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# **Promotion of the Efficient Use of Renewable Energies in Developing Countries**

## **Energy related socio-economic factors in rural areas in Cambodia**

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**Table 1: EDC installed Capacity & Maximum Output, MW**

Item/Year	2003	2002	2001	2000	1999
Installed Capacity	158.4	157.4	137.39	122.4	119.8
Max Output	124	123	112.5	97.5	97

The Major consumption of electricity is centred in Phnom Penh, which accounts for four-fifths of the total electricity supplies by EDC while the provincial towns account for the remaining one-fifth of the total electricity consumption. The total installed capacity for other provincial towns is only 34 MW with a maximum demand of 23 MW.

**Table 2: Power Demand and Forecast in Cambodia**

Item/Year	2004	2006	2008	2010	2012	2014	2016
Power, MW	273	331	404	477	558	651	746
Energy, GWh	1036	1215	1454	1700	1968	2292	2634

The supply requirements are projected to increase on an average by 18% per year over the next 12 years, and the peak load is expected to reach up to 746 MW in 2016 with majority of the growth coming from Phnom Penh.

**Table 3: Power Demand and Forecast in Cambodia for Detail (MW)**

Item/Years	2004	2006	2008	2010	2012	2014	2016
Banteay Meanchey	10.0	12.0	14.5	17.3	20.0	24.0	26.0
Battambang	12.0	15.0	18.5	22.4	27.0	31.0	33.0
Kampong Cham	13.0	15.2	17.9	20.5	23.0	26.0	29.0
Kampong Chhang	2.8	3.4	4.0	4.7	5.0	6.0	7.0
Kampong Speu	3.8	4.7	5.9	7.2	9.0	12.0	16.0
Kampong Thom	4.5	5.3	6.4	7.5	9.0	10.0	11.0
Kampot	10.1	13.9	16.3	18.9	25.0	28.0	33.0
Kandal	6.7	7.9	9.2	10.6	12.0	13.0	15.0
Koh Kong	1.4	1.7	2.0	2.3	3.0	3.0	4.0
Kratie	5.7	6.8	8.0	9.4	11.0	12.0	14.0
Mondul Kiri	0.4	0.5	0.6	0.7	1.0	1.0	1.0
Phnom Penh	170.0	207.0	256.0	304.0	357.0	419.0	483.0
Preah Vihear	1.0	1.1	1.4	1.6	2.0	2.0	2.0
Prey Veng	5.5	6.8	7.8	9.0	10.0	11.0	13.0
Pursat	4.2	5.0	5.9	6.9	8.0	9.0	11.0
Ratanak Kiri	1.5	1.7	1.9	2.2	2.0	3.0	3.0
Siem Reap	7.1	8.4	10.0	11.5	13.0	15.0	17.0
Sihanoukville	4.8	5.5	6.3	7.3	8.0	10.0	11.0
Stung Treng	0.9	1.1	1.3	1.5	2.0	2.0	2.0
Svay Rieng	2.8	3.2	3.9	4.4	5.0	6.0	6.0
Takeo	4.2	4.9	5.8	6.7	8.0	8.0	9.0
TOTAL	272.4	331.0	403.6	476.6	558.0	651.0	746.0

As EDC is not being able to meet the growing demand of electricity, it developed a policy of off-grid power supply and is also purchasing electricity from IPPs (Independent Power Provider) under the PPA at an agreed price of 8.7 cents per kWh. Under PPA, three private

companies are already supplying electricity to EDC in Phnom Penh namely: Cambodia Utility Pte.Ltd., Jupiter Cambodia and Cambodia International Hydropower Development Co. Ltd.

**Table 4: Official Electricity Tariffs of EDC (Residential)**

Unit		Riel/kWh	US\$/kWh
Phnom Penh	0-50 kWh	350	9 Cents
	51-100 kWh	550	14 Cents
	> 100 kWh	650	16 Cents
Sihanoukville		500	13 Cents
Kompong Chhang		850	21 Cents
Takeo		900	23 Cents
Battambang		960	24 Cents
Government		700	17 Cents
Customers	NGO's Office	800	20 Cents
	Foreigner's House		
	Embassy		
Business	Small Business	650	16 Cents
	Medium Business	600	15 Cents
	Large Business	500	13 Cents
	Medium Voltage	480	12 Cents
Industry and Handcraft	Small Business	650	16 Cents
	Medium Business	550	14 Cents
	Large Business	500	13 Cents
	Medium Voltage	480	12 Cents

By 2007, Cambodia will also be importing electricity from Vietnam. The cost of electricity at the border with Vietnam is estimated to be 6.02 cents/kWh and would be available at 8.5 cents, after addition of EDC costs. Present production cost of EDC is 12.5 cents/kWh and the official tariff is between 9 cents/kWh in Phnom Penh and 24 cents/kWh in Battambang, among the highest in the ASEAN region. As EDC does not provide access to squatters and other areas where the poor community live, the poor are forced to buy electricity from private contractors who buy electricity at 16 cents/kWh. There were private contractors found to be selling a minimum of 250 kWh and maximum of 5000 kWh per month.

## **2.2 Urban (Municipal of Phnom Penh)**

The city of Phnom Penh is the major electricity consumer of Cambodia as it accounts for 81.5% of the country's electricity consumption. The city has an installed capacity of 124 MW and a maximum output of 101 MW. Of the total installed capacity of 124 MW of Phnom Penh, the three IPPs under PPA supply 63 MW.

**Table 5: Production in Phnom Penh**

Sn.	Plant	Capacity in MW
1.	C2	18 MW
2.	C3	15.4 MW
3.	C4	2 x 5 MW
4.	C5	3 x 6 MW
5.	C6	5 x 7 MW
6.	IPP - 1: Cambodia Utility Pte. Ltd.	5 x 7 MW
7.	IPP - 2: Jupiter Cambodia	10 x 1.5 MW
8.	IPP - 3: Cambodia Internationa Hydropower Development Co. Ltd.	2 x 6 MW

The progressive tariff rates that charge 9 cents/kWh for consumers using less than 50 kWh and 16 cents per kWh for consumers using more than 100 kWh aims to benefit the poor. The poor people without access to the EDC grid, however, end up paying a higher price, as they have to purchase electricity from EDC at 16 cents/kWh and resell it to the local community at rates ranging from 22 cents/kWh to 50 cents/kWh. The purchase price of electricity to private contractors itself is high as they have no formal contract with EDC and thus have to pay 16/kWh cents because they end up consuming more than 100 kWh from the EDC grid.

EDC in Phnom Penh has 140,918 customers (approximately 59% of the households) who consume 88.45% (478.1 GWh) of the total energy sales in Cambodia (540 GWh). Almost half (47.5%) of the total energy sales in Phnom Penh come from residential customers, 23.09% from commercial sources and 12.44% from industrial purpose. Though Phnom Penh consumes three fourths of total electricity generated in the country, there is still a high usage of charcoal and fuel wood brought from peri-urban and surrounding rural areas which causes serious environmental damage to the places from where it is brought from.

## 2.3 Rural

Rural Cambodia still rely on traditional sources of energy such as charcoal and wood energy; fuel wood meets 84% of the primary energy consumption and is likely to be an important source of energy for the coming years as well. The use of fuel wood for energy is not confined only to rural areas but is being used also in the urban areas and for commercial and industrial purpose also.

## 2.4 Potential for RE application

### 2.4.1 Biomass

A level of potential availability is perceived for the use of biomass residues in power generation. Biomass for electricity generation has an important role in rural electrification strategy. Private sector involvement in biomass for electricity generation is also important for rural energy development.

According to a theoretical biomass potential for 2005 reaches to about 700MW. At present, however, there is very little electricity production from wood-based fuel (Anlong Tamey gasifier project in Battambang 7 kW + 20 kW). A funding support from NEDO (2004) was able to construct 1 biogas (2 x 35kW) in combined with 50kWp PV system.

The general trend of the use of wood and other biomass material throughout Cambodia is summarized as follows:

- 94 % of fuel wood is used directly as fuel;
- 6 % of fuel wood is converted to charcoal;
- 90 % of total fuel wood supply is consumed directly by households in rural areas;
- 8 % of total fuel wood supply is used in other urban households;
- Less than 1 % of total fuel wood supply is used in industrial sector;
- Less than 1 % of total fuel wood supply is used in service sector;
- The other biomasses such as wood, wood waste and rice husk are used by brick kilns, bakeries, and food processing;
- Cane husk, palm branches and tree leaf are used by cane sugar and palm sugar producers;
- Coconut branches, coconut husk and rice husk are used by rural households for cooking animal food; and
- Some rural households use coconut branches, palm branches, rice straw with cow dung, rice husk and wood waste for cooking their food.

#### **2.4.2 PV solar**

The use of PV Technologies in Cambodia has been developing very slowly and their status is mainly in research & development and demonstration stage.

In Cambodia the use of solar photovoltaic (PV) technology has started since 1997 for lighting, radio, TV and telecommunication in the rural areas. The total installation is about 1,000 kWp and primarily has been installed on telecommunication repeater station in remote areas. Most of the solar home systems (SHS) with an output of 12V, 50-70Ah battery capacity, resulted from donor projects supported by SIDA, NEDO, UNICEF, FONDEM, other donors and individual donors or family members living in France, Canada and USA. All the appliances are imported from other countries and are in demonstration stage.

The following is a brief on several solar projects:

Germany's support project through Carl Dulsberg Gesellschaft (CDG) provided training for PV technology, biomass and Operation and Maintenance of PV system.

Swedish International Development Cooperation Agency (SIDA) sponsored research program on solar PV, solar drying, biomass and briquette stoves. SIDA also provided funding for installation of solar home systems with the capacity of 1,240 Wp.

New Energy and Industrial Technology Development Organization of Japan (NEDO) funded the installation of a PV battery charging system and a PV-Water pumping with the total

capacity of 3,276Wp. NEDO also funded for the construction of 2 hybrid system pilot research projects, one is PV and micro hydropower (80kWp+40kW) and another one is PV and biogas (50kWp+60kW) and includes mini grid system, both of them already put into operation since July 2004.

FONDEM Health Centers provided the fund for installation of solar system in 45 rural health centers from 1999-2002 and also developed a standard solar installation kit, including 170Wp light, radio and refrigeration, to reduce system costs and facilitate maintenance.

### **2.4.3 Wind energy**

The main obstacle to wind potential assessment, as is the case for all other forms of renewable energy technologies, is the absence of reliable data over both short and longer time series. Weather observation remains rudimentary and restricted to a handful of sites in Cambodia. To calculate the wind conditions for each region in Cambodia, NEDO (2002) uses a combination of Cambodian geographical features and global weather data from the English Weather Bureau. The southern part of Tonle Sap Lake, the southwestern mountains and the southern coastal areas have favorable wind conditions. The Wind Atlas of South East Asia, produced by the World Bank's ASTAE program in 2001 is the most extensive study of wind resources ever undertaken for this region. It identifies over 6,500 square kilometers of land in Cambodia with an average wind speed above 6 m/s, with smaller areas above 7 m/s. The commercial viability of potential projects is determined by a number of site-specific factors, such as proximity to transmission and transport costs. However it is important to note that significant wind generation has been established in many countries with wind speeds similar to Cambodia. And the viability of projects in Cambodia will be assisted by Cambodia's extremely high cost of electricity from fossil fuel sources. Funding and finance of such projects is also emerging with projects such as the World Bank's Rural Electrification Fund, and potential participation in the Clean Development Mechanism under the Kyoto Protocol. For example, Sihanoukville, the main commercial harbor of Cambodia and a popular resort area. Given the expected demand in coastal areas surrounding Sihanoukville, electrification by wind power warrants further investigation.

### **2.4.4 Small Hydro power**

The government's electrification master plan is essentially based on the establishment of a national grid and the construction of hydropower stations. Three of the hydroelectricity projects currently planned will have an installed capacity superior to 100 MW. Under Cambodian law, Environmental Impact Assessments (EIA) will be required for all the stations that exceed 5 MW of installed capacity. Having a rich water resource, Cambodia has the second largest hydropower potential in the Lower Mekong Basin with 10,000MW estimated capacity (90% is located in Mekong and its tributaries while 10% is situated in the southwestern coastal part). Based on RETs in Asia (2002) with focus on Cambodia, the country has only two hydropower plants – Kirirom I invested by CETIC (with 12MW upgraded capacity) and Chum Hydropower Plant with 1MW installed capacity. Another investment by

CETIC is the Hydropower Kirirom III Project. The Hydropower Kamchay, which has a projected capacity of 180 MW, is now under bidding process

The often quoted figure for Cambodia's hydropower potential was provided by an Asian Development Bank's report, where it is argued that the Mekong River and its tributaries have potential for the generation of 8.6 GW of electricity (ADB, 1999). MIME is even more enthusiastic in its estimates of Cambodia's hydroelectric potential with about 10 GW. The electrification master plan argues that given "the topography and high rainfall", many areas of Cambodia are favorable to the development of mini-hydro schemes of 100 kW to 5 MW. The 5 MW limit corresponds to the maximum installed capacity of a station that does not require an EIA for construction. Under assistance of JICA, in cooperation with MIME and (EAC), the "General Requirements of Electric Power Technical Standards for the Kingdom of Cambodia" had been established. This document has the following main purposes:

To specify the technical, design, and operational criteria of electrical power facility, house wiring and electrical appliance;

To ensure that the basic rules for supply of electricity are fair and non discriminatory for all consumers of the same category; and

To maintain the technical standards (levels) of electrical power facility, house wiring and electrical appliance installed in the Kingdom of Cambodia.

## **2.5 Acceptance of RE**

Following the principle of free enterprise and market economy system, Royal Government of Cambodia has made significant step in institutional strengthening and good governance. The process of investment in Cambodia is a direct and open process, mode of participation of private investors through international competitive and transparent bidding for significant projects follows the new approach for the development and approval of private investment projects in a transparent manner.

The Ministry expressed that there is a need for more support from the Royal Government of Cambodia to be able to overcome serious barriers and hence promote RE technologies and facilitate private sector participation. Ministry of Industry, Mines and Energy identified that (1) RE development is a key element of the Royal Government of Cambodia's rural electrification strategy, for generating electricity; and (2) support from donors for assistance in training and financial matters is crucial and significant in promoting RE development in Cambodia.

**Table 6: Potential of different renewable energy sources**

RE Source	Opportunities
Biomass	<ul style="list-style-type: none"><li>• Various fuels available (rice husks, straw, biogas, palm oil, forestry residue, plantation timber/crops (e.g., rubber))</li><li>• Many technologies now mature and in use elsewhere</li><li>• Need thorough resource assessment + feasibility studies current fuel uses must be investigated</li></ul>
PV Solar	<ul style="list-style-type: none"><li>• Excellent potential</li><li>• Extensive demonstrations by NEDO and others</li><li>• Opportunities for Grid-Interactive inverters in towns and small grids</li></ul>
Hydropower	<ul style="list-style-type: none"><li>• Excellent potential, proven ability in-country</li><li>• Pico/micro suitable in many small villages on rivers</li><li>• Mini – projects identified and investigated in Meritech study</li></ul>
Wind	<ul style="list-style-type: none"><li>• Large utility scale (&gt;500kw): 8 areas identified by modeling as good potential, now need monitoring and investigation</li><li>• Small domestic scale (&lt;500kW): demonstration projects by NEDO Takeo, but one turbine damaged and monitoring unsuitable</li><li>• Further investigation needed</li></ul>

At present, the power supply network in Cambodia consists of small stand-alone power units. There is a clear need to build a nationwide power transmission network that can provide the link to all generators and distributors. In addition, the issues on shortage of supply of electricity and correspondingly high tariffs in Cambodia should be addressed. Apart from Phnom Penh and a very few provincial towns with adequate power supply, a big part of the country's power supply has been provided by private contractors operating small generators offering excessive tariff of 1,000 to 1,500 Riels/kWh.

The report on that development of RE sources in Cambodia is still slow to date in the region due to the following reason:

- Lack of experiences for the energy sector;
- Limited policy and framework;
- Lack of funding for the sector;
- Inadequate data and information; and
- Insignificant utilization of the RE sources in the contribution to the total energy supply mix which is based on imported fuel oil for power generation

### 3 Information through out survey

#### 3.1 Target groups

In Cambodia there are still many places without proper access to electricity, and the high cost per kWh, especially in the rural off-grid areas, causes problems. With having the detailed information of living conditions and energy use in rural areas, COMPED has selected the target group in Pursat, Kompong Chhnang, Svay Rieng and Kompong Cham province, and carried out a survey of 1000 households. In addition, some other data were extracted from the Internet.

##### 3.1.1 Gender (where applicable)

**Table 7: Provincial population**

Location: Province & district	Commune	Popul.	Households	Village	Men	Women	Chil.
Pursat							
Sampov meas	Svay At	4433	894	5	1836	1577	1020
	Pteah Prey	16524	3226	10	6939	6889	2696
Phom Kravanh	Leagn	8583	1643	8	3014	3697	1872
	Rkat	3997	782	4	1401	1900	696
Kampong Chhnang							
Rolea Bier	Tuek Hoat	7998	1526	10	3323	3548	1127
	Choeung Kreav	6425	1379	11	2726	2486	1213
Kompong Chhnang	Pa Er	5799	1105	4	815	2932	2052
Svay Rieng							
Svay Chrom	Chambak	9702	1997	10	2114	4296	3292
	Kruos	11289	2964	11	3242	4191	3856
Kampong Cham							
Ponhea kraek	Kong Kang	14690	3001	16	3761	3961	6968
	Total	89440	18517	89	29171	35477	24792

### 3.1.2 Household sources of income (main source of income)

#### 3.1.2.1 Pursat province

**Table 8: Number of interviewees in Pursat province**

Communes	Svay At	Pteah Prey	Rkat	Leagn	Pursat Pro.	Percentage
Farmers	16	13	19	15	63	25.2%
Teachers	6	5	6	10	27	10.8%
Own Business	7	17	4	5	33	13.2%
Govt. services	10	11	5	5	31	12.4%
Craftsmen	5	6	10	9	30	12%
Others	16	18	16	16	66	26.4%
<b>Total</b>	<b>60</b>	<b>70</b>	<b>60</b>	<b>60</b>	<b>250</b>	<b>100%</b>

#### 3.1.2.2 Kampong Chhang province

**Table 9: Number of interviewees in Kampong Chhnang province**

Communes	Choeung krev	Pa Er	Tuek Hoat	Kom. Chhang Pro.	Percentage
Farmers	50	30	45	125	50%
Teachers	5	10	12	27	10.8%
Own Business	7	5	7	19	7.6%
Govt. services	5	15	10	30	12%
Craftsmen	1	2	2	5	2%
Others	12	18	14	44	17.6%
<b>Total</b>	<b>80</b>	<b>80</b>	<b>90</b>	<b>250</b>	<b>100%</b>

#### 3.1.2.3 Svay Rieng province

**Table 10: Number of interviewees in Svay Rieng province**

Communes	Kruos	Chambak	Svay Rieng Pro.	Percentage
Farmers	69	45	114	45.6%
Teachers	26	19	45	18%
Own Business	21	12	33	13.2%
Govt. services	23	11	34	13.6%
Craftsmen	1	1	2	0.8%
Others	10	12	22	8.8%
<b>Total</b>	<b>150</b>	<b>100</b>	<b>250</b>	<b>100%</b>

#### 3.1.2.4 Kompong Cham province

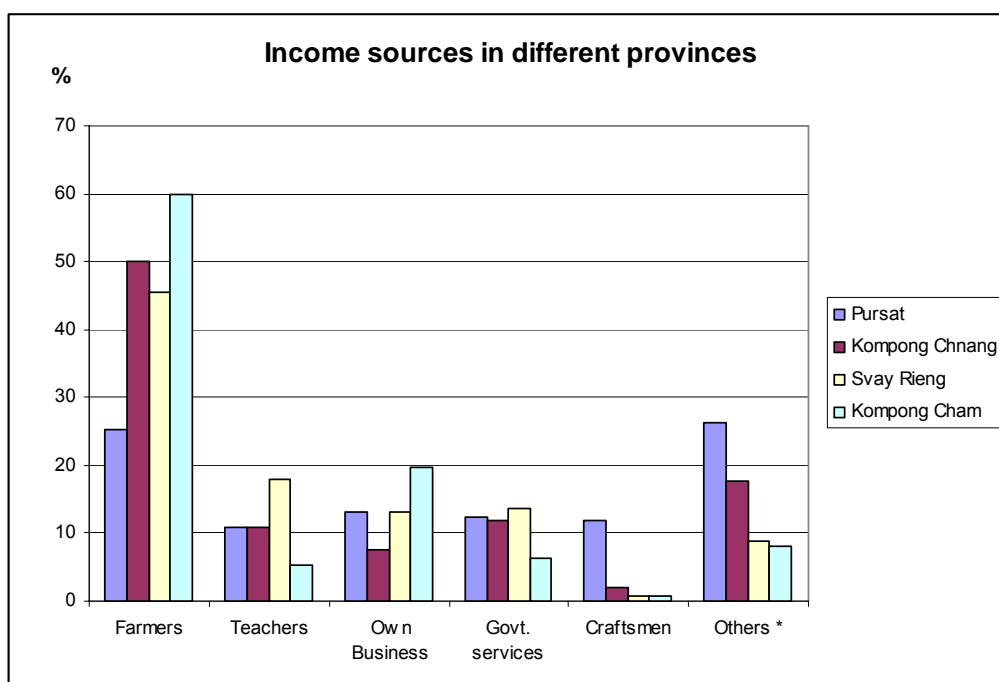
**Table 11: Number of interviewees in Kampong Cham**

Communes	Kong Kang	Kompong Cham Pro.	Percentage
Farmers	150	150	60%
Teachers	13	13	5.2%
Own Business	49	49	19.6%
Govt. services	16	16	6.4%
Craftsmen	2	2	0.8%
Others	20	20	8%
<b>Total</b>	<b>250</b>	<b>250</b>	<b>100%</b>

### 3.1.2.5 Comparison

**Table 12: Number of interviewees in the four provinces**

Communes	Pursat	Kompong Chnang	Svay Rieng	Kompong Cham	Total	Percentage
Farmers	63	125	114	150	452	45.2%
Teachers	27	27	45	13	112	11.2%
Own Business	33	19	33	49	134	13.4%
Govt. services	31	30	34	16	111	11.1%
Craftsmen	30	5	2	2	39	3.9%
Others *	66	44	22	20	152	15.2%
<b>Total</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>1000</b>	<b>100%</b>



**Figure 2: Sources of income among the selected target groups, in four different provinces in Cambodia**

The survey carried out in 1000 households, provides information of the personal income in 4 provinces, which are Pursat, Kompong Chhnang, Svay Rieng and Kompong Cham. It can be seen, that the main source of income is farming. 45.2% of the households indicated, that they are Farmers. Own business was indicated to be the source of income in 13.4% of the households, while 11.2% were Teachers and 11.1% in Government services. The amounts of Craftsmen were 3.9% while the others\* were 15.2%.

Others \* = There are several items such as laborer, housewife, taxi driver, student, and jobless person amounting totally 15.2%.

### **3.1.3 Different areas of living**

Pursat province is divided in 6 districts, which are Bakan, Kandieng, Krakor, Phom Kravanh, Sampov meas (the biggest one), and Veal Veang. The total number of inhabitants in Pursat are 360,445. The two districts, which were selected for the survey, are Sampov Meas and Phom Kravanh, with four communes that are Svay At, Pteah Prey, Rkat, and Leagn. The target groups were 250 households.

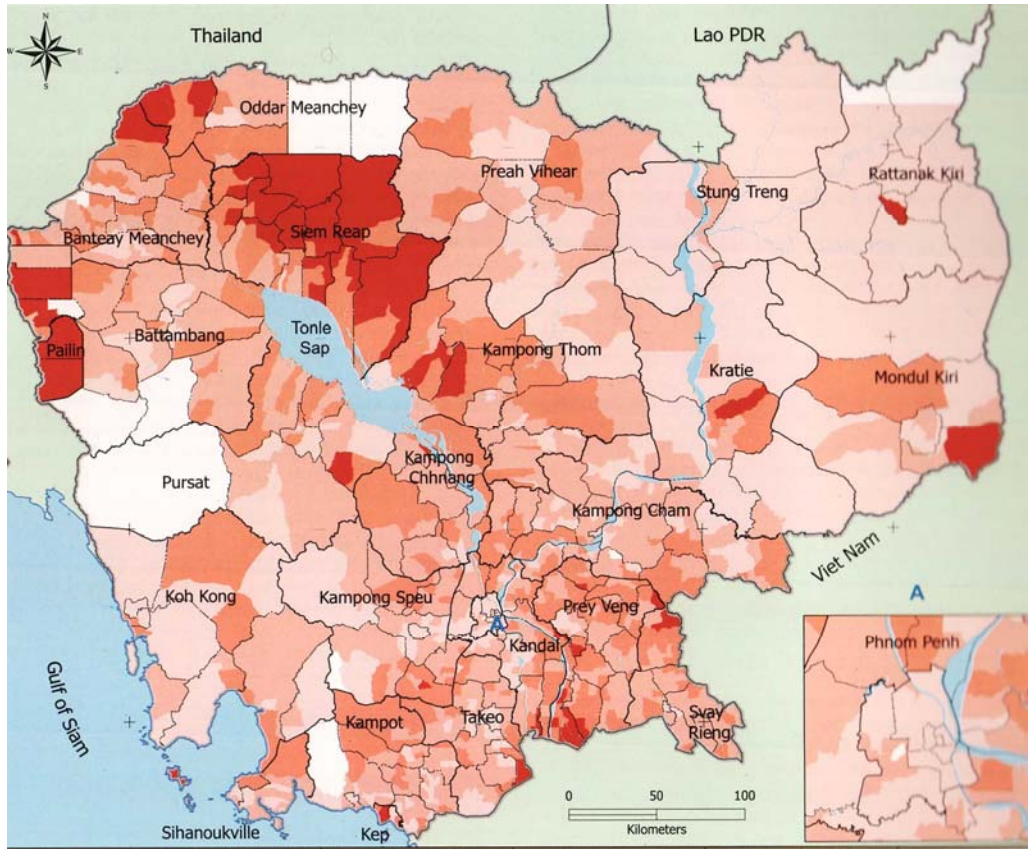
Kompong Chhnang province is divided into 8 districts, which are Baribour, Chol Kiri, Kompong Chnang, Kompong Leaeng, Kompong Tralah, Rolea Bier, Samakki Mean Chey and Tuek Phos. The total number of inhabitants in Kompong Chhnang is 417,639. The two districts were selected for the survey, are Kompong Chnang and Rolea Bier with three communes, that are Choeng Krev, Pa Er and Tuek Hoat. The target groups were also 250 households.

Svay Rieng province is divided in 7 districts, which are Chathea, Kompong Rou, Romdoul, Romeas Haek, Svay Chrom, Svay Rieng and Svay Theab. The total number of inhabitants in Svay Rieng is 478,252. One district, Svay Chrom, with two communes, Chambak and Krous, were selected as target group, consisting of 250 households, as well.

Kompong Cham province is divided into 17 districts, which are are Bateay, Chamkar Leu, Cheung Prey, Dambaer, Kompong Cham, Kompong Siam, Khong Meas, Koh Suothin, Krouch Chhmar, Memot, Ou Reang Ov, Ponhea Kraek, Prey Chhor, Srey Santhor, Stueng Trang, and Tbuong Kmoum. The total number of inhabitants in Kompong Cham, are 1,608,914. One district, Ponhea Kraek, with the commune Kong Kang was selected as target group for the survey of 250 households.

## **3.2 Socio-economic data**

The survey provided socio-economic data for the division of several different characteristics in the target areas. Cambodia belongs to the Least Developed Countries LDC. In 1999 its total Gross Domestic Product (GDP) was \$3.1 billion, yielding a per capita GDP of just \$270, among the lowest in the world. The economic growth has been quite fast and the GDP per capita was estimated to be 2 600 \$ (measured in PPP) in 2006. Figure 2 indicates the poverty rate in different parts of the country.



**Figure 3: Poverty rate in different areas of Cambodia**



### 3.2.1 Household incomes in different target groups

The survey data of the household incomes, within the different targets groups, in the different provinces, is given in the Table below.

**Table 13: The average income per households**

In come in average per month	Pursat	Svay Rieng	Kompong Chhnang	Kompong Chham
Farmers	25 \$ - 50 \$	20 \$ - 50 \$	20 \$ - 50 \$	20 \$ - 50 \$
Teachers	25 \$ - 70 \$	20 \$ - 85 \$	25 \$ - 80\$	30 \$ - 100 \$
Own Business	125 \$ - 200 \$	50 \$ - 180 \$	50 \$ - 150 \$	150 \$ - 300 \$
Govt. services	15 \$ - 125 \$	20 \$ - 100 \$	20 \$ - 100 \$	20 \$ - 150 \$
Craftsmen	30 \$ - 100 \$	30 \$ - 50 \$	30 \$ - 50 \$	30 \$ - 100 \$
Others	30 \$ - 50 \$	25 \$ - 50 \$	25 \$ - 50 \$	25 \$ - 50 \$

The table above shows the average incomes in different households, in four provinces. For a farmer household, the average income ranges between 20 \$ to 50 \$. According to the results of COMPED' s survey, 45% of the households have farming as their main source of income. The average income in farming households, are not very different from the average income in other households, according to the survey. Although the maximum income of farmers seems to be lower than in other income groups.

In teacher households the income varies between 20 \$ and 100 \$, with little variation between different regions. Most of Cambodian teachers try to increase their earning by private tuition.

There are a lot of own businesses opening in the free market of Cambodia, which are expected to have a significant impact on Cambodia's economic growth. According to survey, the income varies from 50 \$ to 300 \$. There is also a considerable regional variation, in the incomes of those, having there own business, as can be seen in the Table above.

Government services in Cambodia have an income, following the position of them. As a normal officer the income is 15 \$ or higher and it is calculated following the salary scale of Cambodian Royal Government. The incomes of government services ranged from 15 \$ to 150 \$ in the survey areas, according to the Table above.

The income of a craftsman, varies between 30 \$ to 100 \$, without much difference between the regions.

### 3.2.2 Household size

Figure 3 provides information about the household size, in different parts of Cambodia.

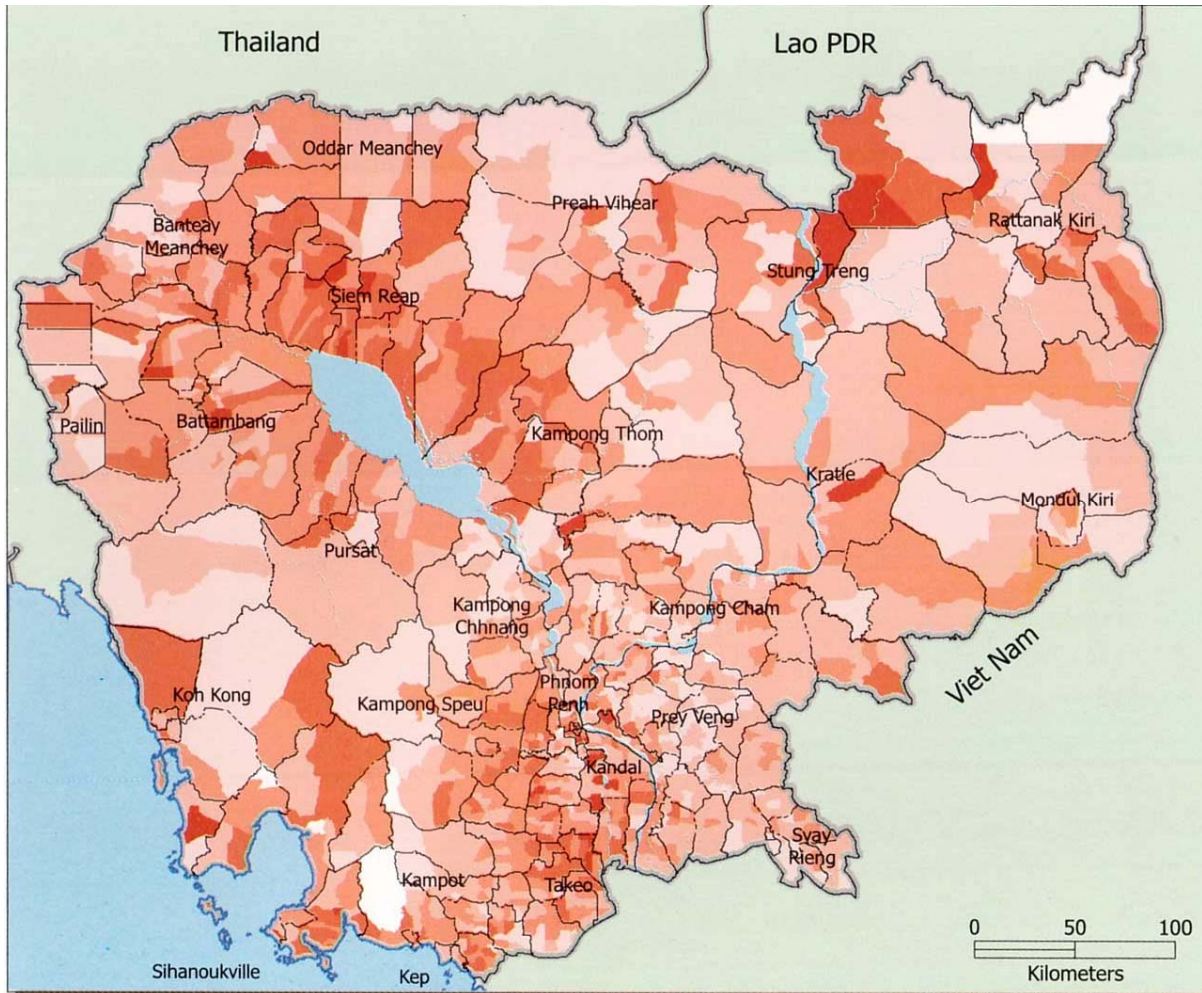
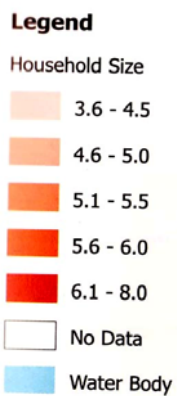


Figure 4: Household sizes in different areas of Cambodia



The survey results for the household size among the target groups in the different areas are shown in table below.

**Table 14: Average household size in the four provinces**

Household size in average	Pursat		Svay Rieng		Kompong Chhnang		Kompong Chham	
	Children	Families	Children	Families	Children	Families	Children	Families
Farmers	3 to 5	63	3 to 5	114	3 to 5	125	3 to 8	150
Teachers	1 to 3	27	1 to 3	45	1 to 3	27	1 to 3	13
Own Business	2 to 5	33	2 to 5	33	2 to 5	19	3 to 5	49
Govt. services	1 to 3	31	1 to 4	34	1 to 4	30	1 to 3	16
Craftsmen	3 to 5	30	3 to 5	2	3 to 5	5	1 to 3	2
Others	3 to 5	66	3 to 5	22	3 to 5	44	3 to 5	20

With very high fertility from 1980, Cambodia had close to 5.2 million children below age 15 in 1994 constituting 47 percent of the total population. The child population size had fallen slightly to 5.1 million by 2004 because of declining fertility since 1995 but its share of the total population had fallen to 38 percent.

The fertility in rural areas has not been declining slowly. In urban areas the greatest decline in fertility has occurred in Phnom Penh — from 4.0 to 2.1 children per woman.

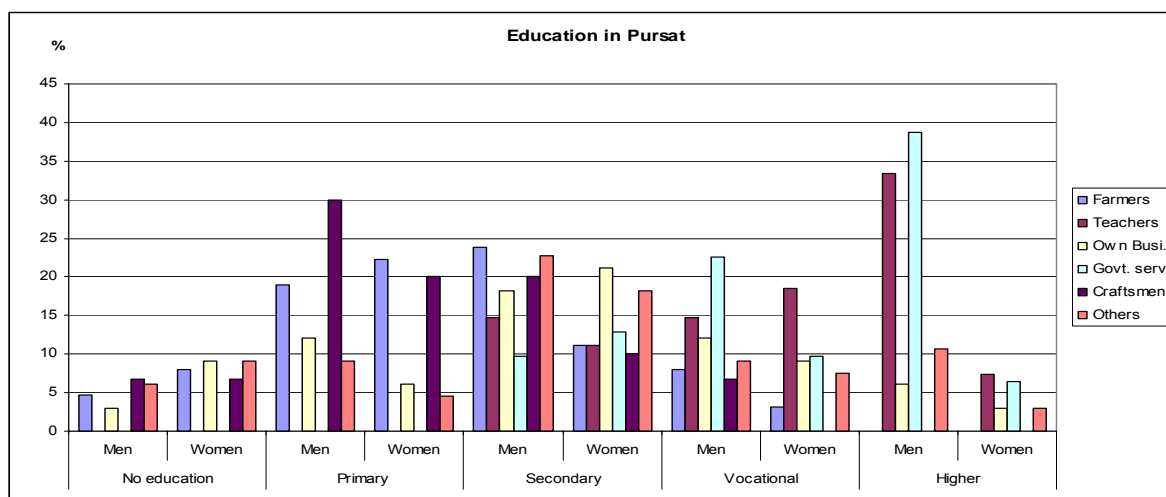
According to COMPED survey the farmers have highest number of children ranging from three to eight while e.g. teachers have normally only one to three children.

### **3.2.3 Level of education of the target group**

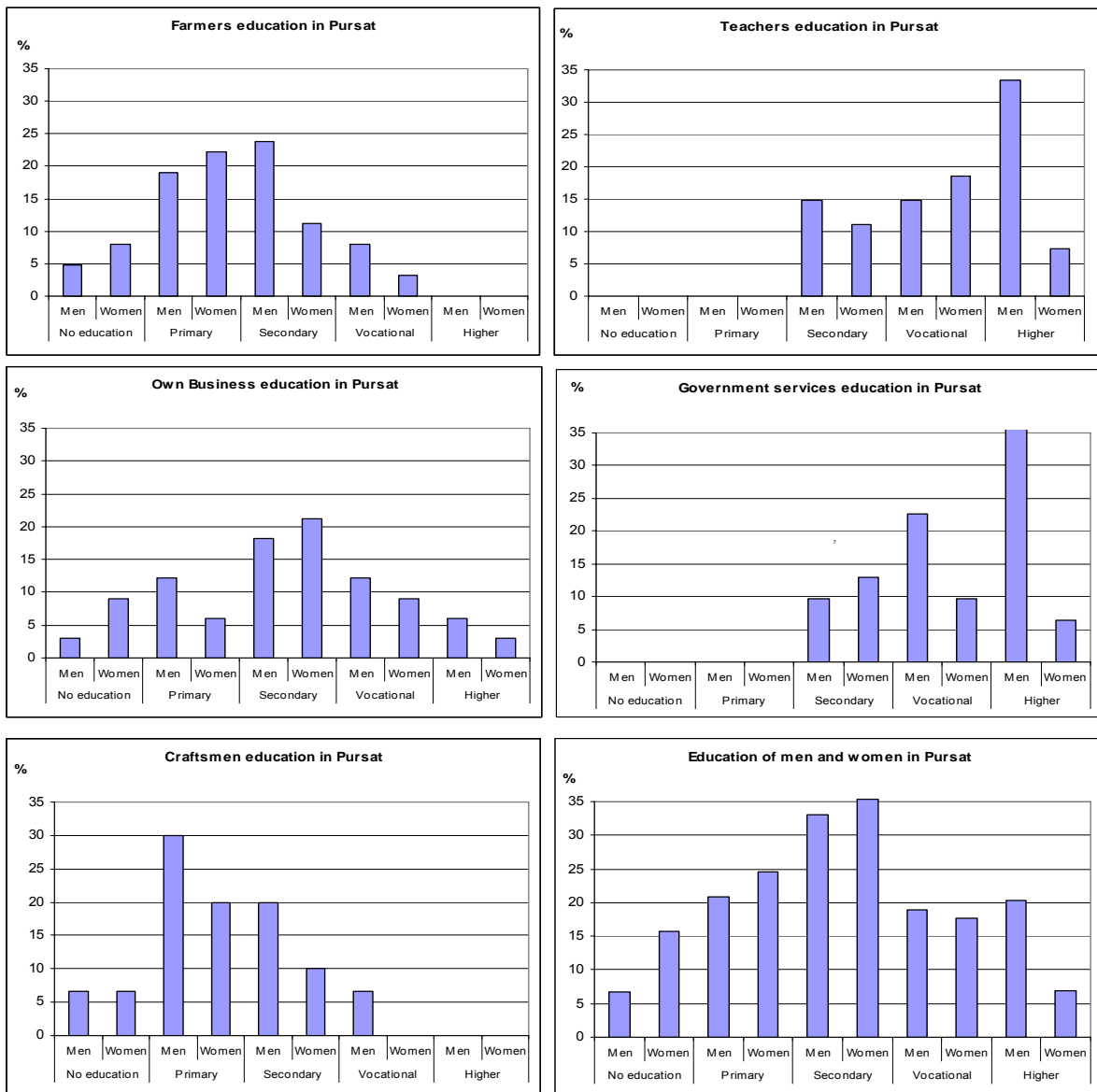
The survey provided information of the level of education of men and women in different households (farmers, teachers, etc.) in the different target group areas of Pursat, Kompong Chhnang, Svay Rieng and Kompong Chham. The survey results for Pursat are shown in Table below and with the attached figures.

**Table 15: Level of education in Pursat province**

Education in average	Pursat										Total
	No education		Primary		Secondary		Vocational		Higher		
	Men	Wom	Men	Wom	Men	Wom	Men	Wom	Men	Wom	
Farmers	3	5	12	14	15	7	5	2			63
Teachers					4	3	4	5	9	2	27
Own Busi.	1	3	4	2	6	7	4	3	2	1	33
Govt. serv.					3	4	7	3	12	2	31
Craftsmen	2	2	9	6	6	3	2				30
Others	4	6	6	3	15	12	6	5	7	2	66
<b>Total</b>	<b>10</b>	<b>16</b>	<b>31</b>	<b>25</b>	<b>49</b>	<b>36</b>	<b>28</b>	<b>18</b>	<b>30</b>	<b>7</b>	<b>250</b>



**Figure 5: Education of different household members in Pursat**



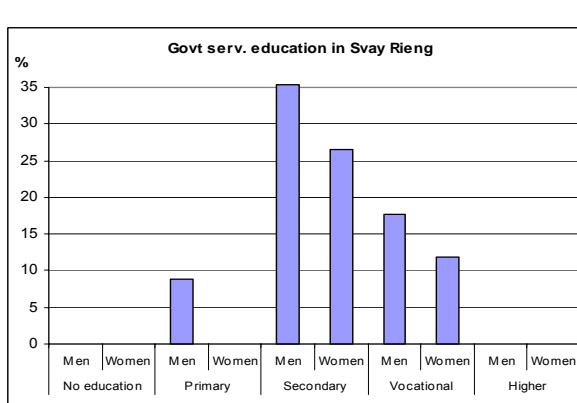
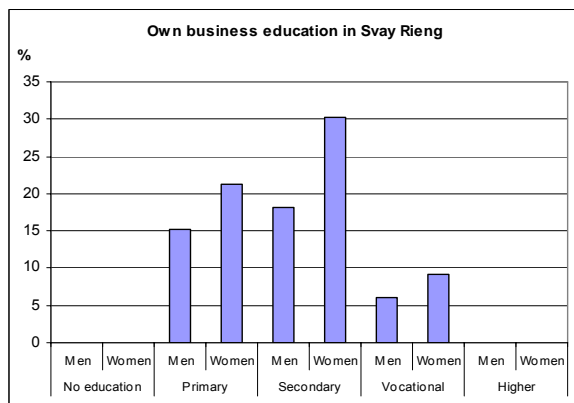
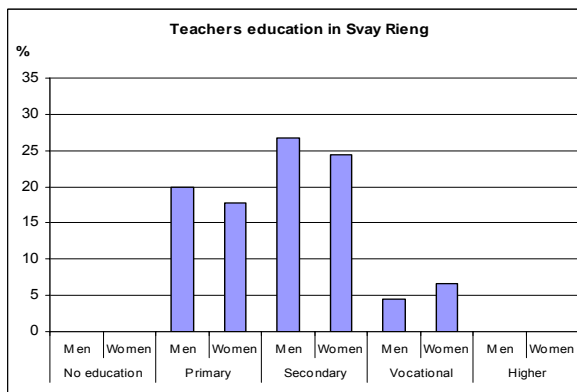
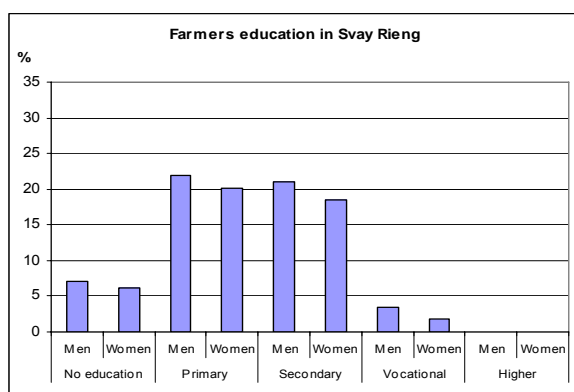
**Figure 6: Education of household members with different income sources in Pursat and comparison of education of men and women.**

From the figures it can easily be seen that the teachers and those working for the government have highest education while the craftsmen have clearly lowest level of education in Pursat. Men seem to higher education than women.

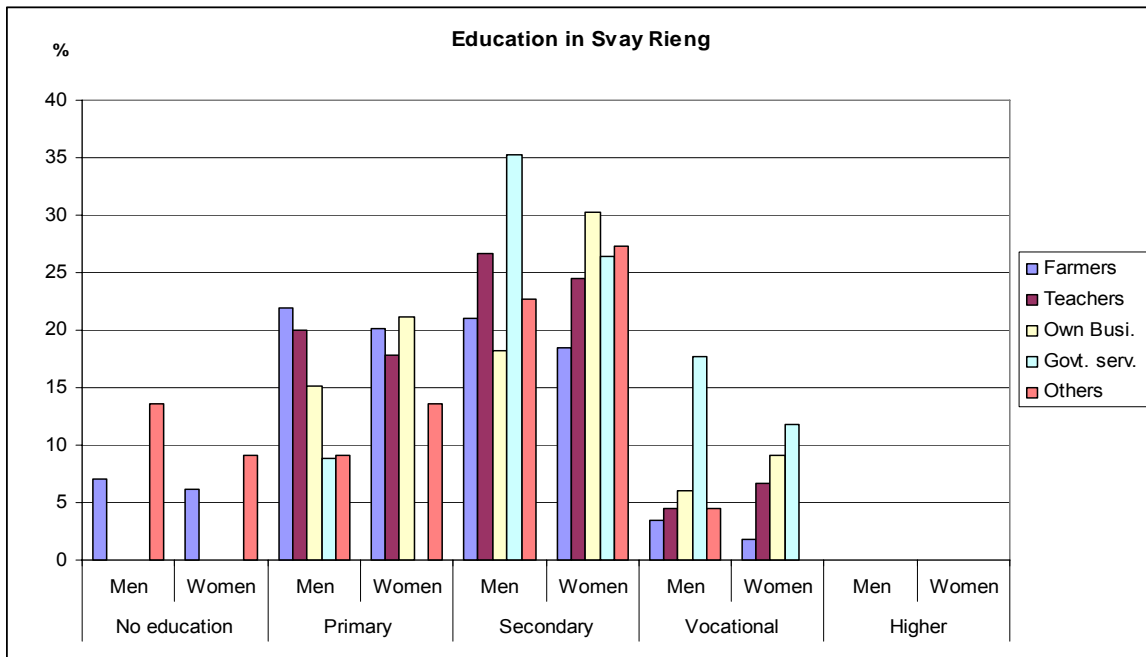
The survey results for the level of education in Svay Rieng are shown in the following Table and figures.

**Table 16: Level of education in Svay Rieng province**

Education in average	Svay Rieng										
	No education		Primary		Secondary		Vocational		Higherr		Total
	Men	Wom	Men	Wom	Men	Wom	Wom	Men	Wom	Men	
Farmers	8	7	25	23	24	21	4	2			114
Teachers			9	8	12	11	2	3			45
Own Busi.			5	7	6	10	2	3			33
Govt. serv.			3		12	9	6	4			34
Craftsmen					2						2
Others	3	2	2	3	5	6	1				22
<b>Total</b>	<b>11</b>	<b>9</b>	<b>44</b>	<b>41</b>	<b>61</b>	<b>57</b>	<b>15</b>	<b>12</b>			<b>250</b>

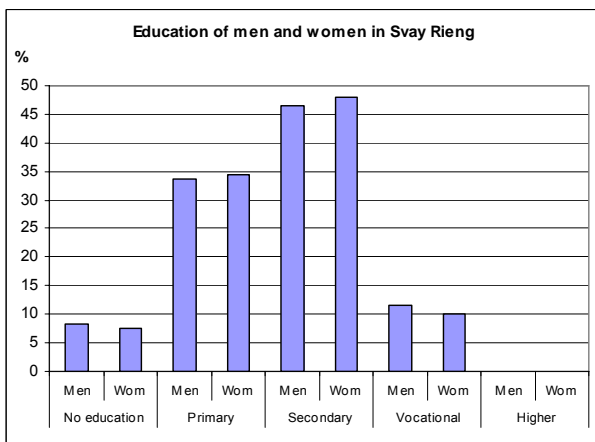


**Figure 7: Education level in household with different income sources in Svay Rieng.**



**Figure 8: Education of different household members in Svay Rieng**

The general level of education in Svay Rieng seems to be lower than in Pursat with nobody having higher education level and only about 10 % having vocational training.

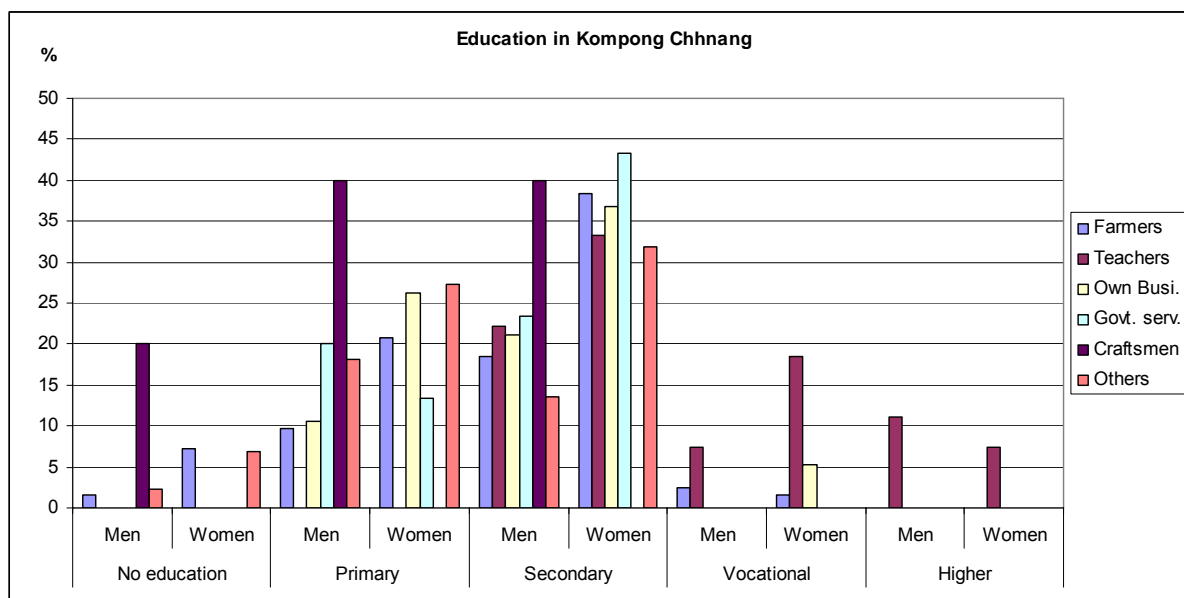


**Figure 9: Education level of men and women in Svay Rieng**

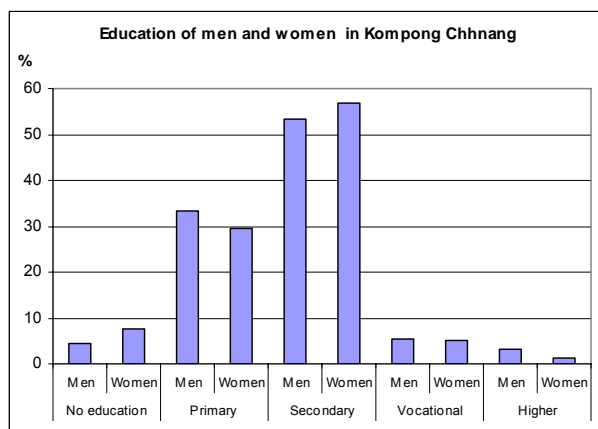
The education level results of the survey for Kompong Chhnang province are shown in the following table and figures.

**Table 17: Level of education in Kampong Chhnang province**

Education in average	Kampong Chhnang										
	No education		Primary		Secondary		Vocational		Higher		Total
	Men	Wom	Men	Wom	Men	Wom	Wom	Men	Wom	Men	
Farmers	2	9	12	26	23	48	3	2			125
Teachers					6	9	2	5	3	2	27
Own Busi.			2	5	4	7		1			19
Govt. serv.			6	4	7	13					30
Craftsmen	1		2		2						5
Others	1	3	8	12	6	14					44
<b>Total</b>	<b>4</b>	<b>12</b>	<b>30</b>	<b>47</b>	<b>48</b>	<b>91</b>	<b>5</b>	<b>8</b>	<b>3</b>	<b>2</b>	<b>250</b>



**Figure 10: Education level in households with different income sources in Kampong Chhnang**

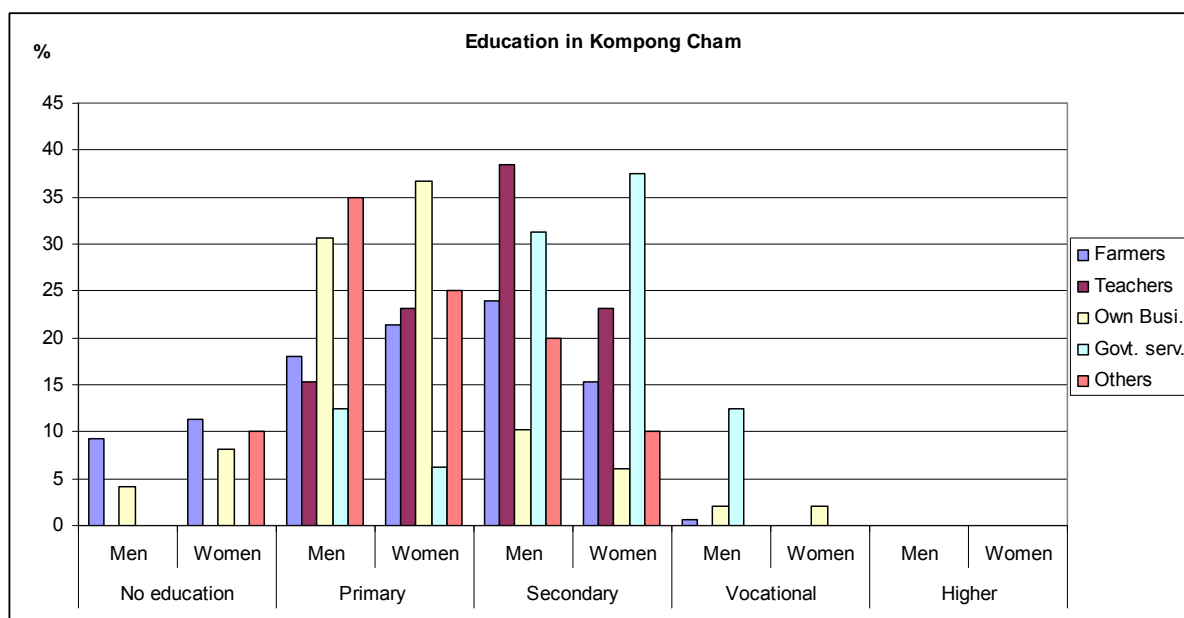


**Figure 11: Education level of men and women in Kompong Chhnang**

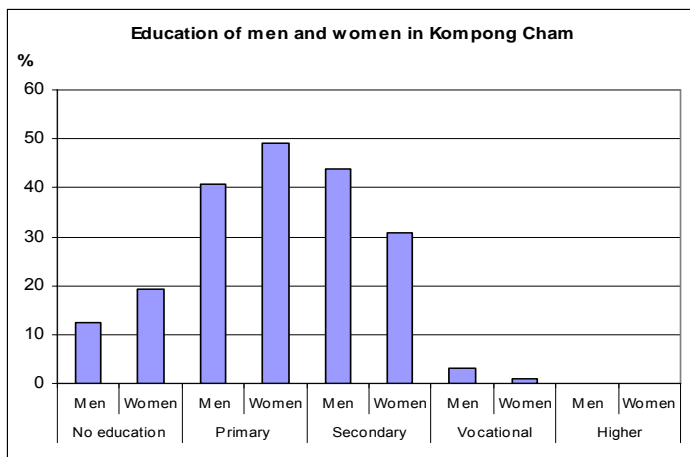
The education level results of the survey for Kampong Cham province are shown in the following table and figures.

**Table 18: Level of education in Kampong Cham province**

Education in average	Kompong Cham										
	N		P		S		V		O		Total
	Mn.	Wn.	Mn.	Wn.	Mn.	Wn.	Mn.	Wn.	Mn.	Wn.	
Farmers	14	17	27	32	36	23	1				150
Teachers			2	3	5	3					13
Own Busi.	2	4	15	18	5	3	1	1			49
Govt. serv.			2	1	5	6	2				16
Craftsmen					2						2
Others		2	7	5	4	2					20
<b>Total</b>	16	23	53	59	57	37	4	1			250



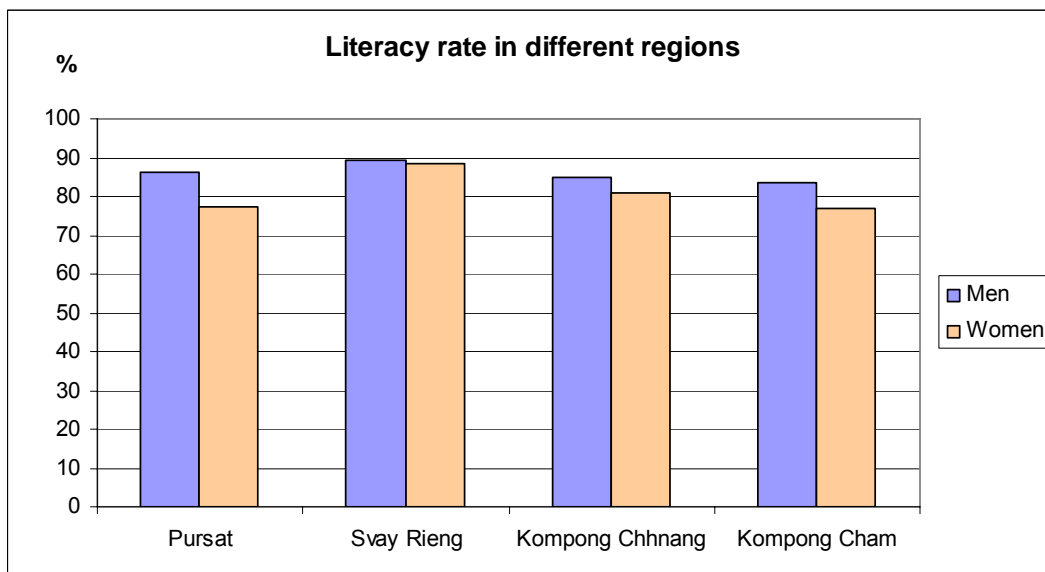
**Figure 12: Education level in households with different income sources in Kompong Cham**



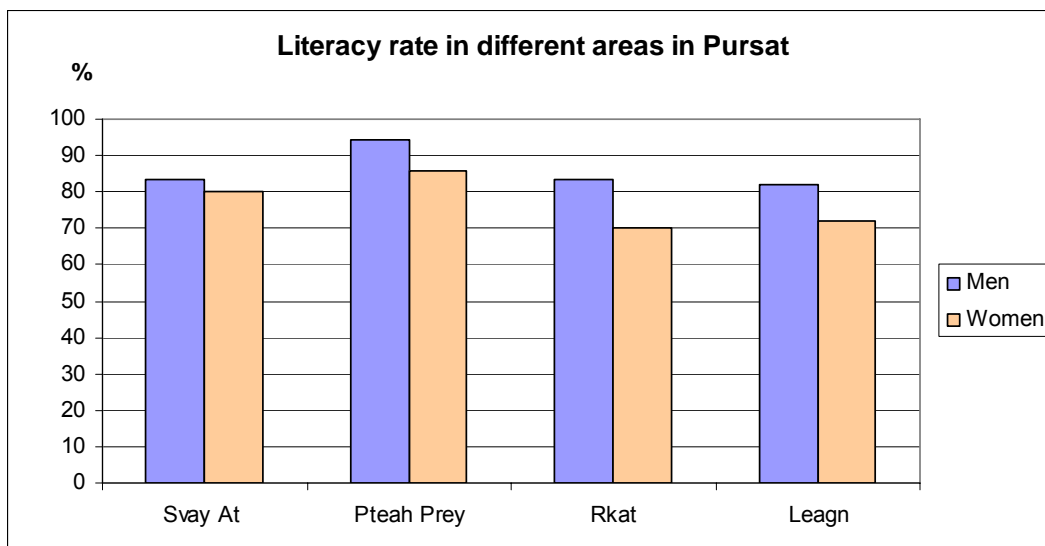
**Figure 13: Education level of men and women in Kompong Cham**

### 3.2.4 Literacy rate in household

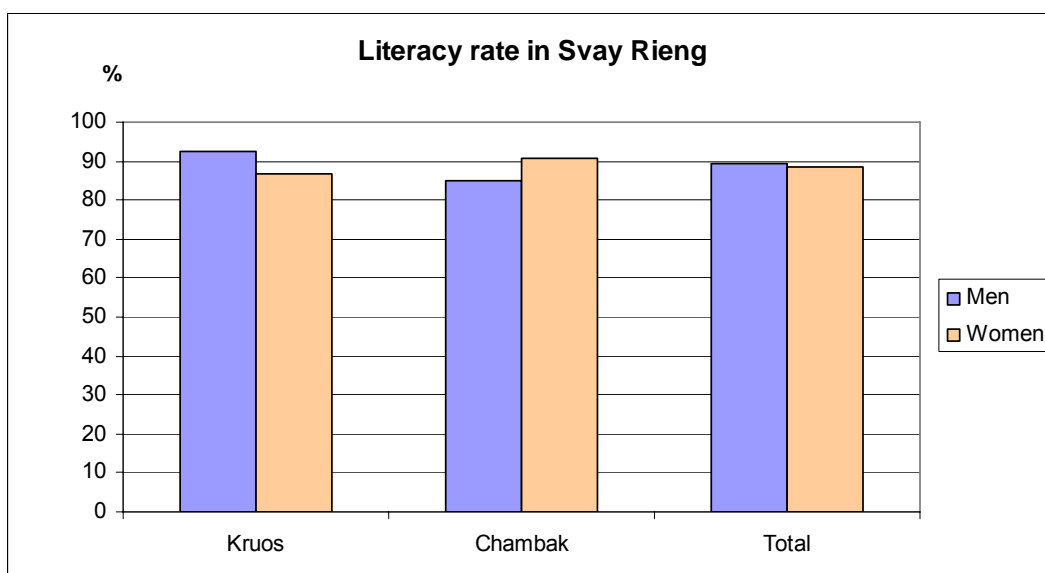
The literacy rate in Pursat, Kompong Chhnang, Svay Rieng and Kompong Chham is shown in Fig. 13.



**Figure 14: Literacy rate of men and women in different provinces in Cambodia according to COMPED survey**



**Figure 15: Literacy rate of men and women in different areas of Pursat in Cambodia according to COMPED survey**



**Figure 16: Literacy rate of men and women in different areas of Svay Rieng in Cambodia according to COMPED survey**

According to the survey there seems to be some variation in literacy rate in different areas in Cambodia. The literacy rate of men seems to be higher than that of women in most of the areas according to the survey.

### 3.2.5 Sources of energy

This table as below is the result of 1000 questionnaires combining information from Svay Rieng, Kompong Chham, Kompong Chhang and Pursat provinces of different sources of energy that are used in the household.

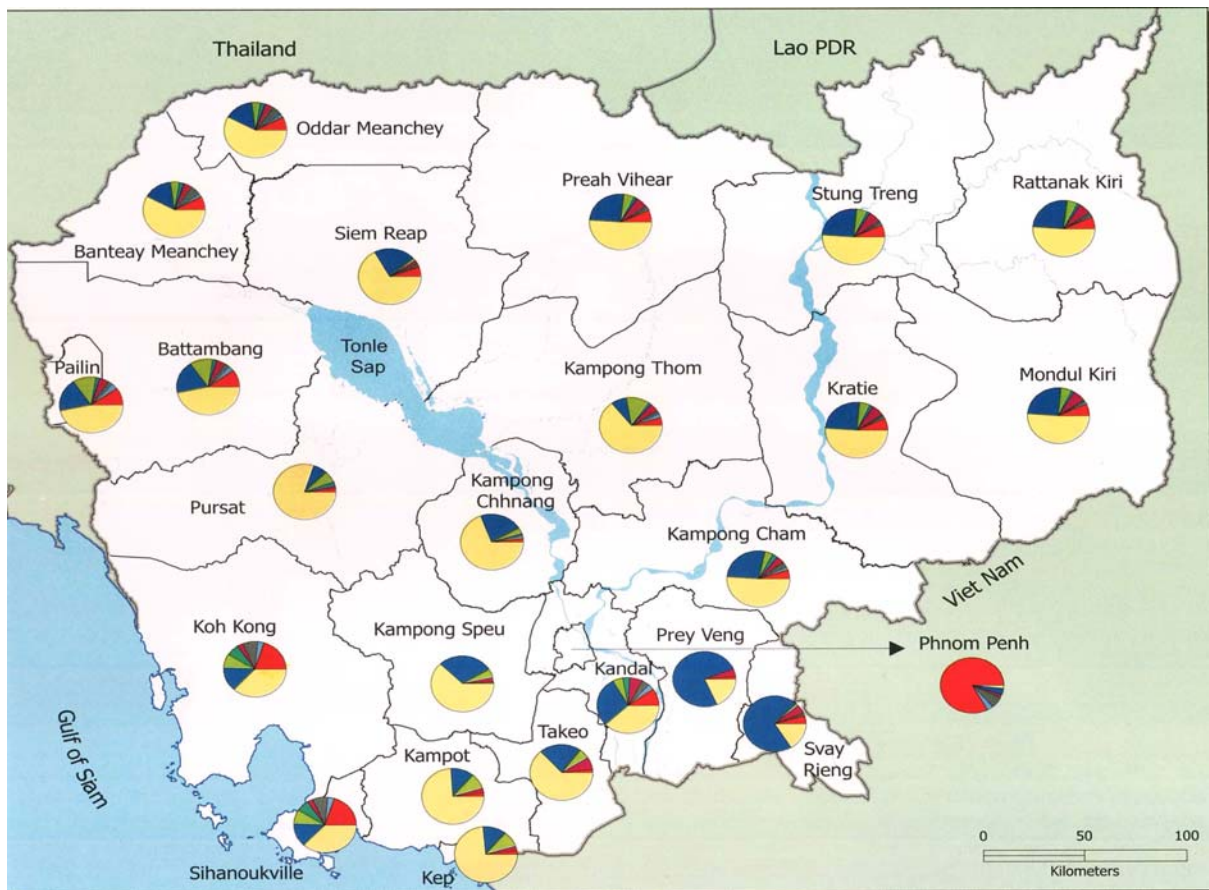
**Table 19: The average sources of energy using**

In average of using	Farmers	Teachers	Own Business	Govt. services	Craftsmen	Others
Fuelwood	5 – 80 kg	10 - 100 kg	10 - 100 kg	60 – 180 kg	5 – 80 kg	5 – 100 kg
Charcoal	1 - 5 kg	10 - 100 kg	60 - 100 kg	60 - 100 kg	1 - 5 kg	1 - 5 kg
Electricity	1 - 10 kWh/ month	10 - 50 kWh/ month	20 - 100 kWh/ month	100 – 150 kWh/ month	1 - 10 kWh/ month	1 - 10 kWh/ month
Gas	3 – 6 kg	15 – 30 kg	15 – 30 kg	15 – 30 kg	3 – 6 kg	3 – 6 kg
Kerosene	1- 3 lit.				1- 3 lit.	1- 3 lit.
Diesel		10 – 30 lit.	20 – 50 lit.	20 – 50 lit.	1- 3 lit	1- 3 lit
Gasoline	30 lit.	30 – 50 lit.	30 – 50 lit.	30 – 250 lit.	30 lit.	30 lit.
Battery	1–2 battery	1–2 battery			1–3 battery	1–2 battery

Normally in Cambodia, especially in rural areas, most of people use fuel wood, charcoal, electricity, diesel, gasoline, battery, and gas. According to the survey Farmer and Craftsmen households use a lot of fuel wood for cooking, up to 80 kg per month. Many farmers have lower charcoal consumption, just about 5kg/per month, because it costs too much. Also the maximum use of electricity is only about 10 kW/per month. As in Pursat province, Leagn commune almost all of people use electricity from private contractor which costs 0.7 \$ per kWh. This cost is too high when compared to farmers' income. Gas is also used very little by farmer and Craftsmen households for cooking. Kerosene is used for kerosene lamps for lighting at night. Most of the farmer and Craftsmen households use gasoline for their vehicles, especially for motorbikes, average consumption being 30 liters per month. There is higher Battery consumption in rural area. Some Farmer and Craftsmen households have 2 or 3 battery in their house as in Kompong Chhnang province.

The Teachers, Own business, and Government services households have higher fuel wood and charcoal consumption. It can be estimated to be up to 180 kg of fuel wood and 100 kg of charcoal per month. The maximum electricity use is about 150 kWh per month. Diesel as well as gasoline is used for the cars with maximum consumption up to 250 liters.

The following figure provides information of household amenities in different parts of Cambodia. The availability of electricity varies considerably in different provinces and has to be taken into account when the survey results are interpreted.



**Figure 17: Household with amenities in different areas in Cambodia.**

**Legend**

% of Households with Amenities

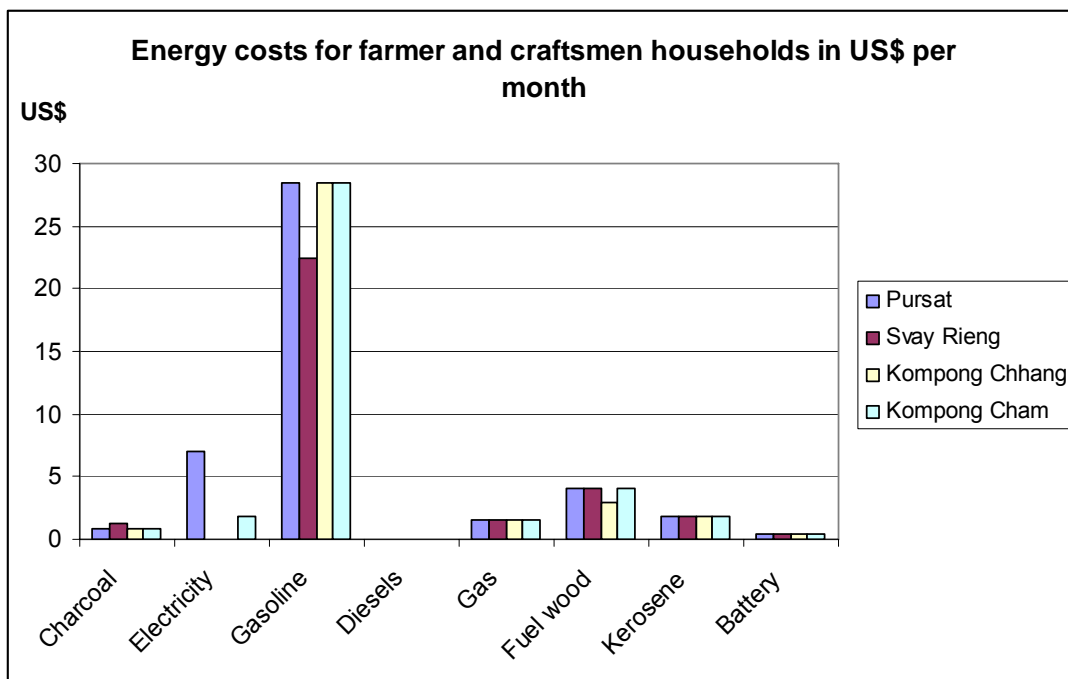
- ETW: Electricity, Toilet and Safe Drinking Water.
- ET: Electricity and Toilet.
- EW: Electricity and Safe Drinking Water.
- TW: Toilet and Safe Drinking Water.
- E: Electricity.
- T: Toilet.
- W: Safe Drinking Water.
- NA: No Amenities.
- Water Body
- Provincial Boundary
- International Boundary

**3.2.6 Expenditure on different energy sources**

The table below indicates the result of the survey for energy use and related costs for Svay Rieng, Kompong Chham, Kompong Chhang and Pursat provinces for different household types.

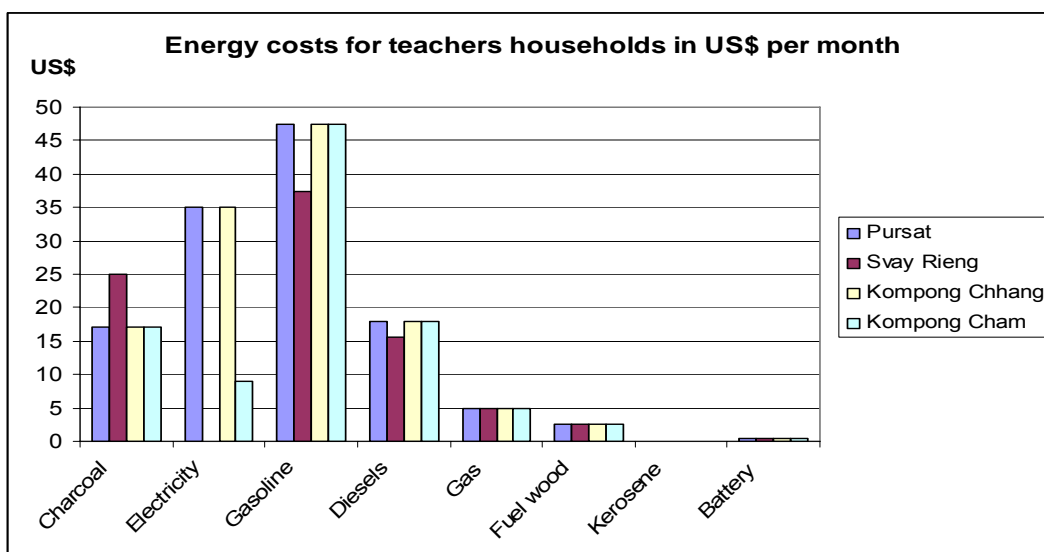
**Table 20: Expenditure on different energy sources**

Expenditure / month	Farmer / Craftsmen							
	Pursat		Svay Rieng		Kompong Chhnang		Kompong Cham	
	Used	Price	Used	Price	Used	Price	Used	Price
Charcoal	5 kg	0.87\$	5kg	1.25 \$	5 kg	0.87 \$	5 kg	0.87 \$
Electricity	10 kWh	7.00\$					10 kWh	1.80 \$
Gasoline	30 lit.	28.5\$	30lit.	22.5 \$	30 lit.	28.5 \$	30 lit.	28.5 \$
Diesels								
Gas	6 kg	1.50\$	6kg	1.50 \$	6 kg	1.50 \$	6 kg	1.50 \$
Fuel wood	80 kg	4.00\$	80kg	4.00 \$	80 kg	3.00\$	80 kg	4.00 \$
Kerosene	3 lit.	1.87\$	3lit.	1.87 \$	3 lit.	1.87 \$	3 lit.	1.87 \$
Battery	12V	0.37\$	12V	0.37 \$	12V	0.37 \$	12V	0.37 \$
Teachers								
	Used	Price	Used	Price	Used	Price	Used	Price
Charcoal	100 kg	17.00\$	100 kg	25\$	100 kg	17.00 \$	100 kg	17.00 \$
Electricity	50 kWh	35.00\$			50 kWh	35.00 \$	50 kWh	9.00 \$
Gasoline	50 lit.	47.50\$	50 lit.	37.5 \$	50 lit.	47.50 \$	50 lit.	47.50 \$
Diesels	30 lit.	18.00\$	30 lit.	15.6\$	30 lit.	18.00 \$	30 lit.	18.00 \$
Gas	15 kg	5.00\$	15 kg	5.00\$	15 kg	5.00\$	15 kg	5.00\$
Fuel wood	100 kg	2.50\$	100 kg	2.50 \$	100 kg	2.50 \$	100 kg	2.50 \$
Kerosene								
Battery	12V	0.37 \$	12V	0.37 \$	12V	0.37 \$	12V	0.37 \$
Own Business								
	Used	Price	Used	Price	Used	Price	Used	Price
Charcoal	100 kg	17.00 \$	100 kg	25 \$	100 kg	17.00 \$	100 kg	17.00 \$
Electricity	100 kWh	70.00 \$	100 kWh	70.00 \$	100 kWh	70.00 \$	100 kWh	18.00 \$
Gasoline	50 lit.	47.50 \$	50 lit.	37.5 \$	50 lit.	47.5	50 lit.	47.5 \$
Diesels	50 lit	30.00 \$	50 lit	26.00 \$	50 lit	30.00 \$	50 lit	30.00 \$
Gas	15 kg	5.00 \$	15 kg	5.00 \$	15 kg	5.00 \$	15 kg	5.00 \$
Fuel wood	100 kg	5.00 \$	100 kg	5.00 \$	100 kg	5.00 \$	100 kg	5.00 \$
Kerosene								
Battery	12V	0.37 \$	12V	0.37 \$	12V	0.37 \$	12V	0.37 \$
Govt. services								
	Used	Price	Used	Price	Used	Price	Used	Price
Charcoal	100 kg	17\$	100 kg	25 \$	100 kg	17 \$	100 kg	18.00 \$
Electricity	150kWh	105\$	150kWh	105\$	150kWh	105\$	150 kWh	105\$
Gasoline	250 lit.	237.50\$	250lit.	187.50\$	250 lit.	237.50 \$	250 lit.	237.50\$
Diesels	50 lit.	30\$	50lit.	26\$	50 lit.	30\$	50 lit.	30\$
Gas	15 kg	5\$	15kg	5\$	15 kg	5 \$	15 kg	5 \$
Fuel wood	180 kg	9\$	180kg	9\$	180 kg	9 \$	180 kg	9 \$
Kerosene								
Battery	12V	0.37 \$	12V	0.37 \$	12V	0.37 \$	12V	0.37 \$



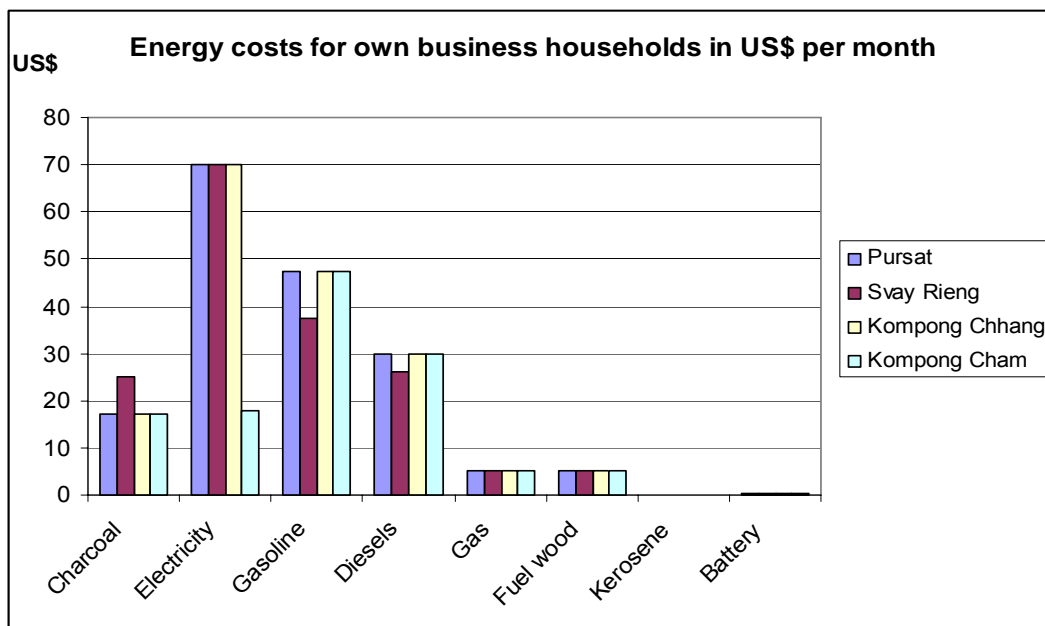
**Figure 18: Energy costs for farmer and craftsmen households per month in different districts. Average total energy costs are about 40 US\$ per month per household in the survey areas.**

The survey results show that most of the energy expenditure in farmer and craftsmen households goes to gasoline purchases. The total household expenditure on energy is about 40 US\$ per month, which is considerably high if we compare it with the household incomes which is between 20 – 50 US\$ per month according to the survey. The household members often have also additional sources of income, which explains the possibilities to use larger expenditure on energy.



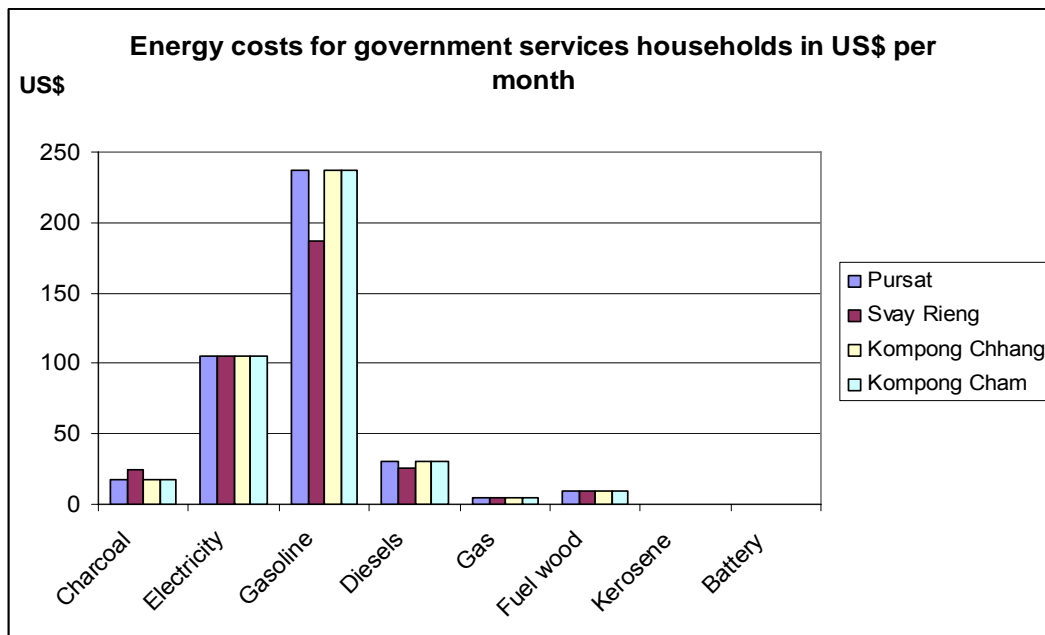
**Figure 19: Energy costs for teacher households per month in different districts. Average total energy costs are almost 110 US\$ per month per household.**

In teacher households the energy expenditure is distributed mainly between gasoline, electricity, charcoal and diesel consumption. The average expenditure on energy is about 110 US\$ per month which is considerably high compared to the 25 – 100 US\$ incomes.



**Figure 20: Energy costs for own business households per month in different districts. Average total energy costs are about 160 US\$ per month per household.**

In own business households the energy expenditure is distributed mainly between electricity, gasoline, diesel and charcoal consumption. The average expenditure on energy is about 160 US\$ per month which is quite high compared to the 50 – 200 US\$ incomes.



**Figure 21: Energy costs for government services households per month in different districts. Average total energy costs are about 390 US\$ per month per household.**

In government services households the energy expenditure is distributed mainly between gasoline and electricity consumption with diesel and charcoal having lower share. The average expenditure on energy according to the survey is very high, about 390 US\$ per month, exceeding the 15 – 150 US\$ incomes considerably. The household members often have also additional sources of income, which explains the possibilities to use larger expenditure on energy.

### **3.2.7 Prices of different energy sources**

The household survey in Pursat, Svay Rieng, Kompong Chnang, and Kompong Cham provided different energy prices in each province. For instance the price in Pursat is 0.17 \$ per kg for charcoal, 0.75 \$ per liter of gasoline, 0.52 \$ per liter of diesel while the price in Svay Rieng is 0.25 \$ per kg for charcoal.

### **3.2.8 Time allocated for fuelwood collection (by women, men, children)**

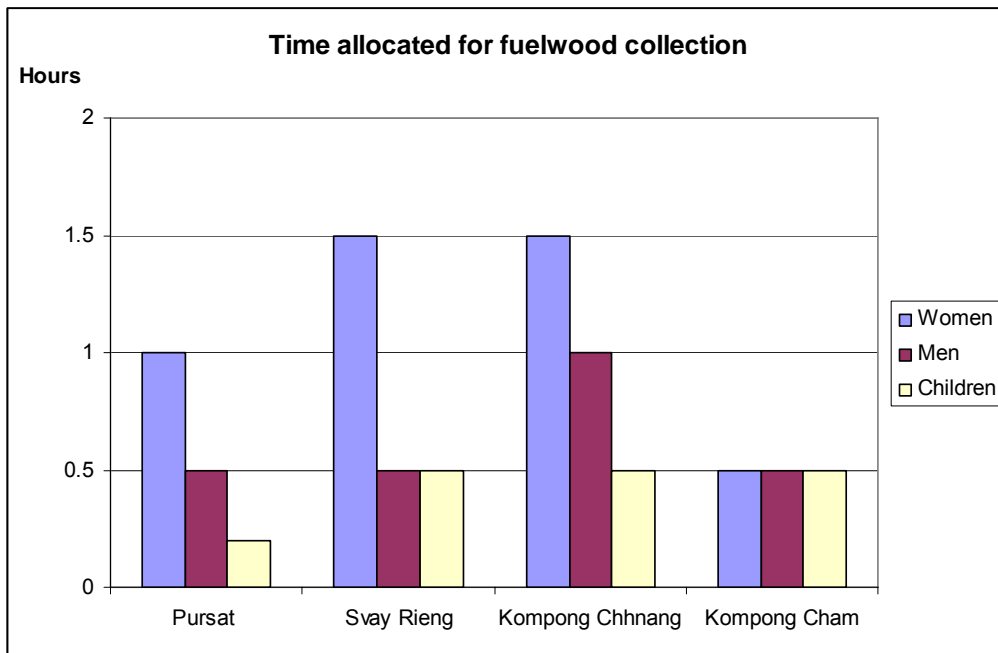
Generally among the farmer households over 65% are women and women have dual responsibility for farm as well as household management, also women have on average 20% lower literacy rates than men. The time allocated for fuel wood collection varies considerably depending on the area and availability of wood in close by areas. According to the COMPED survey the households allocate daily over 2 hours for fuel wood collection, which, on the one hand, considerably decreases possibilities to allocate time for productive purposes. On the other hand, fuel wood is gathered freely decreasing the needed expenditure on energy and time allocation for income generation purposes.

According to the COMPED survey it can be seen that in farmer households in Pursat province women allocate one hour per day for fuel wood collection and men allocate 0.5 hours per day and children also allocated 0.2 hours per day.

In Svay Rieng province, women allocate 1.5 hours for fuel wood collection and men allocate 0.5 per day and children allocate 0.5 hours.

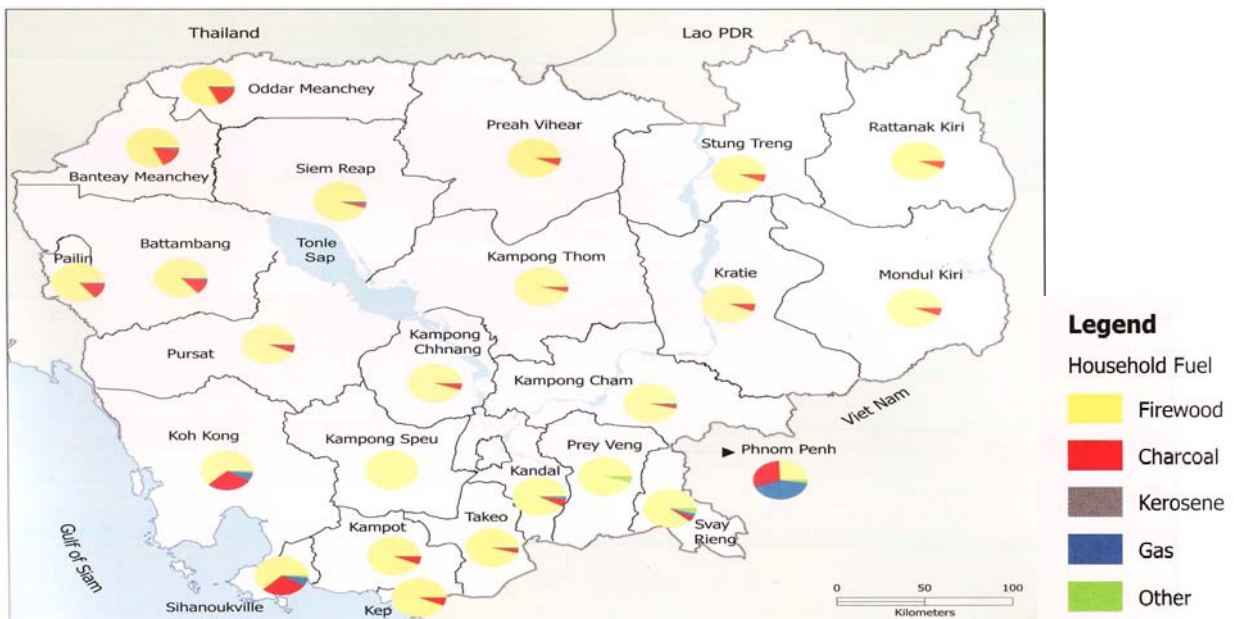
In Kompong Chhnang province, women allocate 1.5 hours for fuel wood collection and men allocate 1 hour per day and children also allocated 0.5 hours per day.

In Kompong Cham province, women allocate 0.5 hours for fuel wood collection and men allocate 0.5 hours per day and children also allocated 0.5 hours per day.



**Figure 22: Time allocated daily by women, men and children for fuel wood collection.**

The energy end use varies considerably in different areas in Cambodia. Figure 21 shows the energy sources for cooking in different provinces.



**Figure 23: Fuel use for cooking in different provinces in Cambodia.**

### 3.2.9 Health effects

There are many cases in Cambodia about premature death such as HIV/AIDS, smoking, cancer. For this report only premature death cause by indoor air pollution, and respiratory disease are quoted. COMPED's questionnaires and statistic health in Cambodia showed that there are 184 premature death per month in Kompong Cham province, 26 premature

death per month in Kompong Chhnang province, 124 premature death per month in Pursat province and 82 premature death per month in Svay Rieng province.

### **3.2.10 Knowledge of renewable energy**

COMPED questionnaires in the four provinces showed that 80% of 1000 households did not know about such Renewable of Energy concepts as wind power, hydrology, biomass and PV solar.

## **4 Appendices**

### **4.1 Appendix 1: Report Form**

#### **Energy related socio-economic factors in rural areas in Cambodia and Lao PDR**

The socio-economic study should be based on statistical sources, research reports and other sources available. The time limit (20 days allocated for the study) does not allow questionnaire based survey.

#### **Target groups**

The target groups of the socio-economic study are not determined by the Description of the Action. It is relevant to define the target groups according to the data availability and the spatial and socio-economic coverage. The target of the project also determines that the target groups should be mainly living in rural off-grid areas.

The target groups can be defined according to the following characteristics:

#### **Gender (where applicable)**

- Women
- Men
- Children

#### **Household sources of income (main source of income)**

- Farmers
- Small entrepreneurs
- Craftsmen
- Fishermen
- Government service
- Own business/shop
- Other (explain)

#### **Different areas of living**

- Province 1
- Province 2
- Province 3
- Province 4
- etc.

#### **Socio-economic data**

The socio-economic data to be collected according to the division of characteristics above should include:

Household incomes in different target groups

- (e.g. household income per month in farmer household in Province 2 on the average)

#### **Household size**

- (e.g. household size in fishermen household in Province 3 on the average is 3 adults and 5 children)

#### **Level of education of the target group**

- Primary education
- Secondary education
- Vocational education
- Other higher education
- No education
- (e.g. in craftsmen households in Province 4, 40 % of men have primary education, 30 % of men have secondary education, 30 % of men have vocational education, 70 % of women have primary education, 20 % of women have secondary education)

#### **Literacy rate in household**

- (e.g. in farmer households in Province 1: 40 % of men cannot read and write, 60 % of women cannot read and write)

#### **Sources of energy**

- (how much different sources of energy are used in the households, kg, litres, kWh per month)
- Fuelwood
- Charcoal
- Other biomass (what?)
- Solar heat
- Solar electricity
- Mini hydro
- Biogas
- Kerosene
- LPG
- Diesel
- Gasoline
- Coal or lignite
- Geothermal
- Wind
- Other

#### **Share of different sources of energy**

#### **Expenditure on different energy sources**

- (e.g. 2 USD is used for charcoal, 3 USD for kerosene per month in farmer household in Province 5 on the average)

#### **Prices of different energy sources**

- (prices that the household pay on the average in different areas)

**Time allocated for fuelwood collection (by women, men, children)**

- (e.g. in farmer households in Province X, women allocate 2 hours per day for fuelwood collection, men allocate 0.2 hours per day and children allocate 1.5 hours per day)

**Energy end use**

- Cooking
- Lighting
- Motive power (car, motorbike)
- Water heating
- Space heating
- TV, radio, phone, other entertainment
- Refrigeration
- Air conditioning, fans
- Productive activities (e.g. rice mill)
- (sources of energy for different purposes e.g. kg, litre or kWh per month)

**Health effects**

- Number of premature deaths caused by indoor air pollution
- Costs related to respiratory diseases caused by indoor air pollution (open fire)
- (average on the province level e.g. 50 premature deaths per month in Province 3)

## 4.2 Appendix 2: Questionnaire Form

### Questionnaire

#### 1- General Information

1. Name:      Sex:              Age:              Position:
2. Family member:
3. Address<sup>3</sup>
4. Date of questionnaire:

#### 2- Level Education

1. Primary school:    2.      Secondary School:
3. Vocational education:    5.      Other:.....

#### 3- Household sources of income

1.      Amount of income in Family:    2.      Sources of income:
3.      Income per month:    4.      Other:.....

#### 4- Expenditure

1.      Electricity:    2.      Water supply:
3.      Cooking:    5.      Other:.....

#### 5- General Information on the company: Type of industry

1.  Large scale enterprise      4.  Small and medium enterprise
2.  State enterprise      5.  Staffs:
3.  Private enterprise      6.  Income per year:

6- Information on company's buildings

1. Amount of building: 3. Volume of buildings in m<sup>3</sup>:

2. Year of construction: 4. Roof area in m<sup>2</sup>: 3. Cost of construction:

5. Share of flat roof in %:

6. Share of not flat roof in %:

7- Type of industry:

1. <input type="checkbox"/> food processing	8. <input type="checkbox"/> commercial
2. <input type="checkbox"/> timber industry	9. <input type="checkbox"/> steal industry
3. <input type="checkbox"/> textile industry	10. <input type="checkbox"/> transport service
4. <input type="checkbox"/> chemical industry	11. <input type="checkbox"/> rice mill
5. <input type="checkbox"/> electronic industry	12. <input type="checkbox"/> tourism
6. <input type="checkbox"/> construction material	13. <input type="checkbox"/> furniture
7. <input type="checkbox"/> handicrafts	14. <input type="checkbox"/> workshop
15. <input type="checkbox"/> other .....	

7- From which source do you get your electricity?

1.  national el. Grid      2.  of grid source.....

8- Please specify the of grid sources:

3.  own generator      6.  Car battery
4.  joint generator 7.  Others.....
5.  PV panels

9- Please specify the kind, consumption and cost of the energy source you use:

1. <input type="checkbox"/> electricity		kWh/year		US\$/year		US\$/kwh
2. <input type="checkbox"/> coal		Kg/year		US\$/year		US\$/kg
3. <input type="checkbox"/> Fuel wood		Kg/year		US\$/year		US\$/kg
4. <input type="checkbox"/> Gas		l/year		US\$/year		US\$/l
5. <input type="checkbox"/> Fuel		l/year		US\$/year		US\$/l

6.	<input type="checkbox"/>		Kg/year		US\$/year		US\$/kg
		Charcoal					
7.	<input type="checkbox"/>	Sawdust	Kg /year		US\$/year		US\$/kg
8.	<input type="checkbox"/>	rice husk	Kg /year		US\$/year		US\$/kg
9.	<input type="checkbox"/>	corncoobs	Kg /year		US\$/year		US\$/kg
10.	<input type="checkbox"/>	Other	Kg /year		US\$/year		US\$/kg
11.			.../year		US\$/year		US\$/...

10- When do you use each of energy?

Please indicate the hours of energy use per day in the following table

		week	11.1 Mon	11.2 Tue	11.3 Wed	11.2 Thurs	11.5 Fri	11.6 Sat	11.8 Sun
	days								
	energy type								
1	<input type="checkbox"/> electricity								
2	<input type="checkbox"/> coal								
3	<input type="checkbox"/> fuel wood								
4	<input type="checkbox"/> Gas								
5	<input type="checkbox"/> Fuel								
6	<input type="checkbox"/> Charcoal								
7	<input type="checkbox"/> Sawdust								
8	<input type="checkbox"/> rice husk								
9	<input type="checkbox"/> corncoobs								
10	<input type="checkbox"/> others:								

11- What is your energy consumption per month?

		electricity	Charcoal	fuel wood	Gas	Fuel	coal
		kWh/month	Kg/month	Kg/month	l/month	l/month	Kg/month
1	Jan						
2	Feb						
3	Mar						
4	Apr						
5	May						
6	Jun						
7	Jul						
8	Aug						
9	Sept						
10	Oct						
11	Nov						
12	Dec						

		Sawdust	rice husk	corncobs	others
		kWh/month	Kg/month	Kg/month	...../month
1	Jan				
2	Feb				
3	Mar				
4	Apr				
5	May				

6	Jun				
7	Jul				
8	Aug				
9	Sept				
10	Oct				
11	Nov				
12	Dec				

12- What do you use the energy? (When and type of energy such as charcoal, battery...)

	When	Energy
Cooking		
Light		
TV, Radio,		
Refrigeration		
Other		

13- Time allocated for fuel wood collection (by women, men, children)

Time	Morning		Evening and Night	
	5 to 8	9 to 12	1 to 5	6 to 11
Fuel wood				
Farm field				
Cooking				
Other				

14- How many energy of the total energy you use? do you use for heat generation or cooling?

- 0%      1-20%      21-40%      41-60%      61-80%      81-100%
1.       2.       3.       4.       5.       6.

15- Do you know Renewable energy? (PV solar, Biomass,...)

1.  Yes      2.  No

☐ If you don't know please skip to question no. 19)

-A- If you know, what kind of energy do you know?

1.  PV Solar      5.  Hydrology
2.  Fuel wood      6.  Biomass
3.  Wind power      7.  Geothermal
4.  Biogas      8.  Solar thermal



17- What organizations are you involved?

- 1.  Nothing
- 2.  Women community
- 3.  Youth community
- 4.  Agriculture development
- 5.  Irrigation management
- 6.  Market cooperation
- 7.  Electrification
- 8.  Village committee
- 9.  Village security
- 10.  Other.....

-A- If you are involved, why did you join this group?

- 1.  Access services
- 2.  Access technical support
- 3.  Community leadership role
- 4.  Financial benefit
- 5.  Noone else to assist
- 6.  Community development
- 7.  Was asked to
- 8.  Other.....

-B- What roles do you perform in this organization?

- 1.  Administration
- 2.  Management
- 3.  Extension
- 4.  Maintenance
- 5.  Practioner
- 6.  General member
- 7.  Other.....

18- If you are not involved, why are you not involved in this group?

- 1.  No time
- 2.  No interest
- 3.  No financial support
- 4.  Other responsibilities

19- What effort or capital do you invest in your participation?

- 1.  Time
- 2.  Land
- 3.  Hour per week
- 4.  Activity
- 5.  One year period
- 6.
- 7.
- 8.
- Others.....

3.  Money      6.  Member

20- Will you continue your involvement in this group?

1.  Yes      2.  No      3.  Not sure

21- Would you be willing in working within a similar organization related to energy production?

1.  Yes    2.  No    3.  Not sure

22- Did you ever have Health effect?

1.  Yes    2.  No

Please specify .....

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