will extend electricity services to only about 15-25 percent of the rural population in the next 10 years, leaving 60-70 percent of Cambodians beyond the reach of the electricity grid. EdC has a policy of restricting the sale of power to legal property owners or tenants only. This forces people in illegal housing or slums to buy electricity from individuals who illegally trade power at extremely high prices and through infrastructure that is often unsafe and unreliable for end-users.

In rural areas, REEs play a dominant role in the private sector by generating electricity through diesel-powered generators. With over 700 REEs in Cambodia, the total production of electricity is approximately 14.5 million kWh. Most REEs operate below accepted standards and provide costly electricity, ranging from an average of US\$0.50 to US\$1.00 per kWh. Due to high diesel prices, many REEs stop their business or incur losses as neighbours request them to keep generating electricity. Although EAC licenses require a minimal fee, most REEs prefer to operate without licenses to avoid the payment as they are wary of the high transaction fees in license applications.

With LA batteries providing about 30 percent of rural household energy needs for lighting, virtually every village in the country has at least one BCS. Altogether, these stations charge batteries for more than 400,000 families in Cambodia (NIS 2005). Like REEs, the battery-charging operations are also characterized by the use of low-tech processes that often lead to defects such as overcharged batteries.

Alternatives to traditional electricity – such as RETs – have a very low penetration in the energy market and, at best, appear in the form of pilot projects. For instance, of the estimated 3665 GWh/year (gigawatt-hour per year) wind energy potential, only a small percentage of it is being tapped (Table 3) (Williamson et al. 2004). Besides a dozen very small wind turbines and some wind water pumps, only one medium-size wind turbine is planned in Sihanoukville (ASIAPROECO 2005). The ICSs, however, have achieved the biggest success among all the new technology options, with 30 percent of the urban households currently using ICSs and saving more than 100,000 tonnes of carbon dioxide per year. The need for ICSs and sustainable charcoal production is extremely important as the total amount of fuelwood used in Cambodia is estimated at 4.5 million tonnes of wood per year (Mansvelt 2006b).

The relatively high hydropower potential is now being extended with a 193 MW dam in Bokor National Park (close to Kampot), while other dams are being planned in the north-eastern and south-western provinces (Kingdom of Cambodia 2006). However, as the rainy season lasts only about 4-6 months, there still remains the need for other energy sources during most of the dry season. SME-Renewables, a new company related to the NGO SME-Cambodia, is now taking the lead in promoting biomass gasification.

*Alternatives to traditional electricity – such as RETs – appear in the form of pilot projects.*

**TABLE 3**  
**RENEWABLE**  
**ENERGY OPTIONS**  
**IN CAMBODIA:**  
**TECHNICAL**  
**POTENTIAL AND**  
**CURRENT**  
**UTILIZATION**

Energy source	Technical potential (GWh/year)	Current utilization (GWh/year)
Hydropower	37,668	55
Biomass	18,852	not known
Solar	65	1
Wind	3,665	-

Source Williamson et al. (2004)

### Box 5: KEY CONCERNS CONFRONTING MODERN ENERGY ACCESS FOR POVERTY REDUCTION

- In areas where electricity is provided by REEs, high tariffs prevent low-income families from accessing power. Schools, health centres and local government offices also lack resources to pay for modern energy services. Cambodia's electricity tariffs are among the highest in the world, with EdC charging about US\$0.18 per kWh, and REEs about US\$0.25 per kWh. However, in deeper rural pockets, the price often varies between US\$0.18 and US\$1 per kWh (MIME 2007b).
- Without any concerted strategy to create uniform, subsidy-based tariff structures, the rural poor are forced to look for cheaper, less efficient options.
- Other technologies – such as solar home-lighting systems – face cost barriers, including high import taxes on equipment, or have been unable to move beyond the pilot stage, as in the case of wind pumps and biofuels.
- Capacities to identify commercial opportunities, understand and select appropriate technologies, and develop and operate projects are limited.

### *Energy efficiency concerns*

High costs of energy in Cambodia force consumers to use energy prudently. Despite such an unfriendly market, financial sources for upgrading energy efficiency are restricted. Moreover, capacities to launch energy-efficient technologies are stuck either in the pre-pilot or pilot stages and most of the initiatives are focused on the electricity sub-sector.

### Box 6: LIMITED FOCUS ON ENERGY-EFFICIENCY FOR MEETING ENERGY NEEDS OF THE POOR

- Most private power producers have only a basic understanding of power generation, with a working knowledge of diesel generator sets. This tendency inhibits the adoption of more efficient fuels for power generation. Consequently, the cost burden of running a plant through diesel generators of varying efficiency is passed on to the consumers.
- Because they are outside the official monitoring and regulatory mechanisms, most REEs do not meet accepted standards of safety, technical efficiency or service (for example, very few provide 24-hour electricity).
- EAC regulates and promotes low price schemes to REEs and provides free efficiency training, but only small improvements are feasible because of high diesel prices, low consumption and a limited number of customers.
- Large-scale energy efficiency retrofits have a considerable cost burden attached to them and require donor financing.

#### *Energy entrepreneurship concerns*

As can be seen from the above discussions, most entrepreneurship in the energy sector is concentrated on technologies that fare low on the energy ladder. The inefficient diesel-based generation of electricity, charcoal production and LA-battery use are considered unsustainable and unfavourable to the country's environment. What exacerbates the situation is a lack of a vibrant, private renewable energy sector. Only a small number of companies procure, design, assemble or distribute renewable energy equipment and services. Government initiatives such as REF (supported by the World Bank) are crucial to boosting private entrepreneurship in the energy sector, with specific focus on rural areas and renewable energy. With the REF, the Government hopes to leverage private capacities to extend modern energy services to rural areas and thus aid the emergence of small industries and increase opportunities for rural income generation. However, the fund is just a first step and legal frameworks and policies are needed as mentioned earlier to support the implementation of rural and renewable energy projects.

*Most energy entrepreneurship concentrates on technologies that fare low on the energy ladder.*

### Box 7: KEY CHALLENGES TO POVERTY-DRIVEN ENERGY ENTREPRENEURSHIP

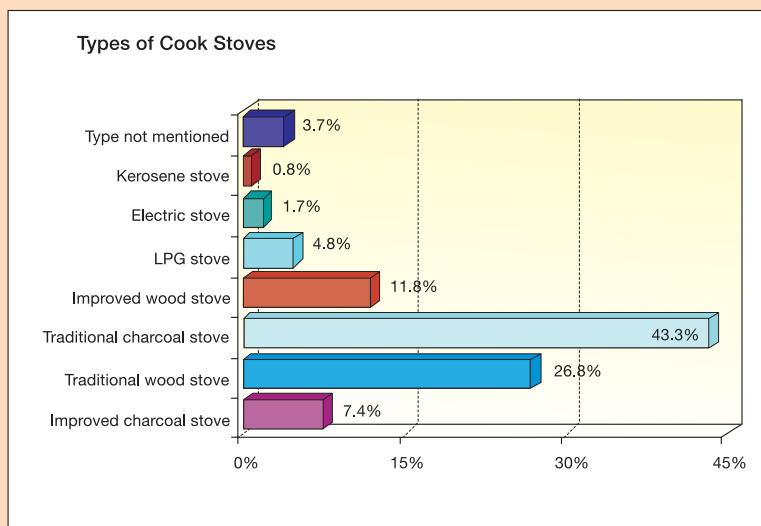
- Apart from REF, most other initiatives, such as the MIME-introduced draft Sub-Decree on promoting private sector participation, focus only on involving entrepreneurs in the electricity sector.
- Other energy entrepreneurship is largely informal and unregulated. Most energy entrepreneurs confine their operations to profitable urban centres.
- SMEs operating in rural and remote areas lack access to grid electricity and are forced to either purchase expensive power from REEs, or to run their own, equally expensive, diesel generators. With few viable and affordable alternatives, most rural SMEs opt for locally available energy sources (such as wood) for productive use. This reduces the efficiency and quality of their output.

#### *Gender concerns*

Cambodia is ranked low in terms of gender equity measures in Asia, positioned slightly higher than Lao PDR, but lower than Viet Nam. With that said, Cambodia's level of women's involvement in its economy is high, with about 72.4 percent of Cambodian women involved in economic activities, compared to 73.9 percent of the men (UNDP 2006). For women, these activities often include household and SME bookkeeping. Nevertheless, persistent traditional attitudes lead to a high gender imbalance, which manifests itself through inequalities in educational attainment and literacy, rates of child labour, access to public services and representation in decision-making. The Cambodian Women for Peace and Development Association studied the impact and improvements of RET on the situation of women in rural areas (CWPD 2001). The study gathered all kinds of data on energy use by rural household, energy cost, collection time, and electrical appliances from 1,777 households in 7 provinces. In 2001, it was found that 11.8 percent of households used the improved charcoal stove and 7.4 percent made use of an improved wood stove (Figure 4).



**FIGURE 4**  
**TYPES OF COOK**  
**STOVES USED IN**  
**RURAL**  
**HOUSEHOLDS**



Source CWPD (2001)

### *Limited access to finance*

Cambodia has an emerging microfinance market, but many people in need of loans must either travel to provincial or district towns or rely on private money lenders who charge exorbitant interest rates. Bank loans need high collaterals, have prohibitive interest rates and short repayment terms. These conditions make bank loans particularly difficult for SMEs and REEs since they ideally need long-term and low interest rates to be able to invest in grid extension and efficient or renewable energy generating equipment (Harner 2002).

In the absence of an accessible and organized financial sector, an informal group of local lenders has emerged as the most viable source of finance for most Cambodians. Informal sector loans comprise 39 percent of all loans offered in rural areas, and come with varying, but always high, interest rates (informal 4-10 percent per month). In rural Cambodia some NGOs are providing soft-loans related to project activities. The Association of Cambodian Local Economic Development Agency (ACLEDA) Bank, a major micro-finance institution, has a wide network in the country. It has attempted to bring down interest rates to encourage lower income households and rural SMEs to access loans for productive uses. To cite an example, the interest could be 4 percent per month for an average loan, and if the borrowed amount is US\$10,000 or more, it could be 1.8 percent per month, with collaterals (GVEP 2005).

*Bank loans need high collaterals, have high prohibitive interest rates and short repayment terms.*

With regard to finance for energy-based enterprises in particular, funding for most REEs comes from private capital or in the form of loans from the informal sector. Foreign direct investment, micro-finance and commercial bank loans are restricted only to licensed REEs. However, foreign sources of funding for power sector development are seen to be increasing in Cambodia. In this context, the Financial Sector Blueprint (2001-2010) – supported by the Asian Development Bank (ADB) – aims to provide a strategy and coordination mechanism for the financial sector. However, issues that still need to be worked upon include the short time period of licensing, the lack of information or knowledge of loans that are available for the rural sector, and the high transaction costs of all informal fees.

### Box 8: KEY CHALLENGES PERTAINING TO FINANCING ISSUES

- No specific financing mechanism is available outside of the electricity sub-sector, such as for BCSs or charcoal producers.
- There are only a few policies, such as the Land Law 2001, that pertain to finance for business. They tend to be rather ambiguous and lead to inconsistent approaches.
- There are no laws defining rules of corporate governance, making it difficult for banks to assess a loan-seeking company's management and business conduct.
- In the absence of strong laws on liquidation and mergers, instances of fraud make banks apprehensive about extending loans to energy enterprises.

### *Poorly developed management information system*

A scarcity of sector-specific information pervades all economic and social sectors in Cambodia, and the energy sector is no exception. This is primarily due to weak coordination amongst and utilization by departments of existing data collection and documentation mechanisms. In addition, Phnom Penh is the hub for knowledge on energy options, but the information rarely reaches rural communities, as provincial departments lack the capacities to execute awareness programmes.

Despite these overarching problems, Cambodia has made some headway in establishing an information generation system through the National Institute of Statistics (NIS). NIS conducted the Cambodian Socio-Economic Study 2003-2004 to update Cambodian MDGs as well as the Statistical Yearbook 2005 (NIS 2005). The SEILA programme has also

*Information on energy options rarely reaches rural communities.*

contributed to data compilation at the village level through the involvement of village heads and commune councillors. Workshops, television and radio programmes, training courses, and the internet are the main avenues of information and knowledge acquisition.<sup>4</sup> The Global Village Energy Partnership (GVEP)-Cambodia used existing data to graph a useful footprint of rural energy use by income group. Only a few NGOs like GERES and Development for Appropriate Technology (DATE) and local associations such as the Wood Energy Network Cambodia (WENetCam) and the Renewable Energy Private Sector Association are active in rural areas to bring sustainable energy technology to the people.

One of the best existing practices includes a community forestry project in Takeo province, which has been successful in increasing sustainable access to wood energy for rural households. The GERES-led CFSP has also developed replicable practices for the design and dissemination of ICSS<sup>5</sup> (Baskoro 2005).

### Box 9: KEY CHALLENGES TO BUILDING MANAGEMENT INFORMATION SYSTEMS

- There is a shortage of documented information on the energy sector since few systematic studies have been undertaken to assess consumer patterns of energy use and energy supply trends. Therefore, official data on energy provision in rural areas and information on the socio-economic impact of energy is scanty. Local government representatives, such as DIMEs in provincial towns, have limited capacities to collect and disseminate information from and to rural areas and thereby provide strategic guidance to focus energy policies.
- As for data collection, most household surveys include indicators on the sources of lighting and cooking fuel, thus providing a fair estimate of the type of energy used by different households. Information on energy use by SMEs is more difficult to obtain and no census has been conducted thus far. Primary data and information on village energy markets, energy use in agriculture, and productive end-use of energy are limited, and the little available information generally consists of extrapolated sample studies.

<sup>4</sup> The SEILA database is accessible at [www.seila.gov.kh](http://www.seila.gov.kh).

<sup>5</sup> For more information, refer to: [www.cfsp.org.kh](http://www.cfsp.org.kh).

*The existing M&E framework is not specific to concerns related to energy or its linkages to poverty.*

### **Weak monitoring and evaluation framework**

The existing monitoring and evaluation (M&E) framework in Cambodia is largely confined to the overall development process and is not specific to concerns related to energy or its linkages with poverty. At a broad level, M&E frameworks pertain to Cambodian MDGs and NPRS 2002-2005. The SEILA programme has been useful in building M&E capacities at the local decentralized level.

Institutional responsibilities pertaining to M&E of national plans and programmes are entrusted to the Ministry of Planning. The Ministry carries out large-scale surveys through NIS, and is mandated through the Statistical Law 2005 to centralize all data collection programmes. NIS released a new database called CAMINFO in 2004, which has tried to combine all available data into a unified database system. NIS has developed basic M&E capacities and can, over a period of time, analyse poverty and energy data for cooking and lighting. In November 2006, with the technical support of GERES-Cambodia, MIME launched a UNDP-sponsored project titled 'Preparatory Activities for a Rural Energy Programme'. During this project, the NIS data on rural energy use was analysed. A future projection on rural energy use and policy recommendations will be formulated to generate a sustainable supply.<sup>6</sup>

#### **Box 10: KEY CHALLENGES TO DEVELOPING EFFICIENT MONITORING AND EVALUATION SYSTEMS**

- The energy sector lacks a M&E structure that can take advantage of the data generated through NIS and SEILA. As previously mentioned, data collection and analysis systems in the sector are confined to the electricity sub-sector. This makes it difficult to gauge energy indicators, particularly the ones related to the socio-economic impact of energy services in rural areas.
- The relationships among energy, poverty and gender have not been examined, thus making it difficult to create targeted energy interventions to reduce the incidence of poverty. However, data are available and a relatively straightforward analysis at MIME could create a rural energy balance that will be valuable for development planning.

<sup>6</sup> For more information, refer to [paredp@online.com.kh](mailto:paredp@online.com.kh).

Cambodia needs to develop comprehensive energy strategies to overcome some of the challenges identified in the previous section. Furthermore, the strategies have to be specific enough to yield tangible and quantifiable benefits. The following are strategies that would address Cambodia's specific poverty and energy concerns, potentially leading to the achievement of the MDGs. The agencies deemed to have the capacities for enabling the processes are also mentioned in the discussion.

### ***A parent agency to address issues related to energy and poverty***

In order to successfully carry forward the agenda of energy and poverty, the Government needs to establish or appoint a central government agency which has the capacity to analyse government strategies for sustainable rural energy development. This central agency would also focus on the planning and coordination of initiatives related to energy and poverty concerns. A sub-committee for rural energy planning, consisting of rural stakeholders, can be established in order to provide inputs to the main agency.

The main agency can host the TWG on Energy and Infrastructure, and should be made responsible for including the poverty dimension into energy plans. The central agency, along with TWG, can then facilitate coordination between MIME and the Ministry of Health and Education to create institutional synergies.

### ***Extending the policy framework to renewable energy technologies***

One of the key elements for linking energy and poverty is a policy framework that promotes and enables energy-efficient technologies. National institutions must therefore encourage firm enactment and enforcement of policies for RET development and application. Moreover, cross-sectoral institutional synergies need to be directed towards vigorous promotion and proliferation of RETs. The successful operation of RETs is crucial to Cambodia's energy security goals and poverty reduction objectives.

As a start, the Government of Cambodia is in the process of developing a Renewable Energy Law. It is important to note, however, that further monetary and partner support is crucial, and would allow MIME to lead an integrated policy to promote RETs. This became clear during two renewable energy workshops in Kampong Speu and Svay Rieng province, where most

***Create a leading agency that would also focus on the planning and coordination of initiatives related to energy and poverty concerns.***

*Helping REEs increase their efficiency would also help in bringing down the cost of operations and the tariffs.*

communes are unaware of effective energy saving options and other RET possibilities. The main feedback was that workshops were not as useful as bringing RETs to the people (MIME 2007b).

CFSP initiated a successful ICS programme. About 30 percent of urban families (120,000 families, to be precise) are using the improved stove, thus saving 22 percent on fuelwood and charcoal (Mansvelt 2006b). Each stove saves one ton of carbon dioxide per year if used on a daily basis (Buysman 2006). The Government could establish ICSs as a benchmark product and then motivate, and possibly even provide incentives, to manufacturers to stop producing the traditional inefficient stoves. The Government will require some initial support from development partners to create new standards for cook stoves. A good example is the ongoing study by the MEF that is supported by the World Bank to analyse the effect of the reduction of import tax on renewable energy equipment.

### *Efficient checks and balances*

On the regulatory front, privatizing EdC would allow it to streamline operations and boost business efficiency. Further, a clear and uniform tariff structure is essential to stopping arbitrary electricity pricing by REEs. Drawing on the draft tariff-setting policy of 2004 and the Sub-Decree on the Principles for Determining the Reasonable Cost in Electricity Business of 2005, this tariff structure could incorporate a subsidy mechanism, making it easier for the poor to access affordable electricity, while still ensuring reasonable returns for entrepreneurs. MIME could undertake the responsibility of proposing tariff rationalization to the Council of Ministers.

At the decentralized level, the validity period of licenses should be extended for all REEs, thereby providing adequate time to recover high investments. The licenses should be contingent on the delivery of desired tariff and efficiency standards, and failure to do so would result in license revocation. In the end, the consequences of these changes would be cyclical; the efforts of EAC to increase the efficiency levels of REEs and facilitate an increase in long-term loans would also help in bringing down the cost of operations, and consequently, the tariffs.

### *Enhancing capacities*

A decentralized system for energy service delivery is a key requirement to meet the challenges of energy and poverty in an integrated manner. Since programme formulation is still largely a donor-driven process, the programme development agenda may not incorporate the necessary

capacity development. Hence, it is essential for international assistance to include financial and knowledge-building support for programme implementation. Linkages between energy and poverty with regard to capacity development should be adequately incorporated into the project execution cost by the development support and donor community.

At the national level, any government initiative aimed at stimulating private sector involvement in the energy sector should include a technical advice and training component on the relationship between energy and development concerns. The proposed partnership among MIME, EAC and EdC to train private technicians offers a workable solution to bridge the capacity gaps in the private sector.

At the local level, institutions like DIME should be provided funds and training to build capacity for executing programmes. Also, efforts should be made to train DIMEs on other energy technologies such as RETs, and to familiarize them with linkages between energy and socio-economic development. Organizations with experience in RET development, such as CKN and GERES, should extend the existing training linkages to local institutions.

### **Needs-based programmes**

In order to work towards local development in general and poverty reduction in particular, Cambodia should adopt a ‘needs-based’ approach to its energy development programmes. A percentage of the revenue collected from the oil import tax and the electricity import tax could be used to execute decentralized energy projects that focus specifically on poverty reduction. It would also be desirable to share experiences and lessons learnt out of small-scale but effective projects and other similar initiatives with government agencies, so as to scale up and institutionalize the policy and planning framework. Moreover, international donors can also provide financial support for decentralized energy initiatives that are linked with poverty concerns. The decentralization reform programme – SEILA – with its cross-sectoral orientation, provides a good platform to facilitate such initiatives and, in this context, funds and capacity assistance can be provided to SEILA to introduce the energy component into its rural initiatives. The commune counsels could be trained to integrate RETs into their development plans. In addition, the UNDP sponsored ‘Preparatory Activities for a Rural Energy Development Programme’ should be materialized into a full scale programme.

One of the key constraints for the poorer and deprived sections of the rural community is their unsustainable dependence on traditional sources of fuel, such as fuelwood. The low-income groups, especially women and

*The proposed partnership among MIME, EAC and EdC to train private technicians could bridge the capacity gaps in the private sector.*

children, face great difficulties in collecting fuelwood from far-away places. Besides, they also face health hazards due to direct combustion of fuelwood in traditional cook stoves. In this context, it would be useful to promote efficient low-cost technologies. The National Biogas Programme's (NBP) subsidization of biogas digesters and the ICS programme initiated by the CFSP are two successful examples. To further the benefits, NGO projects, such as the CFSP, which aim to promote efficient cook stoves and sustainable charcoal production, should be extended adequate legal and regulatory support. In order to facilitate such programmes, the Wood Energy Working Group of Cambodia could draft a fuelwood policy and add a legal basis to administer the production, distribution, sale and utilization of fuelwood and biomass wastes.

Support could also be directed to the Forestry Administration, Energy Department and the Department of Land Management in order to formulate regulations for energy plantations. Fast growing trees and biodiesel have high potential in Cambodia, but small-scale projects (such as the biodiesel project from DATE) have to prove their economic, environmental and social sustainability before big-scale projects are promoted. Farmers, communities or companies who want to grow biofuel, including trees, in a sustainable way should have clear guidelines and regulations.

Tree plantation that promises fuelwood should be encouraged by giving it special preference, replacing the existing uncontrolled and unsustainable harvests of the remaining deciduous forests in Cambodia. GERES is now exploring and promoting certification systems for sustainable firewood and charcoal production. This promotion should come with special low tax schemes and be excluded from unofficial road fees.

### ***Facilitating renewable energy delivery***

As mentioned earlier, remote rural communities are not served by EdC or REEs, so they have to depend on inefficient technologies to meet their energy needs. Without energy-based enterprises in these areas, circumstances have severely restricted economic development and significantly prevented livelihood enhancement. In this context, it is imperative that RETs that offer an option of decentralized delivery of efficient energy be taken beyond pilot stages. Further, it would be useful to implement an incentive-and-deterrent regime where low-cost clean technologies receive subsidies while inefficient technologies invite taxes.

There is a need to increase the dissemination of RETs to the poorest segments of communities and rural enterprises. For this to happen,



international agencies and NGOs need to collaborate with MIME in order to enable policies and make adequate resources available, including low interest and long-term loans, to support renewable-energy-based REEs. Also NTTI should be supported in order to enhance its Energy Park initiative as a focal point for RETs promotion. At the policy and regulatory level, the dissemination of RETs can be further pushed by exempting duties and taxes for import of technologies, which can again be facilitated by MIME and MEF. It has been suggested that import tax on renewable energy equipment should be reduced from 35 to 10 percent and that the possible extra revenues from the increased import could be used to support rural energy businesses. Cambodia needs to adopt options that focus on efficient utilization of local resources and generation of employment through energy service delivery.

Agricultural waste, farming of palm sugar cane and other trees for energy plantations, and coconut and rice husks can be used for generating electricity through gasification, thereby replacing the existing diesel generators. The gasifiers are economically viable, whereas grid extensions to rural areas are not, and the technology has proven successful in Cambodia through the work of Canada-Fund and UNDP. A local NGO, SME-Cambodia, is supporting rural development through private sector aid and has introduced Indian gasifier technology into Cambodia. In Anlong Tamey, a village in the Battambang province, the Community Energy Cooperative (CEC) bought biomass from farmers who grow the fast-growing, nitrogen-fixing intercropping tree, *Leucaena cephalous*. The CEC then sells electricity at a lower price than most REEs in other villages (SME-Renewables LTD. 2005). The JICA Master Plan shows that at least 3,000 villages are suited for gasification as the best possible option for electrification (JICA 2006).

Local initiatives are already beginning to prove their viability. SME-Renewables, a local company, has successfully sold the first 200 kVa gasifier to a rice miller, serving as a good pilot to demonstrate its economic feasibility. As has already been proven in Anlong Ta Mei of Battambang Province, the gasifier can displace 75 percent of the diesel cost, and agricultural waste can be transformed into charcoal bricks. Potential other technology is currently being developed as well. GERES Cambodia is experimenting with a new cook stove – the gasifier cook stove – which uses any kind of agricultural waste as fuel, such as that from coconut, sugar cane or chopped woodchips. However, more research is required to study the efficiency and applicability of these gasifier cook stoves.

***Cambodia needs to adopt options that focus on efficient utilization of local resources and generation of employment through energy service delivery.***

*The promotion and growth of rural entrepreneurs is vital in addressing poverty concerns.*

Jatropha is another plant for which biodiesel production has high potential as a renewable energy source in Cambodia. Organizations such as SME, CKN and GERES could initiate further research on biomass and biodiesel, while international donors and the Government could contribute funds. Another related issue that needs to be addressed is the formulation of a policy for sustainable charcoal production. International donors can facilitate policy formulation by working closely with MIME, MEF, MAFF, EAC and EdC. Village energy plantation programmes for sustainable charcoal production and fuelwood supply should lead the way to resolve the wood energy crisis in Cambodia.

### *Promoting efficiency*

One of the key factors constraining the use of energy for poverty reduction is the high cost of electricity, and the increasing difficulty to collect or buy fuelwood or charcoal. At the root of these problems are the inefficient technologies used by REEs, BCSs and charcoal production units. The poor population of Cambodia is adversely affected in that, not being able to afford the costs, cannot keep up with technological advancements concerning energy usage. In this context, it is desirable to seek out private and NGO-led energy-efficient projects, such as establishing more efficient diesel generator sets as well as extending financial assistance for energy-efficiency programmes to EEOs at MIME.

It is also essential to establish minimum performance standards and efficiency criteria for those energy systems that have the potential to reduce poverty. In this context, it would make sense to support the CFSP with new training centres for ICSs, and to extend governmental support to BCSs by identifying them as REEs.

### *Enhancing productive use of energy*

The promotion and growth of rural entrepreneurs is vital in addressing poverty concerns. The Government should, therefore, encourage renewable energy entrepreneurship by providing long-term loans at low interest rates, along with initial investment support. The World Bank-supported REF is a genuine step toward supporting rural electrification; however, it does not focus on other sources of energy such as fuelwood. Associations such as the Renewable Energy Private Sector Association, Improved Cook Stove Producers and Distributors Association Cambodia, and Rural Electricity Entrepreneurs' Association must be encouraged to fund bottom-up approaches to boost energy-based SMEs and livelihoods in rural areas.

The Government should recognize and support energy-based SME associations through incentives, clear tax regimes and SME investment sector support programmes. In order to extend benefits to the energy sector, a working group comprising members of private energy enterprises could be formed along the lines of other professional SME associations, such as the rice millers association, which uses rice husks as a main source of power. Other commercial activities that use a lot of fuelwood energy include the family-based sugar palm production, noodle-making, soybean processing, and brick and tile-making industries. The work of NGOs, such as GERES, that developed a post-combustion stove for small-scale industries, need support. These stoves save half the fuelwood compared to the conventional stoves used now (CFSP 2004).

### ***Incorporating gender concerns in energy-poverty linkages***

WENetCam, which addresses gender concerns through efficient cook stoves and sustainable charcoal production, should be extended adequate legal and regulatory support. As mentioned earlier, in order to alleviate women's drudgery, it is desirable to scale up and promote the use of low-cost technologies, such as ICSs, bio-digesters, solar lanterns and batteries. Since the availability of finance for modern energy options is a critical factor, involving women should be a step in the right direction, as they are often involved in the accounting. To this end, it would be useful to build the capacity of microfinance institutions, especially the ACLEDA Bank, to expand loan portfolios so as to include basic energy services for cooking and lighting. It is also necessary that women are included during the planning, development, implementation and monitoring stages of programmes and projects in order to ensure that their specific needs are sufficiently identified and addressed.

UNDP is promoting the participation of women in governmental bodies, coordinated by the Ministry of Woman Affairs. MIME has also taken part in this initiative. Energy programmes should also require women to participate in decision-making at local levels. Building the capacity of women through the local DIME offices is necessary, and this can be done in close cooperation with the SEILA programme and NGOs like WENetCam.

### ***Boosting financial support***

To underscore the essential role of modern energy services in tackling poverty concerns, Cambodian banks should be provided international support to stimulate the domestic loans market. International banks and

***To alleviate women's drudgery, it is desirable to scale up and promote the use of efficient low-cost technologies.***

finance institutions could provide loans at low interests to local banks. This would have a direct and positive impact on the provision of local loans for productive uses of energy. Also, MIME should be provided with legal support to help dedicate loans to nurture SMEs. Another complementing source for energy project financing could be carbon finance. Many renewable energy and energy efficiency projects have the potential to reduce greenhouse gas (GHG) emissions and provide finance through the clean development mechanism (CDM). Cambodia has a designated national authority (DNA) in place, and the first CDM project has been approved and registered by the CDM Executive Board.

In Cambodia, small-scale CDM projects are considered a high priority because they have potential to meet the country's technology and end-use needs. Also, their replicability potential is usually high. Presently, the CDM, however, largely fails to support clean energy projects that serve the energy needs of the poor. Small-scale projects are in a disadvantaged position due to the high transaction costs compared to the amount of certified emission reductions (CERs) they are able to produce. This is so despite the simplified modalities and procedures available to them. Additionally, methodological issues and risk-sharing on future trade bar small-scale projects from accessing CDM funds.

One way to reduce transaction costs is through bundling several small-scale CDM projects together and developing them as one larger CDM project. Whether this can substantially reduce the prohibitive transaction costs is, however, project-specific. Also, the new initiative of programmatic CDM involves an aggregation of a number of relatively small emission reduction activities into a larger bundle called the Programme of Activities (PoA). Both the above-mentioned 'single project activities' require compliance with detailed rules, which are time-consuming and require greater expertise. Another source for carbon finance is the non-regulated carbon market, which favours GHG emission abatement and projects with high social value. These voluntary carbon offsets are free of the stringent guidelines, lengthy paper work and high transaction costs. Cambodia has the option to explore all of the above, with a combination that suits their particular needs.

The World Bank has provided a seed grant to GERES (in collaboration with the DNA) to set up a carbon help-desk. It will help project developers with technical assistance and facilitation to get fair deals when marketing their emission reductions. GERES Cambodia has successfully assisted a local NGO in getting carbon funds from Europe for a programme that will place efficient stoves in 450 school canteens. Moreover, a rice miller has installed a gasifier and sold the carbon credits as verified emission

reductions (VERs). The NBP is in the process of certification and could gain substantial financial support, if the project is approved by the CDM Executive Board. The process of approval involves many risks and the high investments in baseline studies, methodologies and certification. Other Cambodian companies are also interested in mitigating their emissions. Projects or programmes of ICSs, gasifiers, tree plantations, efficient charcoal kilns, solar lanterns, ceramic water filters<sup>7</sup> and so on could try to sell carbon credits either through the regulated or non-regulated carbon market. However, it must be noted that there is generally quite a significant difference in the price of the carbon credits sold, depending upon the market. CERs are generally worth more than VERs. Therefore, higher price in the regulated market could offset higher transaction costs. Hence, the decision of choosing suitable carbon markets for Cambodian emission reduction projects should include a consideration of all the different issues and target the basic energy access issue at a decentralized level.

### *Improving information flow*

Rural families could benefit a lot from simple modern energy services. Many of them are not even aware of the existence of these options. The establishment of a national body for energy information dissemination will be necessary. This organization should launch targeted information drives, while selecting its modalities based on the message, medium and audience. Meanwhile, training programmes and workshops should be organized to build capacities in provincial DIME offices to spread the word in rural areas.

In order to capture issues related to poverty reduction, information on SMEs and REEs could become freely available if the accounting and client management software developed by SME-Cambodia is widely adopted. An appropriate software system is currently being tested by a few REEs.

The relatively high percentage of ownership of televisions and radios makes these media ideal for promoting energy-related information. Over 50 percent of Cambodia's rural population has access to radio while 45 percent has access to television (NIS 2005). Worldwide, mass media has been a successful information tool. EEO and MIME must together explore ways to harness the capabilities of radio, television and the print media to inform and educate rural communities on energy efficiency and affordable options. As a first step, awareness can be generated in rural communities through energy and poverty-reduction related programmes on television

*The establishment of a national body for energy information dissemination will be necessary.*

<sup>7</sup> The use of ceramic water filters can reduce a substantial amount of fuelwood and charcoal as the drinking water does not need to be cooked anymore.

***At the operational level, DIMEs across the country must be trained and adequately compensated to conduct data collection exercises.***

and radio. Such programmes could focus on the simple techniques of energy conservation, reducing household energy bills, renewable energy options and so on. The NGO Research Development International (RDI) has a media suite producing videos appealing to Khmer-style karaoke culture. RDI produces popular karaoke videos on clay water filter, rope pumps (a project promoted by the World Bank) and treadle pumps. This is a very innovative approach for the promotion of energy efficiency technologies in villages.

### ***Measuring the impact***

A detailed set of indicators should be developed to monitor poverty reduction through energy improvements. Some of the key indicators to monitor poverty reduction through energy provision could include the following:

- The number of households with energy-efficient cook stoves
- The number of energy-efficient REEs and BCSs
- The number of schools and health centres with access to sustainable energy supply
- The number of SMEs adopting energy efficiency practices and/or using RETs for their energy needs
- Tonnes of wood produced in energy plantations
- The number of IPPs adopting energy efficiency measures

Data generated by GVEP to map energy use by poorer income sectors can be used to establish indicators for energy and poverty. In addition, MIME and UNDP can request for NIS's involvement in the analyses of energy and poverty data. At the operational level, DIMEs across the country must be trained and adequately compensated to conduct data collection exercises. Some missing data – for instance, energy use by SMEs and biomass flows – could be integrated in regular surveys for data collation by various ministries, NIS and SEILA. The recommended central coordinating agency on energy and poverty could work together with NIS, SEILA and ministries to analyse the available figures on poverty and energy concerns.

NIS has the basic user profile for cooking and lighting, as well as information on income groups collected over many years. The Energy Department could take the lead to work with the Ministry of Agriculture to collect information on available energy resources based on agricultural wastes. The Forestry Administration could be convinced to work on the demand and supply of fuelwood. This will help determine land resource needs for fuelwood tree farming.

**M**any people in Phnom Penh and other urban areas are experiencing economic development. However, the rural areas are being left far behind, as some even experience ‘negative’ growth. To develop rural areas, providing modern energy services to the poor is a critical component that needs immediate attention.

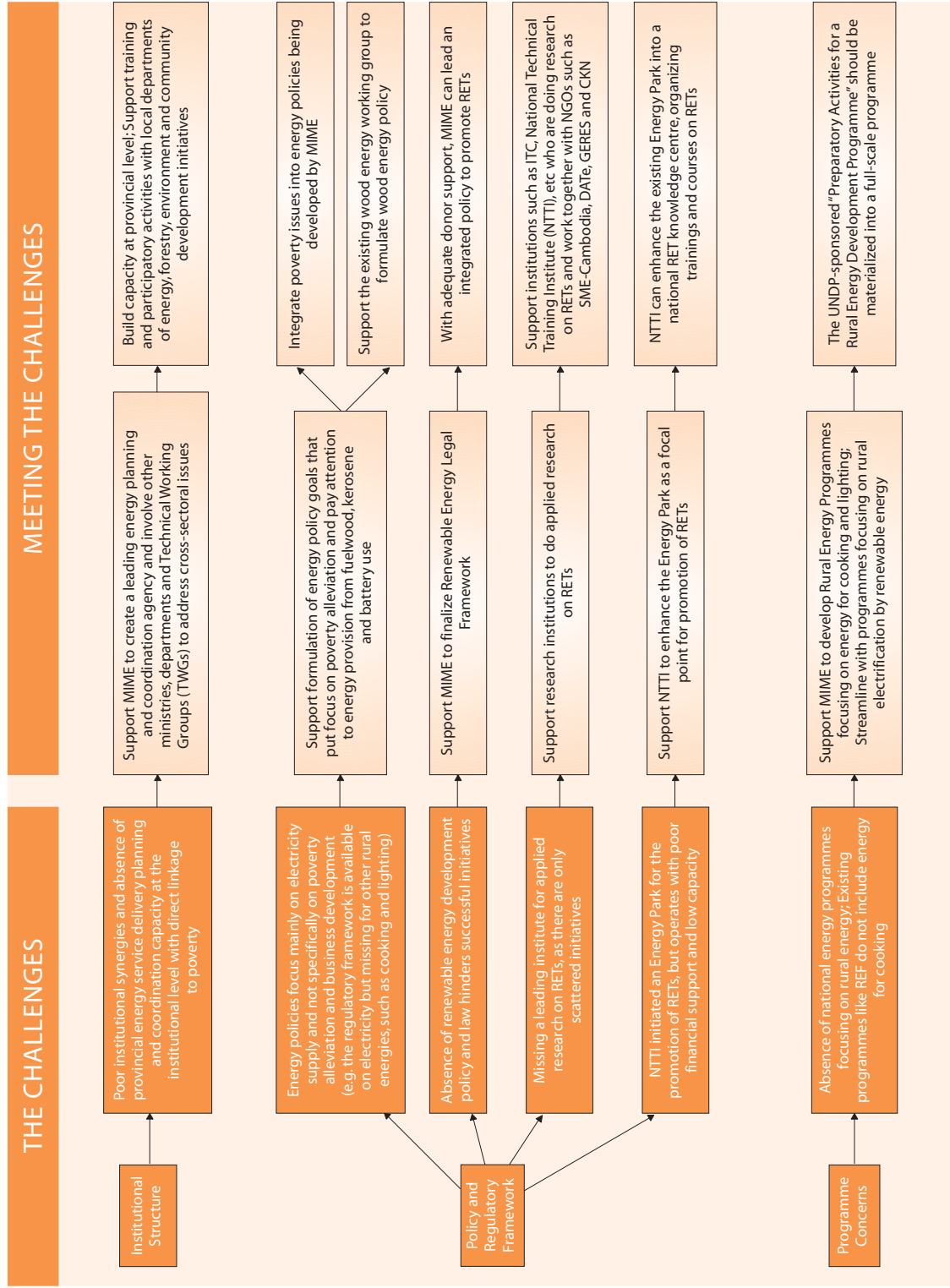
At the national level, there is need for a coordinating agency to focus on issues related to energy and poverty. MIME is the apex agency that needs support and capacity-building to enable project implementation to reach rural communities. The recently ratified CESS offers a good policy framework for programme implementation. The challenge is to focus on the energy needs of the rural poor and to generate a sustainable and efficient supply of basic fuels such as firewood, charcoal, kerosene and LA batteries. It is also important to focus on the productive use of energy, without providing expensive electricity that might only be used for entertainment purposes. RET capacity-building and promotion on a national level is important. However, at the provincial and community levels, energy coordination should be a top priority. Since women use most energy for household work, their participation in energy planning, especially through the implementation of programmes at the commune and village levels, becomes essential.

Financial support and small loans are important to boost productive use of energy in rural villages and should be accompanied with a secure investment climate and clear tax regime. Perhaps the most important and feasible intervention is the promotion of RETs. Large-scale awareness of these technologies and, ideally, their provision to rural households is required. Though many rural folk are interested in RETs, they are not available in rural areas. ICSSs, for example, are sold only in urban areas.

The above-mentioned activities as preliminary priorities can make for a good start for a rural energy development programme by MIME. However, more effort, many more programmes and additional support will be needed to improve the livelihoods of rural families. The reality is that poor, rural families often rely on firewood that threatens them with smoke-related health problems. They either have poor quality kerosene lighting or pay for immensely expensive local electricity grids. If Cambodia’s rural poor population is not granted fair access to the efficient energy they deserve, inequality will persist and perhaps grow stronger. To avoid this frightening path, the Government of Cambodia and international agencies must consider poverty reduction and energy programmes together when planning and implementing future development strategies.



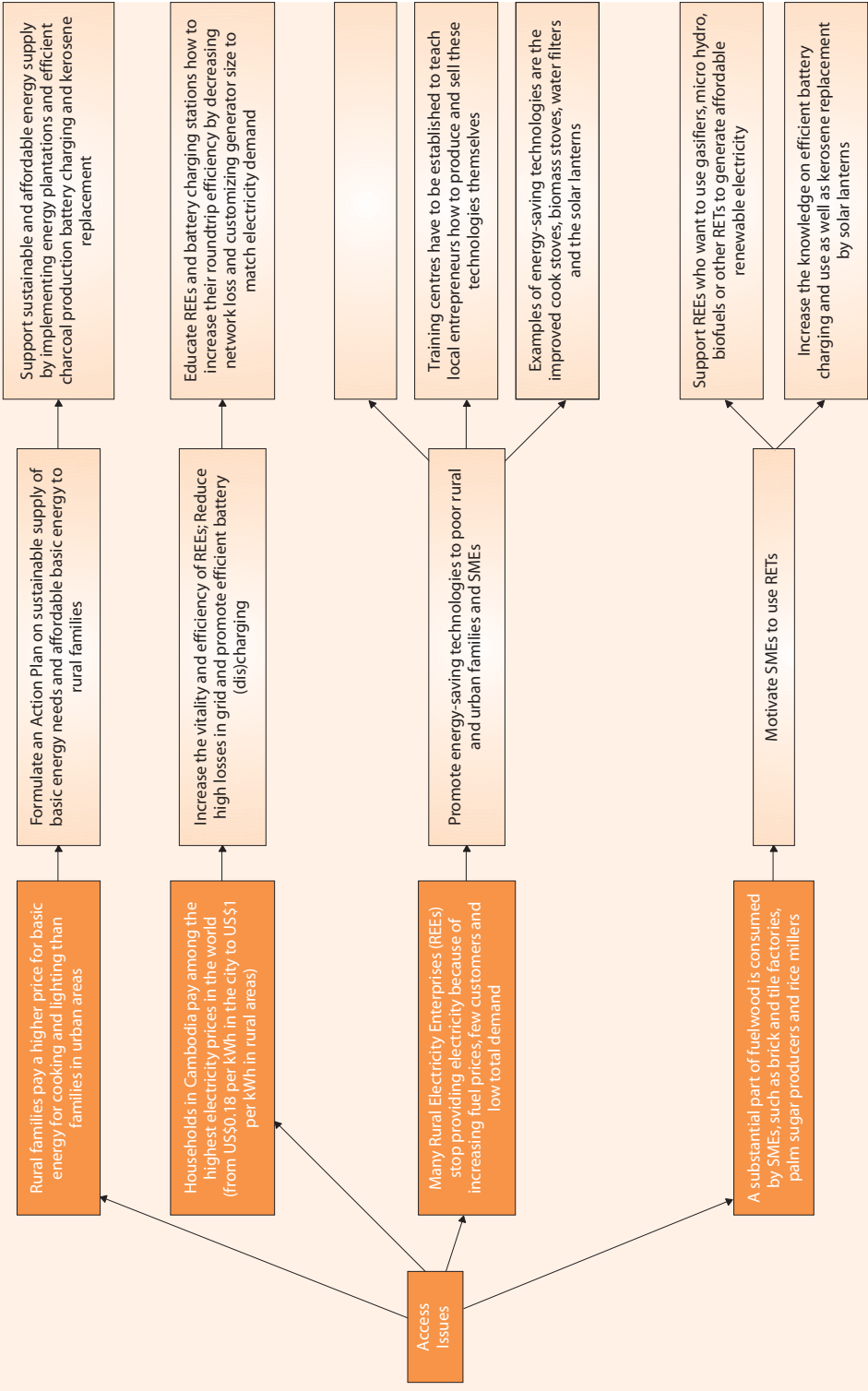
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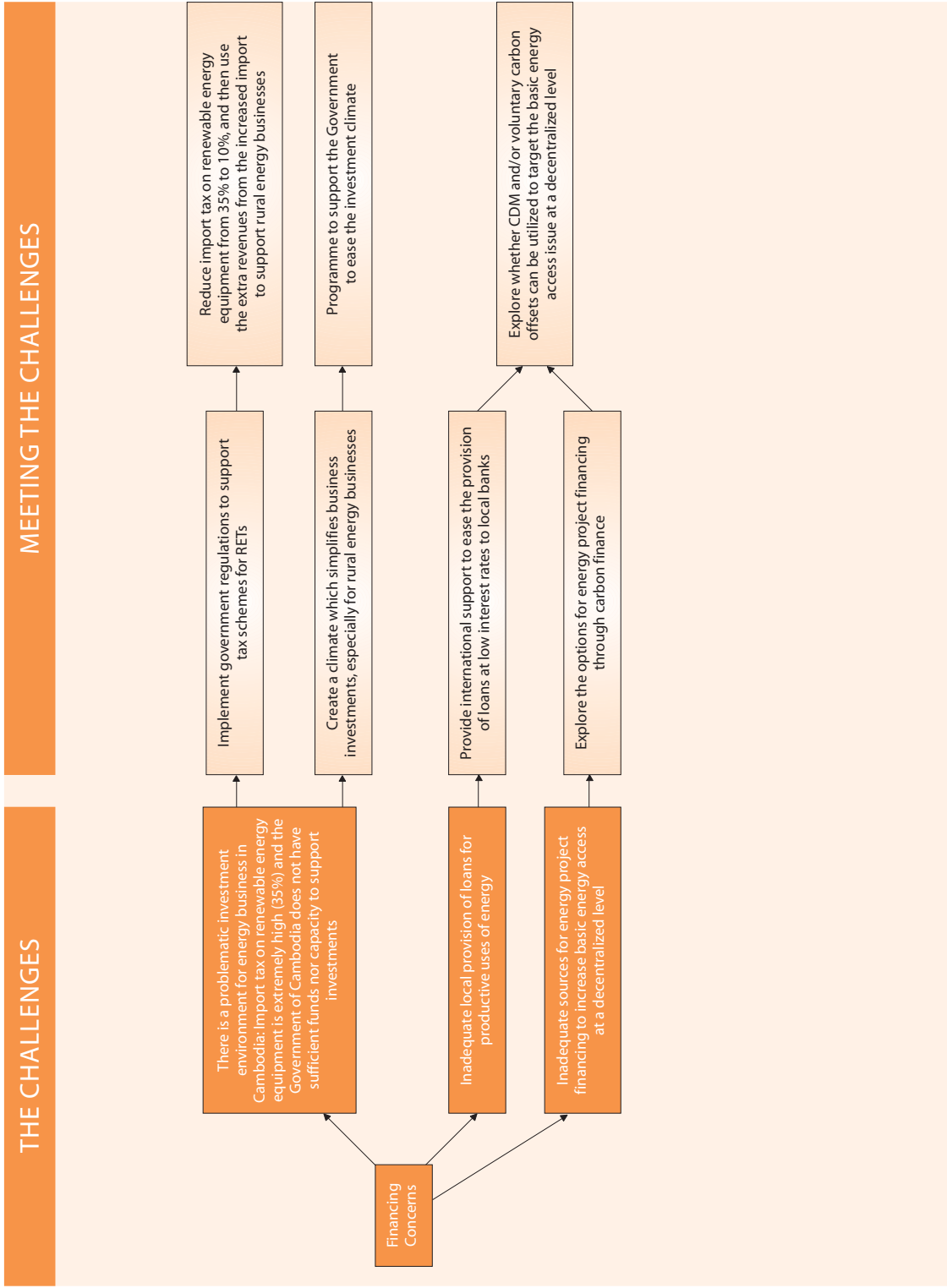


## THE CHALLENGES

## MEETING THE CHALLENGES



**SCHEMATIC REPRESENTATION OF CHALLENGES AND MODALITIES TO MEET THE CHALLENGES (CONTINUED...)**

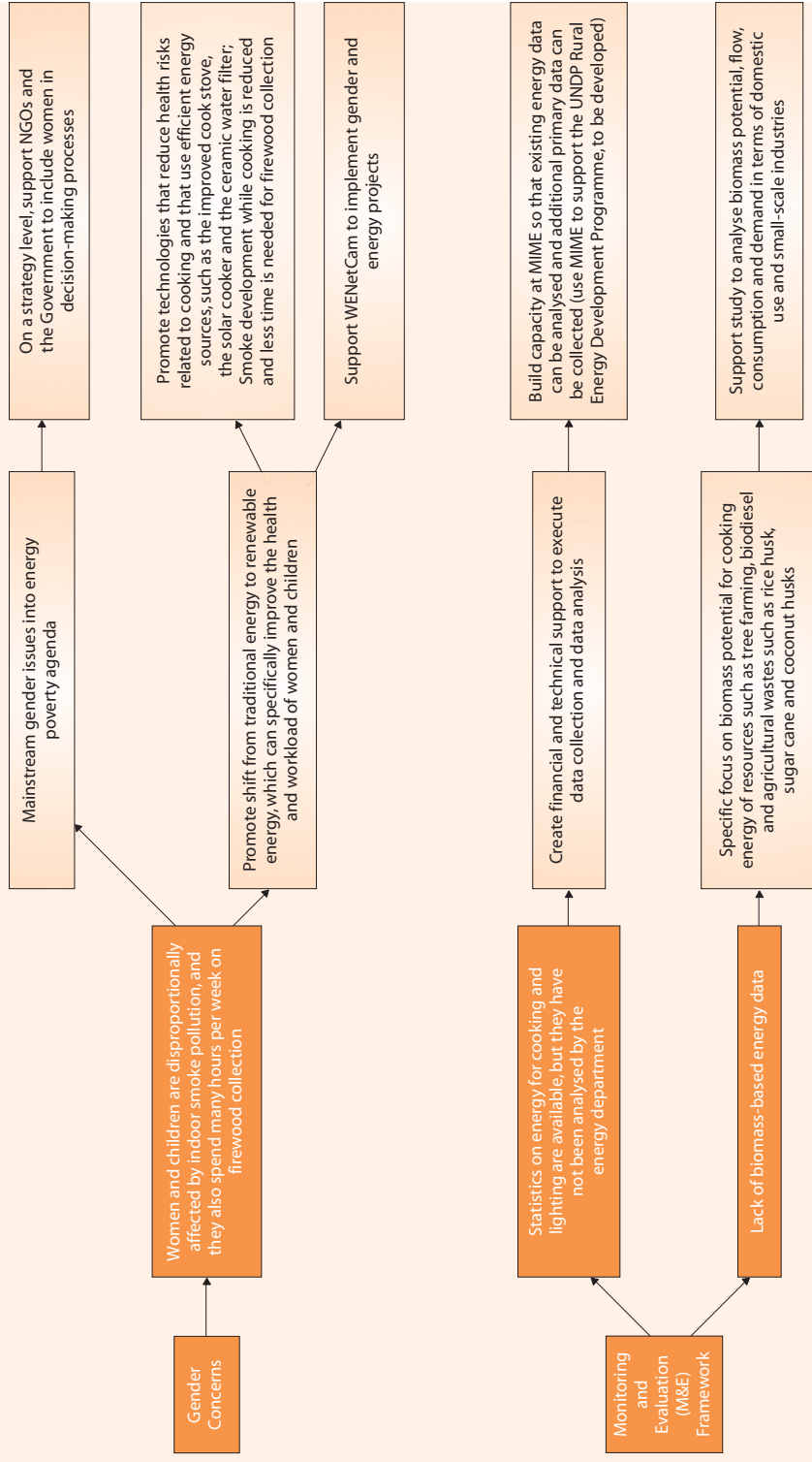


**THE CHALLENGES**

**MEETING THE CHALLENGES**

## THE CHALLENGES

## MEETING THE CHALLENGES



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The UNDP Regional Energy Programme for Poverty Reduction (REP-PoR) aims to affect broad-based interventions in the energy sector, focusing on Asia Pacific countries. The emphasis is on harnessing energy effectively to meet developmental targets laid out in the Millennium Development Goals. As a first step to achieve the objectives of REP-PoR, this publication reports on Cambodia's energy sector and its linkages to poverty concerns, gaps therein, and modalities for overcoming the same. It aims to facilitate the inclusion of a strong energy component to Cambodia's socio-economic development programmes.

