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# RENEWABLE ENERGY PROJECT

## CONCEPT PAPER
## ON
## COMMUNITY ENERGY SERVICE PROVIDER

**March 2008**

European Union

Government of Nepal

# MESSAGE FROM THE EC DELEGATION TO NEPAL

# PREFACE BY ED-AEPC

# ACKNOWLEDGEMENT BY NPD-REP

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# ABBREVIATION AND ACRONYMS

| | |
|---|---|
| AEPC | ALTERNATIVE ENERGY PROMOTION CENTRE |
| ACAP | ANNAPURNA CONSERVATION AREA PROGRAMME |
| AC | ALTERNATING CURRENT |
| CBG | COMMUNITY BASED GENERATION |
| CBOM | COMMUNITY BASED OPERATION AND MAINTENANCE |
| CBRE | COMMUNITY BASED RURAL ELECTRIFICATION |
| CSP | COMMUNITY SERVICE PROVIDER |
| CESP | COMMUNITY ENERGY SERVICE PREOVIDER |
| CESCO | COMMUNITY ENERGY SERVICE COMPANY |
| CESO | COMMUNITY ENERGY SERVICE OPERATOR |
| CFUG | COMMUNITY FOREST USERS' GROUP |
| CTC | COMMUNITY TELE CENTER |
| CO | COMMUNITY ORGAIZATION |
| COPE | COMMUNITY OWNED PRIMARY EDUCATION |
| DANIDA | DENISH INTERNATIONAL DEVELOPMENT AGENCY |
| DC | DIRECT CURRENT |
| DDC | DISTRICT DEVELOPMENTCOMMITTEE |
| DEF | DISTRICT ENERGY FUND |
| DLGSP | DECENTRALISED LOCAL GOVERNANCE SUPPORT PROGRAMME |
| DVD | DIGITAL VESATILE DISC |
| ESAP | ENERGY SECTOR ASSISTANCE PROGRAMME |
| ECCA | ENVIRONMENTAL CAMPS FOR CONSERVATION AWARNESS |
| ESCO | ENERGY SERVICE COMPANY |
| EUC | ELECTRICITY USERS' CO-OPERATIVE |
| EU | EUROPEAN UNION |
| FECOFUN | FEDERATION OF COMMUNITY FOREST USERS' GROUP- NEPAL |
| GON | GOVERNMENT OF NEPAL |

| | |
|---|---|
| ICT | INFORMATION AND COMMUNICATION TECHNOLOGY |
| KW | KILO WATT |
| KWH | KILO WATT HOUR |
| KAAA | KADOORIE AGRICULTURAL AID ASSOCIATION |
| LV | LOW-VOLTAGE |
| LDF | LOCAL DEVELOPMENT FUND |
| MW | MEGA WATT |
| MHFG | MICRO HYDRO FUNCTIONAL GROUP |
| MEDEP | MICRO ENTERPRISE DEVELOPMENT PROGRAMME |
| (I) NGO | (INTERNATIONAL) NON GOVERNMENT ORGANIZATION |
| NEA | NEPAL ELECTRICITY AUTHORITY |
| NEWAH | NEPAL WATER FOR HEALTH |
| NRP/NRS | NEPLESE RUPEES |
| O & M | OPERATION AND MAINTENANCE |
| PV | PHOTOVOLTAIC |
| PPP | PUBLIC PRIVATE PARTNERSHIP |
| REP | RENEWABLE ENERGY PROJECT |
| REDP | RURAL ENERGY DEVELOPMENT PROGRAMME |
| REAP | RURAL ENTERPRISE ASSISTANCE PROGRAMME |
| SNV | NETHERLAND CO-OPERATION AGENCY |
| SHS | SOLAR HOME SYSTEM |
| TOR | TERMS OF REFERENCE |
| TV | TELEVISION |
| TA | TECHNICAL ASSISTANCE |
| UNDP | UNITED NATIONS DEVELOPMENT PROGRAMME |
| VDC | VILLAGE DEVELOPMENT COMMITTEE |
| VAT | VALUE ADDED TAX |
| WHO | WORLD HEALTH ORGANIZATION |
| WP | WATT PEAK |

# Executive Summary

Despite of having vast potential of economically viable hydro-resources, Nepal is facing acute shortage of energy supply. The situation of energy supply in rural areas is pathetic. Though, grid electricity is the least cost energy provision/option, due to rough terrain and scattered human settlement of the rural areas, grid extension to those areas, especially remote hill districts, within foreseeable future is next to impossible. Thus, decentralized energy service provision may be an effective and alternative energy service option to meet the raising energy demand of rural people in the aforementioned circumstances. Among the various decentralized energy service technologies, solar PV is one of the proven and potential technology for rural electrification

Renewable Energy Project (REP), a joint initiative of Government of Nepal (GoN) and Commission of European Communities (EC) has been working for the promotion of Institutional Solar Photovoltaic System (ISPS) in rural areas of 21 districts of Nepal. For this, REP has developed Community Energy Service Provider (CESP) approach which could be one of the most appropriate and possible energy service delivery approach to serve the rural people in order to fulfill their energy demand.

Community energy Service Provider (CESP) is an Energy Service Company (ESCO) which is owned and operated by a community owned legal entity located in the serviced community. The CESP provides energy services on a "fee-for-service" basis to public institutions (schools and health posts), water users households/groups and to small enterprises(tele-communication, computer literacy, entertainment community and milling), In future, CESP may expand their scope for other viable energy options too The CESP concept differs from the existing energy service approaches mainly in terms of institutionalization procedures, organizational structure, nature of business and energy service provision. CESP is a public-private partnership (PPP) initiative which provides off-grid energy services from stand-alone solar PV systems through an arrangement under which a public authority contracts a private entity to provide a number of services to a community on a pluri-annual basis. The recipients of the service pay a fee for the service fixed at a level reflecting the local population's ability to pay. In addition, the public authority pays a subsidy paid to the contracted private service provider covering the difference between the full commercial cost of the service and the user fee. The subsidy allows private entrepreneurs to engage in the service as a commercial activity. The terms and conditions of the activity are regulated in the contract between the authority and the private service provider.. The CESP is managed by the local Community Organization (CO) with proven operating experiences and is engaged in both "not-for-profit" and "for-profit" energy sales.

The CESP receives the energy equipment (and some associated civil structure) free of charge from REP. In return, the CESP uses the equipment to generate energy and supply it to a number of specified final uses and users on terms and conditions that are specified in the equipment contract signed between the CESP, DDC and AEPC, along the provisions of the agreement between the Government of Nepal and European Commission

Based on the pre-defined quantifiable selection criteria, maximum 10 Community Organizations (COs) formed and promoted by donor agencies as well as government and non government organization were initially selected from each REP district for energy demand collection.

Based on the technical feasibility assessment of energy demand submitted by the COs, 168 COs have been confirmed in a view to transform them into the CESPs. Among the selected COs, about thirteen nine(39) percent are co-operative, about fourteen (14) percent are community forest users groups and about forty seven (47) percent are other groups (Women group, Agriculture group and village group). After substantial enhancement of their technical, financial, organizational and business competences, they will be transformed into the CESP as legal business entity (Co-operative) but the CO will not be encouraged to transform itself into a CESP, but to set up a CESP as an independent legal entity.

Though energy service to communities, social institutions, business enterprises and others is the major activity of the Co-operative (CESP), it may, mainly mother organization, is encouraged to engage others for social and income generating activities too The Co-operative (CESP) owns the solar PV systems installed by REP through 100% equipment grant (which covers only the cost of Solar PV equipment), takes the responsibility of repair and maintenance of the system and provides energy services to the users through energy service agreement, for a fee. The Co-operative will have separate bank account as well as books of account for CESP related transactions. As an independent legal business entity the co-operative can procure required managerial & technical services from third parties and can take loan from financial institutions. Energy supply to social institutions (schools, health posts), for drinking water pumping system to water users, and for individual productive appliances (milling, audio-video entertainment, computer use including Internet and email uses) are the main potential business areas of the CESP. Thus, CESP is not an "energy utilities" providing a specific energy service to all households and institutions in the community. It provides a range of services to institutions and to individual households having the ability to pay for the service

CESP will set financially viable and economically affordable tariff that covers CESP's full costs for providing the energy services: costs of operation, maintenance and rehabilitation as well as the costs of management and administration. The basic tariff principles of CESP are: Cost of energy production tariff for energy service to public institutions and water pumping; Commercial tariff (which includes the certain percentage of profit margin also) for business entrepreneurs (milling, entertainment community, tele-communication) and average tariff (of all activities combined) must as a minimum, cover the cost of the CESP operation.

Many CESPs will be involved in both “non-commercial” and “commercial” activities. The latter generate profits. Albeit small. A part of the profit on the commercial activities is generated by the commercial-entrepreneurial skills of the CO which manages the CESP; therefore, it should be entitled to receive the “entrepreneurial part” of the profit and use it for whatever purposes it wants. But a large part of the profit is generated by the 100% subsidy which reduces the cost of the energy service to a lower level than the cost of competing energy suppliers. The “subsidy part” of the generated profit should accrue to the community as a whole. Hence, the

annual profit is distributed between the CO and the community the annual profit is distributed between the CO and the community

The lifetime of the CESP's solar energy equipment comes to an abrupt end when the national electricity grid reaches the community. The statutes of the CESPs must foresee what is to happen with the CESP's equipment when the grid reaches the community.

The logical approach is to hand-over the energy equipment provided by REP as property to the local electricity cooperative formed to manage the local grid. It would be up to the local electricity cooperative to decide whether it wants: (i) sell the equipment on the second-hand market for solar panels and/or (ii) let the solar panels feed power into the local LV-grid, thereby reducing the amount of electricity which is purchased from NEA at the level of the substation. If the electricity cooperative decides to sell the equipment, the sales revenue could become part of the electricity cooperatives co-financing contribution to the construction of the local distribution-grid.

When project life ends, there will be two claims on the funds that are in the CESP bank account. The local community will have a claim on unused funds that were deposited to pay for future spare parts. The CESP/CO may be owed payment for staff time and management fee. The funds properly owed to the community can be handed over to the electricity cooperative, to the local school, to the local clinic, depending on the regulation in the CESP charter.

Alternative Energy Promotion Centre and Local Government Organizations (DDC/VDC) are the major regulatory organizations that monitor and supervise the performance of CESP and control over the misuse of the CESP properties.

# 1 INTRODUCTION

## 1.1 Background

### 1.1.1 Energy supply and demand in Nepal

Nepal has vast potential hydro-resources; the economic potential for hydropower is estimated at 43,000 MW. Yet, hydro electricity accounts for only 1% of total energy supplies. Firewood (68%) and agricultural waste (15%) are the main sources of energy, while petroleum products (8%) have replaced dung (8%) as the third most important source of energy supply in terms of energy content.

The national electrification rate in 2006 is around 44% with a very uneven regional and urban/rural distribution. In urban areas, where less than 20% of the national population live, the household electrification rate is close to 100%; the rural is around 38% - being highest in the accessible lowland regions (the Terai) and lowest in mountain communities that take from 2 hours to four days to reach by foot.

### 1.1.2 Government policy for decentralization of energy supply

In the 10th Five-Year Plan of GoN from 2002 to 2007, the electrification rate is planned to be extended from 39% of the population to 55%. Although urban areas are largely electrified, rural-urban migration continues to push for the extension of urban grids. Yet, the electrification goal calls for rural electrification over 5 years of almost 1,000,000 rural households, out of which 70 % or 700,000 were assumed to be electrified through extension of the national grid, while the remaining 30% were to get electricity service from individually owned solar photo voltaic systems and isolated micro-hydro grids.

To accelerate rural electrification and reduce the costs of rural power supply, the Government has adopted a decentralized approach to electrification. Since 2003, the expansion of the national grid into rural areas is undertaken in partnership between NEA and rural electricity user cooperatives.

### 1.1.3 Government promotion of renewable energy

The Alternative Energy Promotion Centre (AEPC) under the Ministry of Science, Technology and Environment has, since it became operational in 1999/2000, implemented an ambitious program to promote biogas, solar PV and micro-hydro-projects in rural Nepal. From mid-2000 to mid-2005 Nepal achieved, on a per rural capita basis, the fastest penetration of renewable energy systems in support of rural electrification:

- two thirds of the increase in the rural electrification rate from 30% in year 2001 to 36% in year 2004/05 came from off-grid solutions in the form of isolated micro-hydropower grids and stand-alone solar home systems.
- annual sales of solar PV-systems (SHS) per capita (or per un-served rural household) are high and increasing with over 65,000 SHS being installed from 2001 to 2006;

[1] Electrification rate based on the report "An Analytical Report on Determinants of Renewable/Rural Energy in Nepal", December 2005, extending the trend rates to 2006.

- progress in electrification through the implementation of micro-hydropower projects was lower than for SHS in terms of number of served rural households; but compared with progress in other developing countries, Nepal's experience is the international benchmark to beat.

AEPC is national renewable energy authority and executing agency for rural and renewable energy programs financed by various donor agencies.

### 1.1.4 Renewable Energy Project (REP)

AEPC's "Renewable Energy Project (REP)" co-financed by the European Union and the GoN is in line with the Government policy for organizing energy supply through locally based organizations and with Government policy to promote renewable energy. REP provides larger scale PV-systems to "Community Energy Service Providers" (CESP) set up by community-based organizations (CO) that are involved in productive activities (functional groups like e.g. forestry groups) to provide energy to public administration, schools, clinics, water pumping, and "private productive users of power" on a "fee-for-service" basis. About 168 CESPs are to be created; each serving on average a local population of about 500 households. REP's €15.675 million budget is used in the following way: €10 million are allocated to financing PV-related investments, €5.675 million to program administration and supporting activities, such as trainings, information, demonstration and €150,000 to thermal solar energy systems .

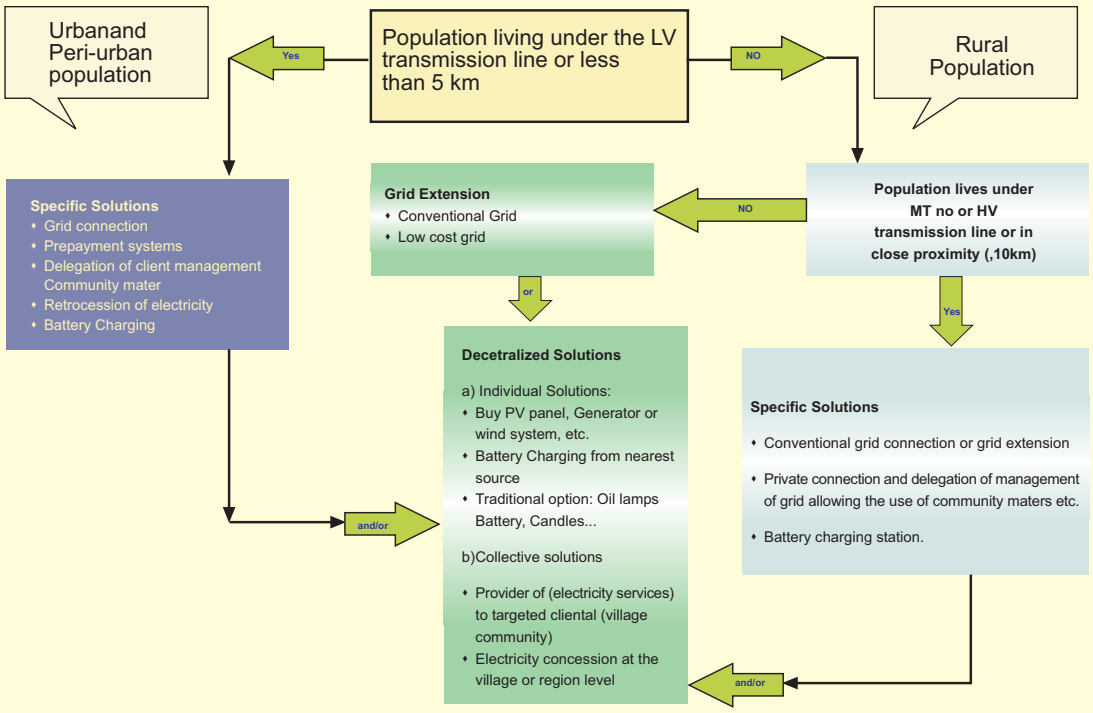
## 1.2 Objective of this Paper

The purpose of this paper is to outline the principles of CESP and the issues involved, and to explain the CESP operational modality as applied in the REP.

# 2 APPROACHES TO DECENTRALIZED ENERGY SERVICE IN NEPAL

## 2.1 Individual and Collective Organization of Local Energy Service

Decentralized electrification differs with regard to technological choices (grid, off-grid (mini-grids and stand-alone systems)), and with regard to the undertaking and management of the electrification projects. The chart below gives an overview of the mix.




***Source:*** *Best Practice Manual Promoting Decentralized Electrification Investment, ESMAP report 248/01 (2001)*

The undertaking and management of electrification projects may be by individual or by collective initiative. Both are supported by Nepalese Government programs.

## 2.2 Local Energy Service based on Private Initiative

An example of local energy service delivery based on private initiative is the direct sale of PV systems by private solar companies to consumers. It is a success story in Nepal, where AEPC with assistance from ESAP/DANIDA has seen a successful development of a private solar sector. Around 26 pre-qualified solar PV-dealers operate in Nepal who sell their systems through retailers trained in the basics of system maintenance

and after sales service. The program succeeded in creating high sales of solar home systems (SHS) during the past 5 years (around 65,000 SHS sold). Key success factors were the well designed subsidy modality and continuous efforts in quality control and local private sector development. Another example is the private entrepreneur owned mini-electricity-utility, where a local private entrepreneur invests in a micro-hydro plant primarily to supply power to an industrial plant, but expands the project to supply grid based electricity to the local community as well.

Solar Home System (SHS) Installed in Rural House

## 2.3 Local Collective Organisation of Decentralised Energy Supply

### 2.3.1 Community Rural Electrification Rules 2060 (A.D. 2003)

The "Community Rural Electrification Rules 2060" by the Nepal Electricity Authority (NEA) allow communities to take over management of their distribution networks and to participate in the construction of new distribution networks. The rules envisage three community based rural electrification schemes/models: (i) Community Based Rural Electrification (CBRE) model for un-electrified area; (ii) Community Based Operation and Maintenance (CBOM) model for existing networks; and the Community Based Generation (CBG) model for communities located far from the nearest national grid.

### 2.3.2 Distribution grids leased by rural electricity user cooperatives

In the Community Based Operation and Maintenance (CBOM) approach the existing network is leased out to the community for operation and consumer service. The property of the distribution system and the substation remains with NEA, which leases the LV-system to a newly created local electricity distribution cooperative at a token price. The lease payment is added as a fixed addition to the kWh tariff paid by the cooperative for the bulk supply of electricity. The cooperative acts as distribution utility, invoicing and billing electricity consumers and paying NEA for the electricity delivered ex substation. Routine maintenance (e.g. tree cutting) is done by the cooperative, major maintenance remains the responsibility of NEA.

Apart from reducing the cost of billing and revenue collection, a major objective of the modality is to reduce the non-technical and technical system losses in the distribution systems compared with the performance when local distribution is performed by NEA. The modality, however, suffers from the classical problem in leased infrastructure of in-optimal routine maintenance (responsibility of the lessee, the cooperative) that leads to excessive costs of rehabilitation (responsibility of the leaser, NEA). The other design problem is that legislation stipulates that the cooperatives cannot charge cost-based

tariffs that are higher than NEA's retail tariffs. As this protects consumers against tariff increases caused by high system losses in the distribution system, the cooperative has limited incentives for proper performance.

### 2.3.3 Distribution grids owned by rural electricity user cooperatives

Under the Community Based Rural Electrification (CBRE) model for un-electrified area, the community gets an 80% capital subsidy from the government, the balance 20% of the cost is to be contributed by the community.
The CBRE modality – in a modified form - is applied in the DANIDA supported "Kailali – Kanchipur distribution line" program which provides 220 rural load centers with electricity distribution infrastructure in the districts of Kailali and Kanchanpur. The program establishes rural "Electricity User Cooperatives" for each load centre, consisting of a transformer and the 400/230 Volt distribution systems. A cooperative supplies one to three villages. The "Electricity User Cooperatives" modality attempts to provide the right incentives for operating efficiency by (i) giving the cooperatives ownership of the system, (ii) linking their retail tariffs to the local cost of supply (not to NEA's retail tariffs), and (iii) giving the cooperatives full responsibility for operation and maintenance. After completion of the construction works the distribution system is handed over to the local Electricity User's Cooperative (EUC) as property. The cooperatives buy power from NEA at an agreed bulk rate.

In the "Kailali – Kanchipur" project, the 80 percent investment subsidy is replaced by a fixed per household subsidy of NRP 7,200. The remaining-finance needed for the investment in the low voltage distribution system including the transformer and the cost of household connections with meters and load limiters is provided by the Ministry of Finance as an index loan at a 2% real rate of interest over 20 years. The loan is administered by NEA, which collects the monthly amortization payment from each cooperative together with the monthly invoice for NEA's wholesale supply of electricity.

A common umbrella organization, responsible to the district-based Union of Cooperatives will be formed under the Cooperative Act within three years from the completion of the construction work. The Union is to provide managerial, administrative and technical services to the load centre cooperatives of the two districts. Its fulltime professional staff will assist with the review of business plans of the individual groups, power purchase agreements, for assisting with administrative services and preparation of contracts for technical services related to O&M.

Physical work related to the electrical installations is assumed to be outsourced to certified private sector entities, which will be established already during the initial connection of households.

The attractive features of the modality are its combination of:

- economies of scale in project finance and administration (loan secured by the Ministry of Finance and administered by NEA)
- economies of scale in technical-operational-management know-how (Union of Cooperatives)
- full local responsibility for the economic consequences of bad management;

[2] An Index loan is a loan, where the annual payment of interest and repayment on principal is inflation adjusted with the inflation rate during the previous 12 months. Due to the low interest rate, the annual payments compared to a normal loan are lower in initial years, but, due to the inflation adjustment higher in later years. This lowers the tariff during initial years; but increases it in the later years.

- all community members are co-owners of the infrastructure
- management capability during operation is strengthened by the technical back-stopping and monitoring though the umbrella organization
- long-term technical performance is ensured through service contracts with outside private companies.

The weak point is the speed of creation: it is difficult to create full "local ownership" of a local organisation that is externally imposed by a donor. It requires program staff with strong social mobilization skills.

### 1.3.4 "Micro Hydro Functional Group" Modality

Under the Community Based Generation (CBG) model, communities operating distribution network and desirous of setting up micro-hydro generation facilities for distribution in their community get a maximum subsidy of NRs 65,000 and NRs 8,5000 (excluding transportation subsidy) per kW installed capacity for the system upto 5 kW and over than 5 kW respectively (as per Renewable Energy Subsidy Provision, 2063).

The CBG modality is applied by REDP, a joint initiative of GoN, UNDP and the World Bank as well as Micro-hydro Project, supported by ESAP/DANIDA.

REDP promotes the active participation of local population in the management and operation of micro hydro-projects. REDP's approach is the bottom-up, with a creation and nurture of a CO for operation of a micro-hydro scheme. REDP encourages local people to form a CO to initiate development work through the self-help approach and mobilize resources within and outside the community. Creating a CO is an important step for REDP as a means to empower local communities through self-organisation. REDP builds the capacity of the COs through direct training, workshops and counseling. Generally, a CO consists of minimum 10 members, but the number can vary depending upon the local situations. In each settlement, there are separate COs for male and female members, as part of the REDP gender equality strategy.

Once the COs become mature, they form functional groups to undertake specific activities like operation of micro hydro. A CO is considered mature when its members start conducting regular meetings, saving regularly, making consensus decisions and recording the decisions in the minute book. Normally, two representatives are chosen from each participating CO to be a part of the executive committee of the

Community Managed Micro Hydro Project

functional group. The REDP assists the local community in the creation of a Micro Hydro Functional Group (MHFG) responsible for planning, implementation, operation and management of a Micro Hydro Scheme. The MHFG submits an application for the implementation of micro hydro scheme to REDP. REDP conducts the feasibility study for the scheme to determine its viability, ascertain the plant capacity, prepare necessary designs and make detailed cost estimations. An approved scheme is implemented by the MHFG.

For the construction of Micro-hydro Schemes, the MHFG mobilizes different sources of financing; and signs separate agreements with REDP, DDC and VDC. REDP provides a grant of Rs.65,000 or 85,000 per kW (maximum) through the District Energy Fund (DEF). DDC/VDC provides financial support in the form of equity investment; once the scheme runs profitably, DDC/VDC receives a return on their respective investments. The community contributes mainly in the form of labor, land etc, but is encouraged to make cash contributions also.

REDP gives technical assistance for completing the procurement and construction process. Upon successful testing and commissioning, all well performing plants are handed over to the community. MHFG completes the formal auditing and carries out the public audit.

MHFG is fully responsible for operation and management of the plant and the distribution network.

MHFG determines the tariff based on loan repayment, depreciation, operating and maintenance costs, development fund etc.

The attractive features of the modality from a sustainability point of view are (i) the slow and gradual social mobilization process towards the creation of a MHFG, (ii) the involvement of the DDC and VDC as shareholders in the project, enabling these to perform a direct monitoring and regulation. The weak point is the poorly defined legal status of the MHFG: the MHFG is kind of a Shareholding Company, but not registered under company law. This should, at least in principle, have a negative affect on its ability to get loans from banks.

There are no fundamental differences between the Micro-hydro schemes supported by ESAP/DANIDA and REDP even though both projects are subsidy based, and work through the local community. In REDP, the Rural Energy Development Section of the District Development Committee is in-charge of the overall programme. Thus, DDC and VDC will have important role for the selection of the micro –hydro schemes and implementation of the selected projects. District Energy Fund has been created by DDC in each REDP districts in order to support micro- hydro schemes. But the working modality of the Micro hydro Project supported by ESAP is different from the REDP approach. The ESAP works through area centers. For this, it has developed selection criteria and evaluation procedures for the selection of area partners. Based on the result of evaluation a mature and capable community organization will be selected to co-ordinate, and to work as the representative of the project in their respective areas. The institutions will be in-charge of the area and is also responsible for the selection and implementation of the micro hydro project, but final selection and approval of the selected schemes will be made by the project (ESAP).

# 3 ESSENTIAL FEATURES OF THE CESP

## 3.1 What is new in the CESP Concept?

The CESP concept differs from the "grid based" approaches described above in a number of aspects. The most important are reviewed below.

### 3.1.1 The CESP is an ESCO which provides non-grid energy services

An Energy Service Company (ESCO) is a company which installs energy systems (or energy saving technologies) at consumer premises and operates the systems for the recipient of the energy output (energy savings) against a fee. The Community Energy Service Provider (CESP) is an ESCO which is owned and operated by a community-based entity. The CESP provides energy supply services on a "fee-for-service" basis to public institutions, water user groups, and to small enterprises.

The CESP does not provide solar home systems (SHS) to households; these are supported by the AEPC's subsidy scheme (through ESAP), nor will CESPs establish solar PV grids to distribute electricity to households. But CESPs can promote the AEPC SHS programme(s) and inform households about the option to purchase a SHS from a nearby PV-retailer.

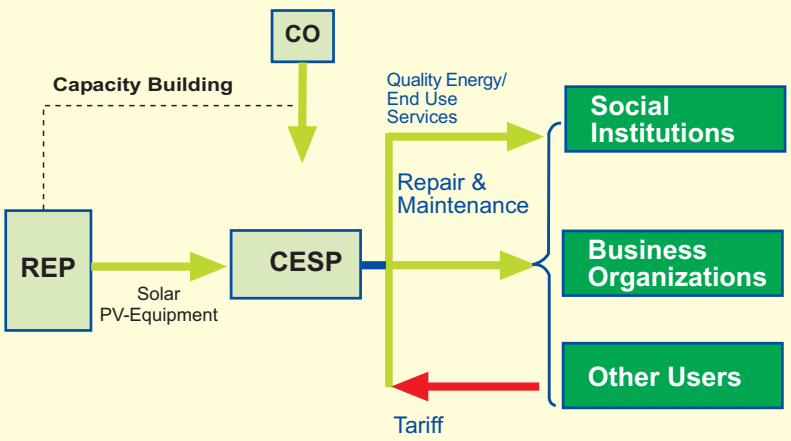
### 3.1.2 The CESP is engaged in "not-for-profit" and "for-profit" energy sales

The CESP sells energy on a not-for-profit basis to "collective users" (water user groups and public institutions) and on a for-profit basis to "individual users" (e.g. milling).

### 3.1.3 The CESP is managed by a local CO with proven operating experience

Unlike REDP and the Kailali – Kanchipur distribution line program, REP does not create a new local organization to provide the energy service. The REP engages an existing CO to set up a CESP as an independent, registered legal entity. The CESP will be the owner and operator of REP-provided equipment while the CO manages the CESP.

### 3.1.4 The CESP is a Public-Private-Partnership (PPP)




A Public-Private-Partnership (PPP) is an arrangement under which a public authority contracts a private entity to provide a number of services to a community on a pluri-annual basis. The recipients of the service pay a fee for the service fixed at a level reflecting the local

population's ability to pay. In addition, the public authority pays a subsidy paid by to the contracted private service provider covering the difference between the full commercial cost of the service and the user fee. The subsidy allows private entrepreneurs to engage in the service as a commercial activity. The terms and conditions of the activity are regulated in the contract between the authority and the private service provider.

Unlike the electricity consumer cooperatives or water user groups, the CESP is not owned collectively by the local community, but by a local Community Organisation (CO) with experience in productive activities, such as a forestry group.

The CESP receives the equipment (and some associated civil structure) free of charge from REP. In return, the CESP uses the equipment to generate energy and supply it to a number of specified final uses and users on terms and conditions that are specified in the equipment contract signed between the CESP, DDC and AEPC, along the provisions of the agreement between the Government of Nepal and European Commission.

## 3.2 Why was the CESP Concept chosen as Operating Modality?

### 3.2.1 The accountability problem in collective ownership

The objective of the CESP modality is to promote efficient operation and accountability for results. The means to achieve this objective is to combine the natural cost advantage of service delivery through a locally based entity with the private profit motive as incentive mechanism.

The common feature of the four modalities discussed in section 2.3 for decentralized organization of energy supply to rural communities, is that the entities are either community or user owned cooperatives. Although success stories exist of community owned rural power systems in the developing world, lack of sustainability is a serious problem for many. Their networks are often in a serious state of disrepair and a high percentage of community owned installed energy/ water pumping projects fails to operate after a few years. Yet, in the same areas, where community owned and operated energy/ water pumping projects fail, privately owned micro-hydro plants operate for years. This indicates that community owned micro-hydro projects do not fail because of a de facto absence of potentially available technical capacity to solve problems when they arise. Failure is caused either by insufficient management capacity of a cooperative (e.g. to contract required technical support), and/or by lack of finance to pay for maintenance and for rehabilitation expenses when such work needs to be done. Examples are legion of diversion of cash-funds in community utilities being diverted to non-utility purposes, such as agricultural projects.

Another difference is that the CESCO is not an "energy utility" providing a specific energy service to all households and institutions in the community. It provides a range of services to institutions and to individual households having the ability to pay for the service. The political need for collective community decision taking is much lower in this case.

### 3.2.2 The risks of a 100% investment subsidy

Providing infrastructure to local communities through a 100% investment subsidy is not ideal from a sustainability point of view: getting something free-of-charge reduces the feeling of local ownership.

In the CESP modality, the equipment is not given to the local community as a whole but to a CO. The CO/CESP has an economic incentive to keep the systems maintained well: it gets no revenue (user payments) when there is no supply; and knows that it has no prospects of getting new equipment free of charge when something breaks down.

REP provides only the energy supply system (total system for water pumping and milling), and not the end use appliances.

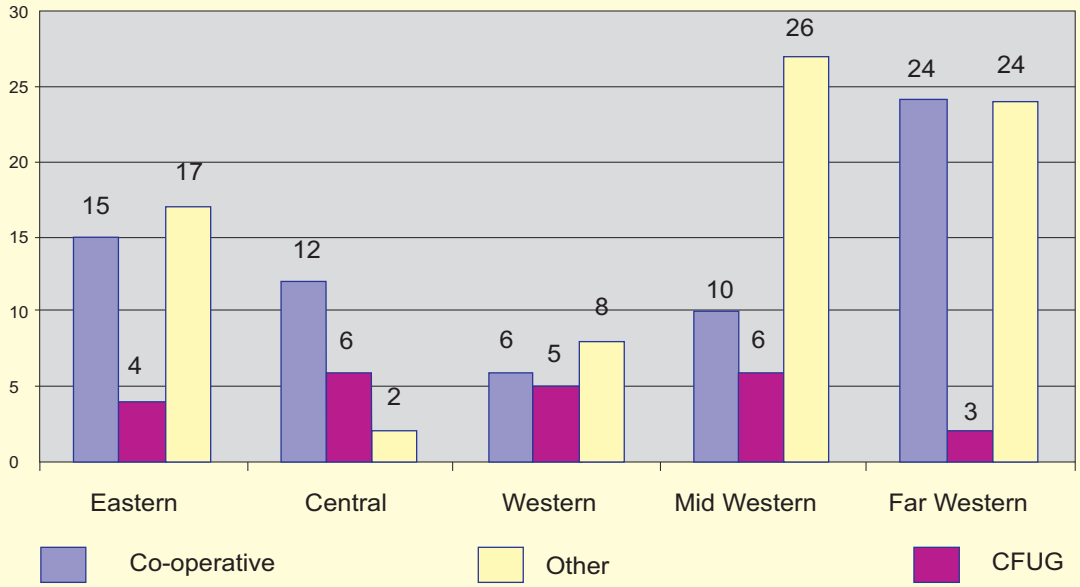
# 4 ORGANIZATION AND MANAGEMENT OF CESP

## 4.1 Transformation of CO into the CESP

REP selected 193 Community Organizations (COs) from 21 districts for energy demand collection, out of which 168 COs have been confirmed in view of the transformation to the Community Energy Service Providers (CESPs).

### 4.1.1 Existing Organizational Status of Selected COs

As REP selected existing COs, there is a significant variation in the objective and working modalities among the promoter organizations and consequently organizational status of the selected COs. The COs can be grouped into the following three major categories:




1. **Co-operative:** REP recommended Co-operative as the business/legal form of CESP.. The cooperatives that applied for REP support had a high success rate, as a rule they fulfilled all pre-requirements set by the project. Hence, about 39 percent of REP COs are Co-operatives, a majority being already registered in the Division Co-operative Offices.. Some COs are working as pre-cooperative and are in the process of registration, and have been included into this category. Two types of Co-operatives are dominant: 1) saving credit co-operative and 2) multi-purpose co-operative.

PTF intetracting with the community

2. **Community Forest Users' Group (CFUG):** About 14 percent REP COs are CFUGs, working under the Federation of Community Forest Users' Nepal (FECOFUN). All CFUGs are formed and managed by local communities and are registered in District Forest Office of their respective districts. The main purpose of the CFUGs is the protection of community forest. However, they also assists their members, to start and operate income generating and other social activities.

3. **Other Groups:** In addition to Co-operatives and CFUGs, other different community organizations , have been selected as REP COs. About 47 percent of REP COs are either women group, agriculture group, or village group.

PTF intetracting with the CO members/community during field verification of COs

- *Women Group:* About 8 percent of the COs are Women Groups which were formed and promoted by Community self-help groups, Donor agencies, Women development office and others in a view of women empowerment through higher income generation activities, social works and saving- credit operations.. Some groups were registered in Women Development Office, VDC, DDC etc., but most are operating as informal groups. Hence, most of them do not have bank account and standard accounting system, though they are engaged in saving credit operation, income generation and other financial activities.

- *Agriculture Group:* The Agriculture Development Office and/or other development organizations working in agriculture sector, initiated and promoted of the creation of agriculture groups as a way to economic development of the community. About 15 percent of REP COs are Agriculture Groups. All Agriculture groups have been registered in District Agriculture Office

- *Village Group:* Different organizations, mainly supported by donor agencies such as MEDEP, DLGSP, REAP, ACAP etc. formed and promoted village groups in order to initiate and accelerate the socio-economic empowerment activities through social mobilization and entrepreneurship development. These groups are generally registered in Local Development Fund (LDF) which is operated under the umbrella of District Development Committee (DDC). About 24 percent REP COs correspond to this group.

### 4.1.2 Energy Demand Collection

The selected COs collected energy demand and submitted it to the REP for feasibility

studies. 769 PV systems received from 168 COs were found feasible and were recommended to the European Commission for funding.

PTF explaining the energy demand collection process

The REP objectives being contribution to the poverty alleviation and improvement of social services, The energy demand was collected primarily from health posts, schools, and mills. Energy demand collected by COs can be classified broadly in two categories:

1) **Energy demand for social services**
2) **Energy demand for income generation.**

1) **Energy demand for social services**

Social institutions such as schools, health posts, and community "clubs" are the major target institutions that will use the energy from the Solar PV System installed by REP. About 70 percent of available funds will be disbursed in this sector. Under this category, following are the major energy applications:

- **Computer-based Education in Schools:** REP has approved two different packages (School I-1000 Wp and School 2- 1900 Wp) for supply of energy to power computer in schools in (about 46 % funds). REP approved technically feasible energy demand received from COs to operate computer education is schools. The package also provides for use of (if any) photo-copying machine, DVD and audio-visual tools in schools.

Solar based community telecom center

- **Vaccine refrigeration in Health posts:** REP provides one Solar PV package (600 Wp) for refrigeration of vaccines in health posts. About 15 percent of available funds will be invested for this purpose.
- **Community Water Pumping System:** REP will support around 30 complete water pumping systems which accounts for about 8% of the funds.

[3]Other relevant Acts for the registration of a company are the Association Registration Act, 2034 (1977) and the Social Welfare Act, 2049 (1992)

**2) Energy demand for income generation**

REP also supports the energy demand received from the COs for the operation of income generating activities. For this purpose, about 30 percent of available funds will be disbursed in capital investment:

- **Community Tele Center:** REP provides energy for community Telecenter operating a telephone, fax, and internet/email in rural community. For this purpose, REP has designed a package of 900 Wp. The total investment for this application will be about 11 percent of total grant.
- **Computer Literacy:** REP provides a Solar PV system of 700 Wp to operate computer literacy classes in the community. About 3 percent of the available funds will be used for this application.
- **Community Entertainment:** REP provides Solar PV system of 200 Wp to operate entertainment activities such as TV, video and DVD viewing in community. The project will disburse about 2 percent of available funds for this application.
- **Milling:** REP also provides package for milling with the capacity of 1500 Wp. About 14 percent of funds will be disbursed in capital investment for milling.

***Besides income generation, Community Tele Centre and Milling will have significant contribution for the delivery of social services in the community especially for communication services and simplification of the physical work of women.***

## 4.2 Business Forms for CESP: Cooperative or Shareholding Company

The CO decides whether to register the CESP as a cooperative (governed by the Co-operative Act, 2048(1991) or as a company (governed by the Company Act, 2053(1996), revised by the Company Ordinance in 2005.[3]

### 4.2.1 Co-operative

According to the Co-operative Act 2048, at least 25 members are needed initially to set up a cooperative. New members can join by Decision of General Assembly.

PTF intetracting with co-oprative members

The co-operative members apply to the registrar at office of the co-operative. With the registration application, they should submit two sets of (i) the co-operative constitution, (ii) work plan of co-operative, and

(iii) statement of shareholders with their agreed share proportion. It also needs the signature of initial members of the co-operative (at least 25).

In a cooperative, the upper decision making body is the General Assembly (Members Council), where each member has one vote. The Assembly verifies and approves the financial statement of the co-operative, elects or dismisses the management committee and account committee, and decides on mergers with other cooperatives or dissolving the cooperative.

The maximum limit of share value to one member is 20% of the total share value; government owned institutions are exempted from this limit.
The Management Board, typically elected every two years by and from the membership, is responsible for daily operation and the long-range development planning according to stated objectives. It consists of a manager, deputy manager (if any), secretary/accountant, and treasurer.

A cooperative can be dissolved only by decision of its members.

A co-operative can operate saving credit schemes for its members.

The financial surplus of a cooperative is called “net margin”, not “profits”. In practice there is no real difference between the two. The Charter of the cooperatives defines how the distribution of net margins is done. For a CESP the charter will establish (i) how the margin is divided between the CESP members and the local community and (ii) how the margin accruing to CESP members is to be paid out as dividends to the members according to either their respective capital contribution or on a per member basis.

### 4.2.2 Shareholding Company

The Company Ordinance distinguishes between “private” and “public” (shareholding) company.

**(1) Private company**

Ownership of “a private company” is limited to a maximum of fifty members/shareholders”. The shares (ownership certificates) of a private company cannot be sold freely to outsiders, a member can sell to a non-member only after having offered these first to the co-members for purchase.

Due to the limits on membership, the management structure, procedures and annual reporting obligations of a private company are simpler than in a public company. In the Assembly of Shareholders, which is the highest authority, the weight of a shareholder’s vote depends on his/her number of shares.

**(2) Public company**

The shares of the company can be sold to outsiders. Large companies, have the additional option to be listed on the stock exchange, making it possible to broaden the

ownership base of the company even further, and increasing the liquidity of shares (enabling shares to be sold relatively fast: finding somebody willing to buy when needed). The public company option irrelevant for the CESP.

### 4.2.3 Recommended option

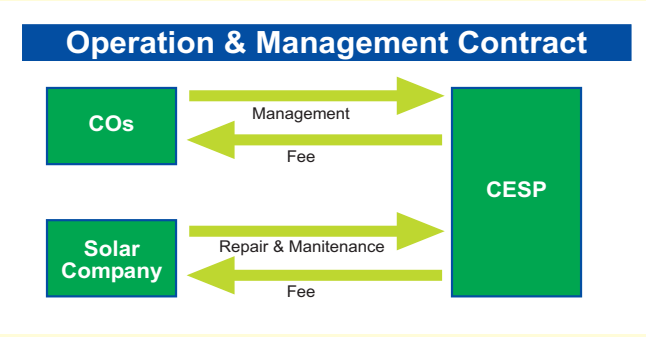
The cooperative is the recommended business form for a CESP for the following reasons:

- The cooperative is the business form, which is best known and understood by the rural population; energy cooperatives in Nepal are already managing micro-hydro schemes and rural grid distribution.
- The taxation and VAT regime in Nepal is more favorable for cooperatives than for companies.

The "one man, one vote" regime is more appropriate than the "one share, one vote" regime. Getting its equipment free of charge from REP, the CESP does not need to raise equity capital to finance investments; all members pay the same nominal fee for their shares.

## 4.3 Relationship between CO and CESP

A CO willing to expand its business to engage in energy service activities will be asked not to transform itself into a CESP, but to set up a CESP as an independent legal entity.




The legal separation includes the CO and CESP bank accounts. The CO-CESP must maintain a subsidiary books of Account (Ledger) and also open separate bank account ( if the volume of the transaction is large) for CESP ( energy business) related financial transactions into which all revenue received from customers for CESP-services will be paid and from which all expenses related to CESP-activities will be drawn.

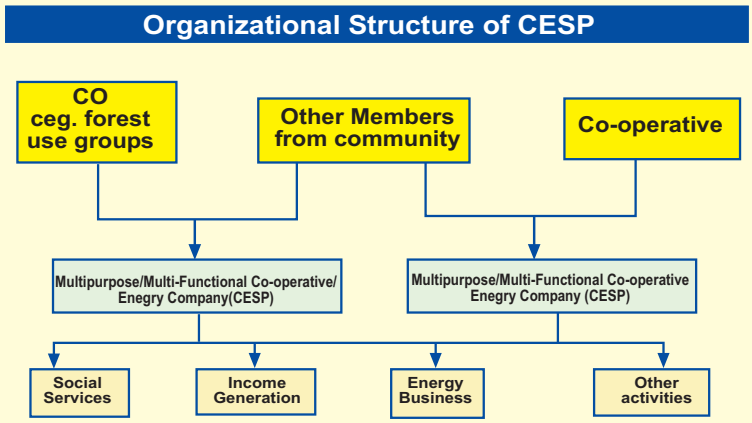
The CESP signs a management contract with the CO, entrusting it against payment of a fee to be responsible for the daily management and operation of the CESP.

To regulate the relationship between the CESP and the CO, two documents – based on standard formats – will be drawn up:

- the founding document and statutes for the CESP, which designates the CO as manager for CESP;
- a management contract between CESP and the CO.

## 4.4 Organizational Structure of CESP

After an intensive capacity building and completion of all required administrative processes, all COs will be transformed into the CESP, as a legal business entity. It is recommended that the "mother CO" remains operational in its initial form. The CESP is constituted as Co-operative. This implies that there are two basis cases: **A**. COs that are Co-operatives which only needs adornment for its constitution as multipurpose co-operative and incorporation of energy service as its one of the major activity; **B** COs not established as Co-operative, now they just establish CESP in the form of Co-operative.




## 4.5 CESP Membership and Management

The CO will be either the sole – or the majority - owner of the CESP; depending on whether it is considered opportune to include non-CO members in the membership of the CESP. Inter alia, this can be needed if the CO-membership is smaller than the minimum membership requirements for establishing a cooperative or a private shareholding company.

PTF explaining the energy service provision in co-operative office

All CO members will be members/shareholders of CESP. But for political and regulatory reasons, the CO may in consultation with REP/AEPC and VDC decide to include one or two other members/ shareholders as well, acting as consumer representatives/ observers in decision taking meetings. Such members could correspond to major end-users.

### 4.5.1 CESP membership composed of CO-members and outsiders

The CO founding the CESP will be the majority owner of the CESP and the majority decision taker in the CESP. The CESP membership will be composed of all CO members. The AEPC/VDC/DDC would monitor that the CESO performs according to the letter and the spirit of the contract, acting as consumer representatives/observers in decision taking meetings.

### 4.5.2 CESP management team composed of CO members and outsiders

By law, the business forms for the CESP require the CESP to have a number of officers: a chairman/manager, a secretary/accountant, and a treasurer. All three work only part-time for the CESP. The CESP Assembly appoints the officers.

It is recommended that the procedures in the CESP charter impose dual signature requirement for the signing of contracts with suppliers of equipment or services and for withdrawing deposits from the CESP bank account: the chairman/manager and the treasurer.

## 4.6 Operation of Energy Service Business

As an independent legal business entity, CESP will focus on energy services to the end users as per the terms and conditions explained in energy service agreement signed by CESP and users' institutions. However, in some cases such as milling, water pumping etc. the CESP may work as an end use service provider too.

**4.6.1 End use appliances owned and operated by other institutions:** In this situation, the CESP owns only the energy equipment and the end use appliances are owned by the user institutions. Hence, CESP service is limited to energy, and not to end-use services. Therefore, the CESP will charge energy tariff to the users' institutions. Computer education in schools and vaccine refrigerator in health posts are some of the example of this category.

**4.6.2 End use appliances owned and operated by CESP:** For some of the applications, such as water pumping and milling , REP is supporting the whole system, not only the solar PV equipment. REP will hand over ownership of the whole system to the CESP. In such cases, CESP itself will be responsible for the maintenance and operation of whole system, not only the solar PV equipment. Hence, CESP will be assumed as service provider rather than energy supplier.

As per the package definition, water pumping system includes PV system plus the storage tank, water distribution system and taps also. Hence the whole system is owned by the CESP. Thus, the role of CESP is not limited to energy provision, it includes also the provision of water. End users (Households) will be charged water tariff which includes energy fee (water pumping charge) plus water distribution charge.

Similarly to water pumping system, milling includes the comprehensive milling system except land and building, and CESP will act as an operator of milling services. So CESP will charge milling fee (Rs. XX for 1 kg of goods grinding) to the end users.

**4.6.3 End use appliances owned by CESP or users' institutions:** If end use appliances such as DVD, CTC, Audio-visual equipment, Computer etc are owned and operated by the CESP itself, the CESP assumes the role of social service provider, as well as energy service. Thus, CESP will charge service fee to the end users. But, in case of end use appliances owned by other institutions, CESP service will be limited to provision of energy and it will charge only energy tariff to the institutions.

## 4.7 How CESP maintains Account of energy business

As a Multi-purpose Co-operative, CESP can engage in multiple activities which creates a multitude of transactions. As solar energy service is the major activity of CESP, most of the transactions will be related to energy business. It is also assumed that CESP will not spend collected energy tariff for other purpose, except expenses related to energy business. Regarding this, besides main ledger, a subsidiary book (a ledger) will be maintained at the CESP. All CESP related transitions will be posted in a subsidiary book first, and then in the main ledger. In case of having a large volume of transactions, a separate bank A/C will be operated for CESP related transactions.

## 4.8 Relationship with Banks/ Financial Institutions

The CESP will have a bank account to be used exclusively for transactions related to energy business:

- all revenue received from customers for energy-services will be paid into the bank account
- all expenses related to energy business will be covered with money drawn from the account.

PTF explaining CESP relationship with financial institutions

The CESP will have a net surplus on the account most of the time, since a large part of its tariffs is payment for future maintenance and replacement: the community must through its user tariffs save funds to pay for the replacement of parts that break down during operation. Yet, if a major expense item occurs, it may happen that the funds for replacement in the CESP-account are too small to pay for the total cost. In that case, it can get a short term “working capital” loan from the bank. Because of its track record of steady cash-flows paid into the account each month, getting a loan should not be a problem.

# 5 BUSINESS AREAS OF CESP

The potential applications for energy services from the CESP that are outlined in the REP background documents cover four business segments:

1. Energy supply to social institutions (schools, clinics)

2. Water pumping for water user groups distributing water to household and productive consumption (animals and irrigation)

3. Energy services for individual households: solar lanterns, mobile phones

4. Energy supply for individual productive applications for existing productive activities such as milling, and grinding, and for new "entrepreneurial activities" such as audio-visual entertainment, computer use, internet access, emailing.

The four business areas require different levels of engagement by the CESP in terms of staff time, entrepreneurial skills, contracts and tariff policies.

- Energy supply to social institutions is provided through long-term contracts; the institution pays a fixed monthly fee to the CESP for the installed capacity. Since no metering is involved, the administrative cost of that service is low.

- For water pumping, the question is whether the CESP implements the activity as an "energy supplier" providing pumped water against a fixed monthly fee to a local water "utility", which sells the water to households on a fee per consumption (or per household) basis, or as a "water supplier" selling the pumped water directly to final consumers. It is recommended that the CESPs stick to selling water to the final consumers, not energy supply only, as CESP is the owner of whole system.

- Energy services for individual households calls for per use(r) charges and commercial tariffs; the monthly revenue from this activity is variable as it depends on the demand for the service.

- Energy for individual productive applications is a commercial activity like milling but similar to the first two business areas in the sense that monthly fees are charged to the Users' institutions, but in case of end use services provided by CESP itself, tariff will be charged per use basis.

The business areas for the CESP are identified in the feasibility study and defined in the constituting documents for the CESP. The feasibility study must include a solid demand study for the potential business areas, eliminating those that are not financially viable.

The business areas defined for the CESP determine whether the CESP is a “for profit” or a “not-for-profit” organization. The first two business segments described above comprise sales to “collective institutions”, the other two to individual users. For social and income distributional equity reasons, cost-of-production (operation) based tariffs will be fixed for the first two categories; tariffs for energy sales to individual consumers are set with reference to market prices for alternative services in the area and will, therefore, normally include a profit.

# 6 STANDARD DOCUMENTS PREPARED FOR CESPs

The standard format documents which REP prepares for the COs/CESPs comprise the following:

***Information material on school PV-systems***

- Information material on PV-systems
- Demand study format
- Technical feasibility study format
- Application by CO to REP for provision of 100% grant financed equipment
- DDC – AEPC - CESP memorandum of understanding
- CESP founding documents: charter, registration form, business plan
- Management contract between CO and CESP
- Energy service contracts with schools and health posts
- Water pumping contracts with water user groups
- Energy service contracts with private entrepreneurs
- TORs for CESP management/officers
- TORs for service staff contracted by CESP
- After-sale-service contracts with solar dealers

# 7 FINANCE

## 7.1 Financing Investments

### 7.1.1 100% subsidy to CESP equipment provided by REP

The 100% investment subsidy enables the CESP to get its equipment free-of-charge upfront, meaning that CESP has no payment of interest, nor repayment of loans to make. The fees charged by CESP need not include an element to cover its annual costs of finance.

During operation the equipment is physically depreciated. The financial cost of that (finance for needed replacement) is part of the cost of operation, and the long-term sustainability of the service calls for tariffs that cover the full costs of operation. CESP's tariff schedule therefore includes a depreciation charge. If CESP were a private, commercial company operating in a competitive environment, a straight line depreciation would be applied (cost of investment divided by number of operating years); this reflects the operator's full cost of capital. Since CESP is a "not-for profit" entity, which charges cost-of-production tariffs (the exception being sales to individuals) and gets interest income on deposits placed in its bank account, CESP needs to put only enough money aside so that the annual depreciation charge together with accumulated interest income covers the future cost of equipment to replace. The reduction in the "cost of equipment charge" compared to a loan-financed investment case is substantial.[4]

Institutional solar photovoltaic system in rural Nepal

The "cost-of-equipment" component in the tariff schedule needs to set aside funds only for wear-and-tear: equipment items that need to be replaced during the lifetime of the project. It does not need to accumulate funds for total replacement, as the expectation is that all CESP-serviced communities will be connected to the national power grid within the next 20 years. 20 years is also the assumed economic lifetime of the PV-panels delivered by REP. There is, therefore, no need in the tariff setting schedule to include funds for the replacement of panels except for, say replacement of 10 percent

[4]As example, let us assume that the CESP invests €100 in a system having a lifetime of twenty years and zero operating cost. In case 1, the CESP gets no subsidy but a 20 years loan at 10 percent real rate of interest to finance the system. ("Real rate" means rate of interest adjusted for inflation. If for example the rate of interest charged by banks is 12% and the rate of inflation 2%, then the real rate of interest is 10%.). The annual cost to cover through consumer tariffs is €11.75; at the end of 20 years, when the system breaks down, CESP needs to take a new loan to buy a new system. In case 2, the CESP gets a 100% investment subsidy on the condition that it charges a tariff enabling the CESP to accumulate enough money to buy a new system after 20 years. If the CESP gets 2% rate of interest on the annual tariff revenue that is deposited in a bank, CESP needs to charge €4.12 per year to cover its full cost of supply. At the end of 20 years the CESP draws the money from its bank deposit to buy a new system.

of the panels, as quality problems or inadequate handling may shorten the lifetime of some panels to much lower than 20 years.

The 100% solar equipment subsidy thus has three implications:

- the lower cost of production enables the CESP to lower its tariffs making the social services affordable to the community;
- the lower cost of production enables the CESP to increase its profits on its commercial energy sales;
- the 100% subsidy provides the CESP with valuable assets that have no debt attached, which enables the CESP to offer the movable parts of its assets as collateral to banks when it needs a loan to finance investments.

### 7.1.2 Investment in appliances financed by consumers

#### Public budget funds for appliances at health Posts

REP standardized PV systems will be delivered to health posts having appropriate electrical appliances. The appropriate appliances in the health posts correspond to solar refrigerators, solar sterilization equipment and laboratory equipment. Acquiring the appliances is the responsibility of end user (health posts).

Health Post in Rural Nepal

The health post management committees are in charge of procurement of the electrical appliances. There are a number of potential sources of financing for these appliances:

- Ministry of Health
- Donor Agencies including (I)NGO, mainly WHO
- VDC and or DDC.

#### Financing the cost of audio-visual equipment and computers in school

During daytime, schools have little demand for lighting, whereas during the evening – when lighting is needed – there is little need for the school facilities for educational purposes. REP is therefore supplying only “larger scale” PV-systems : 1000 Wp (package 1) & 1900 Wp (package 2) These systems are provided only to schools with appropriate electrical appliances. To be eligible for REP-supported PV-systems, a school must have at least two computers and a printer for package 1, and four

computers, copy-machine and a printer for package 2. The proposed packages may also power a color TV and a video / DVD-player.

The school management committees are in charge of procurement of the electrical appliances. There are a number of potential sources of financing for these appliances:

Computer

- Ministry of Education which is currently equipping secondary schools with computers
- Donor Agencies including (I)NGO
- VDC and or DDC
- Public private partnership.

In case a Management Committee is unable to obtain the financing of computers by the Ministry of Education or any another public institution, such as the VDC/DDC, it can explore the option of securing the appliances through a "public-private-partnership" arrangement. A private person (or a local CO) can be the investor-owner of the equipment used at a school under a deal which gives the school access to use the computer and the TV-DVD equipment for a specified numbers of hours each during school days. In return, the investor-owner has access to use the school (or parts of it) during off-school hours free-of-charge (excess for co-payment of the school's monthly energy service fee) to sell computer and internet access and/or TV-on-a-pay-per view basis to the local population.

### Financing milling

REP finances the cost of complete PV-milling equipment (i.e. PV-system, DC motor and milling machine), except land and building.

### *Financing any other end-use –Telecommunication centers, Entertainment,*

REP is supplying a standard PV package to community organizations with a nominal size of 900 Wp for communication centers ( i.e. public telephone, fax, internet) and 200 Wp for entertainment (operation of audio-visual equipment) .These systems will be delivered to the Community organizations having appropriate electrical appliances ( telephone line, communication equipment, audio-visual equipment). Acquiring the appliances is the responsibility of end user: private or public. .

## 7.1.3 Investment in Water Supply

The water users (individual Households) sign the contract with CESP for the supply of drinking water to the village. CESP owns the whole system which includes energy

supply, pumping plus distribution system and taps. Water users are responsible for the management of land required for lying pipeline network, construction of water intake tank, distribution tank and water taps. Moreover, they are also responsible for the management of water source. CESP will be responsible for the repair and maintenance of whole water pumping and distribution system. The users are also responsible to pay water tariff to the CESP as per the terms and conditions stated in the agreement.

Water distribution tape of community managed water pumping system

REP finances the total cost of investment of water pumping system which includes the cost of distribution system and public taps also (one tap for 10 households).

## 7.2 Financing the Cost of Operation: the Energy Service Fee

Options for financing the cost of operation (energy service fee) may not be the same for all institutions. It varies from application to application. REP has defined seven different packages for social institutions such as Health Posts, Schools (2 packages), Entertainment Community, Community Telecom Centre, Milling and Water Pumping. For social institutions such as Health Posts, Schools, budget allocation by the relevant Ministry while allocating annual operating budget of these institutions will be one of the potential financing option But for other applications, tariff from the end users (except some grant from VDC/DDC and local NGO etc) will be the only option for financing the cost of operation

### 7.2.1 Health post operating budget

The appliances of the health post offer little potential for income generating activities, beyond very small scale revenue from charging cell phones. The Management of the health post, therefore, must negotiate an increase in its annual operating budget.

### 7.2.2 School operating budget

The annual budget for the school must include a budget line to cover the monthly fee payments for the energy service.

School selected for REP support

Since the objective of the energy service is to improve the quality of education, not to reduce it, the Management Committee must ensure that the annual payment for energy supply, fixed in the contract, does not reduce the budget for other school items such as paper, pencils, books, etc. Since the payment for the energy service leaves the school with fewer funds for its other cost items, other sources of finance must be found to cover the funding gap. One source of finance is an increase in the annual operating budget that is allocated to the school by the Ministry of Education.

Alternatively, the school can get the required fee money from income generating activities. The school has a "unique" asset: a large building and large-sized (class) rooms that are perfect for community meetings and activities; once it has installed electricity, outside school hours the school can be rented out against a "per evening" fee. Another option is to use the school's electronic equipment for income generating activities. The school can, outside school hours, show TV and DVD-films to viewers against a pay-per-view fee or give private persons access to its computers and to the internet against a per time use fee.

For the school in which photocopy is in package, revenue from copying the exam papers will be one of the major financing options of cost of the system operation. Besides this, school may provide copying service to the outsiders and generate additional income.

### 7.2.3 Entertainment Community

Community entertainment which includes audio-visual, DVD etc. is a commercial service which will be carried out mainly to earn profit. Thus, Community Organization will charge higher than the cost of supply fee (with certain % of profit) to the users. The revenue from the service (service fee) will be major source of financing for cost of system operation.

### 7.2.4 Community Tele Center

Community Tele Center which includes public telecommunication, fax, internet etc. will be operated by Community organization to earn profit. As a profit motive this is commercial activity, Hence, the CO will charge higher than the cost of service fee to the users. The revenue from the service (service fee (will be major source of financing for cost of system operation.

### 7.2.5 Milling

Milling is also a commercial activity and will be operated to earn profit. Revenue from the milling services will be the major source of financing cost of system operation

### 7.2.6 Water Pumping

Community water pumping is social activity which will be operated with the main objective of providing drinking water to all people living in the same areas. CESP collects tariff directly from the water users (households), since for this application CESP

itself is a service provider, and not only the energy supplier. Besides this the tariff from the users sometimes VDC/DDC and other local NGOs may provides grant to subsidize the cost of operation of the system.

## 7.3 Issues for the CESP Demand and Feasibility Study

The demand study for the CESP feasibility study includes an appraisal of the likelihood that a school and/or a health post requesting a PV-system has been getting the listed electrical appliances and that it has concluded arrangements enabling it to pay for the cost of operation: both the annual energy fee to the CESP as well as the normal costs of the school or health post. For the water pumping systems, the demand study ascertains co-funding by the VDC and that the water supply tariffs can cover the annual water pumping fee and the cost of pipe maintenance.

Community managed solar water pumping system

# 8 SETTING TARIFFS

## 8.1 Tariff Principles

Sustainability of electricity supply requires that the fee, which the CESP collects from end–users, covers CESP's full costs for providing the service: costs of operation, maintenance and rehabilitation as well as the costs of management and administration.

The CESPs serve different types of customers: households, public institutions, private business and collective service providers. The CESP's flexibility for setting its prices is much larger in the "commercial/ entrepreneurial business areas" (service for individual consumers) than in the "non-commercial" areas (services for collectivity). The flexibility leads to the following basic principles for setting the CESP's tariffs:

1) **The average tariff** (of all activities combined) must as a minimum cover the total operating costs of the CESP, including replacement of worn-out equipment
2) **The tariff for "not-for-profit" services** (energy supply to public institutions and water pumping) is to give a zero rate of return on capital investment that is provided free-of-charge from REP.
3) **The tariff for "commercial" services** (energy for private productive activities) can be higher than CESP's full-cost-of-supply for the service (resulting in a profit), as long as it is lower or equal to the prices charged by private operators in the area for the service.

## 8.2 Cost components

Before CESP can start setting tariffs for its services, it is essential for CESP management to know and to understand its costs of supply. CESP's cost of supply (cost of production) for providing a specific service is composed of the following components:

1. Replacement of worn-out parts and equipment
2. Cost of outside technical service assistance (if/when necessary)
3. Costs of CESP and/or CO part-time staff for daily O&M and service management
4. CO-management fee (for project preparation and project ownership).
5. Insurance premium of the equipment
6. Taxes
7. Annual audit fee
8. Cost of inflation adjustment
9. Other unspecified expenses & communication charge

The last two items are defined in the CO's management contract with the CESP.

### 8.2.1 Accumulation of funds for replacement of equipment

For each energy service, the CESP must accumulate funds in its bank account to pay for the cost of replacing parts having a lifetime lower than the expected lifetime of the service.[5]

The CESP identifies for each service the components that have an expected lifetime lower than the project lifetime. The cost of the component in year 2007 prices divided by the expected years of component lifetime is the amount that needs to be deposited each year.[6] The amount can be slightly lower if the rate of interest paid by the bank on funds in the CESP bank account is higher than the rate of inflation.[7] The cost in that case is equal to the annuity payment, paid during "N" years and at a real rate of interest "i", which is capable of providing the amount "F" in the year "2007 + N".

### 8.2.2 Cost of contracted outside services

As part of its project preparation activities, REP trains CO/CESP staff in the performance of basic service and maintenance. But, the CESP will still need specialized expertise from outside the CO to perform more advanced service. It is recommended that the CESP signs an annual service contract with a solar dealer having a trained retailer in the region to perform an annual service check and ad-hoc assistance when something breaks down that the CO/CESP service staff cannot fix. The cost of that contract (or a lump sum to cover the estimated cost of ad-hoc service assistance) is one of the cost components in the annual service fee which CESP charges for a service.

Rural based repair and maintenance center for solar equipment

In addition, CESP must pay for an annual audit of its accounts performed by an outside accountant.

### 8.2.3 CO management contract with CESP

The CESP signs a management contract with the CO. The contract foresees two types of payments to the CO:

1. payment for mandays used by CO staff in CESP daily operation and management;
2. payment of a CESP management fee.

*Fee per manday for work provided by part-time CESP staff and CO members*
The CESP is managed by its own staff and operated by CO-members.

The CESP management team comprises the chairman/manager, the secretary/accountant, and the treasurer. All are part-time staff.

The CO members who are trained by REP to perform the required operational services

[5]Lifetime of the service = number of years until the community is connected to the national electricity grid.
[6]This is the correct economic depreciation.
[7]Expressed in other words: that the socalled "real rate of interest" is higher than zero. If the bank pays 5% in interest and the expected rate of inflation is 3%, then the real rate of interest is 2%.

and routine maintenance need not be formal CESP staff; they can be contracted by CESP as part-time workers to perform ad-hoc tasks against a specified remuneration. Based on the demand study and on the CESP feasibility study, the REP regional office, the CO and VDC will draw up Terms of Reference (TOR) for the individual members on the management team and for the operational workers. The REP regional office, the CO and VDC will agree on (i) how many mandays of work are required for the tasks to be performed by the managers and operational workers according to the TOR and on (ii) the appropriate level of remuneration per manday per type of manager/worker. Multiplying the mandays estimated in each TOR by the specific remuneration per manday gives the total annual cost for management and operational staff.

As a starting point for discussion the REP regional office could propose the fee rates shown below:

- Cost of technical service staff (on full time basis): 26,000 NRps/year
- Cost of CESP managers (on full time basis): 26,000 NRps/year

These figures would be converted into fees per man/day.

### *Justification for CO management fee*

The CO as project developer and project owner is entitled to a project management fee. During the preparation of the REP project leading to the establishment of the CESP, CO members invest substantial management time in the preparation of the demand study, setting up the CESP, in receiving training, in participating in discussions and negotiations with REP/AEPC/EU staff. This use of time, plus the overall responsibility for taking on the CESP and continuing its operation entitles the CO to a management fee, which is separate from the payment for day-to-day assistance.

When a private project developer & operator prepares a power project, the use of manpower time converted into a financial value (and incurred cash expenses with a rate of interest added) will be counted as his equity investment in the project upon the foundation of the service company and its registration. The equity share entitles the project developer to a share in the profits of the company. The project developer & operator manage the company during operation holding the management contract with the company. The management part is covered by the remuneration for CESP-staff; the project development & owner aspect is covered by the CO management fee.

How can the management fee be fixed? It comprises two types of values: the tangible: compensation for CO member time in the preparation of the project; and the intangible: incentive payment for taking on the responsibility for the CESP-project and for project ownership. There is no objective way to quantify the intangible values. It is recommended to fix the management fee at 0.5 percent of the value of the equipment contract which is provided by the EU/REP/AEPC (onetime payment during the project period). Since the average investment per CESP (10 million euro for 168 CESPs) is expected to be around 5.47 million NRs; the management fee would be around NRps 27,380.

### *Administrative expenses and communication*

In addition, the annual management and operation contract between the CESP and CO must include a lump sum for small scale administrative expenses and communication.

### *Inflation adjustment*

The remuneration is to be adjusted once per year with the annual adjustment in national wages for teachers, nurses and VDC staff.

## 8.3 Fixing Cost of Supply based Tariffs

Supply of energy to schools and health posts, as well as water pumping for water user groups is a "public utility service". For "public utility services" REP/AEPC insists that CESP charges a tariff that covers no more than the CESP's full-cost-of-operation ("cost-of-supply").

### 8.3.1 Tariff for water pumping and for water supply

Community manaed water pumping system

The water pumping system which REP finances for the CESP comprises (i) a solar water pumping system, (ii) a water storage tank, (iii) a water pressure tank and (iv) distribution network.

For water distribution, the intention is to have one water tap point for every ten households that are served. The distribution system includes pipes to deliver water from the water pressure tank to the water supply points (water taps). The tariff for water supply, which the CESP charges to the households and to productive users of water must thus cover (i) the cost of water pumping and (ii) the cost of water distribution (repair and maintenance costs of water distribution system). The spreadsheet model for calculating the water tariff, therefore, makes separate estimates of CESP costs of investment and operation of water pumping and distribution. An indicative example is shown in the page overleaf.

Both tariffs must be calculated in the demand study, as the study is to establish the effective demand for setting up the water service, which depends on its price. Effective demand means that the target population is in fact capable of and willing to pay the cost-coverage price for the service.

The indicative example overleaf leads to a tariff of 90 Rps/households, 85 Rps for water pumping and 5 Rps for water distribution; based on the assumption that the cost of equipment and of the pipes is given free of charge to the CESP . Due to differences in (i) "geography": water depth, density of population and the physical characteristics of the local area, and (ii) "productive uses of water" the cost of supply per community household (based on full payment of O&M) varies tremendously from project to project, please see the table below. It shows costs ranging from 51 to 215 Rps.

| Cost of Water Supply Rps/month per household | | | | | | |
|---|---|---|---|---|---|---|
| Irang | Dumre | Richowk | Todke | Thin | Chiyabri | Moyhira |
| 61 | 215 | 76 | 47 | 154 | 51 | 94 |

To avoid misleading interpretations of the cost differences, one must take note that the costs of supply per household in Dumre and Thin are much higher that in the other projects, due to use of water for washing and for animals and in Dumre also for irrigation. That is, the amount of pumped water per household (including productive non-household water consumption) is much higher in these communities. Since productive users are charged for their water consumption, the household tariffs in the two communities are, therefore, probably similar to tariffs in the other communities.

Table: Cost Structure for Water Pumping and Distribution Indicative Example

| **WATER PUMPING AND DISTRIBUTION** | **Irang** | |
|---|---|---|
| no of households | 74 | |
| INVESTMENT | | |
| **(a) Water pumping and storage (CESP)** | | |
| cost per Wp of solar panels | 6 | €/Wp |
| Capacity | 1200 | Wp |
| Cost of panels (€6*1200*92) | 662,400 | Rps |
| Cost of pump (per unit) | 180,000 | Rps |
| Number of pumps | 2 | |
| Civil works: well outlet and storage tanks | 200,000 | Rps |
| CESP investment for pumping | 1,222,400 | Rps |
| (b) Water distribution) | | |
| Water pipes and water taps | 200,000 | Rps |
| Total Investment | 1,422,400 | Rps |
| O&M | | |
| **(a) Water pumping and storage (CESP)** | | |
| Lifetime of panels | 20 | years |
| Lifetime of pump | 10 | years |
| Cost of O&M (service & small parts) | 2.0% | |
| Cost of O&M (service & small parts) | 24,448 | Rps/year |
| Cost of operator per year | 3,545 | Rps/year |
| Cost of pump replacement (cost of 2 pumps) | 32,878 | Rps/year |
| CO Management fee | 6,112 | Rps |
| **a) In case of total value of CO management fee charged in the initial year only** | | |
| Annual CESP cost of supply for pumping | 66,983 | Rps/year (ist year only) |
| Annual CESP cost of supply for pumping | 60,871 | Rps/year (rest of the period) |
| CESP charge per household | 75 | rps/month(ist year only) |
| CESP charge per household | 68 | rps/month(rest of the period) |

| | | |
|---|---|---|
| **b) In case of CO management fee charged proportionally over the project period** | | |
| Annual CESP cost of supply for pumping | 61,177 | Rps/year |
| CESP charge per household | 69 | rps/month |
| (b) Water distribution | | |
| Lifetime of pipes and water taps | 20 | years |
| Small repairs for damages | 2% | of investment |
| Small repairs for damages | 4,000 | Rps/year |
| CO management fee | 1,000 | rps |
| **a) In case of total value of CO management fee charged in the initial year only** | | |
| Annual CESP cost of water supply | 71,983 | Rps/year (ist year only) |
| Annual CESP cost of water supply | 70,983 | Rps/year (rest of the period) |
| CESP charge per household | 75 | rps/month(ist year only) |
| CESP charge per household | 81 | rps/month(ist year only) |
| CESP charge per household | 80 | rps/month(rest of the period) |
| **b) In case of CO management fee charged proportionally over the project period** | | |
| Annual CESP cost of water supply | 71,003 | Rps/year |
| CESP charge per household | 80 | rps/month |

The monthly tariff is found by dividing the total average annual cost of O&M with the number of beneficiary households and divide that number by 12.

The figures for the cost of investment can be updated to the real figures, once the tender for the investment has been concluded. Few reliable estimates exist of lifetime O&M costs: the final report of the REP identification mission, for example, uses a 3% rule of thumb figure for O&M for all technologies supported by REP, which seems rather simplistic. The figures in the spreadsheet are no more than "best guess estimates" to be carefully discussed with the CESPs.

### *Comparison with water tariffs in other projects*

The cost covering tariff as estimated above is higher than the tariffs charged in other water supply projects that found donors willing to pay part of the costs of O&M; the CESP has no possibility for that.[8] In other rural water supply projects, water tariffs were:[9]

- The NEWAH community drinking water programme, using gravity flow technology (investment cost of Nrs 3,500-4,000 per beneficiary) charges 2-5 Rps per household per month

[8]Unless the DDC decides to subsidize CESP's cost of water supply.
[9]In other rural water supply projects, water tariffs were:

- The Todke Water Pumping System which was installed by ECCA from Australian Aid in Lalpur VDC-3, Siraha (4 KM. North from Golbazar) charges 50 Rps per month per tap
- In the Keshavtar VDC-3, Tanahu solar water pump project, KAAA supported by Gorkha Welfare Organization charges Re. 20 per household per month.
- Irang water pumping sysem at Benegath VDC5 Irang Dhading (the most recent project) charges 50 Rps per household per month

***Tariff methodology proposed for projects with multiple water uses***

The CESP fixes a fixed monthly charge for the water that is pumped into the water pressure tank. Since CESP relies on the water user group's ability to pay for its water pumping service, it has an active interest in the water user group applying a realistic tariff policy. When the pumped water is used both for household consumption and for productive uses, e.g. as in Dumre and Thin, the water user group might apply the tariff setting methodology summarized in the table below.

| Total tariff per beneficiary: "nn" Rps | in % of total | Tariff per beneficiary |
|---|---|---|
| Estimated share of household consumption | "zz" | zz x nn |
| Estimated share of productive consumption: | "yy" | yy times total annual cost= RP |
| washing (in % of productive consumption) | ("aa") | aa times RP / users |
| irrigation (in % of productive cons.) | ("bb") | bb times RP / no. of farmers |
| animals (in % of productive cons.) | ("cc") | cc times RP / no. of animals |

Each consumer category pays a share of the annual cost of O&M which equals its share in total consumption, as estimated by the feasibility study. The feasibility study for the project estimated the need for water to establish the dimension of the system. The study calculated the demand for water per household (typically assumed to be 40 liters per day) and for the productive uses, respectively.

The annual household tariff is found by multiplying the annual cost of the water supply operation with the percentage of annual water consumption assumed to be consumed by households and dividing that number by the number of households.

The total revenue to be paid by the productive consumption of water (revenue from production, "RP" in the table) is equal to the productive user share of total water consumption multiplied by annual operating cost for the water supply system.

### 8.3.2 Tariffs for energy supply to health posts

The CESP installs and operates 600 Wp systems at health posts. The annual fee for the service, which includes maintaining the operation of the system and replacing worn out bulbs is estimated at 760 Rps/year. The cost components leading to the estimate are shown below.

Cost of investment for installed 600 Wp system (to calculate the 0.5% CESP management fee): 6,600 Euro = 607,200 Rps, an indicative example

| Cost of operation & maintenance | |
|---|---|
| 600 Wp system operated by CESP | Rps/year |
| KWh per year | 876 |
| Replacement of battery | 3,428 |
| Replacement of charge controller | 378 |
| Replacement of bulb | 1,400 |
| Annual cost of external service | 400 |
| CESP PV-service staff | 473 |
| CO Management Fee | 3036 |
| a. In case of total CO management fee charged in ist year | |
| Cost per year | 9,115 |
| Cost per month | 760 (ist year only) |
| Cost per kWh | 10 Rps |
| Cost per month | 507 (rest of the period) |
| Cost per kWh | 7 Rps |
| b. In case of CO management fee charged proportionally over the project period | |
| Cost per year | 6,230 |
| Cost per month | 519 |
| Cost per kWh | 7 Rps |

## 8.4 Tariffs set with Reference to Market Prices

### 8.4.1 Tariffs for energy supply to private productive uses

The productive use systems comprise solar PV powered “milling machines”.

The CESP sells energy supply from the PV-systems, entrepreneurs signing energy supply contracts with the CESP..

It is recommended that CESP for sales of energy ( sometimes end use services too) to productive uses charges an annual tariff equal to CESP’s annuitized cost of supply plus a profit element of 15%. Faced with this price, potentially interested public/private companies/cooperatives can decide whether energy supply from the CESP is cost competitive with supply from alternative sources such as water mills or pico-hydro.

Like other productive uses, CESP will charge tariff equal to the cost of supply, plus a profit element of 15% for energy supply to the entertainment and communication services. But the tariff should be cost competitive with alternative source of energy supply.

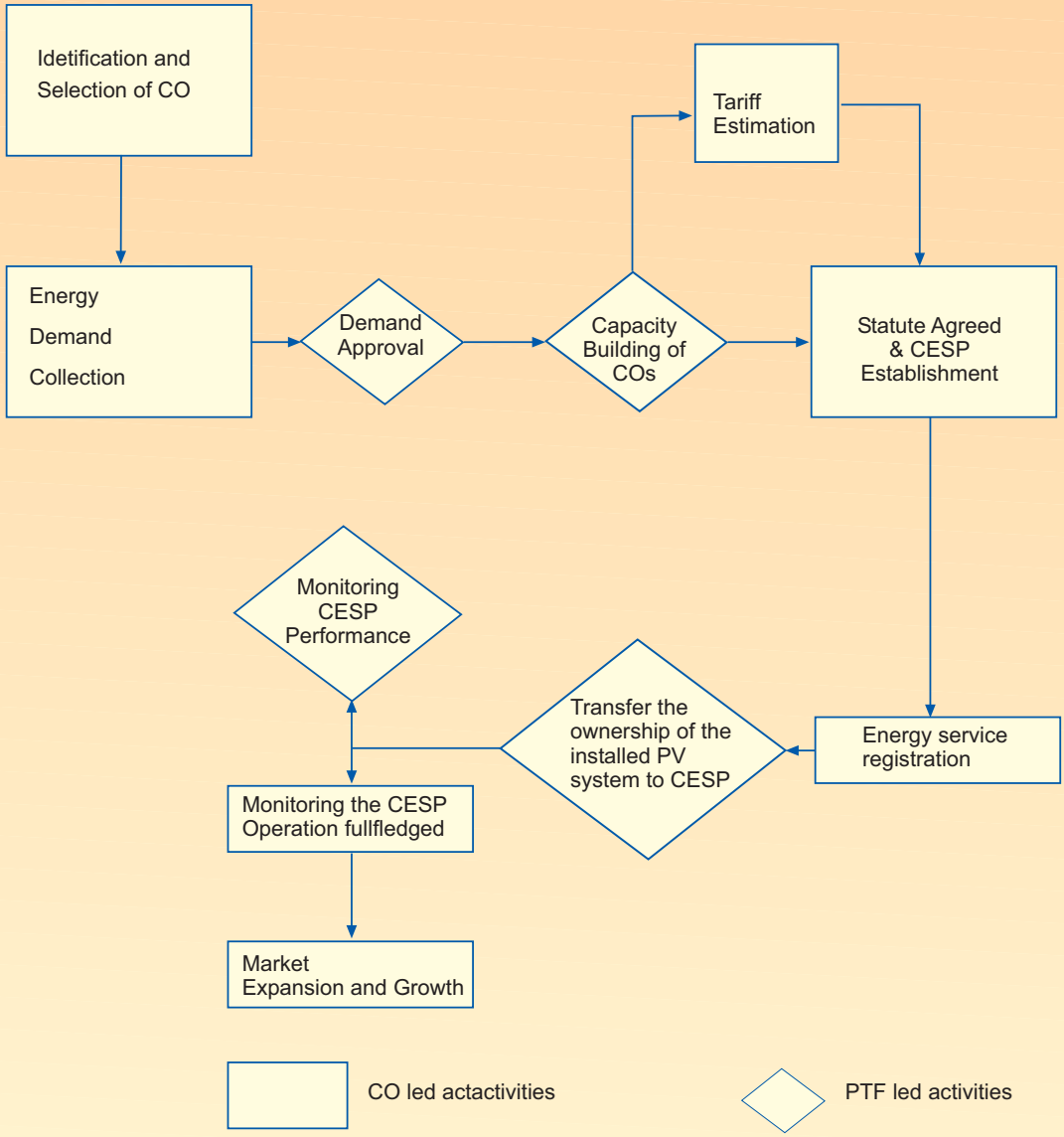
# 9 CESP PROJECT CYCLE

## 9.1 Overview

The CESP project cycle can be divided into the following phases :

1. Identification of COs interested in setting up a CESP; contacts with VDCs, awareness building of target communities and completion the COs selection process
2. Demand study by CO with technical assistance from REP/AEPC regional office to confirm the feasibility of setting up a CESP, and identify the community's priorities for energy services
3. Presentation of proposed energy services and their costs to users to the larger community for discussion.
4. Application by CO/CESP to REP/AEPC regional office to provide the equipment for the priority energy services identified by CESP
5. Preparation of a technical feasibility by REP to specify the technical requirements for the requested equipment package and complete the procurement process..
6. Capacity building of CO in preparation of business plan, account keeping, organizational development, financial management, tariff setting & restructuring, and system operation and maintenance etc.
7. Preparation of CESP business plan and formal CESP documents, fixing of tariffs and creation and official registration of CESP
8. Conclusion of energy service agreements between CESP and end users
9. Contracts signed between CESP, DDC and AEPC for equipment and service provision
10. Implementation of investment and handing over of ownership of equipment to CESP
11. Provision of energy services by CESP and after-sales service by PV-suppliers
12. Monitoring of operation of CESP by REP/AEPC regional offices and DDC/VDC
13. Ad-hoc capacity building activities (technical and management issues)
14. Impact evaluation reports
15. Closure of CESP activity upon connection of CESP-served communities to the grid and division of assets between CO and community

# CESP SET UP AND CAPACITY BUILDING PROCESS FLOW CHART



# 10 DEMAND STUDY

## 10.1 Average REP Investment per CESP

The REP set that the CO requests for energy systems should fulfill three conditions to be eligible for processing:

1. The PV-power capacity of the proposed investment package will be a minimum of 5 kWp (preferably)
2. The CO should apply for 3 different systems with at least one health post or/and one school
3. The cost of the equipment per CO will not be higher than (€59,500).

PTF explaining the potencial applications of solar energy system

The first condition aims at implementing only projects capable of having a minimum impact on the energy situation of a served community.

The second condition is related to the overall project objective: create energy infrastructure for social services as explained in the financial agreement of the project . The third is imposed by the REP's funding constraint. The intention of REP is to create around 168 CESPs. REP's working hypothesis is that on average 500 households live in the area served by a CESP. Since REP has a budget of €10 million to pay for the purchase of equipment for CESPs and their installment, the average investment per CESP that can be financed by REP is € 59,500, or €119 per household.

| Type of Activity | Euro | Rps |
|---|---|---|
| Total REP Funds for Investment | 10,000,000 | 920,000,000 |
| Average investment per CESP (168 CESPs) | 59,524 | 5,476,190 |
| Average investment per household (500 hh. Per CESP) | 119 | 10,952 |
| Cost of water pumping station, including piping system for distribution 9 kW for 420 households | 99,000 | 9,108,000 |
| Average water pumping system 1.5 kW (70 households) | 16,500 | 1,518,000 |
| School PV-system: 900 Wp system (for 2 computers and 1 printer) | 9,900 | 910,800 |
| Health post PV system: 600 Wp (for solar refrigerator, sterilization) | 6,600 | 607,200 |
| Milling system 1.5 kWp: Excluding motor but with AC converter | 16,500 | 1,518,000 |

Since the cost of one school and one health post system varies between €7,500 and €23,000 (92,0000 Rps), the challenge for the demand study is to identify equipment for a maximum value of €27,000

PTF explaining the potencial applications of solar energy system

It is known from contacts between staff in the regional REP offices and target communities that two services in particular arise their interest: water pumping, and milling.

Household electrification is one of the highly demanded application in rural areas. For this, the Solar Home System (SHS) and Battery Charging Station will be the potential electrification options in the rural areas. From the technical and financial support of DANIDA, AEPC/ESAP has been operating subsidy-based SHS in rural areas of Nepal for the last couple of years. Cost of investment in solar-based battery charging station is very high compared to SHS.

The numbers in the table reveal that the prioritization process is tough, as only some of the demand can be satisfied:

- the cost of investment in water pumping stations providing water to all 500 households in the community would amount to about 10 million Rps;
- the cost of a 1.5 kWp PV system for a milling machine amounts to about 1.5 million Rps

The water pumping and milling systems which a CESP installs cannot serve all members of the community, but only a minority of households. Thus, satisfying one type of demand eliminates the possibility to satisfy other types of demand.

The “demand analysis” of the community must decide what kind of package is (i) financially sustainable and (ii) provides the greatest benefits to the community.

Apart from making use of public community meetings to discuss options and identify priorities, it is believed that the VDC can play a useful role in reconciling diverging interests.

## 10.2 Relationship between the Demand Study, Appraisal of COs and the Technical Feasibility Study

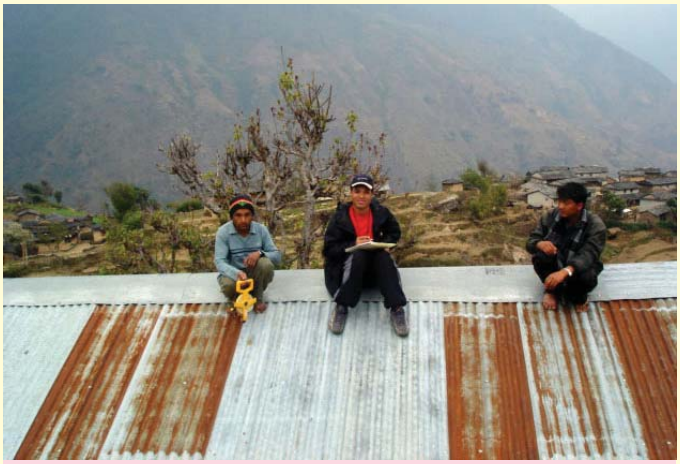
### 10.2.1 Conventional feasibility study and REP approach

In principle, the CESP concept calls for the preparation of a feasibility study covering three issues:

- a demand (or market) study to identify the priority energy needs of the local population and their willingness to pay tariffs for the services that cover the CESP costs of supply;

- an institutional assessment of the CO's capacity to implement the CESP-project;

- a technical feasibility study to confirm the best technical options and the specifications of the material



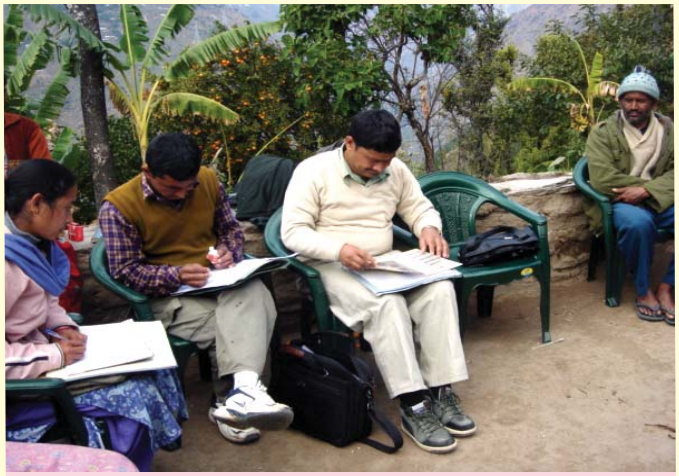
feasibility study of selected energy demand

In the REP's approach, the demand study will be carried out by the CO with support from the REP/AEPC regional office. The REP/AEPC office undertakes the institutional assessment of the CO and its capacity to set up and manage the CESP based on its contacts and discussions with the members. The technical feasibility study will be carried out by technical PV /REP Experts who will look at the technical details, and propose the system design and make a cost estimate.

The proper integration of the market demand, institutional appraisal and technical evaluation is, therefore, performed by the staff from the REP/AEPC regional and head offices as part of their daily duties

### 10.2.2 REP appraisal of COs

The REP offices rank COs in the initial selection process on the basis of their general business objectives, registration status, organizational/logistical capacity, human resources capacity, financial capacity, relevant experience, local legitimacy & outreach. and estimated demand collection. REP has developed quantified shortlisting criteria for this. Based on the CO merit, a maximum number of 10 VDCs from one district in which the top ten ranked COs who have applied ought to be the future CESP, and will be selected for REP Intervention .Only one or two of the top ranked COs of the selected VDC will be further short-listed for the field verification. Finally, the most suitable and physically verified CO during the field verification process will be selected for the energy demand collection. REP field offices will then assists the COs in the energy demand collection.



Verifying the information provided by COs

## 10.3 Organization of Demand Study and Project Approval

### 10.3.1 Energy Demand Collection by CO

COs interested to participate in the REP are identified by staff from the regional REP/AEPC offices who visit communities in the target areas to inform about the possibilities offered by REP.

COs expressing an interest in setting up a CESP are asked to make a demand study to establish the market for potential energy services supported by REP.

REP has prepared some basic documents to assist COs in doing the market study. The demand study is to assess the geographic boundary of the market, economic and the social factors that influence the energy market, the most promising specific market niches, potential customers and potential application of solar energy, end user's affordability. The findings (collected demand) will be presented in an Energy Demand Form designed and provided by the REP.

The regional REP/AEPC office assists the COs in market assessment of the energy services, and demand collection through different awareness creation and social mobilization activities and workshops.

The office also assists the CO in making cost and tariff estimates for the different energy services that the CO/CESP is interested in providing, using the excel-spreadsheet model prepared for that purpose. The demand from the public institutions – schools and health posts – depends on their ability to get grants from other public authorities for the purchase of the appliances. It is expected that the local VDC assists the CO in establishing a reliable estimate of the likelihood that contacted institutions can get the asked for appliances and are able to pay for CESP's service.

Since CESP' tariff cannot be higher than the target population's ability to pay, the ability to pay criterion serves as a cut-off criterion. If the targeted customer cannot afford to pay a tariff that can cover CESP's full cost of supply, then providing the service is not financially and institutional viable to that end user

### 10.3.2 Approval of the Demand

Based on the result of eligibility assessment, and feasibility reports, all eligible applications received from COs will be given marks as well as pass/no pass notes.

The REP confirms that around 168 COs will be selected for assistance from the project. The consolidated energy applications will be forwarded for the procurement process.

Apprisal of energy demand

## 10.4 Estimating Household Ability to Pay

### 10.4.1 Difference between notional and effective demand

The capacity building of the CO in performing the demand study will emphasize the difference between the notional demand and the effective demand for a service.

All energy services supported by REP provide high-value services to the local population. If the tariffs for the services were zero or low, the "notional demand" of the population – meaning its interest in getting the service – would be 100%.

The "effective demand" for a service refers to the demand for a service expressed on the market, when a population has to pay a reasonable tariff for the service in order to access it. Although the tariffs of the CESPs are heavily subsidized, they are not cheap compared to the purchasing power of the population.
The effective demand for a service is, therefore, much lower than the notional demand for it.

### 10.4.2 Information on tariffs and costs of appliances

Giving the population in the community reliable information about the cost to them of getting a specific energy service is essential to establish the effective demand for a service in a demand study.
The information given to households, public institutions and entrepreneurs includes, therefore, in addition to the CESP tariff for a specific service (and the resulting monthly cost of the energy service), also information about the prices and costs of the electricity consuming appliances that consumers need to purchase and maintain in order to use the CESP's energy service.

### 10.4.3 Demand for water

The viability of the CESP's water pumping service depends on the water users' ability to pay the monthly fee for the CESP's water supply. The water users' ability to pay, in turn, depends on the ability of the households to pay monthly water supply fee. The CO therefore, provides information on its monthly tariff per household, which the CO/CESP must charge in order to cover its cost of water supply, comprising the cost of water pumping and the cost of water distribution to the taps.

Water supply is a collective good and the population expects that all households in the service area – all ten households per tap - can access the water tap. Due to this, the ability-to-pay tariff level is defined by the poorest households' ability to pay, unless a two-tier tariff structure is introduced, where the CO/CESP charges poor households a tariff which is lower than its cost of supply per household, and all other water consumers a tariff which is higher than its cost of supply.

### 10.4.4 Demand for audio-visual entertainment

The demand study must establish the demand of the population for "pay-per-view" television service. Like battery charging, this is a niche product. The potential demand

comes from households who are too poor to afford investing in either a SHS or in a battery plus battery charging, but who can once in a while pay for seeing TV.

For reasons discussed in section 7.1, organizing "pay-per-view" television could be an income generating activity enabling a school or a community base organisation to cover some or all of the costs of getting PV-based energy service from the CESP.

### 10.4.5 Demand for telecom, computer and internet services

Due to the "exodus" of young men from villages who go abroad to work (demand for communication), and send remittances back home (ability to pay for communication), there is a potential demand even in poor communities for computer and internet service. This, again, is a potential income generating activity for schools or a community based organisation; and, therefore, needs to be checked in the demand study.

### 10.4.6 Productive demand for CESP energy services

Establishing the effective demand for CESP energy services for productive use activities is probably the easiest activity in the demand study. The CO informs potential entrepreneurs about the monthly cost of its energy service and of associated user investments in electricity using machinery. Based on that, the entrepreneurs can determine, whether (i) the offer is competitive with alternative sources of energy supply and (ii) whether the cost of the final milling service is low enough to have a market for the service.

## 10.5 Estimating Institutional Ability to pay

### 10.5.1 The challenge

The CO established the institutional demand for energy services through direct contacts with the Management Committees for the health posts and the schools in area to be served by a CESP. Interested committees may sign an conditional energy supply agreement with the CO. The agreement is conditional on the side of the committee on its ability to secure funding for appliances and operational expenses; and on the side of the CO on REP's acceptance of its application.

REP prepares information material for its school system and for its health system which the COs can hand over to the management committees. The material informs about the type and size of appliances that can be powered by the designed package of PV-system, which REP offer as a standard, their costs of investment and operation, including the monthly service payment to CESP.

**The challenge for the CO in the demand study is to verify whether:**

1. The contacted public institution can convince the outside public authority to finance its costs of investment and operation, to provide it (i) with the required electrical appliances and (ii) during operation with an increase in its annual budget to cover its costs of operation.

2. Or, whether the institution can identify income generating activities for the appliances or through a public-private-partnership arrangement can access to the appliances.

The demand study must carefully assess the ability of contacted institutions to get the called for appliances, and to pay for the monthly energy service fee without negative impacts on its ability to pay for other essential costs of operation.

If the demand study turns out to be too optimistic, an oversized system will be installed with two negative consequences:

- upfront it represents waste of scarce investment resources;
- during operation it drains the institution for money, which could have been used to improve its service; the institution could start to default on its payments to CESP.

### 10.5.2 Health post and District Health Office

The potential appliances that can be powered by REP's standard sized PV system comprise solar refrigerators, solar sterilization equipment, laboratory equipment. REP clears the information material about the PV-system for health posts with the Ministry of Health which contains information about future development of health posts (rehabilitation works, appliances). The ministry approves the appropriateness of the technologies and the information about their prices.

### 10.5.3 School Management Committee

REP clears its information material about the school PV-system with the Ministry of Education. In addition to information on investment and operating costs of computers, printers, copy machines, it also informs about potential income generating activities that the school can start up with the equipment.

Ideally, the Ministry would follow up on the initiative by preparing guidelines to the school committees on what the issues and options are in the energy supply contract with a CESP, what risks and rewards they imply and what approach the Ministry recommends.

# 11 Sharing of economic Benefits and Regulation of CESP

## 11.1 Regulation of CESP

### 11.1.1 Need for regulation of tariffs and of quality of service

Regulation of an enterprise to protect consumer interests is often seen in mere negative terms by service providers as an administrative burden imposed upon the enterprise. Although regulation imposes costs of transaction on a regulated firm, it also protects the enterprise against unfair accusations of exploiting consumers. The regulatory authority serves as arbiter between enterprise and consumer interests.

The CESP/CO receives high-value capital goods free-of-charge from REP in return for the obligation to provide energy to consumers at rates reflecting a zero rate of return on the capital investment. Due to the obligation to transfer the benefits of free equipment to the consumers, a "consumer protection" argument can be made for imposing some kind of regulatory oversight control over the CESP. However, the need for consumer protection is relatively weak:

- The CESP operates in a local environment, where social pressure serves as an effective control mechanism.
- The low ability to pay of the local population serves as an effective check against exploitative monopoly prices.

The "CESP protection" case for regulatory oversight is, in principle, also weak. The CO/CESP does not invest any capital investment in its water pumping and energy service activities, other than its labor inputs in project preparation. Its risk to the CO of getting involved in the CESP activity is, therefore, rather small. The consequences of a consumer boycott to refuse paying the full cost-of-supply tariff will be felt mainly by the consumers: when no money is available for spare parts, the components break down.

Yet, the fact that the CESP gets the equipment free of charge and that consumers have to pay cost-covering tariffs for the cost of service that are high compared to low monthly family incomes, can give raise to irritations and unnecessary rumors.

In addition, as discussed in section 11.2, there is an issue of profit sharing and of ensuring that funds in the bank account that are deposited to pay for future spare parts, are used for the benefit of consumers only. It is recommended that the super profit which the CESP earns during the operation of energy business will be distributed between the community and CESP on the ratio of 90:10. Fund operation manual will be prepared and implemented as a regulatory document, in order to ensure the proper utilisation of CESP fund and to avoid any kind of misuse.

For "avoidance of conflict" reasons, some regulation of the CESP by outsiders is called for.

### 11.1.2 Institutional responsibility for regulation

The regulation of the decentralized energy service providers, as well as simple monitoring and evaluation of performance (both equipment and entities) is currently being discussed at central and local levels. DDC and/or AEPC are thought to be best suited for regulatory oversight. However, AEPC is located too far away from the communities, and effective monitoring would be hampered by the poor accessibility of rural communities. The local administrative institutions, such as VDC and DDC, are not yet trained to perform quality regulation of energy services. In the DDCs, a number of donor projects are working on the creation and capacity strengthening of energy units within the DDC.

The REP/AEPC regional and head offices will monitor the CESP activities during the initial years of operation covered by the EU's funding of the REP. They have, therefore, a lifetime which is much shorter than the lifetime of the CESP-projects. So DDC or/and AEPC should be authorized as regulatory authority.....

### 11.1.3 Tools of regulation

For the above institutional reasons, REP relies on "local social control, "regulation by contract" and on "self-regulation by the CESP".

The energy service contracts are drawn up by the CESP in collaboration with the regional REP/AEPC office, which has to agree to the terms. The CESP's energy service contracts with consumers fixes CESP's supply obligations, the tariff it can charge, how inflation adjustment of tariffs is done, how profits are to be shared between the community and the CO, and how much money the CESP is paid per year for CO/CESP staff time and management fee. The CESP/CO has no possibility to put in unproductive manday time as a justification to draw an extra payment from the CESP bank account. This detailed default measures, arbitration authority regulation by contract represents "a priori regulation".

"Local social control" is performed by the community as a whole. The population knows that the CO/CESP obtained the equipment free of charge from a donor; the CESP will be under pressure not to exploit its position.

The social control is reinforced by the "self-regulation" of the CESP. The Charter of the CESP makes decision taking very transparent. It establishes that:

- CESP contracts with suppliers and requests for withdrawal of funds (or transfer of funds to the bank accounts of suppliers) must be co-signed by the CESP Chairman and the CESP treasurer.
- The CESP bank account can be used only for transactions related to the CESP.

## 11.2 Sharing of CESP Profits, Revenues and Assets

### 11.2.1 Sharing of annual profits

Many CESPs will be involved in both "non-commercial" and "commercial" activities. The latter generate profits. Albeit small. A part of the profit on the commercial activities is generated by the commercial-entrepreneurial skills of the CO which manages the

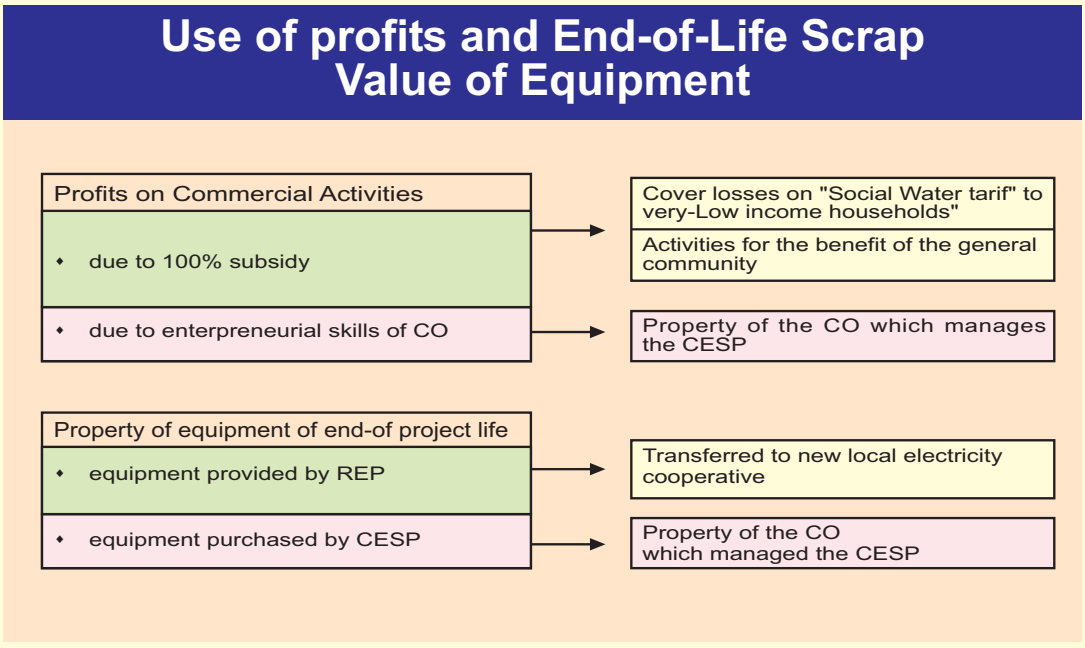
CESP; therefore, it should be entitled to receive the "entrepreneurial part" of the profit and use it for whatever purposes it wants. But a large part of the profit is generated by the 100% subsidy which reduces the cost of the energy service to a lower level than the cost of competing energy suppliers. The "subsidy part" of the generated profit should accrue to the community as a whole.

The statutes of the CESP must define (i) how the annual profit is distributed between the CO and the community, (ii) which uses the community's profit share is to be spend on (a possibility is to use the money to cross-subsidize the water tariff) and (iii) the decision taking procedures for the use of the community's profit share.

One must underline though that the discussion about "subsidy-derived profits" is somewhat academic: due to the population's low ability to pay and the small difference between the CESP's costs-of-supply and the energy service costs of alternative sources of supply, profits will be low and be composed mainly "entrepreneurial profits".

### 11.2.2 Scrap Value of Equipment at End-of-Project Period

The lifetime of the CESP's solar energy equipment comes to an abrupt end when the national electricity grid reaches the community. The statutes of the CESPs must foresee what is to happen with the CESP's equipment when the grid reaches the community.




The logical approach is to hand-over the energy equipment provided by REP as property to the local electricity cooperative formed to manage the local grid. It would be up to the local electricity cooperative to decide whether it wants: (i) sell the equipment on the second-hand market for solar panels and/or (ii) let the solar panels feed power into the local LV-grid, thereby reducing the amount of electricity which is purchased from NEA at the level of the substation. If the electricity cooperative decides to sell the equipment, the sales revenue could become part of the electricity cooperatives co-financing contribution to the construction of the local distribution-grid.

### 11.2.3 Funds in CESP bank account at end-of-project period

When project life ends, there will be two claims on the funds that are in the CESP bank account.

The local community will have a claim on unused funds that were deposited to pay for future spare parts. The CESP/CO may be owed payment for staff time and management fee.

The funds properly owed to the community can be handed over to the electricity cooperative, to the local school, to the local clinic, depending on the regulation in the CESP charter.

# 12 CESP: MAJOR RISKS AND KEY SUCCESS FACTORS

## 12.1 Major Risks and Mitigation Measures

### 12.1.1 Systemic Risks

The term systemic risks refers to risks that are an inherent part of the REP-approach and the CESP concept as such.

The key raison for REP's CESP/CO concept is the belief that an experienced, professional entity can manage a CESP better than a consumer cooperative that is created for the purpose. A key risk issue therefore is "how REP can succeed in identifying and selecting the right CO": assessing that a CO has the capacity for managing the local CESP? The identification of COs to work with in the beginning of the REP field activities may be done in a relatively improvised way. But the active involvement of the CO in the preparation of the demand study gives the REP/AEPC regional office a good insight into the ability of the CO to perform and to take initiative. Provided that the sheer initiation of a demand study is not taken as an entitlement to a CESP-project (with the appraisal by REP of a application for equipment being a mere formality), REP has the opportunity to disqualify under-performing COs from creating a CESP.

Due to time constraints, REP does not undertake professional feasibility studies for each CESP, but splits the process up into a demand study (which is mainly to confirm the energy demand) and a technical feasibility study with the REP/AEPC regional office undertaking the institutional feasibility appraisal as part of its processing work. Undertaking a proper demand study is a complex and specialized discipline. Yet, it is to be performed by the CO within a relatively short time very little time and with little outside technical assistance. The hope is that the CO can compensate its missing technical know-how with its in-depth knowledge of the local situation. In addition the community sensibilisation campaigns undertaken by REP, its information materials and its standard format for the demand study will be of help also.

Who will give TA back-up to CESPs during operation? Some TA is needed for technical back-up, other is needed for management back-up. It is well-known that new community cooperatives ran into difficulties during operation unless they from the beginning receive regular backstopping support. REP provides technical support through CESP service contracts with solar dealers. Long-term periodic management backstopping can be provided through the national Association of Cooperatives.

Who will regulate CESP-performance according to contract and what sanctions can be applied? AEPC and VDC/DDC have few legal sanctions if a CESP under-performs, and none of them is ideally suited to perform economic regulation. REP responds to this challenge through its policy of regulation by contract and by self-regulation.

Sustainability of trained CESP staff. Staff from the CO/CESP will be trained by REP in performing basic service tasks and in the proper operation of the systems. It can

be assumed that the CO will assign some of its best suited members for training. These members, however, will also be those most likely to leave the community to work in Kathmandu or abroad. The mitigating response to is to identify institutions capable of training replacements in time, when key operators announce their intention to leave. The cost of this training, furthermore, should be paid out of the funds that are allocated to replacement of spare parts to avoid that the CESP is economically tempted to under-take insufficient capacity building.

### 12.1.2 Technical Risks

Technical defaults in solar PV-systems occur. The electronics for charge regulation and for lighting have had failures globally, and storage systems, typically electrochemical-lead acid batteries, have also been problematic.

The major technical risks are related to the water pumping activity. AEPC supported in 2001/02 the installation of 22 community owned and managed solar water pumping systems with a total installed capacity of 11.51kWp. The assessment of the existing solar water pumping systems revealed that the pump is the most vulnerable component of system, and that the low quality of civil works and plumbing lead to collapse of the whole system.

The mitigation measures against technical failure comprise: technical training of CESP/CO members, service contracts with solar dealers and generous provision in the tariff to cover the cost of spare parts and replacement of worn-out equipment and insurance premium. In addition, it is expected that the CESP due to its track record of regular deposits of funds in the CESP bank account will find it easy to get a bank loan when it is short of funds to pay for the replacement of a major component.

### 12.1.3 Acts of vandalism and theft

The sustainability of solar systems installed in other development countries and of or solar water pumping systems in Nepal have in some cases suffered either from vandalism or from theft. These risks for sustainability may be mitigated by the following actions:

- creation of community ownership feeling and raising awareness that solar systems need spare parts through social mobilization
- protection of solar modules with fences.
- Insurance.

### 12.1.4 Demand Risks / Market Risks

As a business entity, CESP face normal business risks like failure of clients to pay their bills, poor support from its service delivery chain. Schools and health posts may not have capacity (or willingness) to pay for the service yet react hostile to attempts to move the installed PV-systems. The ”new entrepreneurial activities” – computer use, pay-per-view TV, internet - are based on the notion that supply creates demand. If the demand for the services is insufficient, the entrepreneur will be unable to pay CESP for its energy service. If CESP has not other local customers who have a need for a PV-system of the 500 Wp size, CESP has a revenue problem.

The recovery of a fee is often a function of efficiency of the local management rather than the ability to pay of customers. The main mitigation measures against non-paying clients are:

- CESP can take security deposit from its customers, and
- inscribe in the service agreement that should the client fail to pay a fee for two consecutive payments, the solar system will be removed from its premises.

### 12.1.5 Environmental risks

Though solar technologies are considered to be environmental friendly, it is compulsory to pay proper attention to the environmental management. The systems use acid batteries, special attention should be paid to acid leakage and a disposal/ recycle procedures for used battery should be put in place.

## 12.2 Key Success factors

The term "key success factors" relates to things that an entity must do well in order to succeed.

Implementation of the risk mitigating measures is an obvious example of a key success factor.

**Other key success factors are:**

- securing the active involvement of VDC/DDC in REP activities from the program
- quality of REP/AEPC regional and central office staff
- establish collaboration with experienced NGOs and with the Association of Cooperatives
- quality of TA and capacity building activities
- quality of community mobilization and sensibilisation activities.