

The Current Status of Renewable Energy, Energy Efficiency Development in Cambodia

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II. ENERGY EFFICIENCY ACTIVITIES IN CAMBODIA

1. Background Situation for Renewable Energy Development in Cambodia (1/3)

- At present, the development of RE sources in Cambodia is slow in comparing with other countries in the region, because of the lack of experiences, funds, and inadequate data in this field,
- Current status of RE Technologies in Cambodia mainly in research development and demonstration stages,
- Renewable Energy will reduce the impact on climate change/ decrease the CO₂ emissions and contributed to global warming reduction

1. Background Situation for Renewable Energy Development in Cambodia (2/3)

Renewable Energy Potential

- **Solar Energy**: the average sunshine duration of 6-9 hours per day, giving an average of 5kWh/day. thus, considerable potential of solar energy.
- **Wind Energy**: The southern part of the great lake Tonle Sap, the mountainous districts in the southwest and the coastal regions, such as Sihanoukville, Kampot, Kep and Koh Kong have the annual average wind speed of 5m/s or greater. The total area around 5%.
- **Hydro**: The potentiality (10.000MW, but current contribution to electricity production less than 20MW).

1. Background Situation for Renewable Energy Development in Cambodia (3/3)

Renewable Energy Potential

- **Biomass**: The report prepared by NEDO on “the Assistance Project for the Establishment of an Energy Master Plan” identified significant biomass energy resources from a variety of agricultural residues such as rice husk. , acacia , Cassava Luscenia, Coconut, ..
- **Biogas**: The effectiveness of small scale biogas has been demonstrated in Cambodia by a number of different projects. The use of animal wastes to generate high quality gas for cooking has significant economic, health, social and environment benefits for poor rural households.
- **Biofuel**: Jatropha – 200 ha (Fencing), Palm Oil – 4,000 ha (recently) and can be 10, 000 ha and sugar cane 20,000 ha.

2. Completed and on Going Activities Related to Renewable Energy (1/3)

- **Solar Photovoltaic:** Project with NEDO Japan, SIDA , other international and national institutions including Prime Minister project we had installed around 1.5 MW in the country.
- **Biomass Gasification:** Project with Canada in Battambang (7kw + 20kw) and with DEDE Thailand in Kompong Cham (30kw). On going project in Sambour District, Kompong Thom Province with the capacity 30kw by FONDEM France by 2009 and a number of biomass gasifiers done by local investors
- **Microhydro:** On Going Project with UNIDO capacity 65kw two units (130 kw), Grant from JICA 2 micro hydropower plants 370 kw already put in operation in Nov. 2008.

2. Completed and on Going Activities Related to Renewable Energy (2/3)

- Bio-fuel: Have more than 10 companies doing with Jatropha, planting around 1,000 ha, no once do with big scale yet.
- Bio-Energy: One company from Korea doing on this field with the production capacity of ethanol 36,000 t/year from 100,000 tons of cassava.
- The WB assist to Rural Electrification Fund (REF) by providing granted (GEF) and IDA Loan Aprox. USD 12 mil. to implement the following projects:
 - 1- Expansion off-grid new 50,000 connections with subsidy \$45/connection,
 - 2- Install 12,000 SHS to people in rural areas – people have to pay back all the cost during 3-5 yrs period .

2. Completed and on Going Activities Related to Renewable Energy (3/3)

- The F/S LFG Power Generation Project 2 MW was submitted by Korean Company to MIME.

MIME supports this project as it is the multi-purposes project such:

- to generate electricity by using landfill gas that has been emitted to the air since 1975,
- to reduce Green House Gas, In order to participate in international challenge to cope with climate change,
- to make clean environment In order to eliminate bad smell, fire smoke, fire, and explosion of landfill,

3. Plan for Future Renewable Energy Development

- **GOAL** To improve the current level of electrification and for the poverty reduction as well as enhancing education and medical treatment in the rural areas.
- **PURPOSES**- Study of policies to promote electrification in those areas not yet serviced
 - Introduction and development of Renewable Energy Technologies
 - Study of institution and organization for sustainable operation and maintenance supported by the appropriate business model, including the financial procurement plan.
- **TARGET** To achieve 100% Electrification of Rural Villages by the year 2020.

Framework

Goals and Targets



Goal

- Reduce poverty level
- Improve living standard
- Foster rural economic development

Effects of RE

Targets of Rural Electrification Sector

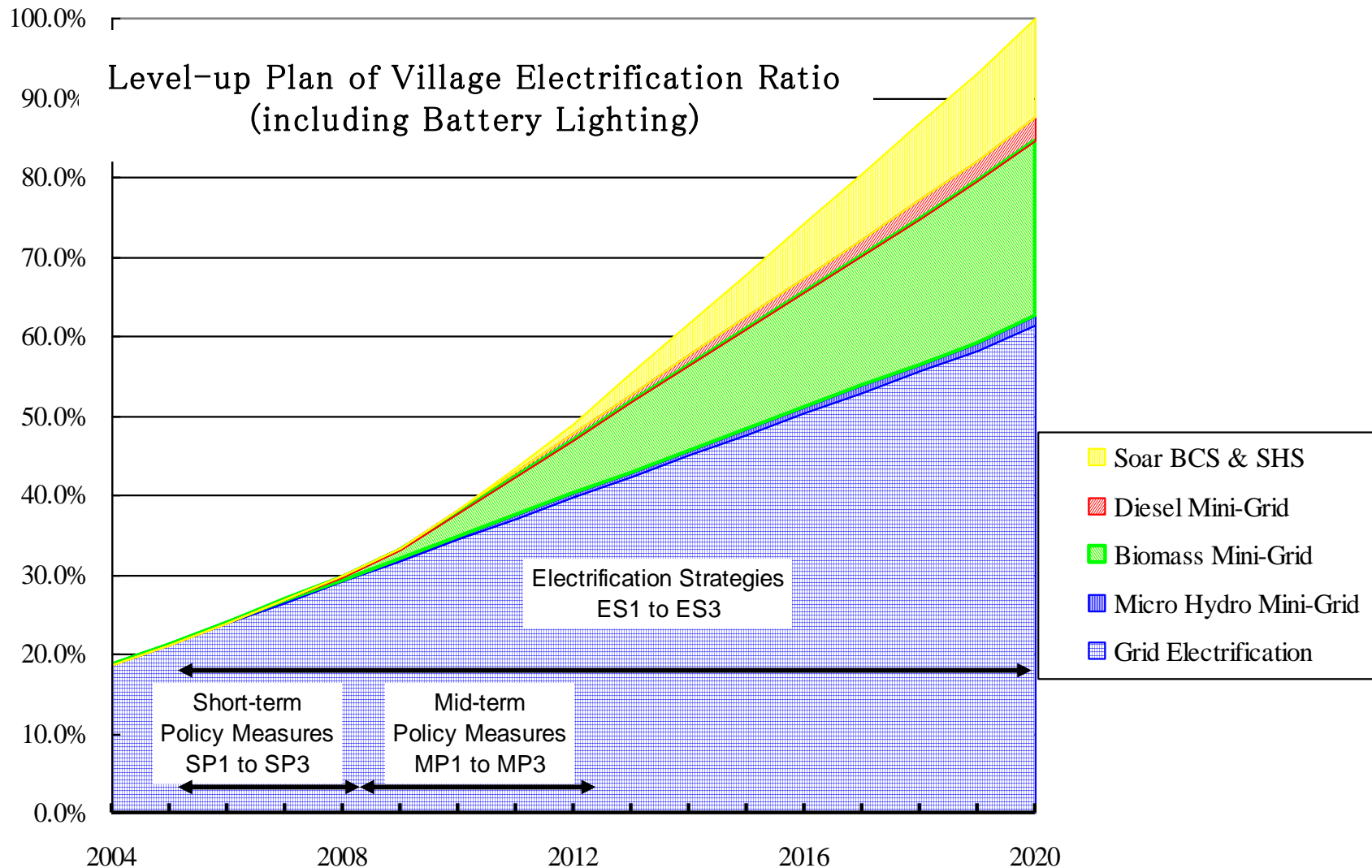
- (1) 100% village electrification by 2020
- (2) 70% household electrification with grid-quality electricity by 2030

Levels of Rural Electrification

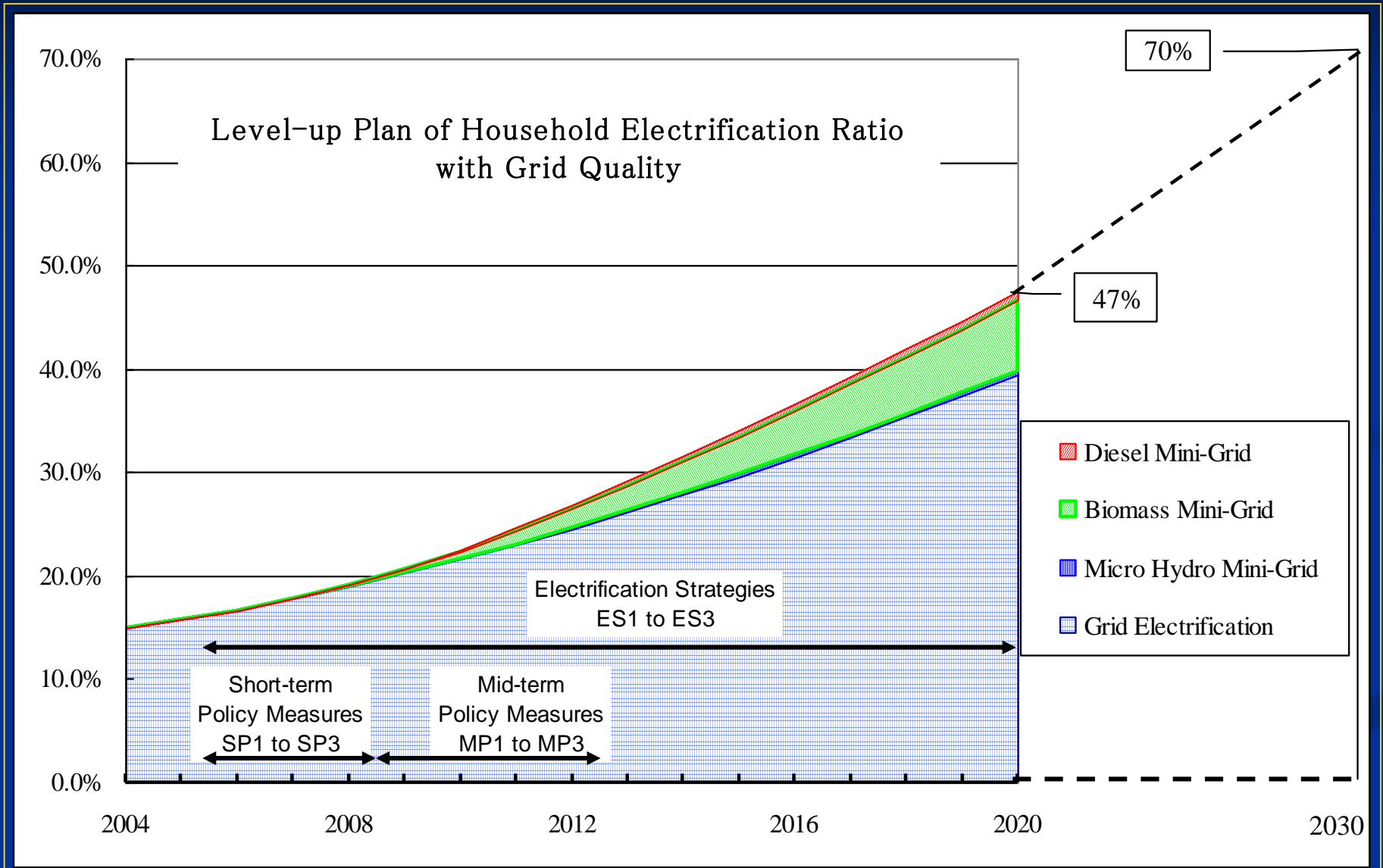
- ~~Three levels of electrification~~
 - Level 3: National Grid (grid electrification)
 - 2: Mini-grids
 - 1: Battery lighting } off-grid areas
- **Use of renewable energy**
 - Mini-grids: biomass and micro hydro
 - BCS: solar, (locally wind)



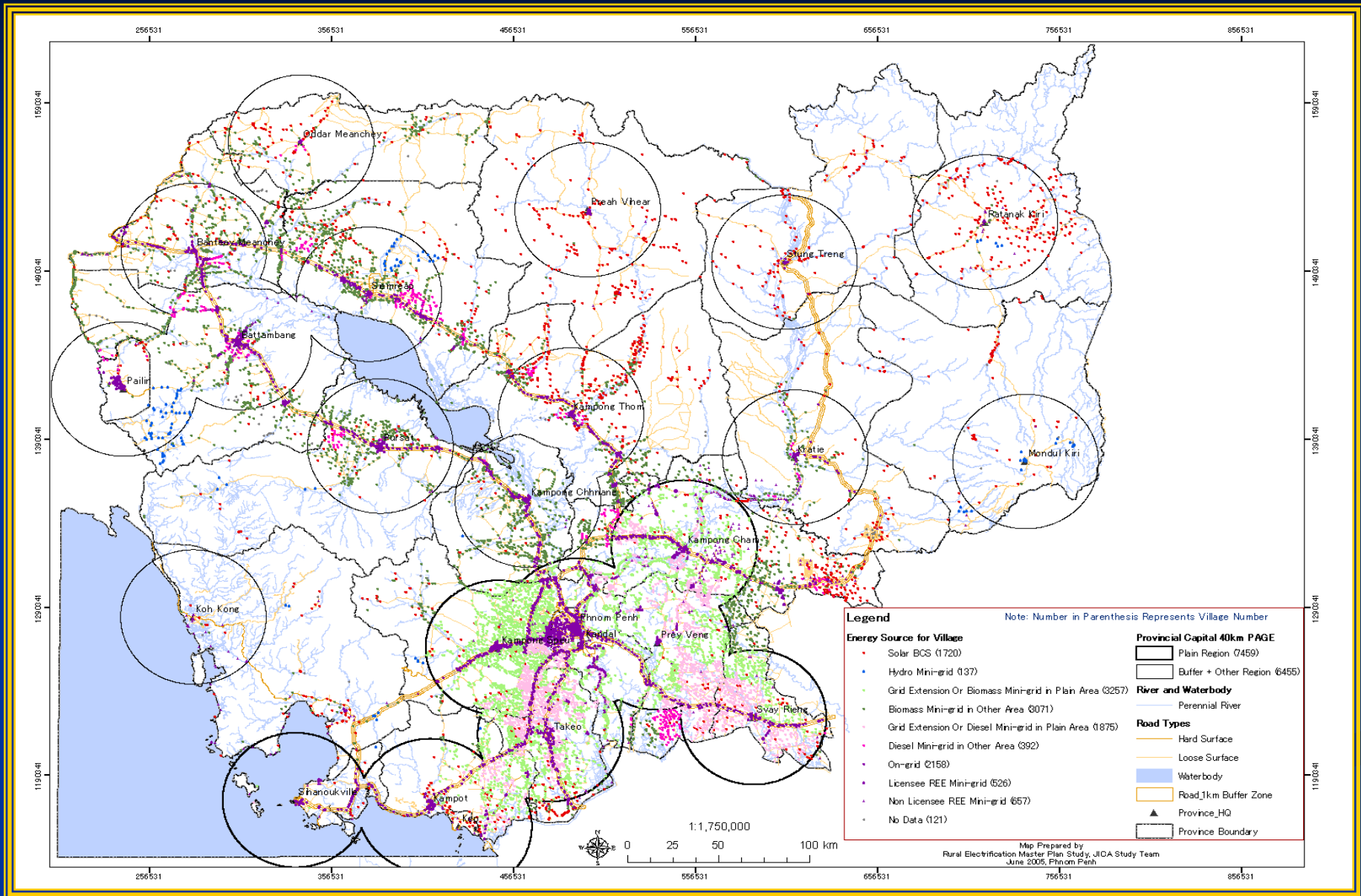
Village Electrification Plan



Household Electrification Plan



Candidate Energy Sources by Village



WB-GEF PROGRAM

National Policy on Rural Electrification by Renewable Energy

- 1) endeavor to provide access to reliable, safe electricity services, with insignificant impact on the environment and at an affordable price for rural communities,
- 2) provide effective legal, regulatory frameworks and various to a encouragements and train the private sector to participate in providing electricity services by renewable energy in the rural areas;
- 3) act as a market enabler, through various incentives, for enabling equity in access to reliable and safe electricity services, with insignificant impact on the environment, at an affordable price for the rural communities;

National Policy on Rural Electrification by Renewable Energy (Con't)

- 4) encourage the efficient generation, transmission and distribution of electricity using the renewable energy technologies, through tariffs, which are in conformity with the Electricity Authority of Cambodia (EAC)'s regulations;
- 5) promote electricity systems by renewable energy at least cost for rural communities, through research and pilot development, as part of RGC's portfolio on grid and off-grid technologies; and
- 6) ensure adequate resources, appropriate institutional mechanisms and training to empower the poor involving in rural electrification to participate.

FINANCIAL RESOURCES (WB/GEF)

- Donations & grants and
- Other sources from the government e.g the government loans from IDA/WB

Summary of the project cost

Type	Local (US\$ M)	Foreign (US\$ M)	Total (US\$ M)
REE off-Grid Extension (40000 HH)	1.82	4.11	5.93
Mini hydro (6.0 MW)	2.81	6.37	9.18
SHS (12000)(GEF US\$ M1.2)	0.79	3.19	3.98
Village hydro (850kw)(GEF US\$M 0.30)	0.53	1.25	1.78
Sub-total REF Component	5.95	14.92	20.87

THE PROJECT INCENTIVE

Type	Grant proposed, US\$ per household connected	Estimated total cost/unit in US\$
New household connected (diesel)	45 \$	150 \$
Mini hydro from 0.5 MW up to 5 MW	400\$/kW installed	1744\$/kW installed
Micro hydro From 50 kW up to 500 kW	400\$/kW installed	2700\$/kW installed
Solar Home System	100\$/set	400\$/set of 40 Wp

Summary of Installed Capacity and Construction Costs (JICA)

Energy Source	Number of villages	Number of households	Number of households to be electrified	Installed Capacity (KW)	Construction Cost (x 1,000 US\$)	
				Total	Total	Estimated cost per household
Grid Extension	753	208,520	208,250	42,000	62,600	300
Solar BCS	1,720	237,570	190,000	8,487	52,891	280
Individual SHS (planned by the WB)			12,000		4,800	400
Mini grid						
Micro hydro	137	18,541	14,833	2,078	14,069	950
Hybrid (micro hydro and biomass gasification)						
Biomass gasification	3,071	501,636	804,844	104,644	342,537	430
Grid extension or Biomass gasification	3,257	504,397				
Diesel	392	69,390	291,011	37,831	87,303	300
Grid extension or Diesel	1,875	294,374				
Sub Total	11,205	1,834,428	1,521,208	194,740	564,200	370
Indirect costs (Sub Total x 30%) (including the administrative management, technical and operational supports, and reserves)					169,260	110
Total	11,205	1,834,428	1,521,208	194,740	733,460	480

Bio-Fuel

■ Biofuel description:

- Biofuel: Liquid and gaseous fuel
- Liquid fuel: Straight Vegetable Oils, Bio-diesel, and ethanol

■ Potential Fuel Crops:

- *Jatropha (Lahong kwong)* and *cassava* are potentially used for production of biofuel (biodiesel and ethanol, respectively).

■ Biofuel Application:

- Biofuels: biodiesel and ethanol
(petroleum fuels)
- Jatropha Oil biofuel: older diesel engines to generate electricity, power, and water pump²⁰

Why the Rural Electrification Enterprise Plant Jatropha and Use Jatropha Oil:

- **High Price of Diesel Oil**
- **Participated in various workshop and seminar on Jatropha**
- **Get assistance from SME Cambodia and Development Advance Technology (DATE)**

II. EE & C Activities in Cambodia

1. ESMAP-WB (1997)
2. ASEAN Energy Cooperation on EE & C (2001-present)
3. ADEME-ENERTEAM (2002)
4. UN-ESCAP-ECCJ (2002)
5. UNDP-GEF (2005)
6. JETRO (2005)
7. Energy Cooperation Project between Thailand and Cambodia (2006)

II. EE & C Activities in Cambodia (Cont.)

BUILDING

- * Energy Audit Training and Site Visit for building
 - + Sofitel Angkor Phokeethra Golf & Spa Resort, Siem Reap Province, 2004
 - + Cambodiana Hotel, 2007
 - + Sorya Supermarket, 2007
 - + Angkor Century Resort & Spa, Siem Reap province 2009
 - + Sothea Hotel, Siem Reap province 2009
 - + Angkor Phokeethra Golf & Spa Resort, Siem Reap Province, 2009
 - + Sokha Hotel, Siem Reap Province, 2009

- * Seminar-Workshop on Energy Conservation for Buildings in Southeast Asia
 - + Phnom Penh Hotel, 23 September 2004
 - + Cambodiana Hotel, 05 October 2007
 - + Angkor Century Resort & Spa, Siem Reap province, 25 September 2009

II. EE & C Activities in Cambodia (Cont.)

INDUSTRY

- Energy Audit training and site visit for Industry
 - + M&V International Manufacturing, 2002-2003 (Phnom Penh City)
 - + June Textile Co.Ltd., 2002-2005 (Phnom Penh City)
- Seminar-Workshop on PROMEEC for Major Industry in South East Asia (2005 Phnom Penh, Cambodiana Hotel)

Energy Management

- Intensive Seminar Workshop
 - 1) Cambodiana Hotel on 11 Sep, 2006, 41 participants
 - 2) Ministry of Industry Mine and Energy (MIME) on 19 Sep 2007, 33 participants
 - 3) Cambodiana Hotel on 15-16 Sep 2008, 42 participants

II. EE & C Activities in Cambodia (Cont.)

- Site Visit of Factory and Building

- 1) Electricite du Cambodge; 2) Electricity Authority of Cambodia; 3) Cambodia Hotel Association; 4) The Garment Association; 5) Cambodia Electricity Private; 6) Cambodia knitting Factory; 7) Cambodiana Hotel; and 8) Ly Ly Food Industry

Date of visits: 13 September 2006

21 September 2007

17 September 2008

- Training on Energy Management Handbook

- 1) MIME Conference room, on 20 Sep. 2007, 33 participants
- 2) Cambodiana Hotel, on 17 Sep.2008,31 participants

II- EE & C Activities in Cambodia (Cont.)

2- ASEAN Energy Cooperation on EE & C

2.2- ASEAN Energy Awards:

- Le Royal Hotel (Retrofitted), year 2001, No.10
- Angkor Century Hotel (New and Existing), 2003. No.7
- Sofitel Angkor Phokeethra Golf & Spa Resort
 1. New and Existing, 2002, No.8
 2. Retrofitted, 2005, No.3
 3. Tropical, 2007, No.2
 4. Energy Management, 2009, No.3



Thank You!

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