

# Preface

Cambodia is a country filled with dreams, hope, and a population ready and willing to embrace competitive markets and advance its economic position in the region. With the lowest per capita income, lowest electrification rates, highest energy costs, and weakest overall economy in Southeast Asia, Cambodia has a considerable challenge ahead as it competes with Thailand and Vietnam for resources and export-related trade.

Electricity is an essential tool for economic development and rural economic transformation. Currently, only a small percentage of our rural population has access to reliable supplies of electricity. Rural consumers are discouraged from using electricity for productive uses and promoting sustainable rural economic development due to high electricity prices and unreliable supply.

The Royal Government of Cambodia recognizes the important role electricity can play in developing value-adding production systems and advancing the use of modern technology in many aspects of business and household life.

The Government's goal to provide a safe and reliable supply of electricity to all rural Cambodian households will be difficult to reach unless we embrace the idea that the private sector must lead the development of rural electrification. Prime Minister Samdech Hun Sen has recommended that we enlist the support of the private sector to promote renewable energy technologies to complement the government's policies and objectives in rural electrification.

During the past two years, the Department of Energy Technique of the Ministry of Industry, Mines, and Energy has facilitated discussions with more than 150 private and public sector participants, donors, and NGOs. We've solicited ideas to identify what the Government can do to enable private sector involvement and investment in rural electrification while promoting renewable electricity technologies.

The Ministry of Industry, Mines, and Energy, together with the World Bank, are honored to present you with this Renewable Electricity Action Plan. The REAP contains the results of our collective efforts and represents the ideas,

suggestions, support, and stated needs of individuals, firms, and government agencies interested in developing renewable energy technologies to meet Cambodia's rural electrification objectives.

The proposed 10-year program identified in the plan is ambitious, but achievable if our government and its supporting ministries collectively formulate policies and a regulatory framework that encourages active private sector involvement.

Like any long-term plan, we will approach the REAP as living document requiring continuous support, updating, and fine-tuning as the electricity market develops and the reality of rural economic development requires adjustments to the plan.

In this respect, we invite our many stakeholders, our multilateral and bilateral partners, and our government ministries to support rural Cambodians in developing renewable energy technologies so we can provide better quality electricity to more of our citizens.

Dr. Sat Samy  
Director, Department of Energy Technique  
REAP Project Coordinator  
Ministry of Industry, Mines, and Energy

# Acknowledgements

After more than two years of support and direction from Cambodia's Ministry of Industry, Mines, and Energy's Department of Energy Technique (DET), World Bank's Asia Alternative Energy Program, and local and international consultants, the first edition of Cambodia's Renewable Electricity Action Plan (REAP) is finished. The concerted efforts and contributions of more than 150 persons have helped to prepare this action plan.

Dr. Sat Samy, Director of DET, coordinated the development of the REAP and kept the momentum of the project moving forward. His heart-felt devotion to Cambodia's renewable electricity development, rural electrification, and growth of the nation is evident to everyone who has worked on the project with him. Dr. Sat Samy's insightful comments, strategic foresight, and candid advice assisted the REAP Development Team to continue the process of rural electrification and promote the strategic, efficient, and effective use of renewable electricity technologies.

The Asia Alternative Energy Program (ASTAE) and the Energy Sector Management Assistance Program (ESMAP) of the World Bank have provided funding and technical assistance support throughout the REAP's development. ASTAE was established in 1992 to mainstream alternative energy – renewable energy and energy efficiency – in the World Bank's power sector lending operations in Asia. Since its inception, ASTAE has continued to support a broad portfolio of alternative energy projects and activities throughout Asia. While lending operations are funded primarily by the World Bank and the Global Environmental Facility (GEF), ASTAE has relied on a number of donors and partners to support its program.

Special thanks are in order for several individuals who contributed more than others to the REAP. Jon Exel, World Bank's Task Manager for the project, was instrumental in getting the project funded and helping the Development Team “stay the course.” His unfailing encouragement was appreciated and accepted. Terry Teoh, Renewable Energy Expert, helped establish the foundation

and support during the REAP preparatory process in 2000 and 2001. Terry's capacity building efforts at DET encouraged private-public sector collaboration and participation and “set the scene” for a successful process. Herbert Wade, Renewable Energy Expert, is internationally recognized as the guru of solar power. Herb offered essential knowledge to the REAP Development Team resulting from his decades of solar energy development work. His keen insights and practical approaches are sprinkled throughout the REAP.

Jean-Pierre Mahe and Herve Conan, Development Experts from Kosan Engineering, brought to the REAP their enthusiasm and creative insights. Their supportive comments were a welcome relief on those days when creative juices flowed slowly for some of us. Danny Simmonds, Hydropower Expert, offered his exceptional hydropower knowledge to the Development Team and helped us to appreciate how critical the participation of local communities is to the development of village-scale hydropower. Seyha Rin, Private Sector Development Expert, earned the respect of the team for his driving mission to actively engage rural residents and entrepreneurs to determine their own rural electrification futures. International best practice confirms the wisdom of the approach. As a result, the REAP consistently promotes “private sector led, government enabled rural and renewable electrification.”

Hing Kunthap's cultural insights and critical renewable energy focus were appreciated and were incorporated throughout the plan. Kunthap helped us view situations and events from a unique vantage point, challenged us when we got stuck, and pushed us when enthusiasm grew thin. Finally, a special thank you to Sovanna Toch and Victor Jona, MIME Energy Experts, who spent countless hours painstakingly searching for the most accurate information available and supporting the Development Team every step of the way. It has been a true pleasure to work with all of you.

Curtis Hundley, Development Team Leader and Project Manager, Cambodia REAP

# How to Use This Document and Add Value to the REAP Process

## A. How to Use this Document

The REAP is designed to be an easy-to-read guide and renewable electricity action plan. The two-column layout is complemented with charts, photographs, tables, and maps to provide useful information about Cambodia's rural and renewable electricity sector.

The main section names appear in the footer of each page. There are three main sections:

- Part 1 – The Country Framework
- Part 2 – Private Sector Investment Opportunities
- Part 3 – Investment Opportunities for Government and Donors

Topic headings are based on an outline format:

- A., B., C. for main headings
- 1., 2., 3. for secondary headings
- a), b), c) for tertiary headings

## B. How to Provide Feedback

The Department of Energy Technique (DET) of MIME, as well as several other government agencies, have willingly accepted a facilitation role for developing a private sector-led, owned, and managed, renewable electricity market. The government's role is to listen to, provide support for, encourage, and assist private sector firms to invest in rural and renewable electricity projects.

The development of a sustainable and vibrant renewable electricity market depends on the willingness of private sector firms to invest in people, technology, research, and renewable electricity projects. As market leaders, private sector firms are encouraged to regularly provide advice to the DET on the course of development, needs of the industry, solutions to problems that inhibit development, and feedback on the benefits received from the government's facilitation efforts.

Meeting the established objectives for rural electrification using renewable electricity technologies is the collective responsibility of all stakeholders, including firms within the private sector, manufacturers, researchers, banks, NGOs, and non-profit agencies, as well as a long list of other market participants.

The DET, as the coordinator for the REAP, solicits the cooperation and participation of local and international private firms and individuals to develop the sector. To promote communication and facilitation, the Director of DET encourages you to provide your comments, suggestions.

The REAP development process is designed to be flexible enough to accommodate all viewpoints and directional changes that arise as information is shared and a clearer vision emerges on how best to promote renewable energy technologies in Cambodia.

Feedback should identify a problem, solution, suggestion, or discussion that leads to more efficient market development. To share information, send an email or post a letter to:

Dr. Sat Samy, Director  
Department of Energy Technique  
Ministry of Industry, Mines, and Energy  
45 Norodom Blvd.  
Phnom Penh, Cambodia  
Email: [mimedet@forum.org.kh](mailto:mimedet@forum.org.kh)

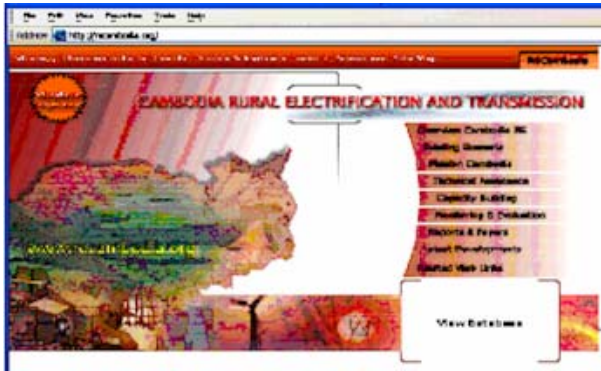
## C. Release of Public Domain Research and Knowledge

Information in the form of Workshop Proceedings, draft laws and decrees, market research, participant and stakeholder distribution lists, presentations made at the workshops, as well as other public domain materials have been or will be released to all interested parties simultaneously. This is being done to ensure there is broad information access and that no interested party gains an unfair competitive

advantage through advantageous access to public domain information.

## D. Visit the REAP Website

<http://www.Recambodia.org>



As part of the REAP development effort, the World Bank, through the Renewable Energy Promotion Program (REPP), funded the creation of a website devoted to Cambodia's rural electrification initiatives. This site provides REAP stakeholders and others with helpful information and resources, reports, surveys, and progress reports. We encourage you to visit and register at the site.

Information related to the Cambodia Rural Electrification and Transmission Project is provided at this website, as well as the information related to the Cambodia Renewable Electricity Action Plan. Information includes an overview of Cambodia's rural electrification efforts, the renewable energy vision and mission, workshop proceedings, reports, and information obtained during the development of the REAP.

## E. Other Helpful Websites

The following Internet websites proved useful as we developed the REAP. These sites were referred to the REAP Development Team by stakeholders.

The REAP Development Team encourages the continued sharing of information resources and contributions to the RECambodia.org website.

### 1. Cambodia Investment Information

<http://www.cambodiainvestment.gov.kh>

The official site of the Council for Development provides investment information, forms, and access to the Cambodian Investment Board (CIB).

<http://www.embassyofcambodia.org.nz/au.htm>

A wide variety of economic and cultural information is available from the website of the Cambodian embassy of New Zealand.

<http://www.nis.gov.kh>

The National Institute of Statistics website provides national economic and statistical data.

### 2. Cambodia Electrification

<http://www.eac.gov.kh>

The website of the Electricity Authority of Cambodia contains licensing information, copies of issued licenses, and up-to-date procedures.

### 3. World Bank and Donors

<http://www.worldbank.org/astae/>

This website provides information on the Asia Alternative Energy Program (ASTAE) established by the World Bank and other donors. The program focuses on renewable energy technologies, energy efficiency products and measures, and the promotion of end-use energy efficiency.

<http://www.worldbank.org>

The World Bank's website describes the various members of the World Bank Group and provides information on World Bank activities in developing countries.

<http://www.adb.org>

This website provides information on Asian Development Bank (ADB) activities, strategies, and objectives, such as reducing poverty, promoting economic growth, supporting human development, improving the status of women, and protecting the environment.

<http://www.unescap.org/enrd/energy/spm/spm.pdf>

The UNESCAP website contains the *Guidelines for Strategic Planning and Management of the Energy Sector*, which was presented by UNESCAP to public and private sector participants in Cambodia in 2002.

#### **4. Public Private Infrastructure Advisory Facility (PPIAF)**

<http://www.ppiaf.org>

The Public Private Infrastructure Advisory Facility website provides information on requesting support and threshold eligibility requirements, activities eligible for PPIAF support, application and evaluation processes, obtaining and submitting applicable forms and activities of the facility.

#### **5. Rural and Renewable Energy Organizations**

<http://www.worldenergy.org/wec.geis/global>

This website provides information on the World Energy Council and its strategy for promoting the sustainable supply and use of energy.

<http://www.aseanenergy.org>

The ASEAN Center for Energy is envisioned to be a catalyst for the economic growth and development of the ASEAN region by initiating, coordinating, and facilitating regional as well as joint and collective activities on energy.

<http://www.nepo.go.th/inter/asean/asean-sec/>

Thailand's National Energy Policy and Planning Office website contains materials from meetings and energy-related agreements between ASEAN nations.

<http://www.ait.ac.th/AIT/servers.html>

The Asian Institute of Technology website provides materials related to energy and other technology issues.

[http://www.nrel.gov/international/china/pdfs/r\\_e\\_forum/lessons\\_learned.pdf](http://www.nrel.gov/international/china/pdfs/r_e_forum/lessons_learned.pdf)

The US-based National Renewable Energy Laboratory website provides lessons learned during rural electrification programs in developing countries and promotes large-scale use of small-scale renewable energy systems.

<http://www.NRECA.org>

The website of the National Rural Electric Cooperative Association of the United States is filled with materials that support the development of community-owned and operated electricity resources.

<http://www.desipower.com>

The Desi Power website is devoted to the promotion of village-scale energy production technologies.

#### **6. Miscellaneous**

<http://www.cia.gov/cia/publications/factbook>

The World Fact Book website contains information on nearly every country in the world.

<http://www.lib.utexas.edu/maps/asia.html>

The University of Texas (UT), Austin website provides online maps, images, database, e-journals, e-books, news sources, and government information.

<http://www.smetoolkit.org/presentation/PresentationHome.jsp>

This website provides the software, business forms, and training materials that assist small businesses to compete.

# Abbreviations, Equivalents, and Measures

## F. Abbreviations

ACLEDA	Association of Cambodian Local Economic Development Agencies
ADB	Asian Development Bank
AFTA	ASEAN Free Trade Agreement
AIT	Asian Institute of Technology
ASEAN	Association of South East Asian Nations
ASTAE	Asia Alternative Energy Program
BOT	Build Operator Transfer
CDC	Council for the Development of Cambodia
CDRI	Cambodia Development Resource Institute
CEE	Compagnies des Eaux Electricite
CFKE	Compagnies Franco-Khmer d'Electricite
CIB	Cambodian Investment Board
CR	Cambodian Riel
EAC	Electricity Authority of Cambodia
EDC	Electricite du Cambodge
EGAT	Electricity Generating Authority of Thailand
EGCO	Electricity Generating Public Company of Thailand
EMP	Energy Master Plan
ESMAP	Energy Sector Management Assistance Program
EU	European Union
FDI	Foreign Direct Investment
FIRR	Financial Internal Rate of Return
GDP	Gross Domestic Product
GEF	Global Environment Facility
GSP	Generalized System Preference
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HV	High Voltage
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IFC	International Finance Corporation
IEC	International Electric Commission
IPP	Independent Power Producer
JICA	Japan International Cooperation Agency
KTOE	Kilo Tons of Oil Equivalency
LOI	Law on Investment
MEF	Ministry of Economy and Finance
MIME	Ministry of Industry, Mines and Energy
MPTC	Ministry of Post and Telecommunication
MPWT	Ministry of Public Work and Transport
MRD	Ministry of Rural Development
NBC	National Bank of Cambodia
NEDO	New Energy and Industrial Technology Development Organization
NGO	Non-Government Organization
NPV	Net Present Value
ODA	Overseas Development Assistance
PMU	Project Management Unit

PPA	Power Purchase Agreement
PPIAF	Public-Private Infrastructure Advisory Facility
PPWSA	Phnom Penh Water Supply Authority
PV	Photovoltaic
RE	Rural Electrification
REAP	Renewable Electricity Action Plan
REB	Rural Electrification Board
REE	Rural Electricity Enterprises
RET	Renewable Energy Technology
RE&T	Rural Electrification and Transmission Project
RGC	The Royal Government of Cambodia
RREF	Rural and Renewable Electricity Fund
SCA	Societe Concessionnaire de l'Aeroport
SIDA	Swedish International Development Cooperation Agency
SPPA	Standardized Small Power Purchase Agreement
TA	Technical Assistance
TOE	Tons of Oil Equivalency
UNFCC	United Nations Framework on Climate Change
UNTAC	United Nations Transitional Authority in Cambodia
USD	United States Dollar
MWRAM	Ministry of Water Resources and Meteorology
WTO	World Trade Organization

## **G. Currency Equivalents and Units of Measure**

Currency Unit = Cambodian Riel (CR)

CR 3,900 = USD 1

Unless stated as Cambodian riels, all monetary amounts are presented in United States dollars.

GW	Gigawatt
GWh	Gigawatt-hour
Kg	Kilogram
kW	Kilowatt
kWh	Kilowatt-hour
kWp	Kilowatt peak
m	Meter
m/s	Meter per second
m <sup>2</sup>	Square meter
MW	Megawatt
MWh	Megawatt-hour
MWp	Megawatt peak
Ton	Metric ton
W	Watt
Wp	Watt peak
TOE	Tons of oil equivalency