



RURAL ELECTRIFICATION WORKSHOP
Bangkok, February 23-25, 2005

**Rural Electrification by
Renewable Energy
in Cambodia**

Dr. Sat Samy
Under Secretary of State
Ministry of Industry, Mines and Energy
Phnom Penh, Kingdom of Cambodia

CONTENTS

- I. Background
- II. Current Structure of Electricity Sector
- III. Power Sector Development Policy and Strategy
- IV. Potential Energy Resources
- V. Rural Electrification (RE) and why RE by Renewable Energy in Cambodia

BACKGROUND

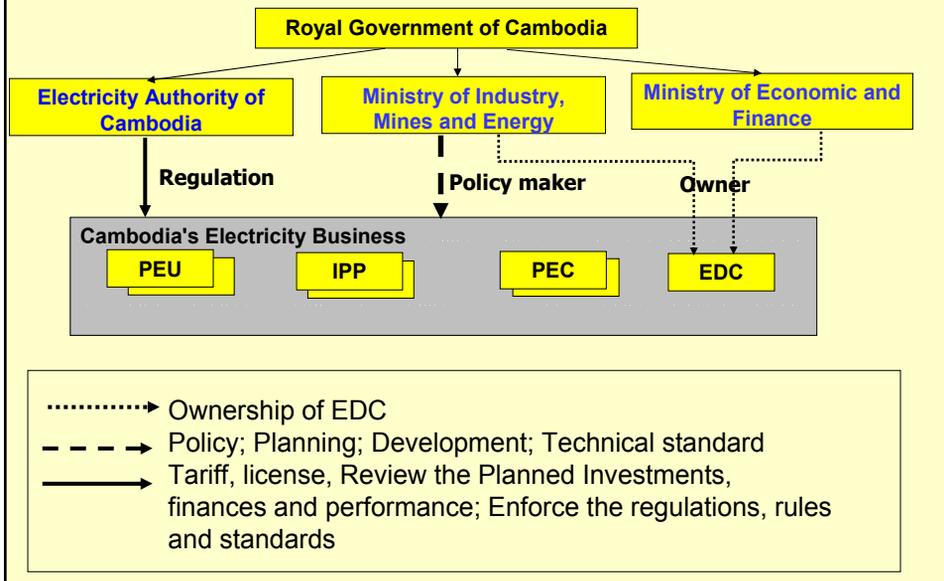
- **Territory: 181,035 sq. km**
- **Population: 13 million (85% in rural areas)**
- **GDP: US\$280 per capita**
- **Electrification rate : 17% (urban~54% and rural~13%)**
- **Energy consumption: 55 kWh per capita**
- **Electric energy price : US\$0.09-0.25 per kWh**
- **In rural area / using battery and diesel generator :
US\$0.4-0.8 per kWh**
- **Generation in 2004 : 200MW and 1,000GWh**
- **Projection in 2015 : 750 MW and 3,000GWh**
- **Main generation source: Fuel Oil (DO and HFO)**
- **High potential of hydro source : more than 10,000MW**

3

BACKGROUND (cont.)

- **March 1996: Corporatisation of Electricité du Cambodge (EDC) as a limited liability state company to supply electricity to Phnom Penh and six provincial towns. In 2004 MIME transfers 7 more provincial towns to EDC. EDC manages about 80% of generation and distribution in the country and also is responsible for all transmission operation.**
- **Feb., 2001 : Promulgation of Electricity Law, setting a framework to regulate the electricity sector.**
- **Sep., 2001 : Establishment of Electricity Authority of Cambodia (EAC), as a regulatory body, which is responsible for licensing, tariff setting and enforcing the performance of the electricity supply industry.**
- **MIME : continues to be responsible for government policy, strategic planning and technical standards for the electricity sector.**
- **Other suppliers of electricity : Private Electricity Operators/Companies, including IPPs, Provincial Electricity Companies and Rural Electricity Enterprises, manage the remaining generation and distribution systems₄**

Current Structure of Electricity Sector



Power Sector Development Policy

It was formulated in October, 1994:

- To provide an adequate supply of energy throughout Cambodia at reasonable and affordable price,
- To ensure a reliable and secured electricity supply at reasonable prices, which facilitates the investments in Cambodia and developments of the national economy,
- To encourage exploration and environmentally and socially acceptable development of energy resources needed for supply to all sectors of Cambodia economy,
- To encourage the efficient use of energy and to minimize the detrimental environmental effects resulted from energy supply and consumption.

Energy Sector Strategy

With referring to the draft CPSS 1999-2016 (WB) & the draft revised 2004-2020, its focus on 3 mains components:

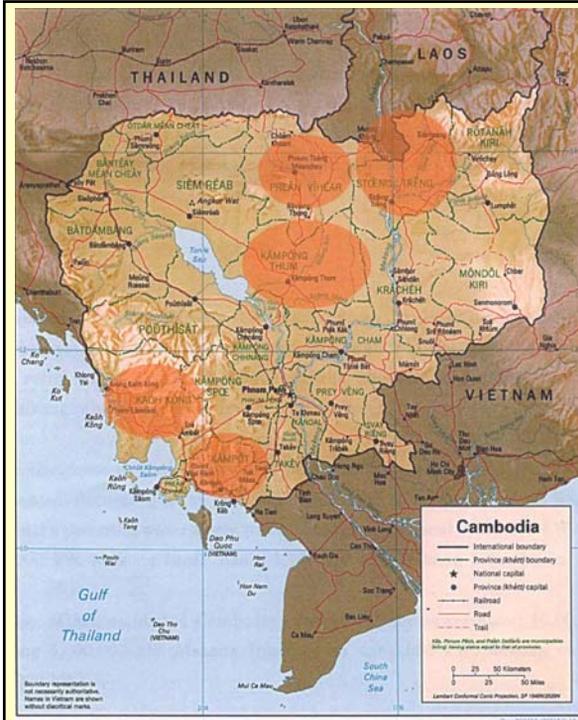
- 1- Generation Master Plan
- 2- Transmission Master Plan
- 3- Rural Electrification

7

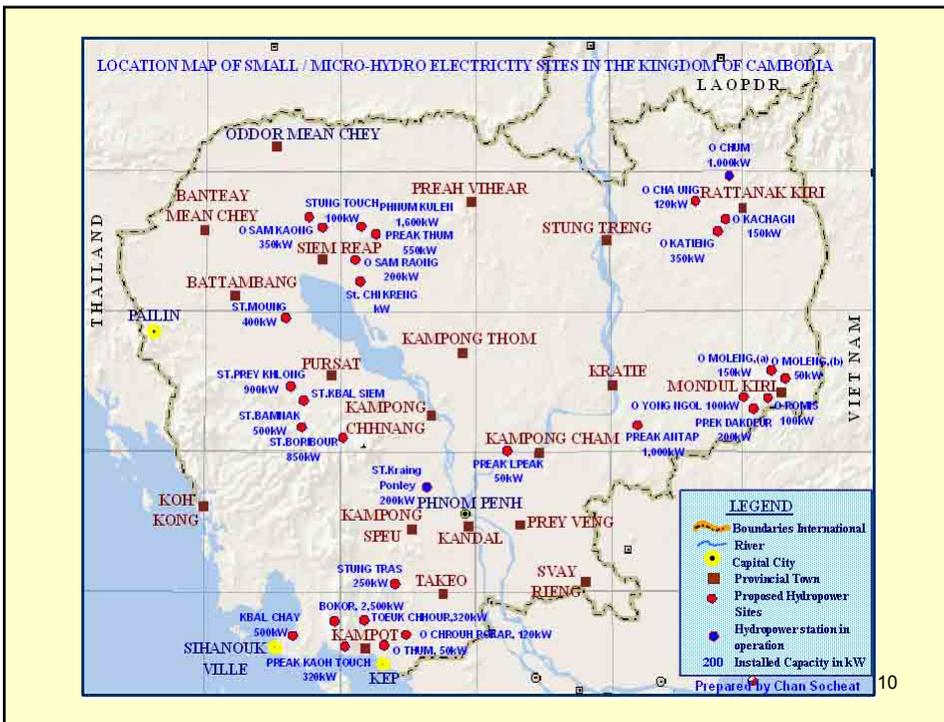
The Potential of Cambodia's Energy Resources

- Petroleum & Natural Gas are under the responsibility of CNPA
- Coal
- Hydropower
- Renewable Energy (solar, wind, mini-micro hydro, wood fuel, biomass, biogas, biofuel etc..)

8



Areas thought to have coal resource reserves

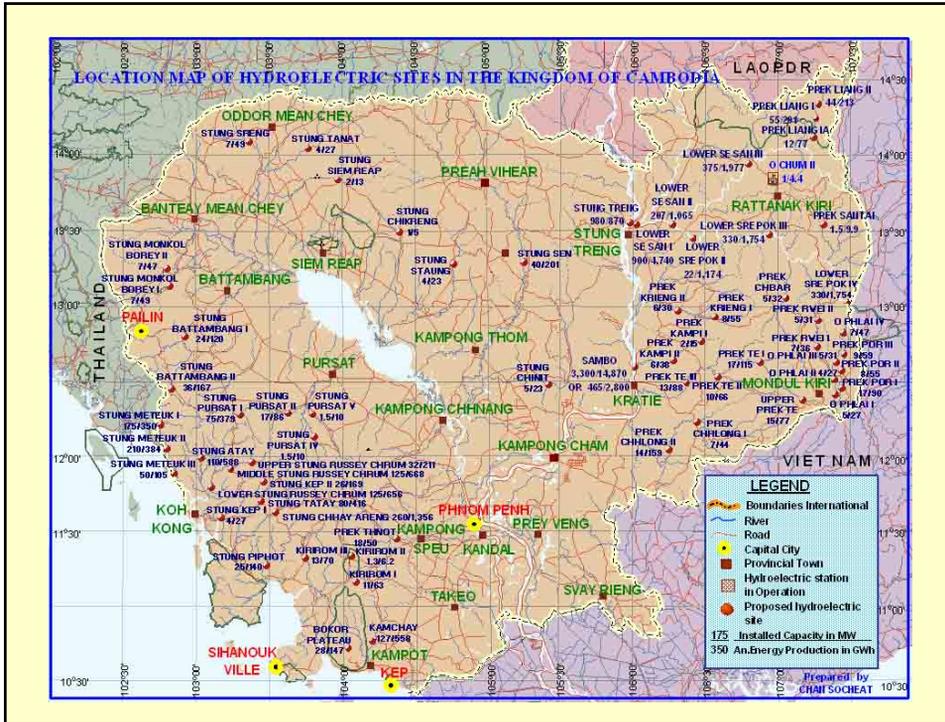


Micro-Hydropower Project																	
Site No.	Hydro Project Name	Province	Map Ref Series L708	Distance from Demand Centre to Power House	Distance from Existing Transmission Line	Catchment Area	Mean Annual Rainfall	Mean Annual Evapotranspiration	Mean Annual Flow	Power Flow	Net Head	Installed Capacity	Annual Generation	Development Cost (USDA/v)			Production Cost
				km	km									km2	l/s/km2	l/s/km2	
1	Kball Chay	Sihanouville	5737III	17.1	8.5	45	3,500	1,100	3.4	3	12.49	312	1,800,583	2,944	144	2,988	0.097
2	Upper Kamchay	Kampot	5830IV	26	13	243	3,500	1,100	18.5	10	37.6	3,132	12,001,374	1,886	46	1,932	0.061
3	Prek Toek Chhu	Kampot	5830III	15.6	4.8	79	3,500	1,100	54.0	5	18.28	762	5,139,374	3,391	33	3,424	0.071
4	O Touro Trao	Kampot	5830III	13.1	2.7	20	3,500	1,100	15	1	134.73	1,122	5,488,956	1,629	13	1,642	0.041
5	Snam Prampir	Kampot	5830III														
6	Bokor Plateau	Kampot	5830III	13.1	2.7	44	3,500	1,100	3.3	3	40	1,000	3,821,728	1,800	44	1,844	0.07
7	Preak Kach Touch	Kampot	5830UTM														
8	Turnap Koum Sav (O THUM)	Kampot	5830UTM														
9	O Chvoh Rokar	Kampot	5830UTM														
10	Stung Tras	Takeo-Kampot - Kg Speu	5831UTM														
11	Phnum Basing Kori (O Chhlueng)	Takeo	5830UTM	40	40	5	1,481	1,000	0.1	0.067	60	30	-	-	-	-	-
12	Stung Krang Pongle	Kg Speu - Kg Chhnang	5832UTM														
13	Stung Sva Slab	Kampong Speu	5831IV	80	30	205	2,200	1,000	7.8	8	56.66	3,804	20,296,185	1,634	54	1,688	0.055
14	Stung Bourbour	Kg Chhnang	5833UTM														
15	Stung Bannak	Kg Chhnang	5833UTM														
16	Stung Kbal Siem (St. Kampong La)	Kg Chhnang	5833UTM														
17	Siem Reap No.1 (eieg French)	Siem Reap	5735I	15	11.9	600	1,200	1,000	3.8	0	0	-	-	-	-	-	-
18	Siem Reap No.2 (Disused Irrigation Vse)	Siem Reap	5735I	0	0.2	670	1,200	1,000	4.2	0	0	-	-	-	-	-	-
19	Siem Reap No.3 (eieg Western Irrigation)	Siem Reap	5735I	17.7	7.8	600	1,200	1,000	3.8	0	0	-	-	-	-	-	-
20	Stung Siem Reap (1)	Siem Reap	5836III	47.9	44	115	1,600	1,000	2.2	3	69.25	1,732	6,639,554	2,120	212	2,332	0.074
21	Upper Stung Siem Reap (2)	Siem Reap	5836III	52.7	48.8	86	1,600	1,000	1.6	3	26.22	656	2,036,354	1,709	88	1,797	0.055
22	Kbal Speu Waterfall	Siem Reap	5836UTM														

11

23	O Sam Raong	Siem Reap	5935UTM														
24	Stung Touch	Siem Reap	5736UTM														
25	O Sam Kaong	Siem Reap	5736UTM														
26	Stung Chi Kreng	Siem Reap	5835UTM														
27	Stung Muong No.1	Battambang	5834III	34	34	546	1,800	1,000	13.9	4	20	400	-	-	-	-	-
28	Stung Muong No.2	Battambang	5834III	18.8	18.8	550	1,800	1,000	14.0	13	4	400	-	-	-	-	-
29	Stung Pursat No.1	Pursat	5733I	40	40	700	1,600	1,000	13.3	4	2	100	-	-	-	-	-
30	Stung Prey Klong	Pursat	5733II	20	20	555	1,600	1,000	10.6	3	2	100	-	-	-	-	-
31	Preak Antap (Memut District)	Kg Cham	6232 IV														
32	Preak Lpeak (Kg Siem District)	Kg Cham	6033UTM														
33	O Chum 1	Ratanak Kiri	6436V	8	3	0.3	-	1,200	3.8	3.8	10	300	-	-	-	-	-
34	O Katieng	Ratanak Kiri	6336II	10	10	44	3,000	1,000	2.8	3	43.05	1,076	4,025,338	2,593	90	2,683	0.087
35	Prek Dak Deur (S)	Mondul Kiri	6434III	11.3	11.3	53	2,600	1,200	2.4	16	14.3	200	1,000,578	5,645	296	5,941	0.14
36	O Phlat	Mondul Kiri	6433I	27	27	95	2,800	1,000	5.4	4.5	92.78	3,478	12,377,213	1,586	75	1,661	0.057
37	Prek Por	Mondul Kiri	6434II	30	30	198	2,800	1,000	11.3	15	38.53	4,800	12,710,928	1,290	62	1,352	0.073
38	Prek Dak Deur (Mentec site) (S)	Mondul Kiri	6434III	13	13	102	2,800	1,000	5.8	5	17.52	721	2,408,226	2,590	115	2,625	0.095
39	O Moleng1	Mondul Kiri	6433 IV														
40	O Moleng2	Mondul Kiri	6434 IV														
41	O Romiss	Mondul Kiri	6435 IV														
42	O Yong Ngol	Mondul Kiri	6436 IV														
43	Kirom III	Koh Kong	573III	140	40	98	2,500	1,000	4.7	5	250.36	8,342	38,792,449	1,344	48	1,392	0.039
44	Phnom Batau Downstream	Koh Kong	573III	140	44	105	2,500	1,000	5.0	5	100.78	4,197	21,302,049	1,188	100	1,288	0.031
45	Phnom Tursang Upstream(2)	Koh Kong	573III	140	2	32	2,500	1,000	1.5	2	188.66	3,143	15,853,167	1,406	6	1,412	0.054
46	Phnom Tursang Downstream(3)	Koh Kong	573III	140	7	53	2,500	1,000	2.5	4	90.11	3,002	14,358,993	1,704	21	1,725	0.071
47	O Sla Upstream	Koh Kong	573III	140	3	54	2,800	1,000	3.1	3	78.15	1,953	10,208,534	1,682	14	1,676	0.058
48	O Sla Downstream	Koh Kong	573III	140	7	75	2,800	1,000	4.3	5	107.64	4,483	13,951,211	2,022	15	2,037	0.048

12



HYDROPOWER DEVELOPMENT IN CAMBODIA																		
No	PROJECT NAME	REGIONS/PROVINCE (DISTRICT)	LOCATION OF DAM LONGITUDE	LOCATION OF DAM LATITUDE	LEVEL OF PROJECT	CATCHMENT AREA, km ²	Basin Area, km ²	RESERVOIR CAPACITY GROSS, Mm ³	RESERVOIR CAPACITY USABLE, Mm ³	FULL SUPPLY LEVEL, m	HEAD USABLE, m	MAXIMUM DISCHARGE, m ³ /s	HEIGHT OF DAM, m	LENGTH OF DAM, m	INSTALLED CAPACITY/MW	PRODUCTION/Year, GWh	IRRIGATION AREA, ha	INVESTMENT COST, \$Million
1	KIRIFOM	KOH KONG (SRE ANBOL)	104 02'	11 14'	Constructed	98.80	10.50	9.00	9.00	446	363	3.70	30	470	12	63	-	22.3
2	KAMCHAY	KAMPOT (KAMPOT)	104 07'	10 43'	Partly Constr.	685	20.00	-	1,270	125	76	102	131	628	127.5	558	-	420.00
			CPEC (1994)	106 00'	12 37'	Fea (1994)	646,000	880	2,050	2,000	40	20	13,000	54.25	30,684	3,300	14870	-
3	SAMBOR	KRATIE (PREK PROSOP)	104 07'	10 43'	Fea (1985)	646,000	4,000	2,050	2,050	-	-	12,000	54	30,684	3,600	18820	-	6,205
			Feasibility	646,000	880	10,000	-	-	-	54	30,700	875	-	630				
			CPEC (1994)	Feasibility	646,000	6	-	105	-	-	3,600	30	20,000	465	2800	-	700	
			CPEC (1994)	Feasibility	646,000	6	-	105	-	-	3,150	30	20,000	350	2800	-	700	
4	BATTAMBANG 1	BATTAMBANG 1 (Ratanak Mondul)	102 54'	12 48'	Feasibility	2,135	92	1,140	1,040	77	77.35	62.00	48.5	4,200	24	120	37,400	48.9
5	BATTAMBANG 2	BATTAMBANG 2 (SRE PONELEU)	102 54'	12 26'	Desk Study	120	16	150	110	672	450	5.88	50	225	36	187	-	65.10
6	STUNG CHHNT	KAMPONG THOM (SANTUK)	105 24'	12 29'	Feasibility	3,770	137	-	590	3120	16	36.50	35	1,100	8.5	44.6	25,400	30.00
		PHNOM TAKHO DAM	-	-	-	137	-	390	-	-	36.50	22	1,098	4.5	22.6	-	23.60	
7	STUNG METEUK 2	PURSAT (KROVANH)	102 46'	12 08'	Pre-feasibility	430	25.50	470	430	250	209	31	65	850	90	488	20,000	9150
8	Lower SE SAN 1	STUNG STRENG (SE SAN)	1076 02'	13 32'	Desk Study	76,700	910	6,400	2,100	65	24	2,810	40	12,500	900	4740	-	1,442
9	Lower SE SAN 2	STUNG STRENG (SE SAN)	106 26'	13 30'	Desk Study	17,070	1,405	12,510	1,400	90	25	1,440	40	7,500	207	2507	-	901.30
10	Lower SRE POK 2	STUNG STRENG (SE SAN)	106 24'	13 26'	Desk Study	29,410	714	12,510	1,400	90	25	1,440	40	4,100	222	-	-	172.20
11	Lower SE SAN 3	RATANAK KIRI (NEUN SAN)	106 56'	14 20'	Desk Level	15,600	980	27,400	3,120	150	59	4715	75	4,300	375	1977	57,000	704.60
12	Upper SE SAN 4	RATANAK KIRI (ANDONG MEAS)	107 20'	13 56'	Desk Level	9,650	146	2,600	1,410	235	78	325	100	1,550	350	1012	-	544.60
13	PREK LIANG 1	RATANAK KIRI (TA VENG)	107 15'	14 14'	Desk Study	910	8	190	110	330	153	27.20	30	300	55	297	-	145.70
14	PREK LIANG 2	RATANAK KIRI (LOM VENG)	107 16'	14 20'	Desk Study	600	13.50	240	180	585	168	17.70	30	250	40	213	-	124.20
15	Lower SRE POK 3	RATANAK KIRI (LOM PHAT)	107 03'	13 23'	Desk Study	28,200	385	8,060	5,310	125	32	775	50	3,800	330	174	65,000	812.00
16	Lower SRE POK 5	RATANAK KIRI (KOH MEK)	107 27'	13 02'	Desk Study	13,800	480	9,000	2,680	190	53	327	70	3,650	235	1233	-	504.80
17	Lower SRE POK 5	MONDUL KIRI (PICH RODA)	107 16'	12 44'	Desk Study	265	5.50	54	51	320	65	7.70	55	500	6.8	38	-	50.30
18	PREK POR	MONDUL KIRI (PICH RODA)	107 26'	12 34'	Desk Study	135	8	80	59	520	146	8.70	55	950	17.3	90	-	85.00
19	O PHLAI	MONDUL KIRI (O REANG)	107 24'	12 24'	Desk Study	95	5.50	37	26	790	134	2.85	45	350	5.2	27	-	22.70

20	Upper PREEK TE	MONDUL KIRI (PEANG)	107 11'	12 24'	Desk Study	112	4.10	-	26	685	-	3.30	90	725	14.7	77	-	57.6
21	STUNG SEN	KOMPONG THOM (SAN THOUK)	105 15'	13 17'	Desk Study	10,500	530	3,660	2,890	43.50	19	145	38	2,700	38	201	130,000	80.40
22	STUNG PURSAT 1	PURSAT (KRAYANH)	103 17'	12 16'	Desk Study	1,000	23	-	123	200	125	18.10	15	200	3.5	9	-	18.60
23	STUNG PURSAT 2	PURSAT (KRAYANH)	103 37'	12 17'	Desk Study	2,880	283	335	100	45	<15	9.70	28	250	17	715	-	59.60
24	PREEK CHBAR	MONDUL KIRI (KOHHEK)	107 03'	13 04'	Desk Study	1,220	70	355	238	144.60	<4.8	-26	30	3,000	-	-	26,000	8.50
25	PREEK SANTI	RATANAK KIRI (LOMPHAT)	107 18'	13 32'	Desk Study	350	14	56	46	140	<5	-6	25	1,600	-	-	6,000	3.30
26	PREEK DRANG	RATANAK KIRI (VA DAR)	107 27'	13 31'	Desk Study	1,250	21	26	56	139	<4	14	30	300	-	-	14,000	2.50
27	PREEK KRIENG	KRATIE (SAMBOR)	106 33'	12 56'	Desk Study	970	41	190	180	110	<10	10	35	850	-	-	10,000	4.80
28	PREEK KAMPIE	KRATIE (KRATIE)	106 16'	12 38'	Desk Study	620	37	235	225	60	<10	7	25	625	-	-	7,000	2.50
29	Lower PREEK TE	MONDUL KIRI (Foh Roda/Keo Sem)	106 45'	12 40'	Desk Study	985	-	285	295	200	<20	15.60	45	450	-	-	-	-
			106 52'	12 38'		445	105	170	160	120	<10	3.10	30	900	-	-	30,000	11.80
			106 46'	12 30'		317	-	70	90	143.50	<7.5	4.40	25	750	-	-	-	-
						225	-	27	22	80	<2.5	1.80	25	800	-	-	-	-
30	PREEK CHLONG	KRATIE (SACUL)	106 26'	12 15'	Desk Study	3,320	87	575	285	63.50	<3.5	24	30	1,800	-	-	24,000	6.90
31	STUNG STAIUNG	KAMPONG THOM (Phak Baing)	105 46'	13 15'	Desk Study	1,500	144	590	550	55	<10	20	25	3,000	-	-	20,000	10.00
32	Lower STUNG RUSEY	KOH KONG (MONDUL SEMA)	103 09'	11 47'	Desk Study	1,020	140	-	21	120	103	88.6	55	200	125	656	-	129.80
33	Middle STUNG RUSEY	KOH KONG (MONDUL SEMA)			Desk Study	-	28	-	277	-	-	43.00	60	1,100	125	668	-	274.60
34	STUNG ATAY DIVERSION	KOH KONG (THMOR BAING)			Desk Study	-	48	-	565	-	-	31.0	55	2,350	110	588	-	156.40
35	STUNG ATAY	KOH KONG (THMOR BAING)	103 26'	11 42'	Desk Study	350	33	610	596	420	180	32.10	55	750	90	418	-	214.80
36	STUNG CHAY ARENG 3	KOH KONG (THMOR BAING)	103 32'	11 37'	Desk Study	950	190	1,750	1,600	210	163	18.7	55	1,200	260	1358	-	501.80
37	KIRIROM PLATEAU	KOH KONG (SPE AMBUL)	103 49'	11 15'	Desk Study	105	4.30	40	38	395	283	3.50	40	300	13	70	-	28.70
38	STUNG PIPHOT	KOH KONG (BOTUM SAKOR)	103 28'	11 16'	Desk Study	1,010	210	3,800	1,810	35	30	89.80	50	1,400	25	140	32,500	62.00
39	PREEK KAMPONG LED	KOH KONG (SPE AMBUL)	103 55'	11 07'	Desk Study	580	57	240	220	22	-4	7	27	650	-	-	12,000	6.70
40	BOKOR PLATEAU	KAMPOT (KAMPOT)	104 03'	10 40'	Desk Study	21	4.10	27	25	950	895	2.32	45	900	28	147	1,500	63.30
41	STUNG METEUK 1	KOH KONG (MONDUL SEMA)	102 47'	12 00'	Desk Study	670	15.40	280	220	130	107	17.30	60	350	25	134	-	76.20
42	RIVER "A"	KOH KONG (THMOR BAING)	103 12'	11 47'	Desk Study	895	6.70	93	81	400	-	10.80	55	500	-	-	-	7.10
43	STUNG SALA MUTHUN	KOH KONG (THMOR BAING)	103 16'	11 45'	Desk Study	100	6.30	66	61	480	-	7.50	55	250	-	-	-	8.50
44	KIRIROM EXTENSION	KOH KONG (SPE AMBUL)	104 02'	11 16'	Desk Study	86	1.70	105	9	465	-	0.48 to 0.60	35	265	13	6.2	-	4.70
45	STUNG KEP	KAMPOT (KAMPOT)	103 23'	11 50'	Desk Study	210	nA	-	-	480	-	-	-	-	-	-	-	7.50

Table lists the priority Hydropower Projects which need the private sector participation.

No.	Project's Name	Installed Capacity (MW)	Annual Energy (GWh)	Project's Cost in Mio. US\$	Purposes	Remarks
1	Kamchay	180	558	250	Power Generation or Irrigation	Prefeasibility Study
2	Kirirom III	13	70	29	Power Generation	Desk Study
3	Battambang 2	36	187	65	Power Generation	Desk Study
4	Battambang 1	24	120	49	Power Generation or Irrigation	Desk Study
5	Stung Atay	110	588	156	Power Generation or Irrigation	Desk Study
6	Middle Stung Russey Chrum	125	668	275	Power Generation	Desk Study
7	Lower Stung Russey Chrum	125	656	130	Power Generation	Desk Study
8	Upper Stung Russey Chrum	32	211	65	Power Generation	Desk Study
9	Stung Meteuk 2	210	384	290	Power Generation or Irrigation	Desk Study in Thailand
10	Stung Meteuk 1	175	350	320	Power Generation or Irrigation	Desk Study in Thailand
11	Stung Meteuk 3	50	105	190	Power Generation	Desk Study
12	Sambor	467 or 3,300	2,800 or 14,870	700 or 3940	Power Generation or Irrigation	Desk Study
13	Lower Sre Pok 2	222	1,174	339	Power Generation	Preliminary Study
14	Lower Se San 2	207	1,065	374	Power Generation	Preliminary Study



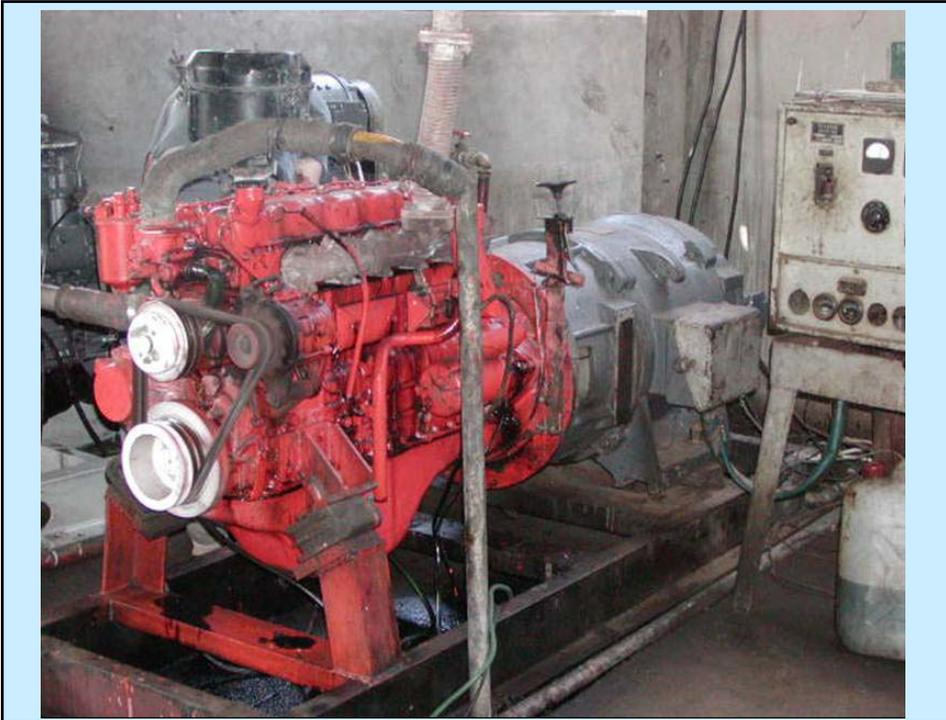
RURAL ELECTRIFICATION (RE)





23

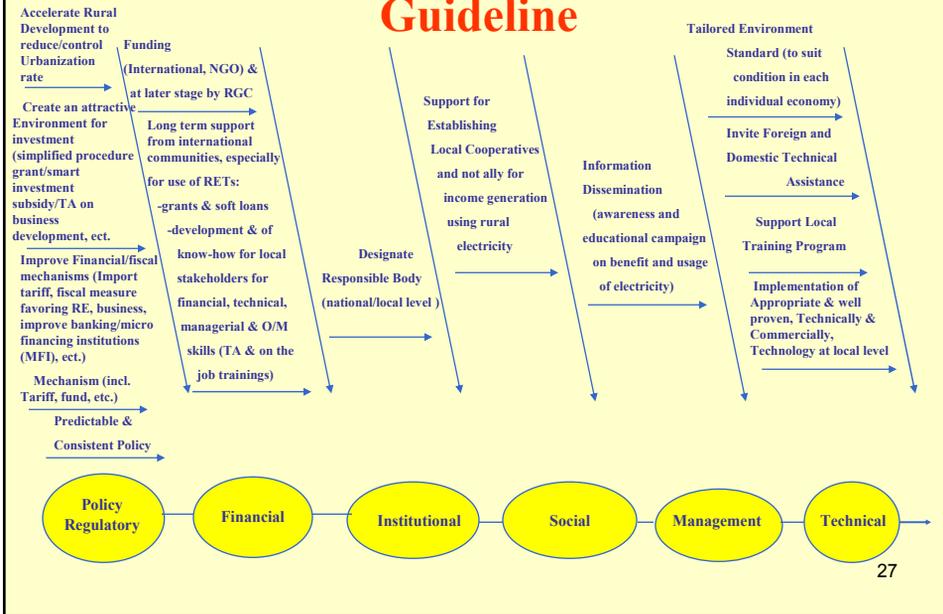




RE – STRATEGY COMPONENTS

- Target to achieve 70% of RE by the year 2030 with grid quality.
- Main components of the Rural Electrification Strategy:
 1. **Grid expansion from the existing**
 2. **Diesel stand-alone, Mini-Utility Systems**
 3. **Cross-border Power Supply from neighboring countries (Thailand, Vietnam and Lao)**
 4. **Renewable Energy (Solar, Wind, mini-micro hydro, Biomass, Biogas, biofuel etc...)**

Schematic Rural Electrification (RE) Guideline



CONCEPT OF SUSTAINABLE RURAL ELECTRIFICATION AND ITSTARGET

Aims at:

- Non-electrified remote areas, which are far from national grid
- Developing the country
- Promoting local resources, such as Solar, Wind, Hidro, Biogas, Biomass, or Geothermal
- People participation.

KEY SUCCESS FACTORS OF SUSTAINABLE RURAL ELECTRIFICATION

Are:

1. To provide sufficient Transfer of Practical Techniques to local staff,
2. To secure Sustainable Revenue at site for Implementation Activities, and
3. Public Participation and Consultation for Planning, Construction, Maintenance and Management.

29

RURAL ELECTRIFICATION BY RENEWABLE ENERGY

• National Policy on Renewable Energy

The basis of the proposed policy is:

- Endeavor to provide access to reliable, safe and environmentally clean electricity services to rural areas, at an affordable cost to the national community;
- Act as a market enabler and encourage private sector participation in providing rural renewable electricity services;
- Provide effective legal and regulatory framework for enabling access to reliable, safe and clean electricity services to rural areas, at an affordable cost to the national community;

30

National Policy on Renewable Energy (cont.)

- Encourage the most efficient systems for generation, transmission and distribution of electricity from clean and renewable energy sources, to enable a rational electricity tariff policy through promotion of differentiated tariffs based on cost recovery principles;
- Promote renewable electricity systems for rural applications, as part of a national portfolio of grid and off-grid technologies, provided they are the least-cost option for the national communities; and
- Ensure adequate resources and appropriate institutional mechanisms to empower the poor, particularly those in rural areas.

31

National Strategy on Renewable Energy

The basic of the proposed strategy is :

- Widely expand the access for electricity services to the rural population through development of appropriate programs and action plans to promote the Renewable Energy Technologies (RET);
- Expand the supply base for renewable energy services by motivating and promoting the participation of private entrepreneurs so as to provide efficient and cost-effective services, which will benefit the whole community;
- Facilitate systematic market and institutional development in renewable electricity sector by creating a comprehensive legal and regulatory framework to enable effective participation of government, private and community based entities in providing electricity services to the rural consumers;

32

National Strategy on Renewable Energy (cont.)

- Ensure a wide and equitable access of electricity services to all sections of the rural population by developing appropriate tariff policies and instituting a rational tariff regime;
- Promote environmentally sustainable small power technologies including RET in on-grid and/or off-grid mode in order to create wide access for rural consumers to affordable electricity services; and
- Contribute to empowerment of the rural poor by creating economic opportunities and uplifting standards of living through electricity services, and through involving them in planning, operation, maintenance and management (OM&M) of programs providing those services.

33

MASTER PLAN ON RENEWABLE ENERGY

Purpose – To identify and evaluate the Renewable Energy Potential for the whole Kingdom of Cambodia

34

RE MASTER PLAN BY RENEWABLE ENERGY

- **GOAL** - To improve the current level of electrification and reduction poverty 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% of Rural Villages by the year 2020.

35

RENEWABLE ENERGY ACTION PLAN (REAP)

- **REAP MISSION**
- **REAP GUIDING PRINCIPLE**
- **REAP LONG TERM TARGET**
- **IMPLEMENT THE 5 YEARS REAP**
- **FINANCIAL RESOURCES**

36

WHY

RURAL ELECTRIFICATION BY RENEWABLE ENERGY IN CAMBODIA???

37

DUE TO THE FACTS THAT

- Some Renewable Energy Technologies (RET) still have some “weaknesses”, in terms of for example, reliability
- Invest cost of RET still high / very high investment cost
- Some RET still under Research & Development (R&D)
- There are no understanding on the RET usefulness & no RET support from policy makers and people
- There are weaknesses in financing, banking & incentive systems (e.g. no import tax, fiscal incentives etc...)

38

IN CASE OF CAMBODIA

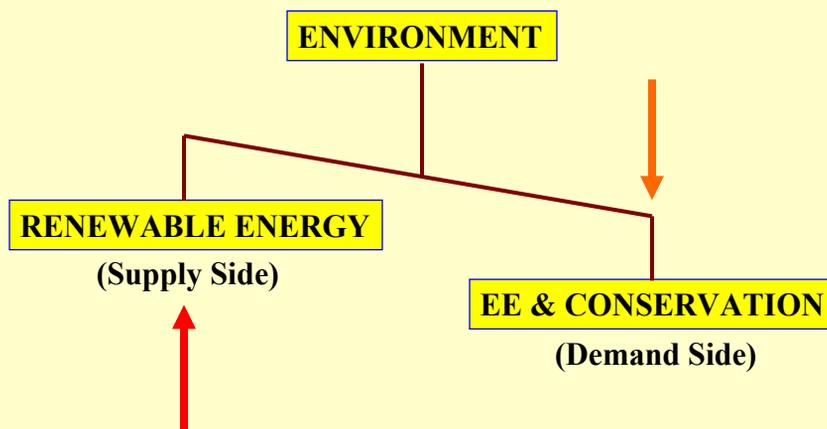
- Because the impact on the environment is one of the major problems facing this new century and the future period of the country, the region and the whole world.

So in this case:

- The Royal Government of Cambodia (RGC) has supported and ratified the Kyoto Protocol in the year 2002
- RGC is progressing from “support” to “concrete implementation” when feasible, notably in the energy field:
 - It promotes and encourages the development of renewable energy on the supply side, and
 - It promotes and encourages the efficient use of energy and the energy conservation, with the EE&EC programme on demand side.
 - Cambodia has indeed plenty of renewable energy resource, which can be converted into electricity, in particular for the supply of rural areas.

39

CONCEPT



40

Rural Electrification-Mechanism

To implement and to achieve the goals set by the policy, strategy and action plan, the RGC must first establish the **Rural Electrification Fund (REF)**

- REF is the creation of the Royal Government of Cambodia and the World Bank, with the goal of encouraging the private sector for investment in electricity supply to the rural population, with smart subsidies and Smart credit scheme for reason of social equity.
- Agreed electricity price sold to the rural population would be such that the rural entrepreneurs will still make project.
- Investment Fund will come from grants and loans with low interest rate and long term period from versions credit and financing institution.

41

EXAMPLE...

- **Financial Resources**

From government budget through MIME.

The main funding sources will be the government loans from WB/IDA,

Other sources: grants from donors, private equity, etc.

SUMMARY OF PROJECT COST

<i>Type</i>	<i>Local (US\$ M)</i>	<i>Foreign (US\$ M)</i>	<i>Total (US\$ M)</i>
REE off-Grid Extension (45 000 HH)	1.82	4.11	5.93
Mini hydro (6.0 MW)	2.81	6.37	9.18
SHS (12 000) (GEF US\$ M 1.2)	0.79	3.19	3.98
Village hydro (850 kW) (GEF US\$M 0.30)	0.53	1.25	1.78
Sub-total REF Component	5.95	14.92	20.87

42

EXAMPLE...(Cont-e)

- **Financing Grants**

<i>Type</i>	<i>Grant proposed, US\$ per household connected</i>	<i>Estimated total cost/unit in US\$</i>
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

43

OTHERS...

- Promote and encourage Rural Electrification Entrepreneurs (REE) to participate by various supports, i.e. ideas, “subsidies”, training for awareness and understanding of renewable energy. The next step would be to reduce, even to spot using Diesel Generation sets and to replace these by Renewable Energy Technologies (RET).
- Create Community Business Associations or Organizations (CBA) in order to develop activities in villages and communes, particularly in remote areas, where private sector is not yet aware of or cannot yet reach.
- Necessity to create NGO, agents, associations, different centres in order to accelerate the development and to reach the targets set by the RGC in terms of RE:
 - 2020 all villages will be electrified by electricity from different forms
 - 2030 70% of rural households with grid quality electricity.

44

BARRIERS

In principle:

- 1. Policy barrier**
- 2. Financial barrier**
- 3. Institutional barrier**
- 4. Social barrier**
- 5. Managerial barrier, and**
- 6. Technical barrier**

45



H.E. Samdech Prime Minister HUN SEN visit Solar Energy System

**PV-Biogas (110 kWp)
Research Cooperation Project (MIME-NEDO)**



H.E. Suy Sem Minister of Industry Mines and Energy visit PV-Biogas

**PV-Micro-hydro (108.7kWp) Research
Cooperation Project (MIME-NEDO)**



Thank you!

Any Question Please?



Contact Dr. Sat Samy

Tel/Fax: 855-23-990602

Mobile Phone: 855-12-299399

E-mail: mimeder@forum.org.kh

Website: [www. recambodia.org](http://www.recambodia.org)