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Energy for Development Synthesis Report





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Project Activities have received funding of the Intelligent Energy Executive Agency (IEEA).

The implementation of the CAP REDEO project has led to several interesting project leads, some of which have been followed-up, while others can be further developed after the finalization of the CAP REDEO project.

A two-pronged approach has been followed. On the one hand a multi-sector and rural development oriented planning tool has been applied in two pilot provinces in Laos and Cambodia, leading to a prioritization of rural electrification options. The prioritized rural electrification options, resulting from the electricity planning approach as introduced by the CAP REDEO project, have been presented and discussed with stakeholders in the pilot provinces in both countries. 'Soft' feasibility of these options has been explored in individual stakeholder contacts, stakeholder consultations and provincial stakeholder meetings¹. 'Hard' feasibility of these options can be assessed by implementing the usual feasibility studies for such investments; this requires 'project owners' which have a clear interest in the electrification option and are willing and capable to assign resources to go through the different project development stages. In none of the two pilot provinces, local stakeholders have stepped forward as 'project owners' to take the identified electrification options to the next stage of project development.

On the other hand stakeholders at local, provincial and national levels in Laos and Cambodia have been mobilized from the start of CAP REDEO project implementation. This has provided insights in their potential and characteristics, both individually and collectively, as clients or end users of energy services as well as actual or potential providers of rural energy services²:

- As such, the stakeholder profiles provide an important 'reality check' for electricity planners, as the success of their planning efforts depends to a large extent on the implementation capacity of - and incentives for - the organizations in the sector.
- During his missions to Laos and Cambodia, the ETC financial expert on project development, Mr. René Magermans, has provided individual advice and guidance to stakeholders on developing the rural energy projects of their interest.
- The bottlenecks and possible solutions for increasing access to modern energy in the rural areas of Laos and Cambodia, as perceived by the different stakeholders, have been identified and shared within the energy sectors of both countries. This covered both institutional and sector development issues as well as policy recommendations³.

¹ See separate CAP REDEO reports on stakeholder consultations and provincial workshops in Laos and Cambodia.

² Reference is made to deliverable D3b.

³ See deliverable D3b and separate CAP REDEO reports on stakeholder consultations and provincial workshops in Laos and Cambodia.

- Finally, ETC - in collaboration with local partners - has followed-up on several of these stakeholder suggestions, in particular in areas of ETC's core expertise: removing barriers for rural energy market development and capacity building in the energy sector, including technical and vocational education and training (TVET). While more will be developed in the course of 2010, this has led to the following 'spin-off' activities of CAP REDEO:
 - ✓ *Pico-hydro innovation and capacity building program* in Laos, a joint initiative of ETC and LIRE;
 - ✓ *Medium voltage curriculum development* targeting REEs in Cambodia, an ETC TTP project in which a local consultant, MIME/DIME, REF, EAC, EDC Training Center and CKN are involved, as well as the licensed REEs;
 - ✓ *Vattanak improved stove dissemination* project for small-scale production of palm sugar, a joint initiative of ETC and GERES in Cambodia.



Rural Electrification Stakeholders' Consultation Report in Lao PDR

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Vientiane, Lao PDR



Lao Institute for Renewable Energy

LIRE

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Vientiane Capital, Lao PDR
November 2009

About LIRE

LIRE is a non-profit organisation dedicated to the sustainable development of a self sufficient renewable energy sector in the Lao PDR. The institute offers agronomical, technological and socio-economic research services, and works to provide a free public resource of information and advice on the use of renewable energy technologies in the Lao PDR. LIRE strives to support the development of the country by exploring commercially viable means to establish renewable energy technologies in rural parts of the country, in areas without connection to the national grid and with little access to technical expertise.

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Acronyms

ADB	Asian Development Bank
CAP REDEO	Capacity and Institutional Strengthening for Rural Electrification and Development
DAFO	District Department of Agriculture and Forestry
DoE	Department of Electricity
EASE	Enabling Access to Sustainable Energy
ECI	Electrical Construction and Installation Enterprise
EdL	Electricité du Laos
GIS	Geographical Information System
IED	Innovation Energie Développement
MEM	Ministry of Energy and Mines
PAFO	Provincial Agriculture and Forestry Office
PDEM	Provincial Department of Energy and Mines
RED	Rural Electrification Division (within MEM/DoE)
VOPS	Village Off-Grid Promotion and Support Project
WB	World Bank

CAP REDEO - Energy Sector Stakeholders' Consultation

1 Introduction

Period for the consultations

The consultations with key energy sector stakeholders, government, private actors and international organizations, were carried out in Khammouane Province and in Vientiane Capital from the 22nd to the 25th June 2009 and from the 23rd to the 24th July 2009, respectively.

Consulted organisations

Provincial level

At provincial level, key persons were interviewed within the following **public** organizations:

- Provincial Department of Energy and Mines (PDEM),
- Provincial Agriculture and Forestry Office (PAFO),
- Provincial Department of Industry and Commerce (PDIC),
- Provincial Department of Investment and Planning (PDIP),
- Électricité du Laos in Khammouane (KDEL),
- Khammouane Electrical Construction and Installation Enterprise (ECI),
- Provincial Department of Science and Technology (PDST).

Representatives of the following **private** companies were also interviewed:

- Donsay Construction and Consulting Company,
- Khamphet Agent,
- Khammouane Electronic Construction and Installation Company, and
- PSP Construction and Installation Company.

A short description of each private company active in Khammouane Province is provided in Annex 1.

National level

At national level, the Department of Electricity (DoE within the MEM) and EdL are the two principal state offices that were consulted.

Others organisations interviewed were private companies comprising of VOPS, Sunlabob Renewable Energy Co. Ltd., the Union of Electrical Construction and Installation companies¹, Soksay Construction Company, Sengsavang Road & Bridges, and Irrigation and Electrical Construction Co. Ltd.

¹ This Union was established by the Chamber of Industry and Commerce in order to form a group able to compete with other foreign companies. The Union consists of 10 companies such as SVT Co. Ltd, Saythone Electrical Co. Ltd, Phetco Team Co. Ltd, Soksay Electrical Engineering Co. Ltd.

One international non-government organisation, SNV Netherlands, was also visited and interviewed by the ETC consultants and LIRE staff.

Annexes 2 & 3 present the list of persons met at provincial and national level, respectively.

Observations about the consultations

Appointments were made with key individuals prior to consultations; however the interview process was found to be challenging. Contacted individuals were often absent. Some previously identified staff had move to another work place. The turnover of staff working within the visited public organisations may explain why newly appointed staff often did not yet fully understand the situation or the plans in the rural electrification sector.

Furthermore, most of the interviewees were not much inclined to discuss the situation of rural electrification in general. Their preference was to talk more about issues that were directly related to their specific field of work only, and that fell under their responsible administrative geographical area. Intention was clearly to avoid interfering with other administrations and department's work.

Structure of the report

The present document provides a summary of the results of these consultations held with various government and private actors. The report is divided into three main sections:

The next, *Section 2*, concerns the **provincial actors'** (i) points of views on the CAP REDEO rural plans, (ii) foreseen bottlenecks in the implementation of these plans, (iii) recommendations to smoothen implementation, and (iv) requirements still needed for successful implementation.

Section 3 presents the results of the **national stakeholders'** consultations. Here general information on the electrification in the rural sector is reported, not specifically on the CAP REDEO scenarios.

Section 4 presents a **list of possible actions** that could be undertaken in the future, as suggested by the stakeholders interviewed at both provincial and national levels.

The lists of the persons contacted and met as well as the questionnaires are presented in the Annexes at the end of the report.

2 Provincial Stakeholders' Consultation

2.1 Perceptions on the CAP REDEO rural electrification plans

Government

Hydropower:

From the point of view of the Provincial Department of Energy and Mines (PDEM), the CAP REDEO rural electrification plans were not considered as actual plans. Those plans are considered to be the results of a practical training exercise conducted by IED by using a GIS software tool (called GEOSIM). As part of a training

project, no serious commitment of the government was taken in order to integrate these plans into the national rural electrification objectives; these plans were not even been disseminated. As a result, almost none of the private actors have heard about these plans.

In general, the locations of the hydropower sites that were identified thanks to the GIS tool are viewed as suitable in terms of water availability, including the provision of water for irrigation for agricultural land. Technically the installation of a hydropower plant for about three villages could be more economically and cost effective than serving one single village. However government staff mentioned that the Nakay (Mon River) site may not be suitable. The Provincial Department of Science and Technology (PDST) and the Provincial



Department of Planning and Investment (PDIP) claimed that this district already has sufficient electricity coverage. There is no further need to target this district since people in the surrounding rural areas of Nakay will soon be serviced with electricity generated by solar home systems (SHS) provided by VOPS (Village Off-grid Promotion and Support Project) - financially supported by the World Bank (WB). This VOPS project is part of the WB Rural Electrification Project Phase 1 (REP1, 2006-2009) with the ambitious target to equip 10,000 households with SHS by the end of 2009². People living in Nakay District are not only electrified by the major Nam Theun 2 (NT2) Hydropower electricity Project and SHS but also by another small hydro dam recently completed, funded by the NT2 Project, located in Vangchang Village. This hydro dam is providing electricity to those persons who are affected or resettled by the construction of NT2 project.

Figure 1: Interview with PDEM in Khammouane Province

The PDST and PDIP have similar comments on potential sites identified in the district of Bualapha. A 60 MW hydro power dam on Xe Neua River is currently under construction and will be large enough to supply electricity to villagers in remote areas. At the same time, the dam will supply power for a mining site that is located close to the Laos-Vietnam border. ECI recently reported that half of Bualapha district still needs to be electrified. The same information source adds that it is better and more appropriate that when rural electrification projects are implemented, the power supply should be subsidized by EDL (or government) for 50% of the selling price, as has been done in other projects and provinces. By supporting the project implementer, the government (EdL) will ensure the same low electricity tariff for all people. This will protect rural people’s interests from private companies who may take advantage by practising higher electricity tariffs. Additionally it will be a great incentive for private sector to be more willing to invest.

Biomass gasification:

All interviewed government staff suggested that the CAP REDEO plans have a low implementation potential. The sites are far away from feedstock’s locations which will induce high transportation costs. In particular, PDIC raised the concern that the sites in Bualapha and Xaybuathong districts are not suitable. The first district

² At the time of the present report, in November 2009, this target cannot be possibly reached.

has insufficient production of rice while the latter can produce rice for only one season per year. This means that, in their view, there are not enough rice husks available in the surveyed area to be able to run a biomass gasifier.

PDEM also added that the feasibility of the biomass plans is hampered in the absence of a detailed cost benefit analysis. However, PDPI argued that such detailed feasibility studies could still be conducted and that these plans may then be found to be suitable for implementation. The costs and benefits of these plans thus remain to be fully assessed. The result of this analysis should then be disseminated to national and foreign private investors. Nevertheless Électricité du Laos (EdL) expressed that these plans cannot be effective anyway as most of the people living in the targeted provinces now have access to electricity.

Private Companies

Hydro and biomass:

Most persons active in the private sector have never heard of or seen the CAP REDEO plans before. They are therefore not involved in the implementation phases at this moment. The plans are not detailed enough and seem to require high investment costs. The plans do not contain feasibility studies, which need to be provided in order to allow investors to gain more understanding of the projects prior to taking the decision to actually invest. Mr. Khamphat, a representative of the VOPS Project, asserted that the Nakay Hydro site may not be feasible. He has extensive experience in Nakay District and observed that this district is already well



Figure 2: Mr. Khamphat, Representative of VOPS (left)

electrified: the additional electricity need is small, only around 10kW. Bualapha district, on the other hand, requires more concerted efforts to provide electricity to the people who live in the rural areas.

Considering the biomass, Mr. Khamphat believes that this technology is unlikely to be developed due to the shortage in the supply of feedstock. He reported that the rice mills stocks are dependent on villagers who bring their grain to be processed in the rice mills. The supply of this feedstock fluctuates according to the rice cultivation season.

The Deputy Director of Donsay Construction Company, Mr. Viengkham Kettavong, expressed that in his point of view the hydro plans do have potential. Their implementation could be viable if the government would support them by providing subsidies of 50% to 70% to lower the electricity price. If there is no support from the government, the company would alternatively have to seek for foreign investors who have extensive experience in the hydropower sector. The government should then act as a credit guarantor for his company in order to gain trust from foreign business people to form a joint venture with his company. He further pointed out that before these plans can be implemented, careful feasibility studies need to be conducted by a project (such as CAP REDEO) or PDEM since this is an important step before taking the actual investment decision. Finally, the most important requirement for the implementation he gave was a high level of demand from the

villagers to be electrified through renewable energies, and that they should also be willing to pay for their electricity consumption via monthly payments. The role of the government, in that case PDEM, is to assign their technical staff to accompany a company to mobilise people in rural areas to understand the business concept and to boost demand for these types of energy.

2.2 Perceived problems in implementation of the plans

Government

There are several bottlenecks identified in implementing these plans. The first relates to **human resource management issues** within government departments. The high turn-over of government staff often means knowledge or training is lost. For example in the Provincial Department of Energy and Mines, one technical employee, Ms. Kounmy, who had knowledge of the CAP REDEO project and knowledge of the GIS software, has been replaced. Her successor Mr. Lae has received very little information about the CAP REDEO project and no knowledge about using the GIS software that had been installed by IED. The GIS program also requires daily software updates through a continuous connection to Internet, to which PDEM does not have access. Due to this the software is now unable to function properly. This lack of knowledge transfer is not unique.

Similarly to Ms. Khounmy, the Deputy Director of the Department of Industry and Commerce (PDIC), Mr. Signuan has left to study for a couple of years. In his Department, no one now knows about the CAP REDEO project or GIS tool. The Provincial Science and Technology Department (PDST) has been split into two Sections. Mr. Khamphai who participated in the workshops organized by IED is now responsible for Water and Natural Resources and thus no longer in charge of Science and Technology topics. The new Head of this Division knows a lot about rural electrification, but little about the CAP REDEO project.

Hydropower:

According to PDEM the financial or technical aspects are not really an issue, but the **interest of local investing companies** does constitute a concern. These hydro sites represent long term investments for those companies.

Large private companies will not be interested in this type of projects due to the small size of hydropower capacity and because of the long term return on investment. The PDIC commented that existing private investors that have engaged into the hydro power sector in Khammouane Province still do not see the benefit of this type of long term investment; unlike those involved in timber, hotel and guest house businesses. Furthermore, the sites are very remote and difficult to access, especially in the rainy season. With low incentives but high difficulties and risks in collecting fees from villagers, investors are unlikely to be interested in investment.

PDST thinks that construction of hydro power projects by private investors for selling electricity to villagers is not worth the investment. The reasons put forward for this reside in the difficulty in collecting fees and inaccessible locations as mentioned above. In addition, before any company will invest in these projects, they will have to study and estimate the expected economic benefits for doing so. They require a cost-benefit analysis and a feasibility study to be conducted, both of which are yet to be done. These studies should be carried out by the project owner, i.e. by the CAP REDEO expert team. The member of PDIP staff interviewed

added that the national private companies in Laos do not have financial and technical capacity to conduct such studies, but in general foreign investors do have these capacities. He further asserted that foreign investors are not currently as active due to the global economic crisis.

Biomass:

All governmental staff consulted did not agree with the idea of developing biomass gasification. They asserted that the main constraints are the **insufficiency of the feedstock and high transportation costs**. They raised the concern of unstable and short (seasonal) supply of the rice husk or saw dust. Rice husk would not only be used to generate electricity but is also used for agricultural and industrial purposes such as production of fertilizers and gypsum board, both of which are in high demand from local farmers and factories. Meanwhile the production of timber has decreased due to lower tree exploitation as a result of stronger legal restrictions on logging. Moreover, PDST reported that there is a Japanese company that invests in the province of Khammouane to process and compact charcoal from saw dust. They explained that the production of this product requires large amounts of saw dust. These additional uses of raw materials induce shortages of such material for the purpose of gasification.



Figure 3: Mr. Singkeo, Head of PST (left)

The distance between the location of the rice mills and the potential biomass plants is another issue. Rice mills are generally small and in scattered locations far away from the non-electrified rural areas. To date, rice mills in these areas are run by diesel generators and are even small, aiming only to serve the people living nearby. As a consequence, small amounts of rice husk are produced there. Rice mills with larger capacities are located in more urbanized areas. Still, these rice mills serve relatively small numbers of customers. In order to supply enough feedstock to the gasifier plant, that would possibly be located in a remote setting, costs of transportation would become a major concern. The small quantities of husk, in scattered locations, make the transportation costs high and impractical. PDEM reported that detailed economic cost analysis and feasibility for such biomass plans do not currently exist. Again, in order to attract investors, detailed feasibility studies would be highly required.

Private Companies

Hydro and biomass:

The private companies in Khammouane province are likely to encounter several bottlenecks if these plans are to come into practice. The first one relates to **financial capacity**. Most of the companies interviewed described themselves as young and small companies, unable to offer investment.

There are both formal and informal SMEs. One of the interviewed firms named *Khammouane Electronic Company*, which registered a capital investment of 210 million Kip (or US\$24,706), has installed a 0.4 kV line to

three villages in two districts, Xaybuathong and Mahaxay.

Another interviewee was a representative agent of the VOPS project. This agent installs solar home systems (SHS) that are provided by VOPS to some villagers in Nakay District. This agent has not yet registered as a licensed company due to financial constraints. However he would like to get the registration license as electrical installation company, which should become possible after the completion of the current assignment for the VOPS project. He also mentioned that he will be able to manage to raise a capital investment registration of 21 million Kip (US\$2,471).

Two companies, *Khamphat* and *Khammouane Electronic Company* explained that they do not have the financial capacity to build and supply electrical power to villages. What they can do is to participate in small assignments given by any winning bidders as sub-contractors. Their assignments would include surveys on the distance between houses and power site location as well as hydrologic and demographic surveys of the site, since low investment costs are involved. They have little capital to do so and their access to loans is limited as their assets cannot meet the loan criteria imposed by commercial banks. In this context, the only option for them is to take part in development projects as sub-contractor.

Another interviewed company, *Dongsay Company*, has a capital investment of 2 billion Kip (US\$235,294) and provides various services such as construction of irrigation systems and buildings, installation of domestic electrical systems and of irrigation pumps, and a consulting services related to social, economic and environmental issues. Their director raised a similar issue that if they were involved in the implementation of these plans they would require financial support from either government or international private companies in the form of public subsidies and joint venture, respectively.

Besides this concern, another constraint is associated with the **affordability and willingness to pay of the electricity users**. The economic situation of the poor people who would be targeted to receive electricity is very low. Experiences in several parts of the country show that rural villagers would prefer to benefit from free projects and that they do not want to pay for electricity as they are poor, creating difficulties when it comes to collecting monthly fees. It was also commented that a large proportion of households who are connected to the national grid still face difficulties to pay their monthly bills. These off-grid projects might eventually cost more than expected to investors if end-users cannot or refuse to pay.

2.3 Recommendations to smoothen implementation

Government

PDEM asked for the GIS programs (GEOSIM) to be re-installed on their computer that was infected by virus and is no longer in use.

Hydro:

In order to smooth the implementation, PDEM suggested inviting **all stakeholders**, including government and private electrical installation and construction companies from Vientiane Capital and Khammouane Province, to participate in a meeting/workshop to be organized by the CAP REDEO project team. This could be the place to continue the discussion on the implementation of the plans: what participants think about them, what information they require and to know if they are interested in these plans. This could be one of the ways to

encourage SMEs to participate in the implementation of these plans. Another way could be to disseminate the plans through communication media such as radio messages and newspaper advertisements.

PDPI suggested that there are several ways to support the implementation of these plans. One of them is to **promote local and international partnerships or joint-venture**. This means that the private sector should cooperate with foreign investors to form joint venture companies. These could solve the financial constraints of the local companies and also encourage them to maintain the operations in the long term. Another way suggested could be to develop project proposals (to implement these plans) to be presented for funding to the government or international donor agencies. PDPI suggested that PDEM should then get the responsibility for presenting plans to the Department of Electricity (DoE) within the Ministry of Energy and Mines (MEM). It is actually DoE's role to **apply for funding from international agencies** such as the World Bank, the Asian Development Bank, other international donors or foreign countries' governments. The MEM then will have to cooperate with the Ministry of Planning and Investment to seek funds since most of international assistance funds demand going through this Ministry prior to the launching of any cooperation.

PDST highlighted that in order to attract more private investors to get involved in the Lao electricity sector other types of businesses like mining should also be looked at. The mining investment plan in Bualapha district is an ideal example of this, combining both mining investment and the construction of a hydro power dam. This hydro plant does not supply electricity exclusively for the mining but also provides nearby rural villages.

More generally, many departments identified the crucial need for **carrying out comprehensive detailed costs analysis, economic, social, and environmental impact assessment studies**. However, it is not clear who should be in charge of conducting these studies. Some participants suggested that PDEM should take responsibility while some others claim that this lies more with the CAP REDEO project team that initiated these plans. Some recommended that it should be the role of the private implementing companies themselves. Nonetheless, PDIP added that after these feasibility studies are formulated, the results should be presented and clarified to investors.

Meanwhile, PAFO claimed that they can facilitate the studies and construction works by issuing permission letters for the potential contractor and also provide technical staff to accompany the contractor to the site. PDST added that in the case that these plans are found feasible, the role of the government should be to facilitate the resettlement of the affected persons. The role of EDL would be to establish the electricity tariff and amount of subsidies.

Biomass:

In case the private investor does not have enough human resource capacity or technical knowledge to conduct the study and technical installations, a PDEM representative said that he could invite a local university expert to train them. Besides, PDIC also suggested that PDEM used to play an important role in coordinating the local authorities at provincial, district and village levels as well as with the project owner.

PDIP advised that PDEM should have a key role in providing technical support for both survey studies and construction works, whilst the PAFO could play a facilitation role in providing technical staff to accompany surveyors to the project sites, specifically where electrification projects are located inside the perimeter of a National Biodiversity Conservation Area (NBCA). This proposed role was confirmed by the PAFO

representative. In addition, the PDIP identified important roles for PAFO in ascertaining the project locations, where the agricultural raw materials are produced, to supply to the gasifiers. PAFO also reminded the audience that statistical information can be provided to investors or concerned authorities who wish to obtain them.

Private Companies

Hydro and biomass:

To support implementation, government authorities have an important task in encouraging private companies' involvement in the rural electrification sector. Mr. Khamphanh, from the PSP Company, mentioned that his company will not be able to participate in the CAP REDEO plans, unless the government has a policy asking for decreased interest rates from banks to investors wishing to engage in any rural electrification business.

2.4 Requirements needed for successful implementation

Based on the conducted interviews, three main requirements were identified to assure that these plans are implemented successfully, as detailed below.

➤ **Technical assistance**

The first requirement relates to technical assistance needs. Investors need to have a clear picture of the plans and scenario prior to taking any decision.

To manage this, detailed feasibility studies need to be carried out. These studies should include desk study, environmental and socio-economic baseline studies as well as a socio-economic assessment. These studies can be carried out by consultants hired by a project owner who may be a government or international organisation or private company.

Furthermore, mobilization of villagers is needed to enable them to understand the importance of the off-grid electricity services. Mobilization can be carried out by either government technical staff from PDEM or an experienced short term consultant hired by a project owner or local NGO. This is especially true regarding the biomass gasification projects since this has been a very new technology not yet known by both private entrepreneurs and villagers.

Once all feasibility studies and the mobilization of the villager's are completed the outcomes should be presented and explained to the potential private actors interested in involvement with the projects' implementation. It is suggested that results should include objectives, methodology for implementation, energy production and electricity power sales. Presentation of the results could be launched at a workshop to be held in Vientiane capital and/or Khammouane province.

➤ **Capacity-building**

The second requirement for the successful implementation of the project plans is to build the capacity of both the government and private companies who are interested in investing in biomass. Biomass technology is not yet well known. It was argued that a project owner, either government, international organisation or private company, should seek a technical expert to provide training to government staff that work in the energy sector

and that are involved in supervising energy/electricity projects.

It is also crucial for private company employees to learn about this new technology including the construction, operation and maintenance techniques.

Besides this, the participation of the villagers or a technician, hired by the project owner, is also crucial for the maintenance of the equipment. This would require training on how to supply feedstock to the market and the training of a village technician to repair the gasifier system. A technician in the village or a technician hired by the project owner should be involved in the daily operation and maintenance to assure sustainability.

➤ **Access to financial resources**

The third factor to be considered is the access to financial resources. Some interviewees mentioned that the government needs to play an essential role as funding provider. When a plan exists to build a hydropower dam, PDEM submits their electricity plan to the national ministry (MEM/DoE) for approval and this ministry usually requests the necessary funds from the Ministry of Finance.

Another way to improve access to financial resources is for the government to present their plans, including detailed feasibility studies, to request a grant or soft loan from international organizations such as WB, ADB, the Japanese International Cooperation Agency (JICA) or other donors. The government could also act as warrantor for the private companies when they wish to apply for local bank loans.

Partial contribution from the government in term of subsidies is another solution. When an investor builds a dam and wants to sell power to villagers with a low tariff, subsidies from the government or international agency are required to allow private firms to gain a profit. ECI Enterprise mentioned that the government can take part in subsidizing half of the price of the electricity produced by private investors.

Private investors argued that to be able to invest government intervention is required to establish special low interest rates for loans dedicated to investments in rural electrification works, allowing more local businesses to participate in the sector.

In the meanwhile, PDEM said it could be a credit warrantor for private companies who wish to invest in this type of business.

However some are of the opinion that in order to enter the market and survive as electricity providers, a local company should seek joint-venture with an international firm that has extensive experience in this kind of business.

Moreover, access to micro finance schemes for the rural people in order to have access to electricity connection can also help to assure the viability of the electrification system.

All of these financial options are possible recommended solutions to increase the access to financial resources. However, the most practical approaches would be a combination of partial government funding, international financial assistance in terms of grant or low long term interest loans that provide financial assistance to the designated government body, like EdL, who would then assist a project owner through the provision of subsidies. The options of lowering interest rates and the provision of micro finance are far more complicated as influencing government financial policies would be a long process. For a joint venture, it is true that it can

boost the financial capacity of a local company, but once again a large international company will not be interested in a small potential profit that is generated from a small business.

3 National Stakeholders' Consultation

The national stakeholders' consultations were carried out prior to the provincial workshops that ran from 1st and 2nd July, and on the 23rd and 24th July 2009, just after the provincial stakeholders' consultations and workshop in Khammouane Province. The first round of interviews was with private companies carried out by the consultant, whilst the second was mainly with government departments, with two private companies, carried out by the LIRE and ETC team. Instead of opting for a national workshop in Vientiane, the ETC team believed a better information exchange would be achieved in face to face discussions.

The consultant team believed that sufficient information was gained about the CAP REDEO plans from the provincial consultations. Therefore, discussions held with the national stakeholders aimed at gaining a better understanding of the rural electrification sector in general and less on the CAP REDEO plans, hydro or biomass in particular. Still, the questions asked remained similar, focusing on: (i) perceptions of the rural electrification planning process, (ii) identifying bottlenecks, (iii) recommendations, and (iv) requirements for successful implementation.

3.1 Perceptions of the rural electrification planning

Government

The Director General of the Electricity Department (DoE), Mr. Hatsady Sisoulath, briefly explained the national target related to electrification: **90% of all people should be electrified by 2020, amongst which 10% will be achieved through off-grid options.** The main grid development works are under the responsibility of EdL while the off-grid development project is currently implemented by the WB Rural Electrification Project (REP). At the moment, the government receives additional funds from the Finnish government to develop a National Strategy for Renewable Energies. The elaboration of this strategy is still under development; the process should be completed by the end of 2009.

The head of the REP division (within the MEM/DoE), Mr. Anousak Phongsavath, seemed to be sceptical about the potential of the biomass gasification technology in the country. He believes that it is not possible in rural areas, as the cost of production is too high and therefore the electricity for the user is too expensive. He also thinks that electricity needs and energy demand should come from the village level, and that the electricity plans should be consolidated with the village and the provincial authorities. Plans must be based on the real needs of the villagers. He suggested the consultant team to write a case study on the works done in Nakay district, where DoE and VOPS have supplied 300 SHS to people who are affected by the Nam Theun 2 Hydroelectric Project.

Private

Mr. Vilath Sihamanivong, President of *Soksay Electrical Co. Ltd*, said that renewable energies offer an ideal method for helping the rural poor gain access to electricity. Although supplying electricity to the poor is a great

idea, investing in building small dams and selling power on their own directly to villagers is not that easy because of the difficulties in collecting electricity fees from villagers. Building the dams and selling the power to the villagers through EdL is more viable. Mr. Sum, a Deputy Director of Sengsavang Construction & Electric Installation Co Ltd believes that a small hydropower project is easy to manage. The solar home system however is a small market and more difficult to manage in terms of operation and maintenance. Investors engaged in the rural electrification face high investment risks due to the **absence of specific regulation or legal framework**. The Provincial Council of Commerce recommended creating a Union of local companies in order to be able to compete with international companies. There are about 10 electrical construction and installation companies that joined together to form such a Union. Such Union's were found at both provincial and national levels, however not much cooperation has taken place so far especially at provincial level.

3.2 Perceived bottlenecks/problems in rural electrification

Government

Mr. Bounngong Bouttavong, the Head of the Planning Division of EdL, mentioned that **capacity-building** is one issue of concern. For example, there is only one member of staff within each office that was trained by IED on the GIS software program. The four offices who received training were: PDEM, EDL Khammouane, EdL National, and RED. When the trained employee is absent, no one else in the office is able to operate the software. Additionally, the computer program installed by IED is not updated frequently due to the lack of access to internet.

Mr. Anousak Phongsavath, Director of the Rural Electrification Division found that **financial resources** are a main constraint for rural electrification development. He is convinced that in order to scale-up the access to rural electrification for the poor it is important to increase funding from international donors to support more projects. Nonetheless, the Director General of the Department of Electricity, Mr. Hatsady Sisoulath, viewed that the lack of information sharing and exchange amongst various actors is a main problem in energy sector.

Private

The Director of *Soksay Electrical Installation and Construction Co. Ltd* mentioned that access to financing or a bank loan is major problem when trying to submit bidding document for hydropower dam construction.

When submitting the tender documents, he was required to attach bank warranty to the principal. Previous experience let him down as he tried to gain access to bank loans or loans from Lao Business people in Germany. He complained further that the process of asset inspection and evaluation to be qualified for a loan by a bank was slow. He had to then try to join capital with his friend but there was still insufficient capital to meet the financial criteria set by the principal. He further commented that the policies of the government are good, however sometimes the implementation or the compliance to such policies is different. Things will be improved step by step.

On the contrary, *Sengsavang Construction & Electric Installation Co Ltd* had no difficulty mobilizing funding for their submission of a bidding proposal as they are financially capable to do so. Still, there is implicit concern about the payments made by a government organization, as a previous project on road construction received slow payment. Despite this, the company does not have a problem in financing.

In terms of technical aspects, Sengsavang Construction & Electric Installation Co Ltd is new to the hydropower sector, especially in terms of rural electrification, and has only educational qualification to do so. The interviewee is concerned that without a careful feasibility study there is a risk of water shortage and of his company running into debt. Furthermore, he added that his company does not have the capacity to prepare a Bill of Quantity, since it has never submitted bidding documents for a hydro project before, except for taking over a hydropower project in Xayabouly Province where the former bidding winner abandoned the contract. He is however willing to learn and build the capacity of his company if any NGO can offer support, especially concerning setting up a business model for rural electrification and its operation.

3.3 Recommendations to smoothen implementation

Mr. Bounthanong Phonthippasa, Head of VOPS, explained that it is not difficult to find agents in the rural areas to promote and install SHS or pico-turbines. However the procurement process is very slow with lots of procedures, which limits the effectiveness of the project. All equipment needs to be ordered from the Vientiane office, and each time is subject to a request for finance according to WB procedures. Mr. Bounthanong thinks that he could operate more efficiently if he could act as a private actor able to make direct orders for the materials that include transportation (on site delivery) instead of going through all the bureaucratic procedures.

Mr. Hatsady (DoE) mentioned that another option could be for the DoE to take the lead in the second phase of the VOPS - WB REP project. This would notably facilitate the control and monitoring of the financial flows.

Regarding the GEOSIM tool developed by IED, Mr. Bounnong (EdL) argued that more people should be trained in GIS in order to solve the problem of the lack of staff that can operate the software. There should be more than one person at each level and office trained. Mr. Hatsady sees an opportunity to expand the training centre of EdL as a Renewable Energy Technology training centre in the near future.

3.4 Requirements needed for successful implementation

The following suggestions were made to assure a successful implementation of rural electrification plans:

- Energy demand at the village level should be assessed first and then the local energy plan should be consolidated with the village and the provincial authorities;
- Electricity tariffs practised for off-grid projects should be the same as for the grid (700 kip/kWh). This will principally ease the acceptability of the project by the users and to enrol also the poorest;
- Government to facilitate the private sector in order to allow them to have to faster and better access to bank loans, so that they can develop energy projects on their own or for implementing tenders issued by either government or other international organisations/companies;
- In all cases, subsidies should be provided to support any rural electrification project happening in the Lao PDR;
- The local private companies cannot work independently but need to establish PPPs. The public partner

- should facilitate the access to financial resources for investment;
- Develop the legal framework in the country to support investment and to facilitate involvement of foreign and domestic private companies in the rural energy sector;
 - Further capacity building on rural electrification planning, coordination and implementation by providing more specific and related training courses to more staff of related government departments private companies who need to be upgraded.

4 Overview of follow-up actions

4.1 Proposed action list - provincial stakeholders

During the provincial workshop, participants endorsed the following possible solutions and approaches as suggested by LIRE:

- Conduct **detailed feasibility studies on renewable energy systems** by the project owner in association with consultants or NGOs where necessary:
 - *Objectives:*
 - ✓ Link policy to planning and implementation
 - ✓ Overcome lack of technical capacity for feasibility studies and impact assessments
 - ✓ Informal introduction of standards, and standard operating procedures
 - *Concept:*
 - ✓ A detailed site assessment carried out as on-the-job training for rural energy developers
 - ✓ Provide best practice examples as a template for developers to follow
 - *Dissemination:*
 - ✓ Direct participation of rural energy developers in preparation of feasibility studies
 - ✓ Disseminate the best practice examples, serving as a guide for future studies

- Provide **capacity-building and training** for staff within public and private organisations, on hydropower (pico- and micro) and on biomass gasification technologies, including technology knowledge, sustainable management and implementation schemes:
 - *Objectives:*
 - ✓ Support self-sustainable development of RE sector on provincial level
 - ✓ Build technical capacity at the provincial level
 - ✓ Improve efficiency in RE through decentralisation
 - ✓ Raise understanding of RE requirements and opportunities
 - ✓ Improve access to resources, e.g. finance, by developing strong inter-linkages between stakeholders
 - *Concept:*
 - ✓ Establish a platform for knowledge exchange at provincial level
 - ✓ Develop appropriate technology tools for RE sector decision makers and developers

- *Dissemination:*
 - ✓ Short class-room training course on technology assessment, operations and management
 - ✓ On-the-job training exercises for site assessment
 - ✓ Training in biomass gasification at existing demonstration facility in Vientiane

- In all cases, develop **Informed Choices** manuals on each potential renewable energy technology following an informed choices approach:
 - *Objectives:*
 - ✓ Tackle information bottleneck in particular at the local level
 - ✓ Increase rate of access to energy by speeding up assessment and planning stages
 - ✓ Equip communities and small and medium enterprises (SMEs) to review their energy needs and local resources
 - ✓ Enable communities/SMEs to choose appropriate (affordable) energy solutions, and then know whom to contact
 - ✓ Short list of viable potential sites for private investors – saving time and money
 - *Concept:*
 - ✓ Information document guiding end-users and stakeholders for decision making
 - ✓ Energy Demand-Based Approach
 - ✓ Consider energy use and not just electricity (e.g. lighting and cooking)
 - *Dissemination:*
 - ✓ Extension service approach (like the NICE approach developed by the Lao Extension Agriculture Project - LEAP)

4.2 Proposed actions list - national stakeholders

Reflecting on the inputs received during the national stakeholder consultation interviews, and in addition to the actions proposed under paragraph 4.1, the consultants recommend the following actions:

- **Provide more training to technicians of District Agriculture and Forestry Offices (DAFO)**
 - *Objectives:*
 - ✓ Build capacity to identify sites with potential biomass resources
 - ✓ Raise awareness of improved uses of biomass (e.g. improved cook stoves)
 - *Concept:*
 - ✓ Train DAFO to understand biomass as an energy resource
 - ✓ Train DAFO to assess rural energy demand and available resources at the local level
 - ✓ Enable DAFO to advise villages and project developers on appropriate technologies to improve biomass utilisation
 - *Dissemination:*
 - ✓ Training of trainers approach: DAFO staff will become technical advisors for rural areas
 - ✓ Technical training on biomass energy technologies

- **Study on improving access to credit for the private sector and grants for government authorities**
 - *Objectives:*
 - ✓ Review current financing mechanisms
 - ✓ Formulate recommendations to enable access to credit, either through a new or existing funds
 - ✓ Improve capacity of government staff to raise funding to facilitate access to grants
 - *Concept:*
 - ✓ Study of current loan application process and economic situation
 - ✓ Produce a guide on applying for finance in rural energy
 - ✓ Evaluate the demand to introduce a new credit facility
 - ✓ Training on searching techniques to find grants calls and writing proposals
 - *Dissemination:*
 - ✓ Recommendations to government and sources of funds
 - ✓ Engagement with project developers

- **Develop integral small scale strategy planning research and studies:**
 - *Objectives:*
 - ✓ Improve local capacity to develop complete services packages for decentralised renewable energy (RE) technologies
 - ✓ Achieve greater information sharing through strengthening exchange of knowledge, information and data to better planning rural electrification and RE introduction activities
 - ✓ Raise public awareness of national efforts to increase access to energy for off-grid communities
 - *Concept:*
 - ✓ Develop awareness-raising tools for rural areas like informed choices manuals
 - ✓ Detailed review of rural energy supply and demand in a sample area, with support of provincial level actors
 - ✓ Develop operational models to implement RE projects at decentralised level, based on pilot sites or demonstration projects that integrate the technical options of the different technologies, natural resources availability within the target area including land use, local socio-economic context, financial conditions, local decision-makers, operators, end-users profiles involving local communities, possible assistance from national authorities
 - *Dissemination:*
 - ✓ Targeted training activities
 - ✓ Awareness-raising materials for public distribution

Annex 1: Short Description of Private Companies in the Energy Sector

Name of organization	Address	Formal/ Informal	Year establ.	# of employees	Registered capital	Services Provided
Khammuane Electronic Co., Ltd	Khammuane	Formal	2008	9	210 million kip	Internal electrical installation. Installation of transmission lines of 0.4 kV in rural area of Khammouane Province
Donsay Co., Ltd	Khammuane	Formal	1998	10	2.8 billion Kip	Consultancy on surveys for civil works, socio-economic studies, installation of transformers to connect irrigation pumps, internal electrical installation, construction of buildings
Khamphat Agent	Khammuane	Informal	2007	5	None	Agent for VOPS to install solar panels in Nakay District
BSP Electrical Construction & Installation	Khammuane	Formal	2004	15	800 million kip	Consultancy on survey, design and construction of hydro power dams in Phongsaly, Hua Phan, Xayabouly and Khammouane provinces
BPN Electrical Construction & Installation	Khammuane	Formal	2000	6		Sales of electrical supplies and equipment, installation of transmission lines and transformers, construction and maintenance of irrigation systems in Xayabouly, Khammouane, Saravanh provinces
Soksay Electrical Construction & Installation	Vientiane	Formal	1989	14	1 billion	Internal electrical installation. Installation of transmission lines below 115 kV e.g. for NT2 project, World Bank, transmission line in Borikhamxay province
Sengsavang	Vientiane	Formal	1992	60	10.2 billion Kip	Internal electrical installation, road and bridge construction, construction of dams, installation of transmission lines and transformers

Annex 2: Contact List of Provincial Stakeholders Met

Names of Persons Intended to meet	Names of persons actually met	Position	Organization	Remarks
Mr. Bounta Bouasavang	Mr. Bounta Bouasavang	Director of PDEM	Provincial Department of Energy and Mines	Co-interviewed
Mr. Lae Nanthasone	Mr. Saysoulin	Head of Energy Section	Provincial Department of Energy and Mines	
Mr. Phonsavath Xayavong	Mr. Phonsavath Xayavong	Deputy Manager	Electricité du Laos Khammouane Province Branch	Met
Mr. Phongphet Panyon		Director of Company	Houng Heuang	Unable to meet
Mr. Khanthy	Mr. Soukaseum Saysombat	Deputy Manager	Electrical Construction and Installation State Enterprise	Met the deputy in stead
Mr. Kamphai	Mr. Singkeo	Head of Science and Technology Division	Department of Science and Technology	Met Mr. Singkeo who is now a Head of STD

Names of Persons Intended to meet	Names of persons actually met	Position	Organization	Remarks
	Mr. Khamson	Head of Administrative Section	Provincial Agriculture and Forestry Service Office	Met
	Mr. Viengkham Kettavong	Deputy Director	Dongsay Construction and Consulting Company	Met and Interviewed
Mr. Singuan Inthalath	Mr. Daolay Keouangdy	Deputy Director of PDIP	Planning & Investment	Mr. Daovy was met and interview instead of Mr. Singuan
Mr. Bounpone Inthijack			BPN Construction and Installation	Not met
-	-		BLE Construction and Installation	No interview was taken place
Mr. Khamphan Vanlasy		Deputy Director	PSP Construction and Installation	Interview on 13 th July 2009 at LIRE office
-	-		Mahaxay Chaleunsap Construction & Installation	Not met
Mr. Bounta Bounlasy		Director	Khammouane Electronic Company	Met and interviewed
Mr. Khamphat Phetsoulin		Agent for VOPS	Khamphat Off-grid Electrical Company	Met and interviewed
Mr. Khoun Sengaphon	Mr. Kongvaly Phetsamone	Deputy Director of PDIC	Provincial Department of Industry and Commerce	Met and interviewed Mr. Kongvaly

Annex 3: Contact List of National Stakeholders Met

Names of Stakeholders	Position	Organization
Mr. Hatsady Sisoulath	Acting Director General	MEM, Department of Electricity
Mr. Chantho Milattanapheng	Head of Division	MEM, DoE, Social & Environmental Management Division
Mr. Anousak Phongsavath	Head of Division	MEM, DoE, Rural Electrification Project Division
Mr. Bounnong Bouttavong	Manager	Électricité du Laos
Mr. Andrew Williamson	Project Manager	SNV, Biogas program
Mr. Andy Schroeter	Director	Sunlabob Co., Ltd.
Mr. Bounthanong Phonthippasa	Director	Village Off-Grid Promotion and Support Project (Sengsavang Co., Ltd)
Mr. Sum	Deputy Director	Sengsavang Road-Bridge, Irrigation, electrical Construction and Installation
Mr. Vilath Sihamanivong	Chairman	Soksay Electrical Co., Ltd
Mr. Phothong Inthapanya	Director	SVT Co., Ltd

Annex 4: Interview Questions for the Government Staff

Interview questions (Government)

Name of Interviewer: **Thongsanti B.Vongsaly**

Name of Interviewee: _____

Organization: _____

Position: _____

Date: _____ / _____ / _____

I. Introduction of LIRE to Interviewees

II. Introduction of CAP REDEO to Interviewees (if necessary)

What is CAP REDEO?

Where is fund from?

When has the project started?

Objectives of the project

Objectives of the interview

III. General Questions

1. What is your opinion about the situation of rural electrification at this moment in Laos in general?
2. What is your opinion about the situation of rural electrification at this moment in Khammouane Province?
3. What plans does the government have at this moment in terms of rural electrification, both in Laos in general and specifically in Khammouane Province?
4. What do you think about the CAPREDEO plans / scenarios? How do they relate to the current rural electrification plans?
5. What do you think about the hydro scenario?
6. How do you think the hydro plans could be implemented?
7. Which parties should be involved?

8. What roles should they have?
9. What would the role of the government be?
10. Are there any changes for any of the scenarios of hydro site?
11. How have these plans changed? Reasons?
12. What bottlenecks do you foresee in the implementation for these hydro scenarios?
13. And in your opinion, how could these be addressed? technical assistance/ capacity building/ financial support
14. What do you think about the biomass scenario?
15. How do you think the biomass could be implemented?
16. Which parties should be involved?
17. What roles should they have?
18. What would the role of the government be?
19. What are the bottlenecks for these biomass scenarios? And in your opinion, how could this be addressed? technical assistance/ capacity building/ financial support
20. What the difficulties or problem do you encounter for implementation?
21. What are requirements still needed for successful implementation? How / where would you be able to arrange these requirements?
22. Is their an interest from the government to be involved in the implementation? If so, could you specify what interest there is for future collaboration?

Annex 5: Interview Questions for the Private Sector

Interview questions (Private Company)

Name of Interviewer: Thongsanti B.Vongsaly

Name of Interviewee: _____

Organization: _____

Position: _____

Date: ____/____/____

I. Introduction of LIRE to Interviewees

II. Introduction of CAP REDEO to Interviews (if necessary)

What is CAP REDEO?

Where is fund from?

When has the project started?

Objectives of this program

Objectives of this interview

III. General Questions

1. Can you explain about your organization? What does it do? What is its role in the rural electrification sector? What projects have you implemented?
2. When did you start your business? How did you start your business? (capital, man power, location etc?)
3. What goods and services do you provide?
4. Where do you provide the services?
5. How much have you been active in rural electrification? And what role do you play?
6. Do you know anything about the CAP REDEO Rural Electrification Plans (hydro and biomass)?
7. What do you think about these plans? (After presenting the plans)
8. How do you think these plans could be implemented? Who should play what role?



9. Would you be interested in the implementation of these plans? How do you think you could contribute to the plans? What could your role be in the implementation? If not, why do you not see a role for your company in the implementation?
10. Why?
11. What are the bottlenecks that you may encounter?
12. How can these bottlenecks be removed?
13. What would you like to say about rural electrification? What are the general problems you have seen in the rural electrification? What are the futures problems that you could foresee? Can these be linked to the plans just presented?
14. Additional questions/comments:
15. Would you be able to attend at workshop on ___/___/___ at _____?



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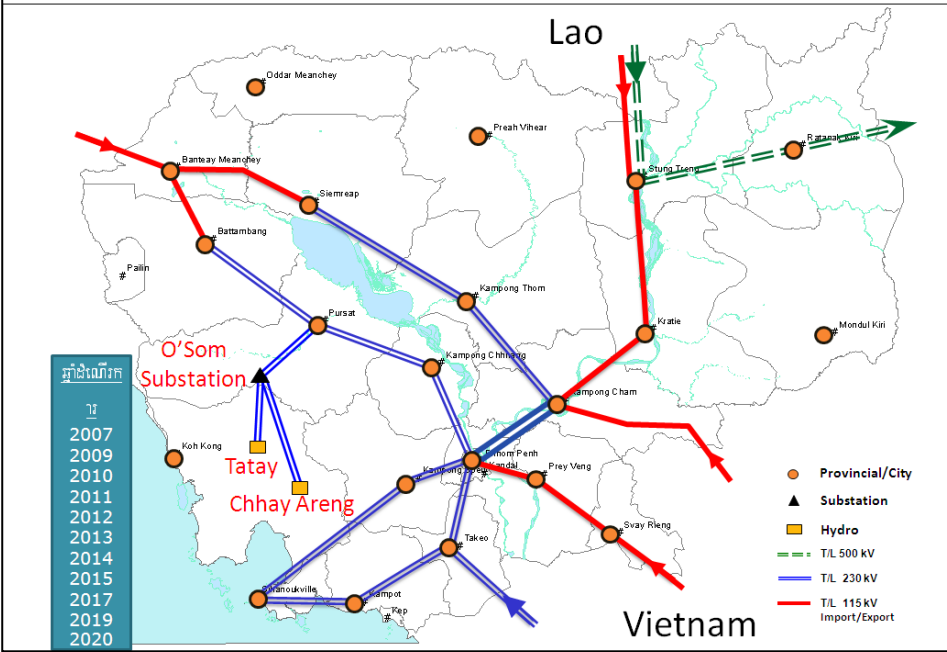
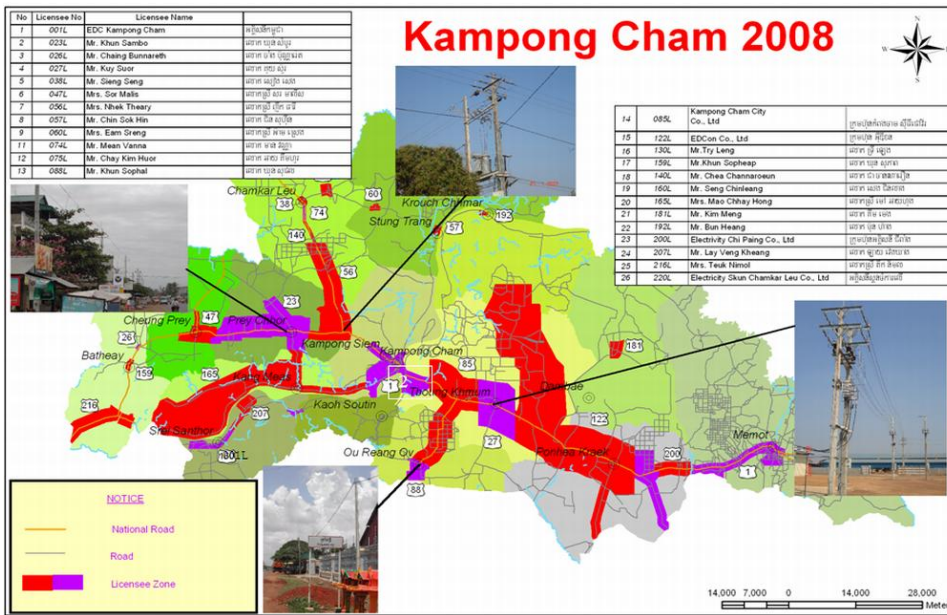


THE RURAL ELECTRIFICATION PLANNING PROJECT CAP-REDEO

Provincial Workshop and Stakeholder Consultations



*Organized by MIME with support from ETC Foundation
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1 RURAL ELECTRIFICATION IN KAMPONG CHAM, A PROVINCIAL WORKSHOP AND STAKEHOLDER CONSULTATION

1.1 Background of the CAP REDEO Project

The objective of the CAP REDEO project in Laos and Cambodia is to improve the impact of rural electrification on sustainable development and poverty alleviation by establishing effective cross-sectoral investment and planning capacities and instruments using Geographical Information Systems as the convening factor. The developed tools and outputs should provide tangible elements for the formulation of appropriate policies and instruments to reach the project objective. Activities carried out by the project include:

- Awareness raising among high level decision makers of the important role energy can play in poverty eradication, through fostering of multi-sectoral working groups;
- Strengthening of local energy expertise of the central planners – Ministry, power utility, regulator and of local Provincial authorities in planning methods;
- Demonstration of energy services for poverty reduction linkages through providing basic infrastructure services and affordable modern income generation opportunities;
- Development of alternative planning approaches for electricity service delivery by emphasizing the socio-economic impact of energy service extension, instead of only relying on technical-economic considerations.

During project implementation technical capacities were developed and stakeholders were endowed with hands-on tools to direct investments and decide between off-grid and on-grid options, renewable or fossil fuel based off grid production – and priority areas from the perspective of maximizing development impact of scarce resources.

In the medium term, the provincial plans could be used to develop electrification projects, from which the local population could benefit. A more integrated approach will contribute to bring additional investments in the sector in synergy with the recently established Rural Electrification Fund in Cambodia.

The methodology used was “hands-on, learning by doing” and included a focus group that was formed at the national and at the provincial levels. Specific training sessions at Provincial and National level were organized.

The result is a set of reports based on planning tools used that can be found on www.cap-redeo.com.

1.2 Activities undertaken

The stakeholder consultations, including the provincial workshop, focused on the relevant stakeholders for the rural electrification options which have been developed by the CAP REDEO project over the last two years. Aim was to include the opinions of both the people responsible for rural electrification planning from governmental institutions, as well as private partners with the potential to implement RE projects. The stakeholder consultations were carried out as part of ETC’s responsibilities in the CAP REDEO project.

The consultations were divided into two main activities: a provincial workshop in Kampong Cham and interviews with the main energy planning institutions. The activities were undertaken by consultant Rogier van Mansvelt with support from ETC staff and in close collaboration with the Ministry of Industry, Mines and Energy. The activities were mainly undertaken in the period from June to December 2009.

During the provincial workshop electricity grid extension and development plans were presented to the local government institutions and rural entrepreneurs, including rural electricity enterprises, battery charging stations and ice plants using biomass gasification. The issues and barriers discussed during the workshop were presented and discussed with the major electricity planners in Phnom Penh.

The following items were used to structure the workshop and interviews:

- Inventory of stakeholder views on the feasibility of electricity sector development plans in general and CAP REDEO rural electrification plans in particular;
- Bottlenecks for rural electrification;
- Discussion of the plans and identified bottlenecks with energy planners;
- Identification of potential project interventions that might contribute to solving the bottlenecks.

In this report first a summary of each workshop presentation is presented as well as the outcomes of the group discussions at the provincial workshop. In the next section a summary of the stakeholder interviews is given and the report ends with conclusions and recommendations for follow-up.

1.3 Report on the provincial workshop

On November 11th 2009 a stakeholder consultation workshop was organized in Kampong Cham Province about the CAP-REDEO rural electrification project. During the workshop presentations were held by the Ministry of Industry, Mines and Energy (MIME), the Electricity Authority of Cambodia, Electricity Du Cambodge (EDC, the National Electricity Utility) and a representative of ETC.

The consultation workshop was organized by MIME in cooperation with ETC. The invitations and local arrangements were perfectly organized by the Kampong Cham Provincial Department of Industry, Mines and Energy (DIME). In total 45 persons (see annex 4) participated in the workshop including Rural Electricity Enterprises (REEs), battery charging stations and one ice plant operator, two representatives from MIME, three from DIME and one from EAC, EDC and the Rural Electrification Fund (REF).

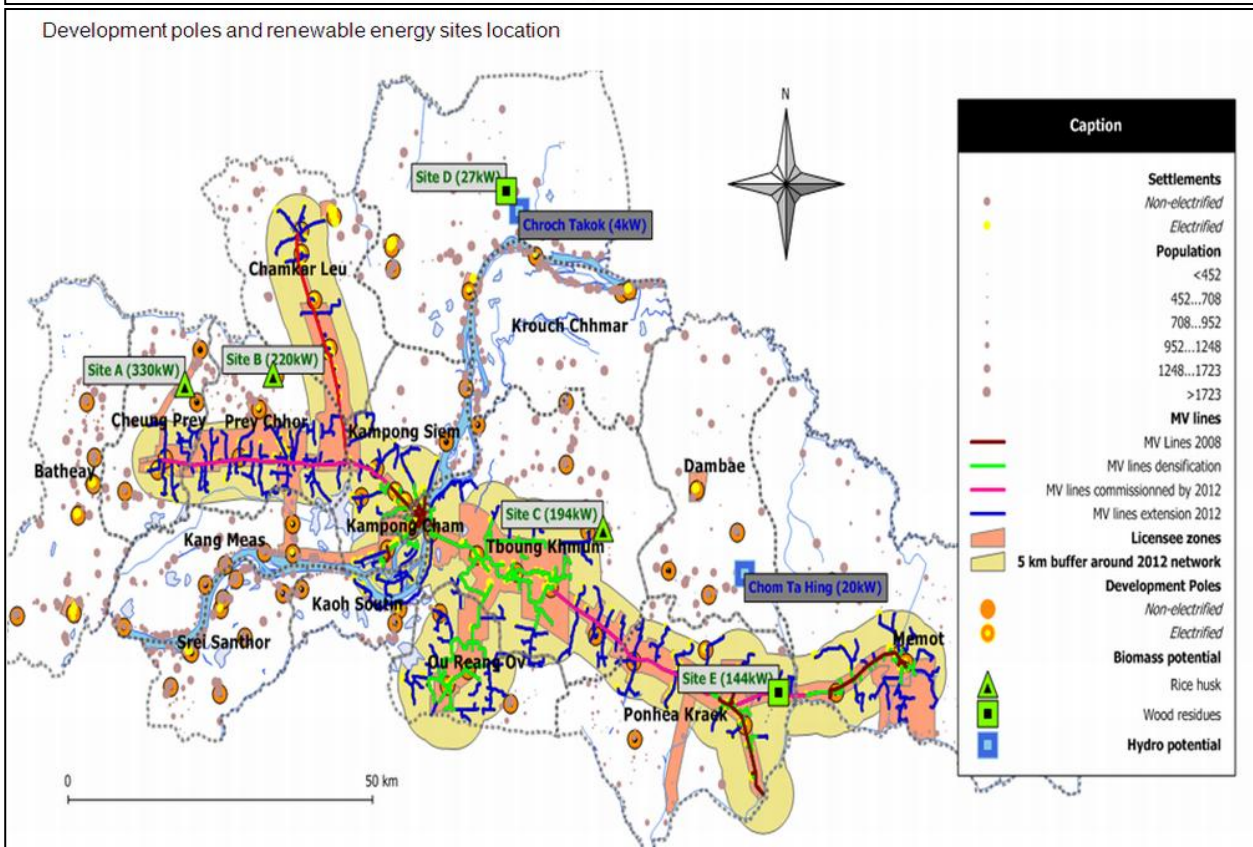
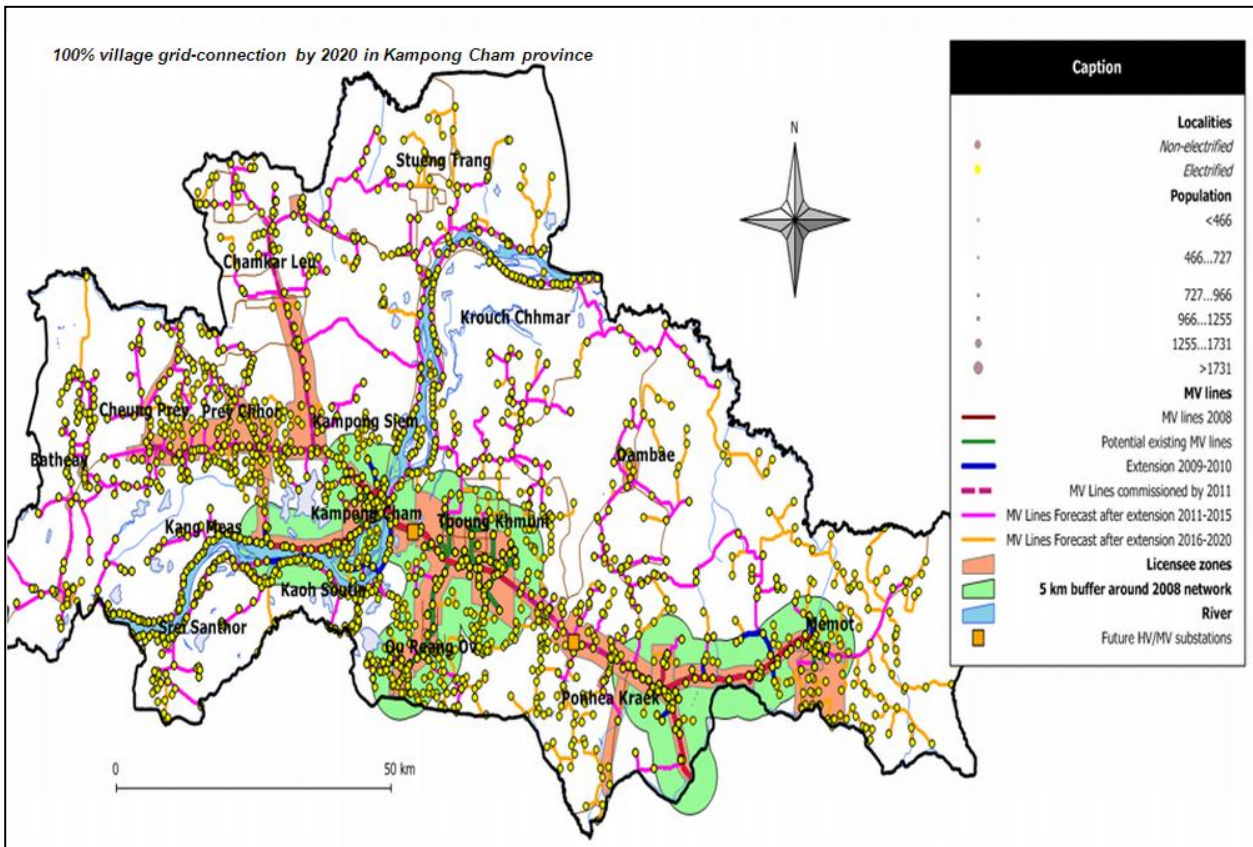
After the opening remarks, Mr. Heng Kunleang, Director of the Energy Development Department from MIME, explained the program and aim of the workshop (see annex 1, 2). All documentation and presentations were translated into Cambodian language to make them accessible for the participants as only a few participants could speak English. Below a short comment on each presentation will be given; in the annexes each presentation is included.

After the workshop in Kampong Cham Province interviews with the main institutions related to rural electrification have been organized and included the REF, EAC, EDC and SME-Renewables. During the interviews the results of the workshop were presented and discussions were held how improved planning could include the issues and barriers raised during the workshop. The IED rural electrification plan developed with GEOSIM software was also discussed during the interviews.

1.3.1 Summary of the presentation on the CAP-REDEO rural electrification planning report by Mr. Heng Kunleang, Director, Energy Development Department, MIME

The participants were not aware of the CAP-REDEO planning exercise and with clear words and simple language Heng Kunleang explained the aim and methodology of the project. Two colored maps were provided to all participants to follow clearly the PowerPoint presentation. Some participants had difficulty to understand the presented maps, however Kunleang took time to explain clearly each item on the maps, explaining about where medium voltage lines would be constructed, in what year and what the planned coverage area was.

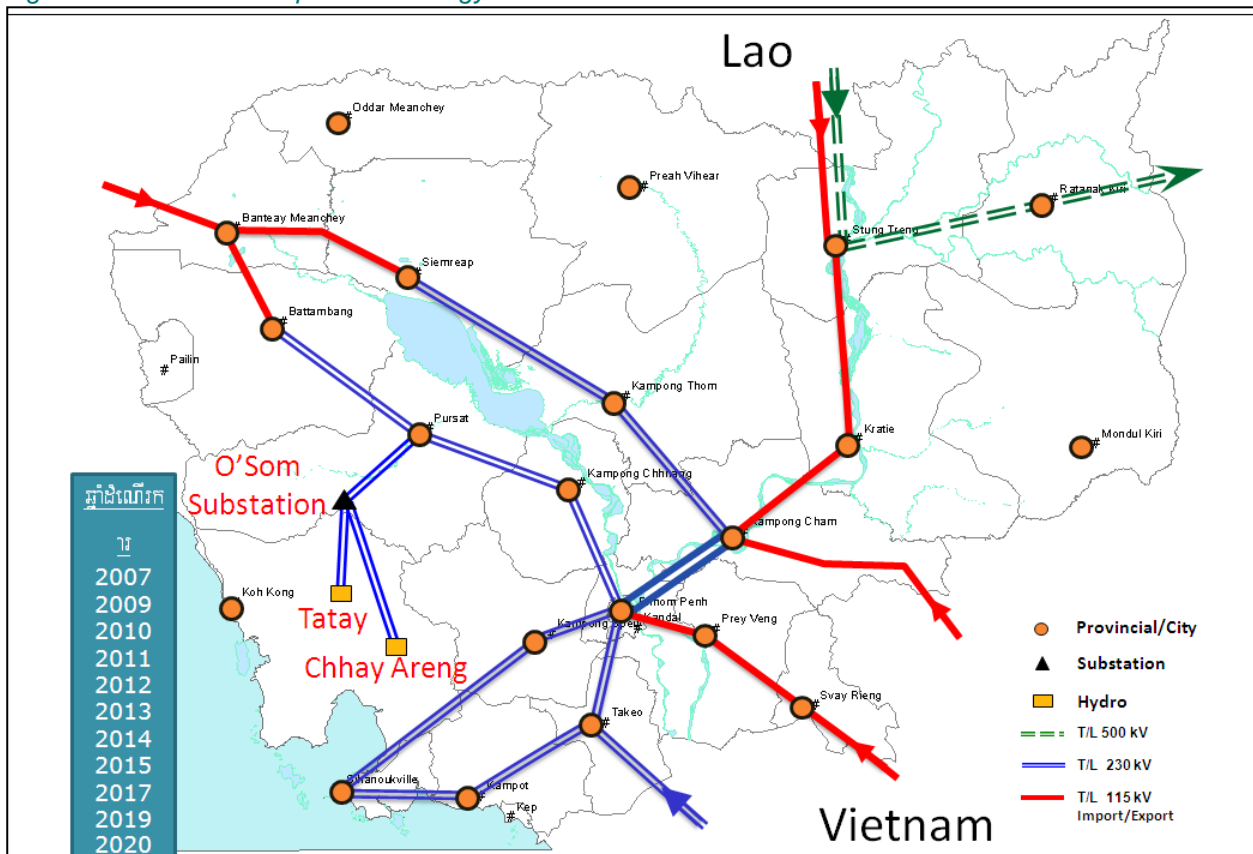
Figure 1: CAP-REDEO Rural Electrification Projection for Kampong Cham using GEOSIM

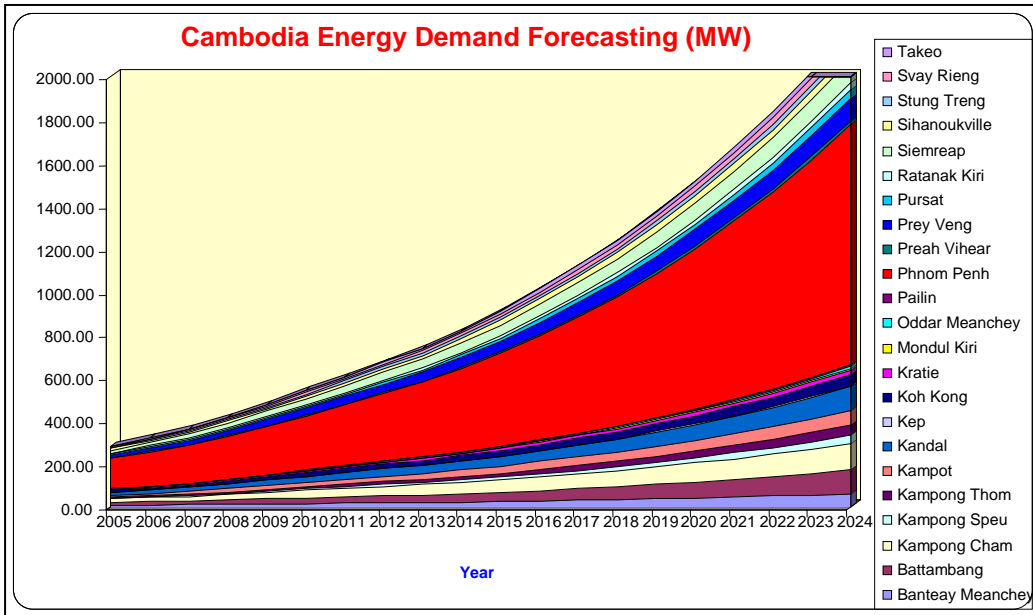


1.3.2 Summary of the presentation on the national grid extension and power generation plan by Mr. Heng Kunleang, Director Energy Development Department, MIME

Since a few months Takeo and Phnom Penh are connected to Vietnam with a 230 kV grid connection. Almost all electricity in Cambodia is generated with diesel and heavy fuel oil except for a small 12 MW hydro power plant in Kirirom that started operating about half a year ago. By 2030 the expected demand will be 3,000 MW from 400 MW in 2009. To generate this demand about 18 large hydro projects are planned to generate 2,000 MW of which 8 are contracted, in total over 1,000 MW by 2013. A number of coal fired plants will generate about 900 MW to backup hydro, as hydro is not expected to provide power all year round and mainly in the rainy season. To distribute the electricity, step by step a National Grid will be constructed by private companies and donor agencies such as the World Bank, ADB and the German KfW fund. During 2011 a 115 kV line will connect Kampong Cham with Vietnam, as the medium voltage line has not enough power to provide electricity to Kampong Cham town. In 2012 a 230 kV line will connect Kampong Cham with Phnom Penh, so hydro power from Kampot could also be used in Kampong Cham province.

Figure 2: Grid extension plan and energy demand load forecast

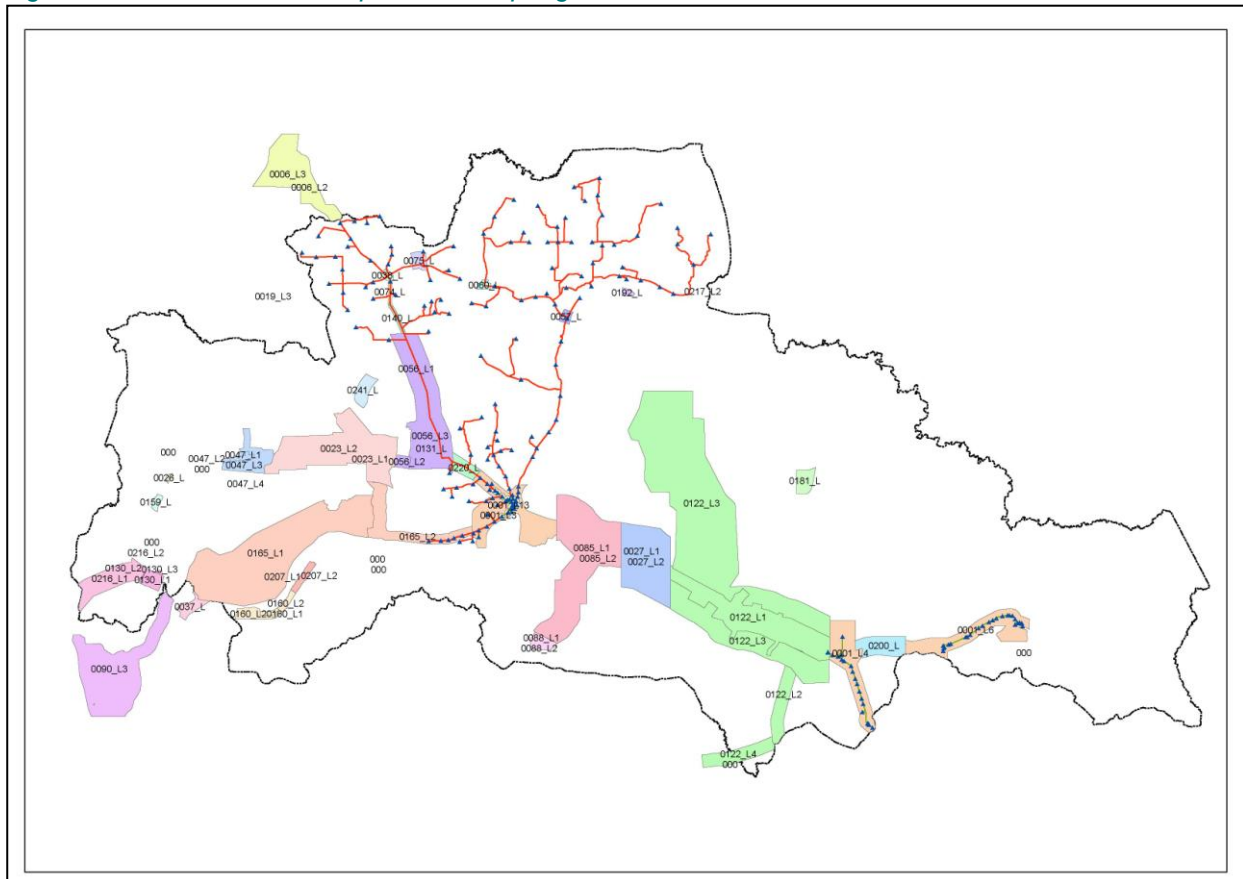




1.3.3 Summary of the presentation by Mr. Houg Chantha, Chief of Technical Office, EDC

EDC presented a plan for the medium voltage grid extension in Kampong Cham for the coming few years. The plan covered only a small part of the IED presented electrification plan, connecting basically the higher populated area north east of Kampong Cham town.

Figure 3: EDC Grid extension plan for Kampong Cham



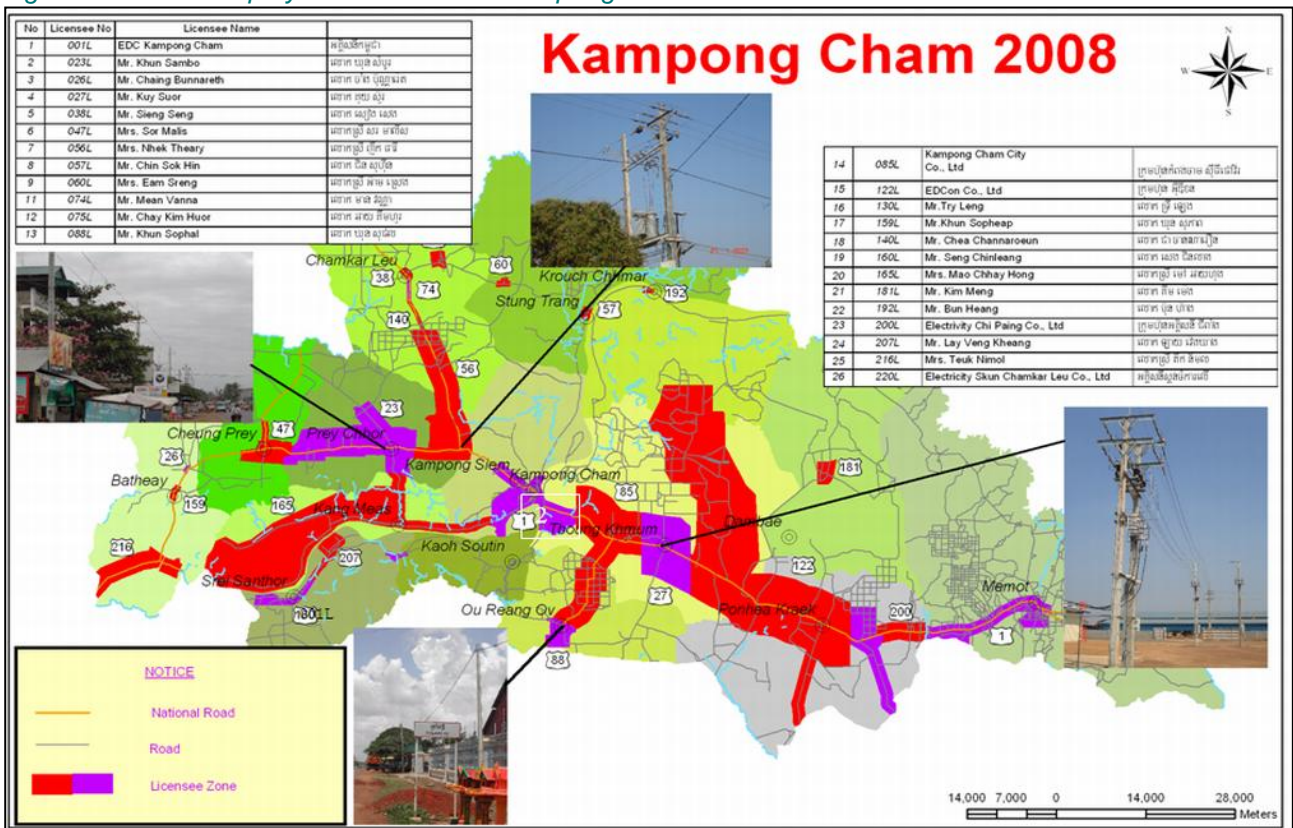
1.3.4 Summary of the presentation by Mr. Yem Piseth, Chief of Distribution Office, EAC

EAC first presented maps of all areas which licensed REEs in Kampong Cham cover, the number of customers and source of electricity, either from diesel or from EDC grid. Now about 8 REEs retail electricity provided by the medium voltage line from Vietnam.

EAC also presented a few new policy matters. REEs are now charging over \$0.50 cents per kWh to their customers. Once they are connected to EDCs grid, which wholesales electricity for about \$0.15 cents, REEs are given the opportunity to keep the electricity price over \$0.25 for a while in order to create a basis to extend grid connections to more distant and remote households. REEs are also summoned not to connect only the most profitable areas but need to connect villages further away as well; if they do not, EAC might not renew their license.

EAC is also in the process of a new regulation regarding the size of the REEs. Smaller REEs in one area are summoned to become one larger REE stretching larger areas in order to reduce costs and increase efficiencies.

Figure 4: Current map by EAC of REEs in Kampong Cham



1.3.5 Questions about the presentations

Question: In the maps presented some REEs are connected but in reality they are not?

Answer by EAC: The maps presented are plans and not reality.

Question: If an REE has a network up to EAC standards can it connect with grid electricity?

Answer EAC: In principle yes, but it depends on the capacity of the line. The line from Vietnam for instance has not enough capacity now to connect more REEs or provide electricity to Kampong Cham.

Answer MIME: Many of the high voltage lines are private investments, the REEs need to negotiate with EAC/EDC/MIME and the private investor about the price and options for connections. But in general MIME and EAC have the aim to connect as many households in rural areas as possible.

Question: Once the 230 kV connects to Kampong Cham, can we connect with it?

Answer MIME: The 115 kV line from Vietnam will already have much more capacity to connect larger areas and many more REEs. Once the 230 kV line connects Kampot with Phnom Penh and Kampong Cham this will also increase the supply to Kampong Cham.

Question: DIME Kampong Cham, can we get the GEOSIM software?

Answer: IED has provided licenses to MIME, REF, EAC and EDC. Private institutions have to purchase the software.

Question: Is EDC using the GEOSIM software?

Answer EDC: There are so many different software tools and EDC is using a different software and not the GEOSIM software.

During the break some participants were asked their opinion about the workshop. Most answered that the information provided in the presentations was new to them. They had heard about grid extension plans but they were not sure if their REE could be connected and what the standards would need to be to distribute electricity from the EDC grid.

1.3.6 Summary of the presentation about Renewable Energy in Kampong Cham by Mr. Rogier van Mansvelt, Rural Energy Consultant

As part of this presentation a handout was provided with the electricity prices in Vietnam to show how cheap electricity is for commerce, industry, irrigation and households. The high electricity prices in Cambodia make competition with any production process difficult. About 1/3 of the produced rice paddy is exported to Thailand and Vietnam as rice milling is much cheaper there. Most processed foods and a large part of the agricultural products and vegetables are imported from Vietnam and Thailand. If Cambodia wants to be more competitive, electricity prices need to be reduced. Currently prices are on average about 10 times higher compared to neighboring countries.

A slide about the JICA Master Plan for Electrification was presented showing an estimated potential for over 3,000 biomass gasification systems. Now only a very few REEs use biomass gasification.

Type of Electrification	No. of Candidate Villages	No. of h.h. to be electrified by year 2020	Total Cost	Total Cost per h.h.	Fund Source of Capital Costs		
			(\$1,000)	(\$/h.h.)	Subsidy	Equity	Loan
Electrified as of 2005	2,062	(350,345)	-	-	-	-	-
Newly Electrified by Grid	6,411	600,000	280,140	467	70,035	42,021	168,084
MHP/Hybrid	137	9,000	11,064	1,229	5,532	1,106	4,426
Biomass	3,071	168,000	99,498	592	24,875	14,925	59,699
Diesel	392	23,000	9,760	424	2,440	2,440	4,880
Sub-total of Min-grid	3,600	200,000	120,322	602	32,847	18,471	69,004
Solar BCS	1,720	60,000	21,045	351	19,993	1,052	0
SHS(World Bank)		12,000	5,520	460	1,380	1,380	2,760
Sub-total of off-grid area	5,320	272,000	146,887	540	54,219	20,903	71,764
Village data unknown	121	-	-	-	-	-	-
Total	13,914	872,000	427,027	490	124,254	62,924	239,848

The IED study also identified that among the off-grid options biomass gasification would be the best option. For Prey Chor for example a 220 kW rice husk gasification system was identified with an estimated cost of 1.4 million dollars and an electricity price of \$ 0.35 per kWh. In reality this REE first constructed a gasifier on its own and later ordered one from SME-Renewables. After less than a year the REE did not pay the monthly fee that should easily be paid out of the diesel savings (up to 75%) and SME took the gasifier back. The investment in the SME-Renewables gasifier was about \$70,000. For ice plants the payback time of gasifiers is much shorter as they run full load for 24 hours a day. Now several ice plants have constructed their own gasifiers for around \$20,000.

Table 14: Biomass projects in isolated mode with possible diesel back-up

Site	A	B	C	D	E
District	Cheung Prey	Prey Chhor	Tboung Khmum	Stueng Trang	Stueng Trang
Type of residue	Rice husks	Rice husks	Rice husks	Offcuts	Offcuts
Installed capacity at the site	330 kW	220 kW	194 kW	27 kW	144 kW
Cluster settlements number	6	4	4	1	1
2009 Population covered	7 131	4 443	3 543	2 667	2 827
Energy from biomass (average on planning period)	59%	61%	63%	15%	61%
Total invest. (Years 1 & 2)	1 260 268	776 188	625 980	384 788	558 712
Total investment ¹⁴ over the planning period ¹⁵ US\$ (excluding maintenance)	2 237 057	1 408 785	1 173 117	766 550	1 012 497
Fuel (dual fuel + back-up) cost over the planning period US\$	2 135 974	1 238 237	932 395	1 754 442	771 652
% of total investment	95%	88%	79%	229%	76%
Levelized cost (US\$/kWh) (residue cost: 7\$/T)	0,35	0,34	0,34	0,44	0,37
Levelized cost (US\$/kWh) (residue cost: 10\$/T)	0,35	0,35	0,35	0,44	0,37

The presentation concluded with barriers for gasification for REEs:

- The first barrier is the source of supply. Rice mills can use rice husk but REEs and ice plants that have gasifiers (mostly 'home made') are at present using rubber wood. The rubber tree offcuts come from old plantations. Not much old rubber trees are left as old plantations are from before the Khmer Rouge regime and most plantations have been replanted during the last few years. Already some ice plants use hard wood from land clearing that also contributes to deforestation. GERES Cambodia estimated that the rubber wood supply would dry up during 2010.
- Rice husk gasifiers are more complex and not easy to build and REEs and ice plants do not have their own rice husk supply such as rice millers do.
- There is not yet a good solution for the tar that is a waste product from gasification. Some REEs have created a small environmental disaster in their backyard.
- The gasifier is dangerous, in one case someone died who went inside a 'home made' gasifier and died as the gasifier was still full of carbon monoxide.

- The efficiency of the gasifier is best at a high constant load. REEs only have a short peak load between 6 and 10 pm. This requires a much too large gasifier or high diesel consumption during the peak load. Industrial electricity or power demand during the day could improve the efficiency. This makes the viability for rice mills (which run about 12 hours a day for 10 months) and especially ice plants (running 24 hours a day, 12 months per year) much higher.
- High prices of imported equipment and low quality of locally constructed gasifiers, no standards or quality check: only the imported gasifiers from SME-Renewables come with a well designed finance, guarantee and maintenance scheme.

Once a national grid is constructed, biomass gasification and biogas plants could increase their economic feasibility in Cambodia, as EDC might be interested to purchase electricity for about \$0.10 per kWh. Now the price of electricity production of IPPs (Independent Power Producers) is much higher and the transport cost through private constructed lines also. The existing rice mills with gasifiers might be interested to mill rice during the night and to sell electricity to the grid during the peak hours.

In Thailand an additional feed-in tariff is provided to boost decentralized renewable energy production by small power producers and although the prices are still lower than those in Cambodia the number of initiatives in growing fast. In Cambodia such a system is not yet developed and could be very attractive to both EDC and local entrepreneurs.

1.3.7 Group Discussions

After a break the participants were divided into four groups to discuss a list of questions prepared by the organizers (see Annex 1).



The first question answered is that REEs were not aware of national and local grid extension plans and found the workshop very useful to get an overview of the plans. The main benefits for REEs to get a grid connection are the lower price and the potential for grid extension and resulting larger number of customers. Barriers related to grid connection are the lack of funds with reasonable loan conditions and the lack of standards of the current REE grids; only with descent standards EAC allows REEs to connect to EDCs grid. Another issue is that even when a new grid is constructed only a small percentage of (usually the richer) households connect and it takes a long time before most people have the money to pay the connection cost, which is often only about \$20-\$50 but families also have to pay for in-house wiring and new 220V appliances. But with grid connection, many more households can afford the much cheaper electricity from ~\$0.70 to ~\$0.30 per kWh and therefore also may find the money to pay for the connection fee. For smaller REEs with about 200 household connections the problems are bigger; a higher price has to be charged (~\$0.80 per kWh) and they make hardly any profit. The REEs are in need for training and investment funding and request MIME/EAC/EDC to provide soft loans and technical support.

The subgroup on gasification had one ice plant owner who said that if EDC would be able to sell electricity for \$ 0.12 cents per kWh, the ice plant would stop using gasification and purchase grid power. On the question whether electricity should be the same price in the country for all households, the subgroup answered that this is impossible with the high diesel price. On the question if it would be possible to reach 70% of the households by 2030, the last subgroup answered that this is based on a decision from EDC to develop the medium voltage network.

The overall evaluation of the workshop was very positive. According to the participants the workshop was very useful, speakers good and the premises of the workshop, the hotel rooms, food and drinks were also evaluated as good. On the question why they joined the workshop, the following answers were given:

- 1- Study about electrical technology (2 times)
- 2- Get more technical knowledge and experiences (3 times)
- 3- Get more technical knowledge for a better business
- 4- Try to understand energy development in Cambodia (4 times)
- 5- Want to get the instruction for electricity
- 6- Want to get information from EDC
- 7- Want to understand EACs principles
- 8- Get the advantages for getting a license
- 9- Develop rural electrification rapidly
- 10- Want to know about the grid expansion
- 11- Try to understand rural electrification development (2 times)
- 12- Get new and good knowledge
- 13- Get new technology to develop own business
- 14- Get knowledge about grid standards (2 times)

The aim of the workshop to inform REEs and battery charging stations about grid extension plans in Kampong Cham was well received by the participants, as most of them were interested to learn more about exactly these issues. Although EDC and EAC try to inform REEs about extension plans this is most of the time only a few months before plans are implemented. During this workshop REEs could actually see if it might take a few years or only months before they could be connected to the grid. Based on the information REEs could make investment plans, for instance to wait of purchase new diesel gen-sets or to concentrate on grid standards improvement and grid extension.

1.3.8 Conclusions of the workshop

The workshop results highlight the issues and circumstances of REEs in rural areas. Low qualification, limited resources for investment, high interest rates, high prices of diesel and relatively small number of customers with low energy demands result in REE businesses that are often rather trying to survive than 'thriving businesses with plans to connect a high number of households that are basically waiting to be connected'. Once REEs construct new lines many households cannot afford to pay for the connection fee, leaving the REE with long lines with low energy consumption. Once REEs are connected to the grid the price of electricity can be reduced, households will consume more and poorer households can connect too.

Main conclusion from the workshop discussions and evaluation form is the high training and investment need. Existing finance is too expensive and payback time too short. Without appropriate additional finance REEs will not be able to undertake much grid extension. The evaluation of the workshop clearly shows the high training needs and guidance needed in all aspects: from the operation, optimizing efficient generation and distribution, calculating best options for extension, all in a way to realize growth in grid extension and quality and making viable businesses.

The feedback in the evaluation forms provides more specific guidance to needs and issues related to REEs and rural electrification.

1.4 Stakeholder interviews

The second main activity undertaken was a series of interviews with the principal planning institutions in Cambodia to discuss outcomes of the provincial workshop and barriers for rural electrification, including how to address them in future plans and activities. A list of questions (see Annex 3) was used to guide the interviews.

1.4.1 Interview with Mr. San Vyrian, REF

The main activities undertaken by the REF were to provide a \$45 subsidy for 50,000 new household connections to REEs. The REF has commitment and contracts with REEs for all the 50,000 new household connections, but they are not yet all connected. A difficulty for REEs is that they receive the first payment once they connected 40% of the requested number of households. In practice REEs find that not as many households as expected pay the connection fee once their distribution line has been constructed. The household connection fee and in-house wiring and basic appliances cost is still a burden for poor households.

The second main task of the REF is to deliver 12,000 solar home systems. Recently the initial subsidy of \$100 per system has been converted into a rent-to-own system based on the Laos model. The REF will hire consultants to develop a suitable rental scheme for Cambodia. In the new rental system the Cambodian Government will bulk purchase the solar home systems and companies can bid to undertake the rental system.

The REF has also a hydro subsidy scheme for micro hydro plants, but only a very few sites have been identified.

The REF has also funds for additional training of REEs that will be a follow-up to the World Bank-ESMAP basic training program. The idea is that training organizations, for instance EDC Training Center and CKN, will provide hands-on training at the REEs to help implement the knowledge obtained during the previous basic training program.

1.4.2 Interview with Mr. Re Seha, Director of SME-Renewables

In 1996 SME-Cambodia, with support from CIDA and later also funds from UNDP, installed a gasification unit in Anlong Tamey, Battambang Province. The system runs on Leucaena wood from plantations around the village. One year later SME-Cambodia installed a 150 kVA rice husk gasifier at a rice mill. During the last years the interest of rice mills has been enormous and over 30 gasifiers have been installed. As this became more a commercial activity SME-Cambodia registered the company SME-Renewables. Gasifiers are especially of interest for rice mills and ice plants as they have a high capacity load over a long period of time (rice mills 12 hrs/day for 10 months/year, ice plants even better 24 hrs/day full year round).

SME-Renewables has now installed 3 gasifiers at larger REEs servicing around 700 households: they work fine and the REEs are content. Another gasifier was installed in Prey Chor, which is also listed as an option in the IED report for renewable energy electricity generation in Kampong Cham. The REE owner bought one system from SME-Renewables but it was not well maintained, the wood too wet and the diesel engines old. The owner was not able to pay back the loan and SME-Renewables took back the gasifier. The REE owner was also busy trying to copy the gasifier himself. According to Seha the economic viability is still reasonable for these 3 REEs: although they do not have similar short pay-back times as ice plants and rice mills, gasifiers can still be economically viable for larger REEs.

Cambodia recently reduced the import tax on gasifier systems from 15% to 0%. As a consequence, SME-Renewables is able to reduce the cost of a system from \$80,000 to around \$64,000. They are still negotiating to lower the 10% VAT. Although they did not make many sales during last year they were busy keeping the installed systems working and now, since the diesel price is increasing again, the market interest for gasifiers will also grow. Another way to reduce cost is to look at local production of (part of) the equipment in Cambodia, for example the filtering system.

There are several copy gasifier models in Cambodia; they are reasonably good but the operators need to maintain the diesel engines every few months as more tar and water comes into the engines. The operators have found ways how to deal with these issues and can make a much more profitable business. Some home-made gasification producers explain nice stories about how they gained the experience building gasifiers during the Khmer Rouge Regime with Chinese technical assistance, many try to show their skills and even mention they went abroad to learn the technology in India to impress potential buyers. But local manufactures cannot offer similar quality guarantees, maintenance and finance options that SME-Renewable offers, so the organization is not too worried about these local manufacturers. It would be interesting to see if EDC would like to buy electricity from rice mills as they now only use 25% of their available rice husk.

1.4.3 Interview with Mr. Theng Marith, head of Electricity Regulation Department

REEs are informed about the grid expansion by EdC or by any private company. When the information is available, EAC also informs the REEs or anyone who maybe concerned. They try to inform them in advance, before the implementation of the grid expansion, so the REE can improve their infrastructure up to standards required for grid connection, on time.

Once REEs get grid connection the electricity price to customers will not directly be the lowest possible in order for the REE to recover the investment cost of upgrading and extending the grid. The REEs are also requested to connect areas with lower economic benefit. Based on experience the electricity consumption will increase about 3 to 6 times after grid connection as a result of the lower electricity price. After one year, the cost will be further reduced.

If grid expansion is implemented by EdC, the electricity tariff will directly be reduced to about 1100-1200 Riels/kWh. But if an EAC licensee implements the grid expansion, EAC should adopt a gradually falling-down tariff. The benefits for the customers are: (1) Quality of voltage; (2) 24 hours supply service; (3) Low tariff, stable (less depending on fuel price); (4) New connections as EAC pushes licensees to expand the distribution zone.

The main problems related to rural electrification are financing the investment. To support investment EAC allows licensees to gradually reduce the tariffs, so an REE can faster depreciate their assets and make new investments.

The main role of EdC is bulk sale of electricity to an EAC licensee. EAC will also undertake zone expansion in some provinces without REEs. EAC has no role in grid extension planning and is considering an operator planning tool as they will have hundreds of licensees more to manage in the future with all new grid extension plans and new private investors for both generation, transmission, distribution and new REEs for household connections each having their own license.

In order to minimize the above mentioned difficulties EAC will, before issuing licenses, require an up to standard infrastructure, an as large as possible distribution zone including towns, business centers but especially the surrounding villages. The main difficulty and at the same time challenge is to extent the network and planning has to be done case by case.

People do not seem to understand well the objective or goal and the difficulties in achieving this. In many cases there are safety issues and conflicts of interest such as: cutting and trimming of trees, house building that does not follow the urbanization norms etc.

Once small REEs and battery charging stations are connected to the grid they can lower their tariffs dramatically, often by more than 50%.

Biomass gasification seems still difficult and not yet a feasible option for small REEs, due to the large investment cost, high operating and maintenance costs and a high load difference between base load and peak load.

EAC has the aim to set one electricity price for all, but 'for now we must consider a reasonable return on investment for the private investors'. The aim is to reduce tariffs as much as possible, but at present prices are depending on the source of generation or import per region. Once all zones are connected to the National Grid, the price may be one for the zones connected to the same source.

1.4.4 Interview with Mr. Badri Rekhani, World Bank Advisor to EAC

Mr. Badri Rekhani mentioned a few interesting points, after the CAP REDEO planning process was explained. He said that the main problem is that EDC, MIME and EAC only have limited planning capacity. Planning depends on donor funding and on private sector initiatives. The government has no funding to pay for grid extension and therefore the need for planning does not seem to be very high. The most logic planning or reality for grid extension is to follow private investors' interest, but this might not be the most adequate approach looking at for instance poverty reduction. EAC tries to coordinate and also support the reduction of electricity cost in rural areas. Once larger grid connections are established and REEs are connected to the national grid, the cost of electricity can come down.

Related to licensing and the role of EAC, as a result of hundreds of private investors and operators, EAC will have a tremendous job in the future to provide each small investor with a license (individual investors sometimes only own one transformer). The need for up-scaling is very important. EAC is already promoting REEs to join together and form larger district enterprises.

About biomass gasification, Cambodia has no feed-in support tariff, so it should be cheaper or similar to the IPP price which is around \$0.11 per kWh. Regarding solar systems it remains to be seen whether the Laos rental system will work in Cambodia.

1.4.5 Interview with Mr. Chan Sodavath, operating managing director EdC

The National Grid is extending fast and EdC is aware of the growing planning needs. At present EdC uses the PSS adapt planning tool, which can also be used to optimize investments, to calculate load flow and to analyze short circuits and for selection of construction materials, size of conductors, transformers etc. For distribution EdC uses PSS-E and GIS mapping to identify and prioritize projects. EdC is planning to synchronize these tools together.

The GEOSIM software cannot be used for the same purposes and is therefore less useful for EdC. At present EdC has only one key for the PSS software but in the near future they will have another 10 keys for the main centers in the country. For the other EdC centers and especially for REEs the GEOSIM could be very useful, however local centers and REEs need long term commitment from trainers to make sure it will be used properly. IED once trained REEs with an optimized billing tool, but this effort needs follow-up.

The costing figures used in the CAP-REDEO were not based on real (local) figures, but if REEs would know how to use it, they could fill in local prices and that would help them to select connection structures to plan grid extension. At present many REEs do not know how to use a computer so there is still a long way to go.

EDC has a plan to spend about 310 million dollars on medium and low voltage grid extension till 2020. With this money 2.5 million new household connections could be realized, connecting 1,400 villages and in total 11 million people. With this plan the target of the Government to connect all villages by 2020 could nearly be achieved.

EDC has no intention to take over distribution of electricity from REEs but likes to bulk sale electricity to REEs. However in areas where there is no REE EdC might undertake distribution, although this has not been worked out in detail yet. It could also be that neighboring REEs will extend their service area. In the 310 million investment plan about 200 million is for 22 kV medium voltage and 60 million for low voltage distribution; the rest for infrastructure, transformers etc.

In the JICA Master Plan the grid extension from the center was around 40 km; EdC will extend to at least 90 km. As a consequence the losses might be higher and the voltage drop also, but it will only be about 1 MW, which is considered relatively small on the overall network and more distant remote villages will be able to enjoy 24 hour grid connection.

Decentralized grid feed-in is very interesting. JICA installed a 200 kW solar system at the Phnom Penh public water company that is synchronized with the grid but not yet reverse synchronized, so in case not all the energy is used it could be sold to the grid with net-metering.

At this time EDC is discussing the opportunity for a 5 MW rice husk generation plant in Battambang but there are no clear estimates about the total amount of rice husk available in that region. Rice husk is also used by

the brick industry, especially in Battambang. A price of around \$0.10 per kWh would be interesting if sold directly into the Battambang grid, as the price from Thailand after distribution is higher.

1.4.6 Training of REES

During the World Bank ESMAP program which ended in April 2009, all licensed REEs in Cambodia have been trained by CKN and EDC Training Center. CKN put together a mobile training for REEs including generator lines, capacitors, and end user connections. During the training REEs learned how to measure and reduce distribution losses and how to optimize system performance. CKN organized trainings in Bantey Menchey for REEs in the North West of Cambodia and one training in Skun for REEs in the Middle and North East of the country. EDC Training Center organized two series of trainings for all areas in the Middle and South of Cambodia. Each training session was conducted during 3 weeks, over a 3 month's time period. The sessions were very well organized and included separate classes and subjects for technicians and managers of REEs. The REEs appreciated the trainings very much and some realized savings up to 20% immediately after the training. The World Bank ESMAP program suggested that follow-up training for each REE could help them to make customized plans for improvement and to actually implement what was taught during the training. An evaluation a few weeks after the training found out that many REEs were not confident to implement the improvements, although many already bought capacitors etc. The World Bank has now allocated money for additional training to REEs which will be coordinated by the REF.

1.4.7 NGO Forum

NGO Forum is a network of NGOs that tries to lobby issues supported by groups of member NGOs. Since several years it follows the large hydro dam development in Cambodia as they affect a large number of people and according to them the mitigation options listed in the Environmental Impact Assessments are not taken seriously by the private investors who build these dams. NGO Forum wants the Government to be stronger to demand these mitigation options or even to halt the projects if there is too much environmental or social damage. As the government has no funding to support mitigation options, there is limited interest to insist companies to undertake them as the investors might withdraw.

On October 27th NGO-Forum organized a national workshop on "Powering the 21st Century Cambodia: Rethinking Cambodia's Energy Future Workshop". A booklet was published with the same title in which it strongly argues for local renewable energy generation and distribution. According to the booklet, large hydro dams and coal fired plans and construction of a National Grid would follow the standard development of western countries while Cambodia has a chance to invest in local options that are more affordable. The publication only mentions biomass, solar and small hydro as options, but there are no economic analyses of the feasibility of these options and no estimates of the total potential of each of these technologies to contribute to the expected increase in demand.

1.4.8 Solar Companies

There are a hand-full of solar companies in Cambodia, of which Khmer Solar and Kamworks are the most active ones in providing solar systems for rural households. Khmer Solar has already sold a few thousand systems over the last couple of years. According to this company, solar is only an option for those rural households who have enough money; families with a motorbike and a color television might buy a solar system. Most of these households require an 80 Watt-peak panel which provides enough power to watch a color TV.

The most common practice of Khmer Solar is to sell only the solar panels, cables and charge controllers at district markets from a mobile truck. Families that purchase the panel already have a battery and know how to install the system themselves. A telephone number is provided in case they have problems installing the panel, but according to Khmer Solar about 90% can install the system without any problem. Without a new battery and the cost of installation, the price of the 80 Watt system is much cheaper and that is what most rural families like and choose for.

Kamworks installs high quality systems for NGOs and institutions. It also develops solar lanterns and recently launched "The Moonlight", a small handy and trendy LED lantern with a small 0.7 Watt solar panel that can be used to replace kerosene lighting and has a high lighting mode for reading, a middle mode for

eating and a low mode that can burn the whole night. The retail price is \$20 which is still a bit high considering the ability to pay of the target group, but might be further reduced if the production is increased. To offer this lantern to rural poor families a payment scheme needs to be developed, as poor families only spend around \$2 per month on kerosene.

As the import tax on solar equipment has been reduced from 35% to 7%, the price of solar panels can be reduced substantially. The import tax on other renewable energy equipment such as gasifiers has been reduced from 17% to 0%.

1.4.9 Battery charging stations

Battery charging stations use generally very old, sometimes even classic one cylinder diesel engines with a few diodes cooled by a household fan and linked up to some 30 or sometimes 100 batteries. If one would calculate the cost and potential energy from diesel, one would realize that each battery is only about half full once returned to the owner after a 5-6 hours charge. Smaller batteries get effectively more energy at a lower cost and large batteries pay more for about the same amount of energy. This seems an interesting unintended cross subsidy as richer families have larger size batteries. The charging owners have hardly any knowledge about electricity and would not be able to calculate the total amount of diesel energy and how much amp-hrs per battery potentially could be charged. The only thing they know is how much they will get at the end of the day and make sure not to spend more on diesel. Often the diesel engine runs at a very low 'revolutions per minute' with dark smoke filling the house of the battery charger's family as exhaust pipes are often not connected. The incredible loud sound of the engine makes it easy for someone to find where the charging station is.

Even given the above circumstances, rural household are generally very content about the battery lighting and the amount of hours of television (mainly black and white) and lighting they get from it. Most families bring the battery about 2-3 times a week and pay about \$0.30 per charge. On average the battery has to be replaced in less than two years, which add at least 2 dollars per month to the total cost for electricity.

Owners of battery charging stations would like to learn more about how to increase efficiency of their system. Investment in new charging sets could increase efficiency but such an investment is unlikely to be paid back from the low charging fees. As still about 1.5 million families in Cambodia rely on battery charging for lighting, the need to improve this mostly forgotten sector is high. There might be as many as 5,000 to 10,000 battery charging stations nation-wide.

2 CONCLUSIONS AND RECOMMENDATIONS

2.1 Conclusions

Electrification rates in Cambodia are lagging far behind compared to those in Thailand, Laos and Vietnam and prices of electricity are much higher. Until a few years ago, not much was happening except for rural electrification plans such as the JICA Master Plan. Since the World Bank and ADB started supporting high voltage lines to Phnom Penh from Vietnam and to Siem Reap from Thailand, private investors have constructed high voltage lines connecting Battambang half way to the grid connection with Thailand and many medium voltage lines are constructed. The medium voltage lines are connecting the main district centers areas around Phnom Penh along the main roads and enable the connection of large numbers of households that before either had no electricity or expensive electricity from REEs; in doing so the price drops by half from around \$0.70 to around \$0.30 per kWh. This makes all kinds of productive uses and household industries more competitive with those in the city who only pay about \$0.20 per kWh.

MIME has also developed a master plan for grid electrification and contracts are signed for the most important high voltage lines and large hydro and coal fired plants. EDC has developed a plan to connect 2.5 million households to its grid, including households currently connected by REEs, at an expected cost which seems much lower compared to the cost estimation in the JICA Master Plan.

Within this context the CAP-REDEO electrification planning project was a small contribution to electrification in the country and has resulted among others in capacity building of MIME, EDC and EAC staff. However none of them is planning to use the software tool as it is not their responsibility (MIME is responsible for planning the National Grid and EAC for licensing) and EDC, for whom the planning tool might be most appropriate, is using other GIS software with similar features such as load and investment optimization. EDC suggested that regional EDC offices and REEs would need training and perhaps appropriate software packages to plan grid extension and cost optimization at the local level. GEOSIM could be useful if local prices are used to help REEs select where to develop grid extension. A few single training modules would not be enough to make people use the software: long term commitment for support is needed as most REEs never used a computer. Training needs to optimize the current system are more urgent and could result in direct savings.

REEs and battery charging stations in particular are not yet making a lot of money and have difficulties in finding financial resources for extension and improvement. There is a high pressure now both from EAC and the local population to speed up grid connections, national and international investors are searching for electrification projects and small REEs have to make up their minds to either form larger networks with REEs in neighboring zones or run the risk to be taken over by larger investors. EDC has not the intention to take over REEs, but EAC is developing stronger policies to create more efficient distribution and scaling-up of networks, demanding REEs to connect also more distant villages. EAC will have an extremely difficult job balancing between hundreds of REEs that need to make a small profit to remain in business and the hundreds of distributors that also demand a return on investment. With the extending grid and more private investors interested in the sector, their role will be more and more challenging and important.

Renewable energy, especially biomass electricity generation from rice husk, might have good prospects in Cambodia as the price of electricity which EDC has to pay to private IPPs and distributors is relatively high and EDC is interested and will develop a feed-in policy. This offers good opportunities for instance for rice mills with biomass gasification systems to run their mills during off-peak hours and provide peak electricity to the grid.

Even if the government target of '70% of all households by 2030' is reached, a few hundred thousand families will not be connected to the grid. For them, better quality battery charging, solar lanterns and solar home systems are probably the best options and systems need to be developed to provide equal investment support. Often millions of dollars are paid for grid extension but only a few millions for off-grid solutions: these should be balanced based on numbers of households. Lately consultants hired by the World Bank presented a Rural Electrification Strategy and Implementation Plan estimating the average grid connection

cost over \$500 per household. A solar company representative suggested that 'for that money you could give a solar home system for free and no more cost to pay for years to come'. These alternative options should definitely be included in such strategies and implementation plans.

2.2 Recommendations

The recommendations are based on issues raised during the workshop and interviews and have been elaborated into suggestions for project activities to support rural electrification:

1. Technical training and investment support for REEs;
2. Electricity planning needs;
3. Improve battery charging services;
4. Solar home systems and solar lanterns business development;
5. Study feasibility of decentralized renewable energy electricity generation.

1. Technical training and investment support for REEs

Present capacities of REEs are still extremely low. The rapid development of the national grid puts a high pressure on REEs to prepare for grid connection. Without a good distribution network up to grid-standards, the REEs will not be able to connect to the National Grid and their license might not be extended. The REEs need to increase the efficiency, management, maintenance, safety, standards. At the same time REEs need to extend the coverage areas and need investment funds with reasonable finance and loan terms.

2. Electricity planning needs

GEOSIM training similar to the one developed for Kampong Cham is not the most optimum support and should be more integrated in existing planning processes and should take into account the level of skills of REEs and local government and utility agencies. EdC recommended that the GEOSIM software tool could be useful for REEs and local EdC offices that will not use the more advanced software of EdC. However such training efforts need long term commitment and follow-up support. Most REEs do not know how to use a computer or have only basic skills, so for most of them an advanced software planning tool is not appropriate.

3. Improve battery charging services

Battery charging stations have been widely neglected by donors and support agencies, despite the fact that they continue to provide electricity to most rural households. Support to battery charging stations to select appropriate generators and energy sources, optimize charging, recycle batteries, and safe treatment of acids could improve the now often precarious charging methods. Coaching and other business development support for these small entrepreneurs could improve their business performance as well as the services to the rural customers.

4. Solar home systems and solar lanterns business development

Several successful solar lantern schemes have been developed in Cambodia, but business development support and appropriate funding are required to launch larger scale production and distribution of the lanterns in Cambodia. In general, a variety of business models adapted to the local institutional context need to be developed to offer a variety of solar products and services in line with the needs of the rural customers.

5. Feasibility study of decentralized renewable energy electricity generation

Implementation of a study to analyze the feasibility of feed-in based on local renewable energy resources and study on the availability and present utilization of biomass resources in the country. The economic benefits of mini-grids using biomass gasification could be increased if connected to the National Grid. The existing decentralized systems are only running for a few hours a day and the actual capacity used is only approximately 10%. The National Grid could also benefit and become more stable by several local feed-in plants. The opportunity in Cambodia is very high as production and transport costs of electricity are already high and subsidies in the form of special feed-in tariffs such as in Thailand are not needed.

ANNEXES

Annex 1 Discussion groups on recommendation for government planning agencies

Discussion groups on recommendation for government planning agencies

(ក្រុម ពិភាក្សាផ្តល់មតិយោបល់សំរាប់ស្ថាប័នរៀបចំធ្វើផែនការរបស់រដ្ឋាភិបាល):

1. EDC and role of REEs (អគ្គិសនីកម្ពុជា និងតួនាទីរបស់សហគ្រាសអគ្គិសនីជនបទ)
2. DIME and role of small REEs and Battery charging stations (មន្ទីរឧស្សាហកម្ម រ៉ែ និងថាមពលខេត្តកំពង់ចាម និងតួនាទីរបស់សហគ្រាសអគ្គិសនីជនបទតូចៗនិងអាជីវកម្មសាកអាគុយ) និងថាមពលខេត្តកំពង់ចាម និងតួនាទីរបស់សហគ្រាសអគ្គិសនីជនបទតូចៗនិងអាជីវកម្មសាកអាគុយ)
3. Biomass gasification and electricity price (ផលិតកម្មឧស្ម័នជីវម៉ាស និងថ្លៃអគ្គិសនី)
4. Main barriers to connect rural areas (បញ្ហាសំខាន់ៗដែលឥតភ្ជាប់ទៅតំបន់ជនបទ)

Questions /issues to discuss during break out session (សំណួរឬបញ្ហាសំរាប់បែកចែកក្រុមពិភាក្សា)

Group 1: EDC and role of REEs (ក្រុមទីមួយ គឺអគ្គិសនីកម្ពុជា និងតួនាទីរបស់សហគ្រាសអគ្គិសនីជនបទ)

- Is it clear for REEs when the National Grid will connect to them? (តើដឹងច្បាស់ទេ នៅពេលណាបណ្តាញជាតិនឹងភ្ជាប់ទៅសហគ្រាសអគ្គិសនីជនបទ?) **Answer:** No information, just learnt from workshop.
- What are the benefits of getting grid connection (តើមានសារៈប្រយោជន៍អ្វីខ្លះនៅពេល មានបណ្តាញជាតិ?) **Answer:** Low investment, the price of electricity is lower, grid extension is larger and customers are bigger.
 - Investment to connect to grid (វិនិយោគតភ្ជាប់ជាមួយបណ្តាញជាតិ)
 - Electricity price change (ការប្រែប្រួលថ្លៃអគ្គិសនី)
 - Customer benefits (ផលប្រយោជន៍អតិថិជន)
- What are problems when connected to the grid (តើមានបញ្ហាអ្វីខ្លះនៅពេលភ្ជាប់ជាមួយ បណ្តាញជាតិ?) **Answer:** Lack of investment costs and lack of technical problem in terms of grid connection.
 - Investment in grid upgrading (វិនិយោគពង្រីកបណ្តាញ)
 - Investment in medium voltage line (វិនិយោគខ្សែតង់ស្យុងមធ្យម)
- What are issues related to EAC and licensing (តើមានបញ្ហាអ្វីខ្លះទាក់ទងជាមួយអាជ្ញាធរ អគ្គិសនីកម្ពុជា និងការចេញអាជ្ញាប័ណ្ណ) **Answer:** Following electric technical standards promulgated by MIME.

- What are main barriers to connect more people to your grid (តើឧបសគ្គសំខាន់ៗអ្វីខ្លះ ដើម្បីភ្ជាប់អតិថិជនច្រើនជាមួយបណ្តាញជាតិ?) **Answer:** Financial and technical problem in terms of connection to the grid.
- Formulate recommendations for MIME/EAC/EDC (រៀបចំមតិយោបល់សំរាប់ MIME /EAC/EDC) **Answer:** Provide funding and technical training.

Group 2: DIME and role of small REEs and Battery charging stations (ក្រុមទីពីរ គឺ មន្ទីរឧស្សាហកម្ម រ៉ែនិងថាមពលខេត្តកំពង់ចាម និងតួនាទីរបស់សហគ្រាសអគ្គិសនីជនបទតូចៗនិងអាជីវកម្មសាកអាគុយ)

- What are problems for small REEs (តើមានបញ្ហាអ្វីខ្លះសំរាប់សហគ្រាសអគ្គិសនីជនបទតូចៗ?)
 - How many customers each of the participants (តើមានអតិថិជនប៉ុន្មាន សំរាប់សហគ្រាសអគ្គិសនីជនបទនីមួយៗ?) **Answer:** In average, 200 households
 - What is the price to charge per kWh? (តើថ្លៃថាមពលអគ្គិសនីប៉ុន្មានក្នុងមួយម៉ែត្រគីឡូវ៉ាត់?) **Answer:** In average, 2700 reils/kWh
 - Plans for extension (ផែនការសំរាប់ពង្រីកបណ្តាញ) **Answer:** Lack of investment funding and technical training
- What are problems, issues (តើមានបញ្ហាអ្វីខ្លះ?)
 - price of Battery charging, make some profit or not? (ថ្លៃសាកអាគុយ តើមាន ចំណេញ ឬអត់?) **Answer:** Low profit
 - clients, more or less (អតិថិជនច្រើន ឬតិច) **Answer:** Less
- What are needs to increase service (តើត្រូវការអ្វី ដើម្បីបង្កើនសេវាកម្ម?)
 - Investment needs? (ត្រូវការវិនិយោគ) **Answer:** Investment funding
 - Training (ត្រូវការបណ្តុះបណ្តាល) **Answer:** Training need
- What is the benefit of grid connection for small REEs and battery charging stations (តើមានផលប្រយោជន៍ក្នុងតភ្ជាប់បណ្តាញសំរាប់សហគ្រាសអគ្គិសនីជនបទតូចៗ និងអាជីវកម្មសាក អាគុយ?) **Answer:** No benefit
- Recommendations for MIME/EAC/EDC (អនុសាសន៍សំរាប់ MIME/EAC/EDC) **Answer:** Providing soft loan and technical supports.

Group 3: Biomass gasification and electricity price (ក្រុមទីបី គឺ ផលិតកម្មឧស្ម័នជីវម៉ាស និង ថ្លៃអគ្គិសនី)

- What is the estimated price per kWh based on (តើថ្លៃថាមពលអគ្គិសនីក្នុងមួយម៉ែត្រគីឡូវ៉ាត់ ផ្អែកលើអ្វីខ្លះ?): **Answer:** In average, 2500 reils/kWh

- Diesel (how much ice per liter of diesel/ or how many liters per day for how much ice (ប្រេងម៉ាស៊ូត : តើផលិតទឹកកកប៉ុន្មានក្នុងប្រេងម៉ាស៊ូតមួយលីត្រឬប្រេងប៉ុន្មានលីត្រក្នុងមួយថ្ងៃសំរាប់ផលិតទឹកកកប៉ុន្មាន?) **Answer:** 50 kg/liter or 150 liters/day for 7500 kg
- How much wood and diesel per day with biomass gasification (price of wood) (តើឈើនិងប្រេងម៉ាស៊ូតក្នុងមួយថ្ងៃប៉ុន្មានសំរាប់ផលិតកម្មឧស្ម័នជីវម៉ាស? ថ្លៃឈើ) **Answer:** Do not know
- By what price ice plants would purchase/connect to the grid. (តើថ្លៃអគ្គិសនីប៉ុន្មានដែលរោងចក្រទឹកកកបានទិញឬតភ្ជាប់ទៅបណ្តាញ?) **Answer:** 450 reils/kWh from EDC
- What is the price REEs can charge with biomass gasification (តើថ្លៃអគ្គិសនីប៉ុន្មានដែលសហគ្រាសអគ្គិសនីជនបទបានលក់ជូនផលិតកម្មឧស្ម័នជីវម៉ាស?) **Answer:** Do not know
- What are problems for REEs to use biomass gasification (តើមានបញ្ហាអ្វីខ្លះសំរាប់សហគ្រាសអគ្គិសនីជនបទដែលប្រើប្រាស់ផលិតកម្មឧស្ម័នជីវម៉ាស) **Answer:** Do not use
- Cost per system self made system (ថ្លៃក្នុងមួយប្រព័ន្ធដែលរៀបចំខ្លួនឯង) **Answer:** Do not know
 - 30 kW
 - 50 kW,
 - 100 kW
 - 150 kW
- Recommendations to MIME/EAC/EDC (អនុសាសន៍សំរាប់ MIME/EAC/EDC) **Answer:** Provide training.

Group 4: Main barriers to connect rural areas (ក្រុមទីបួន គឺបញ្ហាសំខាន់ៗដែលតភ្ជាប់ទៅតំបន់ជនបទ)

- How many km can an REE reach from the generation? (តើចំងាយប៉ុន្មានគីឡូម៉ែត្រពីម៉ាស៊ីនអគ្គិសនីទៅអតិថិជនចុងបំផុត?) **Answer:** 6 km in average
- What to do with people further away? (តើអតិថិជនដែលនៅឆ្ងាយជាង យ៉ាងដូចម្តេច?) **Answer:** Voltage is lower and losses are high
- How to bring electricity to small villages? (តើត្រូវតភ្ជាប់ថាមពលអគ្គិសនីទៅភូមិតូចៗយ៉ាងដូចម្តេច?) **Answer:** To install the voltage distribution 22 kV and 0.4 kV.
- Electricity is now more expensive outside big towns, should there be one price for all households in Cambodia, such as in Laos? (បច្ចុប្បន្ននេះ ថ្លៃអគ្គិសនីមានតំលៃថ្លៃជាងទីក្រុងធំៗ តើគួរមានថ្លៃអគ្គិសនីមួយសំរាប់លំនៅដ្ឋានទូទាំងប្រទេសកម្ពុជាឬទេ? ដូចជាក្នុងប្រទេសឡាវ) **Answer:** Impossible based on diesel fuel cost.

• What would be the role to connect more people, to reach 70% or households by 2030? (តើស្ថាប័នណាជាអ្នកមានតួនាទីដែលភ្ជាប់ជាមួយអតិថិជនច្រើន ដើម្បីទៅដល់ គោលដៅ ៧០ ភាគរយ នៃលំនៅដ្ឋានក្នុងឆ្នាំ ២០៣០?) **Answer: EDC**

- REEs: (សហគ្រាសអគ្គិសនីជនបទ)
- MIME(ក្រសួងឧស្សាហកម្ម រ៉ែ និងថាមពល)
- DIME(មន្ទីរឧស្សាហកម្ម រ៉ែ និងថាមពលខេត្ត-រាជធានី)
- EDC(អគ្គិសនីកម្ពុជា)
- EAC(អាជ្ញាធរអគ្គិសនីកម្ពុជា)

Annex 2: Evaluation Form for Workshop on Rural Electrification in Kampong Cham

At the end of the workshop an evaluation form was distributed and the answers are

1. What is your general impression of the workshop?

Nr.
7 Very Good
20 Good
0 Neutral
0 Bad, please explain

2. What was the reason to join this workshop?

Answers:

- 1- Study about electrical technology (2 times)
- 2- Get more technical knowledge and experiences(3 times)
- 3- Get more technical knowledge for a better business
- 4- Try to understand energy development in Cambodia(4 times)
- 5- Want to get the instruction for electricity
- 6- Want to get information from EDC
- 7- Want to understanding EAC's principles
- 8- Get the advantages for getting a license
- 9- Develop rural electrification rapidly
- 10- Want know about the grid expansion
- 11- Try to understand rural electrification development (2 times)
- 12- Get new and good knowledge
- 13- Get new and technology to develop own business
- 14- Get knowledge about grid standards (2)
- 15-

3. Did you choose yourself or where you asked to join?

Nr.
6 Choose myself
20 Someone asked me to join

4. Was the workshop useful to you?

Nr.
12 Very useful
12 Useful
0 No meaning
0 Not useful, please explain

5. How do you evaluate the speakers?

Nr.
11 Very good
13 Good
2 Neutral
0 Not good, please explain

6. How do you evaluate the workshop place, coffee, water etc?

Nr.
6 Very good
15 Good
5 Neutral
1 Not good. please explain

7. What will you do with your entity on rural energy?

- 1- I need licensees to make electrical business and expand the license zone
- 2- To prepare the grid expansion in line with electrical standard for medium and low voltage(2)
- 3- Related to rural electrification, I plan to expand and find the low cost electricity and adequate generation for the consumers
- 4- I plan to expand the grid to people far away from the road can be supplied electricity(2)
- 5- Grid expansion and decrease electrical cost properly
- 6- Grid expansion for my enterprise
- 7- We need more energy training

8. Any other comments, questions, remarks, or specific wishes?

- 1- How do the organizations related to energy development plan for setting up the same cost? In case of the licensee in rural area cannot sell for the same cost.
- 2- We are the licensee. we do not have more experiences to comply with the standard grid so we need the next workshop to instruct us more
- 3- We need expertise speaker instruct on rural electrification
- 4- We need the rural electrification body help small scale licensee rapidly for expanding the license zone
- 5- We need training for exchanging experiences and fund to get the better grid expansion
- 6- Rural electrification body should fund and technical support to licensees
- 7- We need EAC to support the training
- 8- We need more workshop to get more knowledge(3)
- 9- Why do we have to pay for battery charging service?
- 10- We need EDC, EAC to organize other workshop and fund

Annex 3: Leading questions for interviews

1. Are REEs informed when the National Grid will connect to them?
2. What are the consequences of getting grid connection
 - A. Cost
 - B. Electricity price change
 - C. Customer benefits
3. What are problems when REEs are connected to the grid
 - D. Investment in grid upgrading
 - E. Investment in medium voltage line
4. What are the guidelines for grouping together of small REEs
5. Role of EDC and household connections
6. What planning tool are you using
7. Are you going to use the IED planning tool, why (not)?
8. What are issues related to EAC and licensing
9. What are main barriers to connect more people to your grid
10. What are main responsibilities for
 - F. MIME/EAC/EDC
11. What is the main difficulty for
 - G. MIME EAC EDC

The role of small REEs and Battery charging stations;

12. What are problems for small REEs not licensed by EAC
13. What are problems, issues of Battery charging stations
14. What are needs to increase service, who's role
 - H. Investment needs
 - I. Training
15. What is the benefit of grid connection for small REEs and battery charging stations

Role of Renewable Energy in rural electrification

16. Biomass has been highly recommended by JICA, what is the status, prospectus?
17. How many systems are likely for Cambodia,
18. What size
19. what source, wood/rice husks
20. What are problems for REEs to use biomass gasification
21. What about feed in grid options/ potential /pricing
22. You think Solar Energy can contribute to rural electrification
23. REF 12.000 systems only very small percentage,
24. Any other plans for solar
25. What is effect from Lowering import tax for solar equipment

Main barriers to connect rural areas;

26. Electricity is now more expensive outside big towns, should there be one price for all households in Cambodia, such as in Laos?
27. What would be the main challenge for your organisation to connect more people, to reach 70% or households by 2030?
 - J. MIME
 - K. EDC
 - L. EAC

Annex 4: List of Attendance

Nº	Name	Sex	Position or Occupatin	Address	Phone
1	Lim Sokhun	m	Electricity	Mesor Chrey commune	011 77 99 84
2	Chay Kimhour	m	Electricity	Spey Commune	012 39 71 61
3	Hong Chunbann	m	Electricity	Chamkar Audong Commune	012 27 56 38
4	Hor Lenghey	f	Electricity	Veal Vong Commune	012 421 817
5	Ly Chinnlong	m	Representative of Licensee	Prek Por Commune	012 484 876
6	Heng Peakdey	m	Representative of Licensee		011 73 96 57
7	Hout Sothy	m	Electricity		092 79 26 97
8	Heng Bo	m	Representative of Preychhor Electricity	Prey Totoeung Commune	011 66 47 48
9	Phorn Phath	m	Electricity	Lvealeu Commune	012 23 65 22
10	Mean Vanna	m	Electricity	Svayteab market	012 56 68 40
11	Kim Bohann	m	Electricity	Thnolboth	085 49 45 60
12	Meng Sreng	m	Battery Charger	Krola	017 77 01 13
13	Mao Kokkheang		Electricity	E D Khon Company	012 58 30 74
14	Chin Sohin	m	Licensee	Steungtrang market	011 63 36 36
15	Chhun Vutha	m	MIME	Kratie Province	012 72 88 80
16	Khun Sophal	m	Licensee	Kratie Province	012 40 88 08
17	Som Sokhalin	f	Licensee	Kratie Province	012 34 07 09
18	Toek Seratha	m	Licensee	Kratie Province	097 94 88 947
19	Toek Nimol	f	Licensee	Kratie Province	
20	Sar Malis	f	Licensee	Skun(Kratie Province)	012 94 24 07
21	Seng Chinleang	m	Licensee	Prekpor	012 78 32 25
22	Chang Sunnareth	m	Licensee	Pa av	012 97 80 39
23	Soeung Kunthor	m	Licensee	Soung Electrical Enterprise	012 508 707
24	Path Eanghun	m	Licensee	Kroch Chhmar	012 54 91 68
25	Khun Sopheap	m	Licensee	Batheay	068 89 77 77
26	Binh Chheangphon	m	Chief of Administration office	DIME	012 98 93 49
27	Sann Vereyann	m	Chief of Technology	Rural Electrification	011 85 48 09
28	Yem Visith	m	Office chief	EAC	012 88 84 40
29	Ma Borann	m	Battery charger	Ampil commune	012 55 07 12
30	Hoeng Vanna	m	Battery charger	Krola	092 29 76 12
31	Oeu Lam aun	m	Battery charger	Phnom del	011 44 43 37
32	Seng Kry	m	Bek unlong electricity	Bek Unlong	012 88 11 25
33	Sean Siphann	m	Kdul electricity	Tunlong	012 421 422
34	Ros Saroeun	m	Tumnub cheung prey electricity		011 44 50 63
35	Ean Chheng	m	Ice factory(Kampong Cham)	Kampong Cham city	011 69 53 21
36	Lor Eak kim	m	Rice factory	Skun(Cheung Prey district)	012 832 144

N°	Name	Sex	Position or Occupatin	Address	Phone
37	Khy Khon	m	Battery charger	Toul Beng village	012 50 91 14
38	Chhum Sarath	m	Battery charger	Preychhor commune	099 35 11 53
39	Loun Sopheap	m	Electricity	Vihear thom	012 84 99 69
40	Ung Kimsean	m	Electricity	Thmor poun(preychhor district)	012 86 17 67
41	Chhim Theaream	m	MIME		012 90 81 19
42	Rogier van Mansvelt	M	ETC	Phnom Penh	012 304 332
43	Heng Kunleang	M	MIME	Phnom Penh	012 829778
44	San Vyrian	m	REF	Phnom Penh	
45	Yem Piseth	M	EAC	Phnom Penh	
46	Houng Chantha	m	EDC	Phnom Penh	
47					
48					
49					
50					

Annex 5: Prioritization of the electricity generation plans

Generation Plan for 2006-2010:

- 2006: Commissioned 45 MW HFO (Cambodia Electric Power Co., Ltd.-CEP)
- 2006: Commissioned an expansion plant of KEP 15 MW HFO.
- 2006: Commissioned City Power Corporation: 7.5 MW
- 2006: Commissioned Colben Energy (Cambodia) Ltd. 10 MW in Phnom Penh and 5 MW in Sihanoukville.
- 2006: Commissioned the 10 MW of the Provincial Power Supply Project
- 2006: Commissioning of an additional 10 MW, HFO generation in C5 (Japanese Grant),
- 2008: Power import from Viet Nam 80 MW.
- 2007: Power Import from Thailand 20 MW.
- 2008: Power import from Viet Nam 80 MW.
- 2009: Coal Fired Power Plant 200 MW (IPP).
- 2010: Power import from Viet Nam 200 MW.
- 2010: Kamchay Hydro Plant 193 MW (IPP-BOT).
- 2010: Commissioning of Kirirom III 13 MW hydropower plant (CETIC).

Generation Plan for 2011-2015

- 2011: Commissioning of 125 MW Lower Russei Chrum Hydropower Plant.
- 2012: Commissioning of a Stage 1 90 MW Gas Turbine Open Cycle Power/ Thermal power plant at the coastal areas.
- 2013: Commissioning of Stage 2 90 MW Gas Turbine Combined Cycle.
- 2013: Commissioning of Battambang I and II Hydropower plants with total installed capacity 60 MW.
- 2015: Commissioning of 110 MW Steung Atay

Generation Plan for 2016-2020

- 2016: Commissioning of 125 MW Middle Russei Chrum hydropower plant.
- 2016: Commissioning of stage 3 90 MW Gaz Turbined Combine Cycle
- 2016: Commissioning of 35 MW Upper Russei Chrum Hydropower plant.
- 2016: Commissioning of 100 MW Coal Fired Power Plant in ODM?????
- 2017: Commissioning of 207 MW Lower Se San II hydropower plant.
- 2018: Commissioning of 222 MW Lower Sre Pok II hydropower Plant.
- 2018: Commissioning of 260 MW Stung Chay Areng hydropower plant.
- 2020: Commissioning of 460 MW Sambor hydropower plant (Export Oriented)
- 2020: Commissioning of 980 MW Stung Treng hydropower plant (Export Oriented)

