CESET
Community Energy and the Sustainable Energy Transition in Ethiopia, Malawi and Mozambique

CESET Brief n. 2

Financial aspects of micro- and pico- community energy systems

Introduction

This briefing reviews the financial aspects of micro- and pico- grid community energy systems. Most guidance has been developed for micro-grids, particularly those that operate commercially. However, micro- and pico- systems, given their smaller size (1 to 50 kW), may depend on different funding mechanisms than larger projects. Apart from size, the resource and material requirements of a small community energy system may change them qualitatively.

This briefing discusses some principles for the financial management of micro- and pico-electrical grids, and outlines steps for the development of a financial plan, drawing on previous experiences with micro-grids. It also provides a summary of the different types of costs that will need to be considered, a discussion of additional costs which may be particularly relevant in community energy systems (CES), and concludes with a discussion of the different ways in which cost-recovery could be considered.

Principles for the financial management of CES

The central principle guiding the implementation of CES is that systems will need to recover their costs to ensure sustainability in the long term. The grid system will incur large costs for project and development (e.g. the development of site reports, feasibility and impact studies, financial costs, regulatory costs, land purchase) and running costs (for operation, maintenance and management). Small projects like CESET may start up with capital investment to cover for the establishment costs. However, cost recovery should support running costs alongside larger investments, which may be required to ensure the continuity of the project. Costs will be covered with revenues from connection fees and electricity sales, and, where available, from subsidies. In any case, ensuring a reliable and ongoing source of revenue is vital to maintain the project.

From mini-grid experiences, we learn that financing the system requires looking beyond the material aspects of the projects. CES will require at least two types of financing:

1. Energy end users, for example who may lack the ability to pay for new appliances or one-time connection fees, and therefore require financial assistance to be able to receive electricity from the grid.
2. Energy producers, those that install and operate the grid infrastructure.

Table 1 sets out the stakeholder types and financing requirements for these two user types.

Stakeholder	Indicative List of Typical Financing Needs
Energy End Users • Households • Small enterprises and local livelihoods (including agriculture) • Health, education and community institutions	One-time down payment for energy system (e.g. connection fee) Ongoing payments for energy system (e.g. kWh tariff) Maintenance fees and service payments Purchase of efficient appliances/equipment (particularly small enterprises, local livelihoods and health, education and community institutions) Upgrading energy system (e.g. higher tariff) Start-up capital for livelihoods/enterprises resulting from energy access (productive use of energy)
Energy producers • For-profit enterprises- micro, medium and small sized • NGOs engaged in service delivery	Capital for early stage innovation, R&D and installation and procurement Pilots and demonstrations to prove the service model Working capital for operations Consumer finance/ credit to address affordability gap of end-users Internal capacity building and training Credit for growth and expansion Capital for diversification of products, solution and upgrading technology to meet consumer needs Credit or fee to enable servicing in distant/ remote areas

Table 1 - End User and Energy Producer Financing

Development of a financial plan for CES

A financial plan for a CES should be developed via an iterative system that, based on initial estimations of cost, develops an initial revenue model. This model can be tested and further developed in consultation with the community, which drives the demand for the grid. Figure 1 shows a typical process based on the literature on micro-grids. However, one of CESET's hypotheses is that some of these costs could be negotiated directly with the community, hence reducing the overall costs of the project.

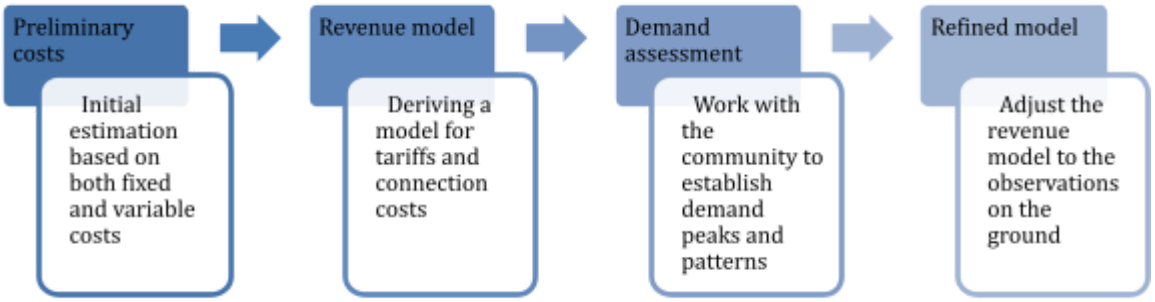

Figure 1: Steps towards the development of a financial plan

This model points towards the need to examine the costs in practice as they unfold in a given context. While micro-grids are dependent on a solid investment plan to attract businesses or other organizations (such as cooperatives) who want to run them, community energy systems may depend on the reduction of operating costs to the minimum.

An outline of the costs of CESs

A CES faces two types of costs: fixed and variable costs.

- Fixed costs are costs related to the establishment of generation and distribution infrastructures. These are costs that the CES will face regardless of the service provided. They can include, for example, the depreciation of assets, interest on debts, fixed taxes and fees, overheads and transactions costs, local operation costs, customer relationship management.
- Variable costs are only incurred when the CES is in operation: they increase with demand. Costs like fuel costs, lubrication oil, maintenance related to throughput, revenue-dependent taxes, etc.

From the point of view of investment, it is useful to distinguish between capital expenditure (CAPEX) costs and operating expenses (OPEX).

- CAPEX are the major investments that will take place during the life of the project. In terms of investment they include long-term capital expenditures (infrastructure and equipment), for purchases that will be used longer than a year.
- In contrast, operating expenses (OPEX) are the expenses that the company incurs in their day-to-day operation: rent, wages, consulting fees, overheads.

CAPEX will cover large investments on fixed costs, while OPEX will cover variable costs plus those fixed costs required to keep the project working.

A pico-system such as the one proposed in CESET entails an initial investment (subsidy) for the CAPEX costs. However, the initial investment may require further investment down the line, to cover additional CAPEX financing needs that may not be covered by the project budget, and that will continue after the funded period has ended (Table 2). These are

CAPEX costs because rather than being directed towards day-to-day operations, they cover sporadic instances and require investment that cannot be fully accounted for in the current year. They all involve operational costs that depend on the quality of negotiations with the community.

Types of costs	Elements that require negotiation with the community
Operational costs involved in the collection and management of metering, billing and payments.	Consideration must be given to implications of choosing mobile, token or cash-based payment systems and of choosing the authority responsible for payment collection. Consideration must also be given to the adequacy of different modes of payment: prepayment, pay-as-you-go, postpayment.
Operational costs involved in after sales and customer service.	Customer issues Customer / staff training and capacity building Customer onboarding, marketing, and upselling
Operational costs involved in technical maintenance.	Call outs for minor repairs Call outs for components replacements Call outs for infrastructure repairs, upgrades, and expansion Safety checks
Consumer / community finance to address affordability gap of end-users and lack of access to financing for small enterprise and community initiatives	It is quite common for mini-grid providers to support customers with financing for appliances, small enterprises and other community initiatives. Legal and financial services fees
Handover costs of transferring micro-grid ownership and management to community body.	Handover staff training Support from CESET / current owner during transition

Table 2 – Examples of exceptional CAPEX costs

Further considerations include the need for agreements with third party suppliers (e.g. metering and payments vendors) and contracts with post-project contractors will need to be agreed to deliver operational support and services.

OPEX cost do not typically become known until after financial close, and often after months of steady operations. However, to aid planning, pre-project financial modelling use rules of them to anticipate what OPEX costs may be. One approach is to estimate OPEX costs as 20% of expected total annual revenues; another is around 5-10% of total CAPEX costs.

For example, if CESET has **a maximum** CAPEX budget of £75,000, OPEX costs could be in the region of £3-10,000 per annum. This value is entirely dependent on the nature of the micro grid installed, including its scale, the existing and future demand on the grid and the baseline economic situation at the chosen site.

Fully understanding CAPEX and OPEX costs for a CES requires substantial stakeholder engagement, technical design iteration, financial modelling iteration, regulatory approvals, community governance, and operational models. Also there is a tendency to underestimate overheads, transaction costs and the management of customer relationships.

Developing a tariff model

There are diverse tariff models that can be employed in CESs. Table 3 outlines some of the types of tariffs that can be considered. One insight from the mini-grid literature is that pay-as-you-go systems tend to compromise the operation of mini-grids because of the lack of a constant revenue stream. However, micro- and pico- grids may have different requirements and can organize the tariff system in different ways. In our case, the tariff structure will have to be closely negotiated with the community and a realistic assessment of their capacity to make payments.

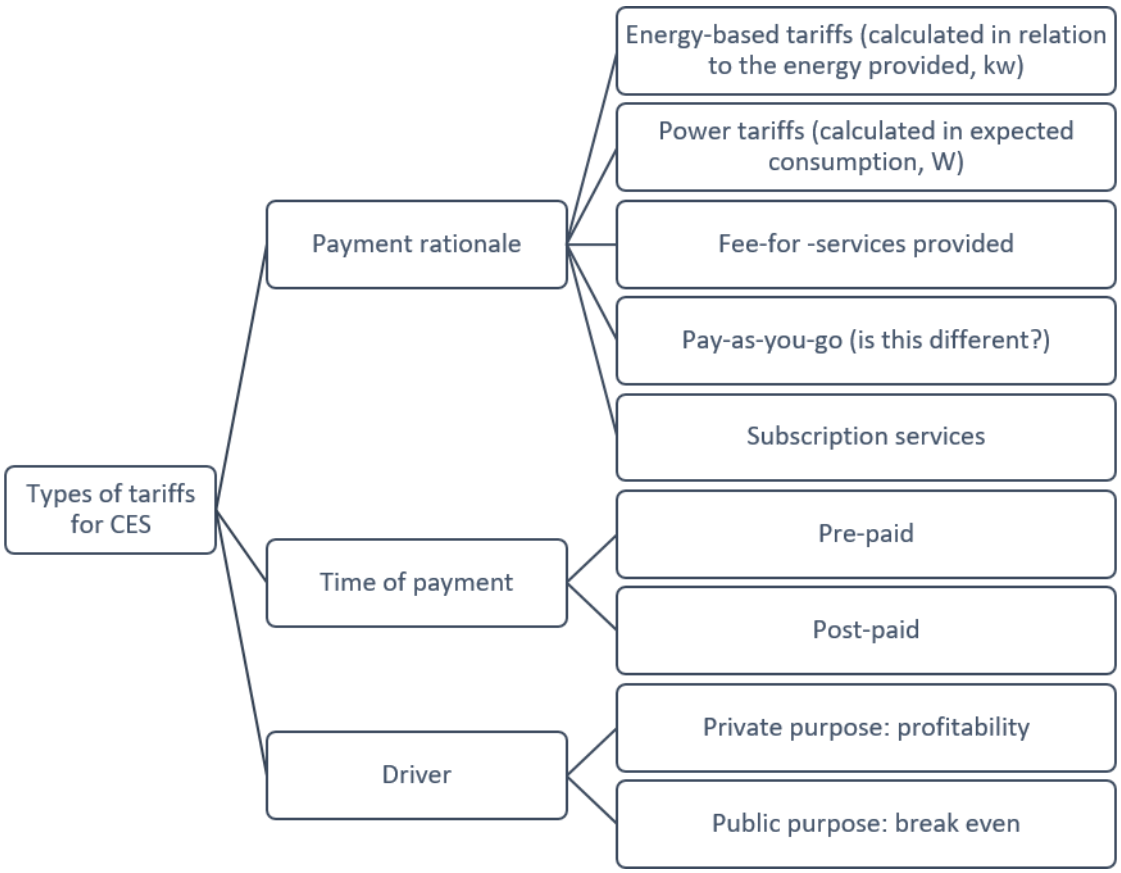

Figure 2 – Types of tariffs

Conclusion

This briefing has outlined the basic financial features of CES development as we are planning to put them in practice within the CESET project. The review raises some important questions of general interest for understanding CES.

The main question is whether a CES can be integrated within a community in a way that the community can reduce its operating costs and support its long term viability. It follows that a process of negotiation of community governance may help redefining the terms of implementation and hence, support the viability of alternative finance models or subscriptions.

The question that follows is which of those costs could be supported by the community. These are two complicated questions which we hope we will be able to answer within the life of the project CESET.

CESET Briefs are short reports on ongoing matters of importance for the project development and delivery

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