A Guide to Monitoring and Evaluation for Energy Projects

Monitoring and Evaluation in Energy for Development (M&EED)
International working group

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Introduction

Many energy projects are faced with the challenge of developing reliable, cost effective and credible means for measuring their effectiveness. This Guide proposes a step by step approach to building project-specific monitoring and evaluation procedures. The guide is intended for projects for which the M&E method has not already been determined by a project donor or stakeholder. The guide was developed by the M&EED Group, as a contribution to the progress of energy access projects.

As with all development projects, energy projects aim to contribute to improving the economic, social and environmental conditions of life in developing countries. Project teams are generally faced with the need (and obligation) to demonstrate that the project does indeed make these contributions, and to do this, a plan for measuring the success, or Monitoring and Evaluation (M&E) is required.

M&E is intended to measure the progress and success of the project according to agreed **indicators**. They may be quantitative or qualitative values which describe reality and indicate degree of change. Ideally, these indicators will be measured at the beginning of the project during the project, at the end of the project, and perhaps several years later. Documenting conditions at the beginning of the project is important because it provides a picture of the status quo or a **baseline** from which to measure progress.

While the need for M&E is general to all projects, the specific tools - indicators, data collection procedures, analytical methods, etc. - applied must be adapted to the specific local conditions and to the needs of stakeholders.

Project teams developing M&E schemes for energy projects face some specific challenges and difficulties, as compared to other types of projects, for instance water, agriculture, health or education projects because :

- Energy services are necessary in the production of food, clothing, health services, etc. As a result, the **causal chain** leading from energy to an improvement in people's lives is often longer and more complex than for other projects.
- Energy services often bring improvements in several areas. For instance electricity can be used to pump water, to refrigerate vaccines, to weld metals, etc. Thus, M&E for energy projects faces the challenge of **measuring improvements in more than one area**.
- The positive impacts of access to energy often may become manifest many years after the project ends. Thus, reliable M&E for energy must often **extend in time** even beyond the project life cycle.
- The positive effects of energy often require many other inputs. For instance energy can contribute to revenue generating activities. But for these activities to be created, appropriate raw materials, markets, skills, transportation, etc. must also be available, or made available by other development activities. Therefore, M&E in energy projects must propose a scheme to **attribute the improvements** to the different factors that were present, in order to identify the specific impact of energy.

So, ideally we wish to measure the impact of energy on development, for example with respect to the Millenium Development Goals (MDG), by looking at variations in indicators. When one looks at causal chains, this objective seems attainable, and that's what the decision makers want.

In practice however this is very difficult. Here are the main reasons :

- We're not sure what to measure, and there are no recognised standards.

- We are incapable of attributing changes in MDGs convincingly to any single factor, as there may be :
    - General factors of context such as macro-economics, politicals, wars, epidemics, climatic cycles, …
    - Local factors of context such as the presence of other infrastructure programmes,
    - Intrinsic factors : each project has a specific design, the beneficiaries can choose different uses for the electricity…

One could carry out extensive (and expensive) field studies, but without ever being sure of having isolated the causal chain. In addition it is often impossible to establish a baseline : what was the energy use before, and how much of that have we substituted ? Establishing a baseline pre-project would be ideal, but in practice it is rarely done.

This guide proposes an approach to at least partially overcome the difficulty, by :

- understanding what the project is made of and why, what is its history, how were the decisions made ;
- focussing on what is easily observable ;
- making some interpretations in terms of impacts on development, based on concensus ;
- establishing an interpretation of the observables by the use of proxies and “reference studies”.

Given these specificities, developing M&E for an energy project can be very challenging. This Guide proposes some ideas and methods to aid energy project teams in meeting this challenge.

The Guide has two parts: a General Methodological Section, describing a 10 step process that project teams may follow to define a project specific M&E scheme and second section with detailed suggestions for how this method can be applied to concrete projects. The General Methodological section consists of 10 steps:

1. Identify your project stakeholders' M&E needs
2. Make a diagram of your project
3. Assign project results to the links in your causal chain
4. Choose indicators and data collection methods
5. Address transversal issues
6. Write up a draft M&E scheme
7. Validate your scheme with your M&E stakeholders
8. Integrate stakeholder comments into M&E design
9. Execute M&E as part of the project
10. Conclusion, present the results of M&E, agree on follow-up of recommendations

The second part of the Guide contains thematic modules on three varieties of electrification, on improved stoves, and on institutional support for projects.

Note that this document only scratches the surface of the many complex issues involved in energy project Monitoring and Evaluation. More information can be found in the M&EED documents and those listed in the Bibliography.

Part 1. A General Framework for M&E

Step 1. Identify your project stakeholders' M&E needs

The first step in designing a project-specific M&E scheme is to identify the M&E information needs of the project's stakeholders.

Identify the project stakeholders who want to receive M&E information. For example :

- beneficiary country public authorities
- donors
- donor country public authorities
- users, clients
- project management team
- stockholders, financial partners
- internal management of the project team itself
- …

For each stakeholder, the project team needs to understand what kind of information they require, how often the require feedback information and how they will use it. It is also necessary to agree on the format of the information (a video, report, photographs, audio recording) and the terminology.

The M&E needs of your stakeholders may be described in calls for tender, grant agreements or in procedure manuals. After studying any such documents, carry out the necessary discussions to have a precise idea of what your M&E scheme needs to do. Be aware of what the results will be used for; fundraising, upscaling or downscaling, contract revision, communication, etc.

Here are some examples of the needs that coulmd be expressed by certain stakeholders :

Stakeholder	Needs
Donor (public and private)	Verifiy the reaching or not of general objectives. Could include transversals (gender, sustainability).
Local authority	Verifiy the reaching or not of local objectives. Show the population and donors the effects.
Operator	Operational and financial reporting/management.
User	Express opinions and obtain answers and improvements.
Evaluator	Verify methods, gain notoriety.

Project documents will in general define the development objectives of the project. Your M&E process should measure the success in meeting these objectives. Try and ensure that there is consensus among all project stakeholders on these objectives. Note that in some cases, there are implicit unwritten objectives, behind the concrete explicit objectives. These assumptions or unwritten objectives may only come to light through discussions, but may be used by some stakeholders to determine the project’s success, so it is important to know/raise/understand them in the beginning.

Example. The explicit objective of a project is to install a mini-hydro power plant and electricity distribution system in a village. Behind this objective, national authorities assume that the project will:
1 create a maintenance infrastructure for the system
2 improve health conditions, by facilitating a vaccination campaign
3 create jobs in the agriculture sector.

In particular, it is essential to understand how project stakeholders believe the project will contribute to national objectives (as defined in national development strategy documents or international objectives inscribed into the Millennium Development Goals (MDGs)).

Step 2. Make a diagram of your project

Projects aim at results. If the project objectives, in terms of expected results, are not clearly understood, return to Step 1. The term "causal chain" describes the links leading from the **Inputs** to your project (money, expertise, equipment, ...) and the project **Activities** to these results. Results may be:
1 direct or indirect
2 dependent solely on project activities, or dependant on a host of events, only some of which are under project control
3 easily visible in the short term, or discernable only with difficulty in the long term
4 economic, social or environmental. Note that the social value added of a project should not be ignored.
5 planned, or unplanned
6 positive or negative.

It is useful to have a visual diagram of the causal chain leading to the expected results, so drawing this diagram is the next step. The first links in the chain consist of the **inputs** that project participants will bring to the project **activities**. The succeeding links represent consequences of the projects' activities with each subsequent link being further removed from the direct inputs of the project.

While the term "chain" is convenient to use, in most cases, the world is more complex than a linear sequence of causes and effects. Generally, your project results, and in particular the long term, downstream, indirect results, will depend on actions and conditions outside of the project's control. Note these actions and conditions and add them as assumptions, risks or external factors on the right side of the causal chain. You will need to use local knowledge of specific project context to identify them.

The links of the chain lead from the *Inputs* which the project partners have committed to bring to the activities, to results which may be quite distant from the projects activities, and that may depend on circumstances or inputs that the project cannot control, or even predict. In many cases, project teams will aim to establish a causal chain extending to fulfilling elements of National Development Strategies, or to some of the Millennium Development Goals.

When the causal chain diagram is complete, it is necessary to choose terms to classify the links of the chain. In many cases, a project stakeholder will specify terminology for these links (see Step 1). In this document, we will use the terminology specified by the Development Aid Committee of the Organisation for Economic Cooperation and Development (DAC/OECD).

Inputs → Activities → Outputs → Outcomes → Impacts

Inputs. Materials and services brought to the field by the project, or by project stakeholders.
Examples: money, equipment such as gensets, technical support services, counsellors and experts, ...

Activities. What the project does.
Examples: mobilizing communities and holding workshops, building power stations and electricity grids, demonstrations of new technology, installing solar water heaters…

Outputs. Goods and services whose production is directly under the control of the project team.
Examples: electricity service to a village, improved stoves, sustainable forest management practices, energy law, ...

Outcome. A first level of consequences, which flow from the energy services which are outputs of the project. Usually depends on inputs, actions and decisions which are not directly under the control of the project team.
Examples: potable household water supply, vaccination programme, time saved by women, increased or new crops grown, wood products from a sawmill, institutional change in the energy sector, integration of energy planning into transport planning, ...

Impacts. Consequences of project activities which are directly related to national development goals and/or the MDGs. Can be far downstream from project activities.
Examples: Gender equality (increased school attendance by girls), health (reduced disease due to vaccination or reduced smoke inhalation), economic well being (from sale of products), quality of life, .

Choose the terms you will use in your M&E scheme.

Option 1: Use the DAC terminology.
Option 2: Use a different terminology specified by a project stakeholder.
Option 3: Define your own terminology, based on your specific needs. Make sure that "homemade" terminology is acceptable to stakeholders.

Step 3. Assign project results to the links in your causal chain

According to the terminology you have chosen for the links, divide the causal chain diagram into these categories, by drawing more or less horizontal lines on your diagram, dividing it into zones corresponding to each link. Note that for complex projects, there may be several causal links for one of the categories of the terminology.

Now begin to fill in the table below. The model table uses the DAC terminology for causal chain links. If you have chosen some other terminology, modify the table accordingly. Copy the elements of your causal chain into the appropriate table cells of the second column. The other columns of the table will be explained in succeeding steps of this guide.

	Elements in your causal chain diagram	Indicators	Data collection methods	Calendar		Who will carry out data collection and processing	Estimated cost
				Baseline	frequency		
Inputs							
Activities							
Outputs							
Impacts							
Synthesis and reporting							

Step 4. Choose indicators and data collection methods

You will need to find ways to measure the changes resulting from your project's activities. The direct changes or *outputs* (such as the number of cook stoves made by the collective) may be easier to measure than the *outcomes* (such as reduced fuel consumption) or *impacts* (such as improved health and well being or gender equity).

As we have said above, development projects aim to contribute to large national objectives such as improving health or gender equality. To be able to do this, you need to find measurable **indicators** that describe these large macro notions, as well as indicators for more concrete achievements… Note that information and indicators do not have to be numeric: indicators may be qualitative. In fact, in some cases, multi-media data - such as pictures, videos, voice recordings - may be pertinent indicators for your project. In other cases behaviour change or attitude may be an indicator. For example recipients of electricity connections in Merlo, Argentina, found that having a customer number and registered address provided the legal recognition and inclusion necessary to apply for other services and be recognised as a citizen. In this way, a national goal of social cohesion was promoted.

In some cases exact information cannot be obtained and **proxies** are used to describe conditions.

> Example. The number of bicycles in a village may be a suitable proxy for wealth of the population.

Each indicator is measured using one or more sources and **data collection methods.** These may be, for instance:

1 physical measurement (satellite data on forest cover)
2 data extraction from public statistics (school attendance, agricultural production, ...)
3 interviews
4 extraction of accounting or administrative data of a public or private organisationfocus groups and other participative methods.

Using several sources and data collection methods increases the reliability of a given measure by cross-checking.

Choose indicators for some or all of the steps of your causal chain. Base your choice on the following criteria:

1 pertinence to your project
2 ease and cost of measurement or data collection
3 interest for project stakeholders

Copy the chosen indicators and data collection methods into columns 3 and 4 of the table.

Keep in mind that it is often difficult to find a practical way to show that it is your project's activities that have indeed led to the downstream results and impacts. Not being able to prove that it was the project (and not some other activity) is a common problem and is known as the "attribution gap".

> ***Attribution gap***
>
> Up to the level of *use of output* attribution is relatively easy in most cases. However, at the levels of "*outcome*" and "*impact*" external factors that cannot be influenced by projects and programs become increasingly important. The attribution gap widens up to an extent where changesobserved in the target area cannot be directly related to project *outputs* any more. Up to the level where a causal relationship between outputs and observed development

changes can be shown, projects are entitled to claim the observed development changes as a direct" benefit. Project and programme goals are set at his level.

Beyond the goal level, projects and programs aim at further *impacts*, which usually are the ultimate reason for the intervention. Most often it is not possible to bring these indirect benefits into a causal relationship as too many actors are involved to clearly isolate the effect of a single intervention. Nonetheless, highly aggregated development results (as, for instance, the MDGs) need to be watched. Even though full-scale attribution is often impossible, the project should aim at providing plausible narrative on the project's contributions to high level development results.

Text adapted from a GTZ document

Step 5. Address transversal issues

There are many cross-cutting issues which may be important to the sustainability and success of your project. You should now proceed to examine your table of elements and indicators, to see if the following transversal issues are adequately treated, taking into account the needs of your project and your stakeholders:

- gender equality, the different impacts of your project on women, men and children
- long term economic and financial viability
- long term technical viability
- social and cultural acceptability of your project activities
- environmental sustainability, including the impact on GHG emissions, biodiversity, forests, ...
- revenue creating activities, job creation
- end user satisfaction
- training and capacity building
- local ownership and participation
- external factors, not under the control of the project, but which influence project results.

You may need to add additional indicators to cover some of these issues. Here we highlight only two of these which are also MDGs: MDG 3: Gender Equality and MDG 7: Environmental Sustainability

Gender Equality: Generally one of the objectives of energy access projects is to promote social equity. This should include equal access to and benefits from the project for women and men. To achieve this gender relations should be included in the design and planning of the project. This means considering the different roles women and men play in the context of the project, and the relations between men and women. A way to start is by collecting data on the conditions of men and women from the beginning of the project. That is, being able to distinguish between women and men's participation by establishing a *gender disaggregated baseline.* Then when monitoring and evaluating the project, the different impacts that the activities have on women and men can be assessed. Both women and men in the project should contribute to this feedback, so that a balanced assessment can be made

Indicators of gendered changes can be quantitative (such as the number of women and men benefiting from the project, the percentage of new stoves made by women, the ratio of girls to boys suffering from ARI); or qualitative (such as changes in attitudes or behaviours, the number of women in decision making positions, or negatively perceived, the obstacles to accepting women's decisions or suggestions).

Environmental sustainability:
Each energy project should be assessed for its environmental sustainability. The aspects of environment most important for developing countries are clean water, clean air, fertile land and preservation of biodiversity. Energy projects should ensure that their activities do not exacerbate any of the current conditions of vulnerability of the environment, and should contribute to

enhancing the sustainability of natural resources to the benefit of local populations. Some of the common environmental problems which energy projects may address may include

- Improving indoor air quality (less smoke)
- Reducing demand for wood fuel
- Decreasing green house gas emissions
- Decentralising energy services to maintain communities' traditional land use

rather than, for example, building big dams ,

Step 6. Write up a draft M&E scheme

You must now complete the table, by:

1 deciding who will carry out the tasks (collect the data) as defined in the table. You may wish to call on outside expertise to carry out some tasks, as this would increase the credibility of the results;
2 determining if, how and when the baseline will be measured, and at what frequency further measurements will be made;
3 estimating the duration and cost of each task.

Examine your draft M&E scheme. Do you feel that it will meet stakeholder needs, at a reasonable cost? You may at this point have to proceed by iteration to arrive at a reasonable cost/quality compromise.

You may wish to transform your causal chain diagram and indicators table into a text document.

Step 7. Validate your scheme with your M&E stakeholders

Present your draft M&E scheme to the stakeholders identified in step 1, to see if it meets their needs. Make necessary adjustments.

Step 8. Integrate stakeholder comments into M&E design

The reaction of your stakeholders to your draft M&E scheme will determine how you may proceed.

Option 1: The draft scheme was validated by stakeholders. The M&E scheme can now be considered to be complete.
Option 2: Some stakeholders have expressed reservations or criticism of the draft scheme. Not to worry, creating an M&E scheme is usually an iterative process. Go back to step 1, and see if you can find ways to meet stakeholder needs, at a reasonable cost.
Option 3: You've been through several iterations, and some stakeholders are still unsatisfied. What are the sources of the problem? Are stakeholder expectations unrealistic, demanding, for instance, rigorous proof of impact on national development goals or MDGs? Can you explain to the stakeholder that within the time and resource constraints of most projects, it is not possible to rigorously prove impact on the MDGs? Can you perhaps find acceptable "proxies" for MDG/development impact? Perhaps the difficulties in developing a satisfactory M&E scheme indicate fundamental difficulties in the project's design. Discuss project design with stakeholders, to see if they are

fundamentally in agreement, both with the activities, and with the elements of risk inherent in the project results. Discuss redesigning, changing the activities, or adding risk mitigation measures, to resolve the problem.

Step 9. Execute M&E as part of the project

The M&E scheme will require tasks to be carried out during all phases of the project. Many of the tasks will be the responsibility of the project team. Some may be delegated to outside experts. In either case, the execution of these tasks must be managed in the same way, and with the same rigor, as all other project tasks.

Collect and collate the data according to your design. When you have it all together, study the information, see what has changed and what has not. Discuss the results with others and decide what it means so that you can prepare the results in the format required by and useful to the stakeholders.

Do not hesitate to keep extensive archives of raw data, intermediary reports, meeting minutes, etc. because they may be very useful in the future.

Step 10. Interpretation, results of M&E

Ideally we wish to measure the impact of energy on the Millenium Development Goals (MDG) by looking at variations in indicators. When one looks at causal chains, this objective seems attainable, and that's what the decision makers want.

Is there any way to overcome the "attribution gap" ? One could carry out extensive (and expensive) field studies, but without ever being sure of having isolated the causal chain. In addition it is often impossible to establish a baseline : what was the energy use before, and how much of that have we substituted ? Establishing a baseline pre-project would be ideal, but in practice it is never done.

One approach to at least partially overcome the difficulty could be to :

- Start by understanding what the project is made of and why. What is its history, how were the decisions made ? The project is designed initially of technical, institutional and economic inputs aimed at reaching objectives. These inputs are however heavily influenced by the context and history of the project.
- In the field, focus on what is easily observable. Avoid attempting to establish complex indicators or make long-winded deductions. Focus on the obvious quantities, in particular the uses of energy. Before making the observations, you should have discussed with the stakeholders which observables are most interesting to them, and can be measured reliably.
- Having measured some observables, having taken note of the project design, its history and context, then you can make some interpretations in terms of impacts on development.
- Interpretation, by nature subjective, should firstly be based on concensus. Focus on the points where stakeholders are readily in agreement.
- The only realistic way to estimate the impacts (on MDGs in particular), in other words to establish an interpretation of the observables, is via proxies and "reference studies". This means using scientific studies carried out in similar circumstances and/or with indicators that can be considered as viable proxies, to establish a parallel with the project being evaluated. Given the vast areas of science involved (medicine, economics, social sciences, environmental sciences, …) this work is arduous and a "menu" or "reference library" of case studies accepted as "reference" needs to be established by the stakholders in this field.

To take an example, an evaluator may wish to interpret the observable presence of electrical lighting in substitution of candles, and its impact on respiratory diseases. He will probably not have the time and means to carry out an extensive medical study. Absence of historical data may make it impossible anyhow. He could however choose to use an existing scientific study, perhaps carried out in another country and in slightly different circumstances, to establish a parallel with his own case. If such a parallel is reasonable and is accepted by the stakeholders, he will then interpret the observables and estimate the probable impacts based on the results of the reference study, not forgetting of course to point out that differences may exist. If the reference study established, for example, a reduction of respiratory diseases by X % over a period of Y years, the evaluator could choose to assume that in his project the introduction of electric lighting will have the same effect.

You are now ready to present the results and recommendations to stakeholders, perhaps at the time of a mid term review, or at the end of the project. This is a very important part of the process and should be obligatory. Take time to do it properly, with preparation and as many stakeholders as necessary. Make sure to discuss and agree on folow-up of the recommendations.

We hope that the M&E scheme that you have developed has aided in managing your project, and in demonstrating its success. We hope also that the M&E scheme will make it possible to learn from the project, so as to improve future activities.

Part 2. Thematic Modules for M&E

Introduction to the Modules

The thematic modules presented hereafter are intended to be used independently once the overall M&E process has been understood. They do not constitute field study manuals, because an evaluation needs to be project-specific, and each evaluator may have his own investigative methods. The modules simply propose a common framework on which evaluations may be constructed.

They are based on a input-output-outcome-impact approach, with each module looking over the four aspects in sequence. They look at the indicators and the units where applicable, and point out a certain number of problems or particularities of each observable.

The reader will notice that the first aspect (inputs) is quite largely explored because it is considered to be a group of observables (ie. something easily visible) the evaluator will encounter in the field. The link between the inputs and the other aspects becomes less obvious however. This is particularly the case for the impacts : interpreting the data to reach conclusions on impacts is the most difficult part of the evaluation. This is the “attribution gap”.

There are three distinct modules on electricity. This is because electricity is an intermediate good *par excellence* and gives the possibility of many different uses, depending on the project design and the wishes of the users. This influences the outputs of the project and increases the attribution gap. One must therefore be aware of the type of project being evaluated, and indeed the three modules do not cover all the possibilities, there may be intermediate or hybrid cases.

In the thematic modules related to electricity, the uses of electricity are considered strategic in the evaluation process. Electricity being an intermediate good (or service), evaluation of impact is more easily carried out by observing and measuring the uses that electricity permits or encourages. Typically in domestic and collective electrification one may observe lighting, audio-visual, refrigeration, small household appliances, water pumping, etc., whilst in productive uses one may observe simple automation and small machinery, etc. One could push this reasoning even further and consider the uses of electricity to be a barometer or a proxy of the outcomes of the project, bringing the evaluation one step closer to impact assessment, even if the attribution of impact to a given use may still be very difficult.

The modules contained in this draft of the M&E Guide cover some, but certainly not all, of the many types of energy projects. It is hoped that future users of the Guide will contribute new modules on other types of projects.

1. Decentralised Rural Electrification

Definition of Decentralised Rural Electrification (DRE)

DRE is defined as the electrification of non-electrified rural areas by means other than extension of the national grid. It involves, in general, the use of individual electrification systems such as household photovoltaic, wind or pico-hydraulic generators, and collective electrification systems such as autonomous micro-grids.

Introduction to the Decentralised Rural Electrification module

This DRE module is associated with the Monitoring and Evaluation for Energy and Development (M&EED) "Guidelines" document, and is part of the M&EED toolbox.

It is intended as a support tool for project teams developing project specific M&E procedures for a DRE project. It does not include what are considered to be generic M&EED issues applicable to all energy for development projects, such as gender, capacity building, greenhouse gas emissions, etc. but focusses on the issues specific to DRE projects.

This document refers to the **Inputs → Activities → Outputs → Outcome → Impacts** terminology of the OECD. Your project may use other terminology in its logical framework. Note that the distinction between categories depends on your project's context. For instance "water pumping" may be considered to be an output, an outcome, or perhaps even an impact, depending on a particular projects context.

This module is organised according to this terminology.

Inputs

It is considered here that we are at project (or programme) level. This project is the resultant of a combination of different economic, social and technical inputs.
It is important to emphasise that one can not evaluate an electrification programme without making reference to it's requirements specification. That means that the objectives of the programme are already one of the important inputs and have their influence on the attained impacts.
DRE energy projects usually use some or all of the following inputs. In developing a project specific M&E scheme, it is useful to construct indicators for the most critical inputs. The following fiches may be useful in establishing the M&E scheme at the input level.

Input fiche

Name of input	**Decentralised rural electrification project or programme design**
General nature of input	**Material** There are two main types of DRE electrification systems : individual (one power source for one client) and collective (one power source for several clients). The equipment destined to be used in the project will almost inevitably be defined from the onset. In many cases it will be of one specific type, for example individual photovoltaic (PV) home systems, or small hydraulic power stations powering village micro-grids. There may be a mix of solutions applied. There may or may not be an imposed set of uses for the electricity produced. The reasons for technological choices may be various, for example : • Ideological (preference for renewable energies) • Industrial (priority given to local industries) • Economic (least cost solution) • Social (most easily socially acceptable solution) • Environmental (least polluting solution) **Financial/economic** Internal rates of return in DRE projects are generally negative. Costs are high due to low density of demand and difficulties of access. Revenues are low due to low solvency. This means that DRE project finance is almost always based on a subsidy. The subsidy may be for total or partial coverage of the investment costs and/or the operation costs. Here are some examples : • Subsidy given (once) for each client electrified • Lump-sum subsidy for a given project/programme • Subsidy of a percentage of the real investment costs • Subsidy of the real operational costs • Subsidy for each kWh sold • Indirect subsidies such as relief from custom duties and taxes. The subsidy may be a grant or a preferential loan. Here are examples of the organisations that may be offering them : • International bi/multi-lateral organisations (World Bank and affiliates, regional development banks, United Nations and affiliates, …) • Foreign aid institutions (AFD, DFID, JBIC, KfW, …) • National and local government (ministries, agencies, provincial authorities, …) • Non-governmental organisations, sponsors, and charities. In addition to the subsidy, classical forms of project finance are applicable such as equity, export credit, and commercial loans. High risks will frequently be an issue and may lead to extensive risk mitigation schemes.

	Institutional The institutional context pertaining to the project will certainly involve at least some of the following players : • National government and policy-makers • Ministry of energy • Electric power company • Rural electrification agency • Poverty alleviation agency • Ethnic minority ministry/agency (if ethnic minorities present) • Agriculture ministry/agency • Local government structures The institutional context will, through policies, laws, regulations and subsidies, define many organisational aspects of the project. The designers and operators, therefore, may or may not have freedom to choose how they organise their projects. Here are examples of the types of projects encountered : • Concession of operation of a public service • Concession of construction and operation of a public service (build-operate-transfer, build-operate-own, build-operate-own-transfer, …) • Commercial projects based on sale of goods or services at real cost + margin • Gifts (total or partial) of equipment accompanied by the establishment of operation structures • Gifts (total or partial) of equipment. The above types of project may or may not include the supply of uses for the electricity, such as lamps, radios, televisions, pumps, refrigerators, mills, saws, etc. Institutions may provide non-financial assistance to projects, for example simplification of procedures (authorisations, visas, qualification of equipment…), training, aid in setting up village associations, and so forth. In addition, in its nature the project may be adressing domestic use, collective use, productive use, or a combination of the three. **Social** The level of social acceptance may have a great influence on the feasibility and sustainability of a project. The social environment, and in particular the beneficiaries themselves, should ideally accept all or most of the following aspects of the project : • The tariffs • The services • The technology • The organisation • The groups (ethnic, social, religious) and individuals involved Information campaigns, discussion groups and other participative methods can be used to influence the acceptance levels of a project.
Who brings the input	The input may be brought by the project itself, by another development project, by public authorities, by private players, or by a combination of these. The project log frame will generally specify how this input will be brought to the activity. The project specific M&E scheme should explicitly make mention of this.

<table>
<tr><td>Objectives and units of measure</td><td>The project/programme may have quantified objectives that one may consider as inputs, in the sense that they are structuring.
Here are some examples, the units of measure are suggested in brackets :
Number of clients connected (number of households) or volume of sales (kWh)
Penetration of the electrification of households (percentage of total households)
Diversity of supply (number of hours of supply per day, limited or free end-use)
Legalisation (number of adresses legalised through billing)
Collective uses (number of schools, clinics, town halls, religious buildings, street lighting, …)
Productive activity (number of new or improved activities) and direct employment (number of jobs created)
Safety (reduction in number of fires, electrocution, …)
Method of energy production (reductions in frequency of fuel spillages, perceived or measured smoke emissions)
Continuity of service (number and/or duration of blackouts and voltage stability (% variations in voltage)
Frequency of illness (frequency of certain respiratory problems)</td></tr>
<tr><td>Issues associated with the input</td><td>The table below contains a list of issues relative to this input. Some of these issues may be pertinent to the project.<table><tr><th>Potential issue or problem</th><th>Points to be attentive to in an M&E scheme</th></tr><tr><td>Maintenance</td><td>Dispersed, exposed to harsh climates, and difficult of access, decentralised systems often suffer from lack of effective maintenance. The common misconception is that renewable energy systems require no maintenance ; this is quite false. Diesel generators also require regular maintenance. Projects must establish effective maintenance, at best by professionnals, at worst by trained end-users. The financing of this maintenance and any spare parts or replacements, is an important issue.</td></tr><tr><td>Limited energy production</td><td>Particularly relevant to individual electrification systems such as PV, wind and pico-hydro, where only small amounts of energy are available daily. Usually adapted to domestic uses, such systems are generally unable to power productive uses requiring more substantial amounts of energy, thus limiting the potential local development.</td></tr><tr><td>Discontinuous power supply</td><td>Individual systems and collective systems (diesel gensets, wind and PV micro-stations) will provide discontinuous service. The genset for example will be activated a limited number of hours per day (evening). The hours of energy supply may not match certain activities. Discontinuous supply makes the use of refrigerators difficult, for example.</td></tr><tr><td>Evaluating solvent demand</td><td>Evaluation of solvent demand, or willingness to pay, is essential in establishing tariffs for “fee for service” projects. However this evaluation is usually very difficult and errors are frequent, causing inadapted products and tariffs. In addition to paying close attention to this subject, projects may need to adjust tariffs and products dynamically. Changes in tariffs however should occur as infrequently as possible as they are not easily accepted.</td></tr></table></td></tr>
</table>

	Pollution from batteries	Renewable energy generators, with the exception of hydraulic turbines, will use batteries to store energy. Batteries are dangerous to health (may cause burns) and pollute if disposed of inappropriately. Correct recycling is strongly recommended.
	Pollution from Diesel gensets	Diesel gensets are generally noisy and this may cause discomfort. The fuel transport, storage and transfer may cause spillages if not carried out properly.
	Use of water resources	In the case of hydraulic power generation, the water resource is used. The project should take into account water use rights (if any) and the local needs regarding drinking water, fishing, and irrigation. Impact on the flora and fauna may be an issue.
	DRE: a “temporary” measure	Social and institutional rejection of DRE may occur if it is perceived as a “stopgap” measure while waiting for “proper” electrification by the national grid. Households and/or local athorities may reject or resent DRE if they think it is preventing the arrival of the national grid.
	Gifts: lack of appropriation	NGO and charity “gift” projects may suffer from lack of appropriation by end-users who undervalue the equipment, having obtained it for free. End-user financial contributions to the equipment, however minimal, can help to limit this effect.
	Fee for service: refusal to pay	A fee for service project, however well-adapted and modest the tariffs are, may be confronted with refusal to pay by the customers. This occurs in populations used to free national programmes and gifts from NGOs, where they consider themselves too poor to have to pay for what are considered to be public services due to them. Considerable upstream effort in appropriation and participation may be necessary.
	Changes in economic conditions	Radical changes in economic conditions occur when, for example, the market value of agricultural goods falls. In rural areas poor populations are very exposed to variations in the price of the goods they produce. In such conditions, the end-users may find themselves incapable of paying, however well the project tariffs were adjusted initially.
	Lack of benchmarking	Stakeholders in DRE projects are often confronted with the lack of equivalent projects (locally or internationally) with which they can benchmark. This may cause the repetition of “obvious” errors and/or excessive prudence leading to blockages.
	Theft	For technologies that are modular and relatively light (photovoltaics, small wind, pico-hydro, …) in certain regions there may be theft of these elements. They can often be resold on local or distant markets. In some countries or regions theft may be a major concern, and measures need to be taken to limit this risk, be they technological (locks, codes, anti-theft electronics) or organisational (watchguards).

	"Ideoogical" bias	The presence of ethnic minorities, very poor populations, and traditional social structures, may lead to inappropriate ideology or bias on behalf of stakeholders. Examples are; refusal to apply fee for service; choice of "the strict minimum" service; imposition of renewable energies regardless of what the optimal solution is; etc. Even though they may be based on some form of preferential treatment, these biases are not always helpful, because they keep the end-users in a situation of dependence, or impose "politically correct" technologies inappropriately. It is important however to understand these standpoints and to take them into account in the evaluations. They can be considered as "hidden agendas" in the project specifications.

Outputs

DRE projects will produce, voluntarily or not, a certain number of outputs. These may be referred to as "observables". Some are difficult to differentiate from outcomes and may appear in both levels of the model.

Output fiche

Name of output	**Decentralised rural electrification project or programme design**
General nature of output	Variations in the economic and social conditions of the beneficiaries
Who participates in producing the output.	All stakeholders.
What to measure: observables	Listed in order of increasing difficulty in observation. **Domestic use** outputs : • Number of clients connected or volume of sales • Penetration of the electrification in percentage of households (administrative, real) • Diversity of supply (free, limited, blocked, …) • Legalisation (through billing) • Domestic comfort (lighting, TV, appliances, ….) • Safety (fires, electrocution, …) • Method of energy production • Continuity of service and voltage stability • Increase in real estate value • Distribution of poor beneficiaries amongst households • Frequency of illness (such as respiratory problems) • Social relationships • Time saving **Collective use** (schools, clinics, town halls, religious buildings, street lighting …) outputs :

	• Number of clients connected or volume of sales • Diversity of supply (free, limited, blocked, …) • Safety (fires, electrocution, …) • Method of energy production • Continuity of service and voltage stability • Social relationships • Time saving **Productive use** outputs : • Productive activity (new or improved activities) and direct employment • Diversity of supply (free, limited, blocked, …) • Safety (fires, electrocution, …) • Method of energy production • Continuity of service and voltage stability • Energy expenditure (with equivalent service) • Time saving
Options for <u>units of measure</u>	**Domestic use** outputs : • *Number of clients connected* : number of households, or volume of sales : kWh • *Penetration of the electrification in percentage of households (administrative, real)* : percentage of total households • *Diversity of supply (free, limited, blocked, …)* : number of hours of supply per day, limited or free end-use • *Legalisation (through billing)* : number of adresses legalised through billing • *Domestic comfort (lighting, TV, appliances, ….)* : no unit of measure • *Safety (fires, electrocution, …)* : reduction in number of fires, electrocution, … • *Method of energy production* : reductions in frequency of fuel spillages, perceived or measured smoke emissions • *Continuity of service and voltage stability* : number and/or duration of blackouts and % variations in voltage • *Increase in real estate value* : increse in market value of m² • *Distribution of poor beneficiaries amongst households* : % coverage of electrification in the low income groups • *Frequency of illness (such as respiratory problems):* frequency of certain respiratory problems • *Social relationships* : no unit of measure • *Time saving* : reduction in time spent at certain household tasks **Collective use** (schools, clinics, town halls, religious buildings, street lighting …) outputs : • *Number of clients connected* : number of buildings, or volume of sales : kWh • *Diversity of supply (free, limited, blocked, …)* : number of hours of supply per day, limited or free end-use • *Safety (fires, electrocution, …)* : reduction in number of fires, electrocution, … • *Method of energy production* : reductions in frequency of fuel spillages, perceived or measured smoke emissions • *Continuity of service and voltage stability* : number and/or duration of blackouts % variations in voltage • *Social relationships* : no unit of mesure • *Time saving* : reduction in time spent on certain community tasks **Productive use** outputs : • *Productive activity* : number of new or improved activities • *Direct employment* : number of jobs created

<table>
<tr><td></td><td colspan="2">

Diversity of supply (free, limited, blocked, …) : number of hours of supply per day, limited or free end-use
Safety (fires, electrocution, …) : reduction in number of fires, electrocution, …
Method of energy production : reductions in frequency of fuel spillages, perceived or measured smoke emissions
Continuity of service and voltage stability : number and/or duration of blackouts and % variations in voltage
Energy expenditure (with equivalent service) : variations in cost of energy with equivalent service or end-result
Time saving : reduction in time spent on certain productive tasks

</td></tr>
<tr><td>Issues and problems associated with the output</td><td colspan="2">The table below contains a list of issues or problems in quantifying or qualifying the output. Some of these issues or problems may be pertinent to the project.</td></tr>
<tr><td></td><td>Potential issue or problem</td><td>Points to be attentive to in an M&E scheme</td></tr>
<tr><td></td><td>Quantification</td><td>For some observable outputs quantification is difficult due to lack of time and means, or impossible for intrinsic resons. Examples are social relationships, education, confort, …
Solutions to overcoming this problem exist but need to be recognised by stakeholders to have any value. Here are some of them :
Use of a proxy
Use of a standardised qualifying vocabulary
Reference to a previous study recognised in the field of DRE or equivalent
Use of illustrative quotations from interviewees</td></tr>
<tr><td></td><td>Typology of output</td><td>The borderline between domestic, collective and productive uses may be hazy (for example when a household has productive uses in an informal, family structure). In such cases this typology need not be applied.</td></tr>
<tr><td></td><td>Sampling</td><td>As in any data collection process, sampling may be used. However special attention must be paid to the issue of representivity. A “sample” that is chosen by a project stakeholder or a local authority may not be representative. Also dispersion of the population may mean that there is heterogeneity in social and ethnic contexts.
The professionalism and experience of the survey team is the only way to minimise this risk.</td></tr>
<tr><td></td><td>Centralised data collection</td><td>Some data may be collected from a centralised source, such as a statistics bureau, a ministry, or a local authority. It should be borne in mind that in many countries data pertaining to rural areas is often out of date and relatively inaccurate. Comparisons with data for urban areas is therefore risky.</td></tr>
</table>

Outcomes and Impacts

Energy services are transversal in nature: economists consider them to be "technical factors of production" that contribute to producing other goods and services. Thus, the M&E scheme for an energy project will probably cover, at the outcome or impact level, non energy products or services.

Identifying the outcomes and impacts of a project.

The following table indicates some of the observables which may result from DRE projects, in order of increasing difficulty of observation. Note that the classification of these results as "outcomes" or "impacts" in the four layer model will depend on the project's logframe, and on the context of the project. The Millenium Development Goals are used a reference for the outcome/impact terminology.

Observable	MDG or similar objectives impacted
1. Number of clients connected or volume of sales	all MDGs, poverty reduction (access to modern energy)
2. Penetration of the electrification in percentage of households (administrative, real)	poverty reduction
3. Diversity of supply (free, limited, blocked, …)	poverty reduction (access for the poor)
4. Legalisation (through billing)	governance (status, citizenship, tenureship), poverty reduction (access to services, increase in real estate value)
5. Collective uses (schools, clinics, town halls, religious buildings, street lighting …)	education, health, governance, security
6. Domestic comfort (lighting, TV, appliances, ….)	quality of life, gender relations
7. Productive activity (new or improved activities) and direct employment	poverty reduction (income), capacity building
8. Safety (fires, electrocution, …)	health, poverty reduction (material wealth, cost to the community)
9. Method of energy production	environment (GHG, soil pollution, air quality, …), health,
10. Continuity of service and voltage stability	quality of life
11. Increase in real estate value	poverty reduction (creation of wealth)
12. Distribution of poor beneficiaries amongst households	poverty reduction (access for the poor)
13. Energy expenditure (with equivalent service)	poverty reduction (negative impact ?)
14. Frequency of illness (such as respiratory problems)	Health
15. Social relationships	governance, gender relations
16. Time saving	health, gender relations

Approach by Uses

From a practical perspective, observables can perhaps best be considered via the **uses** of electricity. The tables that follow summarise the major possible uses, and the observables they give rise to, as well as some suggestions for interpretation.

They are segmented into **domestic**, **collective** and **productive** uses. The overall observable "presence of electricity" heads the tables.

An evaluator may first have to eliminate those uses he is sure not to find and/or he has decided not to investigate.

General Observable : Presence of electricity	**Suggestion for Interpretation**
	Criteria for eligibility to other projects in the area
	Allows a change of status such as the legalisation of the housing
	Adds to the attractivity and growth of the area
	Affects the real estate value of the housing
	Considered as an entry into modern society

DOMESTIC USES :

Energy use	**Observable or quantifiable indicator**	**"Interprétation" and corresponding indicators**
Number of electrified households		
Lighting	1. Number and type of lighting points in households	Household lighting budget modification (directly : 5, 6, 7 or indirectly : 1, 2, 3, 6)
	2. Average number of hours of use	Lighting quality improvement (1, 2, 3, 7)
	3. Presence of other lighting sources	Additional income generated (4)
	4. Activities using electric lighting	Education (4) : improved possibility for home education
	5. Average monthly expenses (for each type of lighting)	Indoor air pollution reduction (4,9)
	6. Average monthly expenses before electrification	
	7. Number and type of lighting sources used before electrification	

Refrigeration	1. Number of electrified households using refrigirators (%)	Reduction (or not) of household's food budget (possibility to by in bigger amount with smaller expenses, but additional expenses on fridge's usage) (2, 3, 5, 6)
	2. Type and number of appliances per household (capacity, volume, w/out freezer, new or second hand)	Food product choice enlargement (4, 5)
	3.Non-electric refrigirator usage and associated expenses	Generation of additional income (8)
	4. Daily time pattern of refrigirator usage	Living standards improvement (4, 5)
	5. Household product choice befeore and after the access to electric refrigiration	
	6. Refrigirator usage for income generation (for example, cold drinks commerce) and amount of revenue generated	
Video and audio usage (TV, radio, Hi-Fi, video)	1. Number of households with TV	Informational access
	2. Number of appliances per household and their type	Comfort improvement
	3. Time pattern of equipement usage (daily time spent for TV)	
	4. Educational usage examples (audio lessons, educational TV programs, pre-recorded educational video programms)	
	5. Local and national news access before and after electrification	
	6. Films' renting or buying expenses	
Cooking	1. Number of households using electric cooking appliances	Cooking budget modification (2,3)
	2. Frequency of usage and usage time	Comfort improvement (2, 3)
	3. Usage of other cooking methods and associated expenses before and after electricity access	
Water heating	1. Number of households using electric water heating	Household budget modification (2)
	2. Frequency of usage and usage time	Comfort improvement (2)
Small domestic appliances	1. Number of households using small domestic appliances	Comfort improvement (2, 3)
	2. Type of appliances used (particularly - ventilators)	
	3. Traditional techniques used for the same domestic tasks	
Information technology	1. Number of households having a computer	Informational access (2, 3)

	2. Number of households with Internet access	Modification of the budget for communication
	3. Typical tasks of computer usage	Additional income generated (3)
	4. Computer usage budget	
Individual water pumping	1. Number of households having an individual electric pump	Comfort improvement
	2.Other water sources presence	Water budget modification
	3. Quality of water pumped with respect to other sources	Health and sanitation improvement (2, 3)

COLLECTIVE USES :

	Uses of electricity			**Suggestion for Interprétation**
COLLECTIVE USES	**Type of collective use**	**Use**	**Observable or quantifiable indicator**	
	Hospital	Lighting	1, Nbr lamps	Quality of patient follow-up Quality of medical activity Comfort of presence in the facilities for patients and staff
			2, Location of lamps	
		Computing	3, Nbr computers	
			4, Uses for computers	
		Medical equipment	5, Nbr electrical equipment	
			6, Type and use of equipment	
		Refrigeration & freezing	7, Nbr of equipment	
			8, Use of equipment	
		water heater	9, Use of hot water	
		Heating	10, location, type and frequency of use of heating	
		Ventilation/air conditioning	11, Nbr and type of equipment	
			12, Use of equipment	
		water pumping	13, Nbr and location of water outlets	
	School	Lighting	1, Nbr lamps	Quality of teaching Quality and quantity of work done by pupils New possibilities in teaching methods
			2, Location of lamps	
			3, Nbr of hours of teaching	
			4, Type of teaching	
		Computing	5, Nbr computers	
			6, Uses for computers	
		Audio-visual	7, Nbr and type of equipment	
		teaching equipment	8, Nbr and type of equipment	
	Public lighting	Public lighting	Nbr lamps	Safety and comfort outside

	Pumping	drinking water	Nb pumps / nb taps	Fewer illnesses du to bad qulity water
	Administrative buildings	Lighting	1, Nbr lamps	Improvement in administration and management of information
		Computing	2, nbr and uses	
		Audio-visual	3, uses	
	community buildings	Lighting	1, nbr and uses	Better community services, more comfortable, access to new services
		Computing	2, nbr and uses	
		Audio-visual	3, nbr and uses	
	religious buildings	Lighting	1, nbr and uses	Comfort
		other equipment (speakers…)	2, nbr and uses	
	collective telecommunication relays	Telephone	nbr and uses	Access to media Access to market information for certain goods (cost, stocks, …)
		Internet	nbr and uses	
		Television	nbr and uses	
		Radio	nbr and uses	

PRODUCTIVE USES :

	Type		**Use**	**Observable or quantifiable indicator**	**Suggestion for Interprétation**
PRODUCTIVE USES	**Agriculture and animal husbandry**	Pumping	Irrigation	1. Capacity and use of pump	Improvement of the quality of products sold, time of conservation, productivity (1 , 5, 6) Possibilities in diversification of products (1, 2, 3, 5, 6, 7, 8)
		Cereal transformation	Mill	2. Frequency of use	
			Removal of grain cases	3, Frequency of use	
			Conservation	4, type of product conserved	
		Conservation of fresh produce	Conservation of meat	5, type of product and finality of conservation	
			Conservation of fruits and vegetables	6, type of product and finality of conservation	
		Transformation of other produce	Drying	7, type of transformation and possibilities of sale	
			Cooking (jams, sauces)	8, type of transformation and possibilities of sale	
	Production	Machines	Small handcrafts	type of machines and utilisation	Increase in quality, productivity
			Cooperatives		
			Factories		
	Retail	Regriferation, freezer	drinks, fresh produce	1, type of products refrigerated or frozen	Fresh produce better conserved Possibility for

		Lighting	2, number and use of of lamps	diversification in retail trade (fresh drinks, Internet,..) Attractivity of the outlets (7) Sale of products by correspondance
		Computing	3, number of computers	
			4, uses for computing	
		Communication	5, Type of equipment	
			6, Uses for the equipment	
		Audio-visual	7, Type and uses for equipment	

2. Rural Electrification by Grid Extension

Definition and general description of Rural Electrification by Grid Extension (REGE)

REGE is defined here as the electrification of non-electrified populations in rural areas by extension of the national grid. It is opposed to off-grid decentralised rural electrification.
In general we can consider rural grid extension as provision of electric energy for households on the basis of an existing tariff system. The main distinction from decentralised rural electrification is the (supposed) absence of consumption limitation for the users – a client (household, collective user or productive client) may consume as much kWh and may have as high kW connection as it is able to pay.
Grid extension programmes may or may not include connection of all households and/or collective users in the given village. Some of the programmes stop at the stage of the medium voltage (MV) infrastructures. This document will deal essentially with the evaluation of programmes providing connections up to the users, as the majority of the impacts (but not all of them) are due to the electricity usage. Still the programmes limited only to the MV infrastructure development have also their positive impacts and must be evaluated according to the declared objectives.

Introduction to the Rural Electrification by Grid Extension module

This REGE module is associated with the Monitoring and Evaluation for Energy and Development (M&EED) "Guidelines" document, and is part of the M&EED toolbox.

It is intended as a support tool for project teams developing project specific M&E procedures for a REGE project. It does not include what are considered to be generic M&EED issues applicable to all energy for development projects, such as gender, capacity building, greenhouse gas emissions, etc. but focuses on the issues specific to REGE projects.

This document refers to the **Inputs → Activities → Outputs → Outcome → Impacts** terminology of the OECD. Your project may use other terminology in its logical framework. Note that the distinction between categories depends on your project's context. For instance "water pumping" may be considered to be an output, an outcome, or perhaps even an impact, depending on a particular projects context. This document is organised according to this terminology.

Inputs

It is considered here that we are at project (or programme) level. This project is the resultant of a combination of different economic, social and technical inputs.
It is important to emphasise that one can not evaluate an electrification programme without making reference to it's requirements specification. That means that the objectives of the programme are already one of the important inputs and have their influence on the attained impacts.
We will enumerate some of the most common inputs related to the REGE energy projects. A particular project will usually use some or all of the following inputs. In developing a project specific M&E scheme, it is useful to construct indicators for the most critical inputs. The following tables may be useful in establishing the M&E scheme at the input level.

Input table

Name of input	**Decentralised rural electrification project or programme design**
General nature of input	**Material** REGE projects do not deal with electricity generation, receiving it from the national grid. So the material inputs will be essentially concerned with electricity distribution and consumption. The project may deal with the whole connection network (from the national high voltage (HV) line to the users' meters) or may include only part of it (medium voltage and low voltage (LV) installations), in which case it will include only some of the following material inputs: • Connection from the national HV grid to the local access point • Local access point step-down transformer • Village-scale distribution MV grid • LV step-down transformers • LV distribution grids • Users' meters with or without prepayment • Interior electric installations **Financial/economic** Normally the REGE projects are associated with high infrastructure costs which cannot be covered by the connection payment due to the low solvency of the potential clients. Infrastructure expenses are generally financed as a part of the national grid extension programme or national rural electrification programme. The necessary investment resources may also have the form of grants or loans provided by international development support institutions or NGOs for a particular project financing. International support and NGOs participation may also take the form of non-monetary aid – machinery, labor and expertise, which will be represented as material and institutional inputs, and it's financial equivalent may be accounted as an economic input. Even if low solvency of rural clients limits the connection fee to a sometimes symbolic amount, it should still be applied either as a lump sum initial payment or as a loan transparently recovered with subsequent usage payments, in order to establish a correct users' perception of the electricity as a marketed good, rather than a free service. The tariff system is normally dependent on the fact that the project is connected to the national network. That usually imposes the application of the national tariff system which may presuppose lower tariffs for rural areas. These special rural areas tariffs may be the indirect subsidy for the poor clients

financed by the relatively richer clients. It is also possible that for a particular project a special tariff system will be designed with lower tariffs more adequate to the local solvency situation. It may be conceived in order to launch the local economic development and to line up the tariffs later when the solvency of the clients will increase. In that case the difference with the national tariffs must be covered by one or another form of subsidy specific to the project.
Summary of the financial/economic inputs:

- Infrastructure development financing:
  - MV installations and grid financing
    - National grid extension programme
    - Grants or loans from the international institutions and/or ONG
    - In kind contribution from the international institutions and/or ONG
  - LV installations and grid financing
    - National rural electrification programme
    - Grants or loans from the international institutions and/or ONG
    - In kind contribution from the international institutions and/or ON
- Household access payment scheme:
  - Level of subsidy for the access payment
  - Lump sum access payment or time-distributed access payment with the initial loan
- Tariff system:
  - Application of the national tariff system (with or without special rural tariffs or social tariffs)
  - Specially designed tariff system with corresponding tariff delta financing

Institutional
The usual institutional framework for REGE projects is usually a national electrification programme. It is normally supervised and implemented by a national authority in charge for rural electrification. This is the main stakeholder in REGE projects.
The following stakeholders will normally be involved in any REGE project:

- National rural electrification authority
- National or local electric power company
- Local government structures
- Local population and associations

Other stakeholders which may be more or less involved are the following institutions:

- National government and policy-makers
- Ministry of energy
- Poverty alleviation agency
- Ethnic minority ministry/agency
- Agriculture ministry/agency
- International development agencies and financial structures
- NGOs

The institutional inputs provided by these stakeholders will include, among others:
From governmental authorities:

- Laws, regulations, long-term development programmes
- Administrative procedures simplifications (authorisations, visas,

	qualification of equipment, custom procedures,…) • Tax alleviation • The project objectives definition and project aims (domestic use, collective use, productive use, or a combination of the three) From foreign partners: • Know-how transfer (technical, managerial) • Aid in setting up village associations • Local capacity training programmes From local populations • Participation in project design • Participation in operating management tasks • Goodwill attitude for project developing staff and equipment **Social** The main social input is the beneficiaries' acceptance of the project, which in turn is determined by the following factors: • the solvency of the clients with respect to the proposed tariff system • forecasted evolution of the revenues and other household expenditures • Correspondence of the proposed services and clients expectations • Technological constraints, maintenance and usage discipline • Acceptance of the "fee for service" approach • Acceptance of the proposed connection schedule (when not all the solvable clients are connected simultaneously) • Religious factors • Local society structure and ethnic factors Information campaigns, discussion groups and other participative methods can be used to influence the acceptance levels of a project.
Who brings the input	The input may be brought by the project itself, by another development project, by public authorities, by private players, or by a combination of these. The project log frame will generally specify how this input will be brought to the activity. The project specific M&E scheme should explicitly make mention of this.
Objectives and units of measure	The project/programme may have quantified objectives that one may consider as inputs, in the sense that they are structuring. Here are some examples, the units of measure are suggested in brackets : • Number of clients connected (number of households) or volume of sales (kWh) • Penetration of the electrification of households (percentage of total households) • Diversity of supply (number of hours of supply per day, limited or free end-use) • Legalisation (number of adresses legalised through billing) • Collective uses (number of schools, clinics, town halls, religious buildings, street lighting, …) • Productive activity (number of new or improved activities) and direct employment (number of jobs created) • Safety (reduction in number of fires, electrocution, …) • Frequency of illness (frequency of certain respiratory problems)
Issues associated with the	The table below contains a list of issues related to this input. Some of these issues may be pertinent to the project.

with the input	Potential issue or problem	Points to be attentive to in an M&E scheme
	Programme objectives	REGE electrification projects may have as an objective not the final clients' electricity access but only an HV-MV connection and MV network creation, expecting the LV grid to develop by other means. In this case even if the project would fulfil its objectives the development impact will be very limited as there will be no actual electricity usage by the clients. That is why for the best development impact the project requirements specification must explicitly aim to the final users connections (LV grid).
	Maintenance	Dispersed, exposed to harsh climates, and difficult of access, rural electricity systems often suffer from lack of effective maintenance. Even if the maintenance of the local network is managed by the representatives of the national electric company, it still may suffer from the lack of qualified technicians ready to move into the project area. That is why, if it is impossible to establish effective maintenance by professionals, local well-trained technicians must be prepared. The financing of this maintenance, and any spare parts or replacements, is an important issue.
	Users' solvency	As mentioned above, REGE projects normally adopt the national tariff system with corresponding tariffs for rural areas or social tariffs for poor clients. Still, in the absence of the special rural tariffs, the social ones may be to high with respect to the rural clients welfare – as they are principally adapted to the urban poor, who have a relatively higher monetary revenues than the rural poor. Another payment problem may be due to the subsequent basic services access development (such as water and sanitation), when the cumulated monthly payments for all utilities will exceed a certain ratio with respect to the user's revenue.
	Special tariffs application	In case when special tariffs are applied for a particular REGE project, even on a temporary basis, the acceptability problems may arise. When the applied tariffs are lower than the normal tariffs, the neighbouring populations, electrified on the regular tariffs, will sooner or later legitimately question why this particular village has preferential status.
	Remote uses connection	The on-grid connection for certain kinds of energy uses may turn out to be too expensive in the case of remote productive uses (such as water pumping for irrigation of distant fields) because of the distance of grid to be extended. In such situations alternative energy sources (diesel pumps, for example) or decentralised electricity production can be used.

	Grid production capacity lack	Even if we have previously stated that we consider the REGE projects as purely distributional projects of the on-grid available electricity, it may occur that there is no available spare capacity in the grid for immediate electricity provision, although the distribution grid is already created. This may be due to the poor planning of the national production capacity development, or just due to the local production problems. Such situation will of course virtually nullify the development impact of the project, but it will also undermine the users' perception of the electrification project. That is why the REGE projects should be conceived in coherence with the capacity availability planning of the grid.
	Gifts: lack of appropriation	NGO and charity "gift" projects may suffer from lack of appropriation by end-users who undervalue the equipment, having obtained it for free. End-user financial contributions to the equipment, however minimal, can help to limit this effect.
	Dogmatism	The presence of ethnic minorities, very poor populations, and traditional social structures, may lead to inappropriate dogmatism on behalf of stakeholders. Examples are refusal to apply fee for service, choice of "the strict minimum" service, imposition of renewable energies regardless of what the optimal solution is, etc.

Outputs

REGE projects will produce, voluntarily or not, a certain number of outputs. These may be referred to as "observables". Some are difficult to differentiate from outcomes and may appear in both levels of the model.

Output fiche

Name of output	**Decentralised rural electrification project or programme design**
General nature of output	Variations in the economic and social conditions of the beneficiaries
Who participates in producing the output.	All stakeholders.
What to measure: observables	Listed in order of increasing difficulty in observation. **Domestic use** outputs : • Number of clients connected or volume of sales • Penetration of the electrification in percentage of households (administrative, real) • Diversity of supply (free, limited, blocked, …) • Legalisation (through billing) • Domestic comfort (lighting, TV, appliances, ….) • Safety (fires, electrocution, …) • Continuity of service and voltage stability • Increase in real estate value • Distribution of poor beneficiaries amongst households • Frequency of illness (such as respiratory problems) • Social relationships • Time saving **Collective use** (schools, clinics, town halls, religious buildings, street lighting …) outputs : • Number of clients connected or volume of sales • Diversity of supply (free, limited, blocked, …) • Safety (fires, electrocution, …) • Continuity of service and voltage stability • Social relationships • Time saving **Productive use** outputs : • Productive activity (new or improved activities) and direct employment • Extended capacity availability for productive tasks • Diversity of supply (free, limited, blocked, …) • Safety (fires, electrocution, …) • Continuity of service and voltage stability • Energy expenditure (with equivalent service) • Time saving
Options for units of measure	**Domestic use** outputs : • *Number of clients connected* : number of households, or volume of sales : kWh • *Penetration of the electrification in percentage of households*

<table>
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(administrative, real) : percentage of total households

Diversity of supply (free, limited, blocked, …) : number of hours of supply per day, limited or free end-use
Legalisation (through billing) : number of adresses legalised through billing
Domestic comfort (lighting, TV, appliances, ….) : no unit of measure
Safety (fires, electrocution, …) : reduction in number of fires, electrocution, …
Continuity of service and voltage stability : number and/or duration of blackouts and % variations in voltage
Increase in real estate value : increse in market value of m²
Distribution of poor beneficiaries amongst households : % coverage of electrification in the low income groups
Frequency of illness (such as respiratory problems): frequency of certain respiratory problems
Social relationships : no unit of measure
Time saving : reduction in time spent at certain household tasks

Collective use (schools, clinics, town halls, religious buildings, street lighting …) outputs :

Number of clients connected : number of buildings, or volume of sales : kWh
Diversity of supply (free, limited, blocked, …) : number of hours of supply per day, limited or free end-use
Safety (fires, electrocution, …) : reduction in number of fires, electrocution, …
Continuity of service and voltage stability : number and/or duration of blackouts % variations in voltage
Social relationships : no unit of mesure
Time saving : reduction in time spent on certain community tasks

Productive use outputs :

Productive activity : number of new or improved activities
Direct employment : number of jobs created
Extended capacity availability : number of productive activities using powerful installations
Diversity of supply (free, limited, blocked, …) : number of hours of supply per day, limited or free end-use
Safety (fires, electrocution, …) : reduction in number of fires, electrocution, …
Continuity of service and voltage stability : number and/or duration of blackouts and % variations in voltage
Energy expenditure (with equivalent service) : variations in cost of energy with equivalent service or end-result
Time saving : reduction in time spent on certain productive tasks

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<tr><td>Issues and problems associated with the output</td><td>
The table below contains a list of issues or problems in quantifying or qualifying the output. Some of these issues or problems may be pertinent to the project.
<table>
<tr><th>Potential issue or problem</th><th>Points to be attentive to in an M&E scheme</th></tr>
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	Quantification	For some observable outputs quantification is difficult due to lack of time and means, or impossible for intrinsic reasons. Examples are social relationships, education, comfort, … Solutions to overcoming this problem exist but need to be recognised by stakeholders to have any value. Here are some of them : • Use of a proxy • Use of a standardised qualifying vocabulary • Reference to a previous study recognised in the field of electrification impact or equivalent • Use of illustrative quotations from interviewees
	Typology of output	The borderline between domestic, collective and productive uses may be hazy. In such cases this typology need not be applied.
	Sampling	As in any data collection process, sampling may be used. However special attention must be paid to the issue of representativity. A "sample" that is chosen by a project stakeholder or a local authority may not be representative. Also dispersion of the population may mean that there is heterogeneity in social and ethnic contexts. The professionalism and experience of the survey team is the only way to minimise this risk.
	Centralised data collection	Some data may be collected from a centralised source, such as a statistics bureau, a ministry, or a local authority. It should be borne in mind that in many countries data pertaining to rural areas is often out of date and relatively inaccurate. Comparisons with data for urban areas is risky.

Outcomes and Impacts

Energy services are transversal in nature: economists consider them to be "technical factors of production" that contribute to producing other goods and services. Thus, the M&E scheme for an energy project will probably cover, at the outcome or impact level, non energy products or services.

Identifying the outcomes and impacts of a project.

The following table indicates some of the observables which may result from REGE projects, in order of increasing difficulty of observation. Note that the classification of these results as "outcomes" or "impacts" in the four layer model will depend on the project's logframe, and on the context of the project. The Millenium Development Goals (MDG) are used a reference for the outcome/impact terminology.

Observable	MDG or similar objectives impacted
17. Number of clients connected or volume of sales	all MDGs, poverty reduction (access to modern energy)
18. Penetration of the electrification in percentage of households (administrative, real)	poverty reduction
19. Diversity of supply (free, limited, blocked, …)	poverty reduction (access for the poor)
20. Legalisation (through billing)	governance (status, citizenship, tenureship), poverty reduction (access to services, increase in real estate value)
21. Collective uses (schools, clinics, town halls, religious buildings, street lighting	education, health, governance, security

…)	
22. Domestic comfort (lighting, TV, appliances, ….)	quality of life, gender relations
23. Productive activity (new or improved activities) and direct employment	poverty reduction (income), capacity building
24. Safety (fires, electrocution, …)	health, poverty reduction (material wealth, cost to the community)
25. Continuity of service and voltage stability	quality of life
26. Increase in real estate value	poverty reduction (creation of wealth)
27. Distribution of poor beneficiaries amongst households	poverty reduction (access for the poor)
28. Energy expenditure (with equivalent service)	poverty reduction (negative impact ?)
29. Frequency of illness (such as respiratory problems)	Health
30. Social relationships	governance, gender relations
31. Time saving	health, gender relations

Approach by Uses

From a practical perspective, observables can perhaps best be considered via the **uses** of electricity. The tables that follow summarise the major possible uses, and the observables they give rise to, as well as some suggestions for interpretation.

They are segmented into **domestic**, **collective** and **productive** uses. The overall observable "presence of electricity" heads the tables.

An evaluator may first have to eliminate those uses he is sure not to find and/or he has decided not to investigate.

General Observable : Presence of electricity	**Suggestion for Interpretation**
	Criteria for eligibility to other projects in the area
	Allows a change of status such as the legalisation of the housing
	Adds to the attractivity and growth of the area
	Affects the real estate value of the housing
	Considered as an entry into modern society

DOMESTIC USES :

Energy use	**Observable or quantifiable indicator**	**"Interprétation" and corresponding indicators**
Number of electrified households		
Lighting	1. Number and type of lighting points in households	Household lighting budget modification (directly : 5, 6, 7 or indirectly : 1, 2, 3, 6)
	2. Average number of hours of use	Lighting quality improvement (1, 2, 3, 7)
	3. Presence of other lighting sources	Additional income generated (4)
	4. Activities using electric lighting	Education (4) : improved possibility for home education
	5. Average monthly expenses (for each type of lighting)	Indoor air pollution reduction (4,9)
	6. Average monthly expenses before electrification	
	7. Number and type of lighting sources used before electrification	

Refrigeration	1. Number of electrified households using refrigirators (%)	Reduction (or not) of household's food budget (possibility to by in bigger amount with smaller expenses, but additional expenses on fridge's usage) (2, 3, 5, 6)
	2. Type and number of appliances per household (capacity, volume, w/out freezer, new or second hand)	Food product choice enlargement (4, 5)
	3.Non-electric refrigirator usage and associated expenses	Generation of additional income (8)
	4. Daily time pattern of refrigirator usage	Living standards improvement (4, 5)
	5. Household product choice befeore and after the access to electric refrigiration	
	6. Refrigirator usage for income generation (for example, cold drinks commerce) and amount of revenue generated	
Video and audio usage (TV, radio, Hi-Fi, video)	1. Number of households with TV	Informational access
	2. Number of appliances per household and their type	Comfort improvement
	3. Time pattern of equipement usage (daily time spent for TV)	
	4. Educational usage examples (audio lessons, educational TV programs, pre-recorded educational video programms)	
	5. Local and national news access before and after electrification	
	6. Films' renting or buying expenses	
Cooking	1. Number of households using electric cooking appliances	Cooking budget modification (2,3)
	2. Frequency of usage and usage time	Comfort improvement (2, 3)
	3. Usage of other cooking methods and associated expenses before and after electricity access	
Water heating	1. Number of households using electric water heating	Household budget modification (2)
	2. Frequency of usage and usage time	Comfort improvement (2)
Small domestic appliances	1. Number of households using small domestic appliances	Comfort imrpovement (2, 3)
	2. Type of appliances used (particularly - ventilators)	
	3. Traditional techniques used for the same domestic tasks	
Information technology	1. Number of households having a computer	Informational access (2, 3)

	2. Number of households with Internet access	Modification of the budget for communication
	3. Typical tasks of computer usage	Additional income generated (3)
	4. Computer usage budget	
Individual water pumping	1. Number of households having an individual electric pump	Comfort amelioration
	2.Other water sources presence	Water budget modification
	3. Quality of water pumped with respect to other sources	Health and sanitation amelioration (2, 3)

COLLECTIVE USES :

	Uses of electricity			**Suggestion for Interprétation**
COLLECTIVE USES	**Type of collective use**	**Use**	**Observable or quantifiable indicator**	
	Hospital	Lighting	1, Nbr lamps	Quality of patient follow-up Quality of medical activity Comfort of presence in the facilities for patients and staff
			2, Location of lamps	
		Computing	3, Nbr computers	
			4, Uses for computers	
		Medical equipment	5, Nbr electrical equipment	
			6, Type and use of equipment	
		Refrigeration & freezing	7, Nbr of equipment	
			8, Use of equipment	
		water heater	9, Use of hot water	
		Heating	10, location, type and frequency of use of heating	
		Ventilation/air conditioning	11, Nbr and type of equipment	
			12, Use of equipment	
		water pumping	13, Nbr and location of water outlets	
	School	Lighting	1, Nbr lamps	Quality of teaching Quality and quantity of work done by pupils New possibilities in teaching methods
			2, Location of lamps	
			3, Nbr of hours of teaching	
			4, Type of teaching	
		Computing	5, Nbr computers	
			6, Uses for computers	
		Audio-visual	7, Nbr and type of equipment	
		teaching equipment	8, Nbr and type of equipment	
	Public lighting	Public lighting	Nbr lamps	Safety and comfort outside

	Pumping	drinking water	Nb pumps / nb taps	Fewer illnesses du to bad qulity water
	Administrative buildings	Lighting	1, Nbr lamps	Improvement in administration and management of information
		Computing	2, nbr and uses	
		Audio-visual	3, uses	
	community buildings	Lighting	1, nbr and uses	Better community services, more comfortable, access to new services
		Computing	2, nbr and uses	
		Audio-visual	3, nbr and uses	
	religious buildings	Lighting	1, nbr and uses	Comfort
		other equipment (speakers…)	2, nbr and uses	
	collective telecommunication relays	Telephone	nbr and uses	Access to media Access to market information for certain goods (cost, stocks, …)
		Internet	nbr and uses	
		Television	nbr and uses	
		Radio	nbr and uses	

PRODUCTIVE USES :

	Type		**Use**	**Observable or quantifiable indicator**	**Suggestion for Interprétation**
PRODUCTIVE USES	**Agriculture and animal husbandry**	Pumping	Irrigation	1. Capacity and use of pump	Improvement of the quality of products sold, time of conservation, productivity (1 , 5, 6) Possibilities in diversification of products (1, 2, 3, 5, 6, 7, 8)
		Cereal transformation	Mill	2. Frequency of use	
			Removal of grain cases	3, Frequency of use	
			Conservation	4, type of product conserved	
		Conservation of fresh produce	Conservation of meat	5, type of product and finality of conservation	
			Conservation of fruits and vegetables	6, type of product and finality of conservation	
		Transformation of other produce	Drying	7, type of transformation and possibilities of sale	
			Cooking (jams, sauces)	8, type of transformation and possibilities of sale	
	Production	Machines	Small handcrafts	type of machines and utilisation	Increase in quality, productivity
			Cooperatives		
			Factories		

	Retail	Regriferation, freezer	drinks, fresh produce	1, type of products refrigerated or frozen	Fresh produce better conserved Possibility for diversification in retail trade (fresh drinks, Internet,..) Attractivity of the outlets (7) Sale of products by correspondance

3. Regularisation by Urban Electrification

Definition of Regularisation by urban electrification (RUE)

RUE is defined as the various « inclusion » electrification programmes aiming to bring an urban population sub-group into a legalised or regularised electricity service framework.
The end-users of such programmes often already have, perhaps for a long time, had access to electricity in the form of organised fraud or theft on local distribution grids. These programmes are aimed at peri-urban popluations in precarious housing (“bidonvilles”, “slums”, “shantytowns”, “barrios”, “favelas”, “townships”…). There are of course periurban areas without electricity but usually electricity is one of the first easily available utilities. In addition these populations are familiar with the uses of electricity.
These programmes are geared therefore to regularising an illegal situation and not to providing an initial access to electricity, but the improvement in the quality of service is almost always very marked and can provoque an important change from an electricity access point of view.

Introduction to the RUE module

This RUE module is associated with the Monitoring and Evaluation for Energy and Development (M&EED) "Guidelines" document, and is part of the M&EED toolbox.

It is intended as a support tool for project teams developing project specific M&E procedures for a DRE project. It does not include what are considered to be generic M&EED issues applicable to all energy for development projects, such as gender, capacity building, greenhouse gas emissions, etc. but focuses on the issues specific to RUE projects and programmes.

This document refers to the **Inputs → Activities → Outputs → Outcome → Impacts** terminology of the OECD. Your project may use other terminology in its logical framework. Note that the distinction between categories depends on your project's context. For instance "water pumping" may be considered to be an output, an outcome, or perhaps even an impact, depending on a particular projects context. The document is organised according to this terminology.

Inputs

It is considered here that we are at project (or programme) level. This project is the resultant of a combination of different economic, social and technical inputs (for example : a tariff fixed by a regulator, a method of electricity production, end-users capable of utilising certain electrical appliances).
It is important to emphasise that one can not evaluate an electrification programme without making reference to it's requirements specification. That means that the objectives of the programme are already one of the important inputs and have their influence on the attained impacts.
It is with the combination of these inputs that one can hope to evaluate or measure and not each one individually. Indeed, certain inputs loose their meaning when taken out of context, especially if one seeks to measure them (for example electric lighting if we don't know what type of lighting was replaced). This module is therefore focussed on a given project and its combination of inputs.

Input fiche

Name of input	**Urban Electrification of Regularization project or programme design**
General nature of input	**Material** RUE projects consist essentially of a replacement of fraudulent electrification by regularised meters, distribution grids, and interior installations. One can differentiate collective solutions with distribution stopping at a delivery point at the periphery of a slum, and individual solutions where delivery goes directly to the end-user or to a representative of a group of end-users (in a road or a block of houses, for example). In many cases the nature of the habitat is such that the technical standards must be adapted (simplified). The fight against fraud is often a strategic point and certain techniques may be used to limit fraud (meters placed high up on poles, etc). Certain techniques may be used to ensure payment (prepayment meters, limitation of power level) The implimentation of certain low-consumption appliances can be made through incentives and information. The use of small renewable energy systems can contribute to limiting local consumption. **Financial/economic** RUE projects are often initiated by electric utilisties seeking to limit fraud (and therefore financial losses) on their grids. They hope te re-establish financial equilibrium. They may be considered to form part of a global approach for the concession, perhaps as an "obligation" in return for access to other, more profitable, activities. Regularisation limits losses, and payment levels are generally high. However it is difficult to acertain if financial equilibrium is reached in existing projects. The poorer customers usually pay faithfully but investments and follow-up costs ("social maintenance") are higher than for regular customers. In some cases (for example in South Africa and India) "energy rights" tariff exist and are a subsidy on the consumption. This influences volume and type of electricity use, and indeed the viability of the projects. **Institutional** The institutional context will, through public policies, laws, regulations and subsidies, "framework" many organisational aspects of the project. The designers and operators, therefore, may or may not have freedom to choose

	how they organise their projects. The institutional context pertaining to urban projects will certainly involve at least the three following majors players : • Electric power company • Local government structures • NGO's The usual players of energy programmes may also be found : • National government and policy-makers • Regulation authority • Ministry of energy • International funding organisations These players will influence the project greatly. Particular attention should be paid to aspects pertaining to : - The electricity sector (production capacity, tariffs and their social dimension, local authority and regulators' expectations, demand-side management policies) - Urban policies in the territories : the « regularisation » of peri-urban areas is an important stake for local authorities. It has implications on the real estate market. - The relationship between the project promoter and the local public authorities (for example the contract for public service concessions) In terms of input the evaluator should be attentive to the objectives fixed by the players and the uses which are aimed for ; in its nature the project may be addressing domestic use, collective use, productive use, or a combination of the three. **Social** As part of an evaluation of the social inputs one should be attentive to the following points : - Who were the principal beneficiaries of the fraud ? - What were the costs and benefits of the fraud ? - What are the expected benefits for the end-users : cost, quality of service, quality of life, legal value of billing. - Which tariffs for which services ?
Who brings the input	Project leader (the local utility) under the supervision of local authorities and/or NGOs having acess to these periurban area.
Objectives and units of measure	Special attention should be paid to "official goals" (objectives set up by the authorities and/or the promoters). The project/programme may have quantified objectives that one may consider as inputs, in the sense that they are structuring. Here are some examples, the units of measure are suggested in brackets : • Number of clients connected (number of households) or volume of sales (kWh) • Penetration of the electrification of households (percentage of total households) • Payment coverage • Diversity of supply (number of hours of supply per day, limited or free end-use) • Legalisation (number of adresses legalised through billing) • Collective uses (number of schools, clinics, town halls, religious buildings, street lighting, …) • Productive activity (number of new or improved activities) and direct employment (number of jobs created) • Safety (reduction in number of fires, electrocution, …)

	• Continuity of service (number and/or duration of blackouts and voltage stability (% variations in voltage) • Frequency of illness (frequency of certain respiratory problems)	
	Potential issue	Points to be attentive to in an M&E scheme
	Social management and monitoring	RUE is often the first basic service to be inserted into abandonned peri-urban areas. It comes as a competitor to an illegal activity and makes new customers pay regularly. It supposes the development of original solutions (inserting the frauders into the system). It requires regular contact with the clientele so that the project develops and maintains (payment, state of the equipment). This work can be complicated by the fact that "normal" clientele (local authories, rich inhabitants) may have the habit of not paying their bills, which can provoque a rejection of payments in the slums.
	Limited power	The projects can be designed specifically for domestic uses and are therefore generally unable to power productive uses requiring more substantial amounts of energy, thus limiting the potential local development. One must be watchful of the limits (technical or social) of the implimentation strategy and the methods used by end-users to overcome these limits.
	Evaluating solvent demand	Evaluating solvent demand is difficult generally. The cost of fraud may be a reference but uses usually increase. In cases of extreme poverty the energy expenses may weigh heavily on a family budget. Subsidies and DSM may limit this effect. However when complementary utilities are to be paid (water, telephone) overall solvency is to be considered.
	RUE a "temporary" measure	Regularisation of an electricity service can be considered to be a first step to complete legalisation of a given zone or slum. Local authorities may therefore resist it and/or impose technical and non-technical conditions making the electrification somehow temporary (for example by refusing the use of an official billing system).
	Lack of benchmarking	RUE best practices are slowly diffusing but are not yet very well known.

Outputs

RUE projects will produce, voluntarily or not, a certain number of outputs. These may be referred to as "observables" (in the sense that the effects appear and may be visible, others may not, and not always in the way one expects). Some are difficult to differentiate from outcomes and may appear in both levels of the model.

Output fiche

Name of output	**Urban Electrification of regularization project or programme design**
General nature of output	Impacts in the economic and social conditions of the beneficiaries
Who participates in producing the output.	All stakeholders (including the end-users who may create "new uses" for their electricity service)
What to measure: observables	Listed in order of increasing difficulty in observation. **Domestic use** outputs : • Number of clients connected or volume of sales • Penetration of the electrification in percentage of households (administrative, real) • Diversity of supply (free, limited, blocked, …) • Legalisation (through billing) • Domestic comfort (lighting, TV, appliances, ….) • Safety (fires, electrocution, …) • Method of energy production • Continuity of service and voltage stability • Increase in real estate value • Distribution of poor beneficiaries amongst households • Frequency of illness (such as respiratory problems) • Social relationships • Time saving **Collective use** (schools, clinics, town halls, religious buildings, street lighting …) outputs : • Number of clients connected or volume of sales • Nombre par type (écoles, marchés, lieux de cultes, mairie…) • Diversity of supply (free, limited, blocked, …) • Safety (fires, electrocution, …) • Continuity of service and voltage stability • Social relationships • Time saving **Productive use** outputs : • Productive activity (new or improved activities) and direct employment • Diversity of supply (free, limited, blocked, …) • Safety (fires, electrocution, …) • Method of energy production • Continuity of service and voltage stability • Energy expenditure (with equivalent service) • Time saving
Options for	**Domestic use** outputs :

units of measure	• *Number of clients connected* : number of households, or volume of sales : kWh • *Penetration of the electrification in percentage of households (administrative, real)* : percentage of total households • *Diversity of supply (free, limited, blocked, …)* : number of hours of supply per day, limited or free end-use • *Legalisation (through billing)* : number of adresses legalised through billing, acces au credit, facilitation de demarches…. • *Domestic comfort (lighting, TV, appliances, ….)* : number of unit per use. • *Safety (fires, electrocution, …)* : reduction in number of fires, electrocution, death (fire department statistics). • *Continuity of service and voltage stability* : number and/or duration of blackouts and % variations in voltage • *Increase in real estate value* : increase in market value of m² • *Distribution of poor beneficiaries amongst households* : % coverage of electrification in the lowest income groups (poor of the poors) • *Frequency of illness (such as respiratory problems):* frequency of certain respiratory problems (health services statistics?) • *Social relationships* : declarative (satisfaction questionnaires) • *Time saving* : reduction in time spent at certain household tasks (declarative) **Collective use** (schools, clinics, town halls, religious buildings, street lighting …) outputs : • *Number of clients connected* : number of buildings, or volume of sales : kWh • *Diversity of supply (free, limited, blocked, …)* : number of hours of supply per day, limited or free end-use • *Safety (fires, electrocution, …)* : reduction in number of fires, electrocution, … • *Method of energy production* : reductions in frequency of fuel spillages, perceived or measured smoke emissions • *Continuity of service and voltage stability* : number and/or duration of blackouts % variations in voltage • *Social relationships* : number, visitors to collective buildings, longer use of collective buildings, access to telecommunications. • *Time saving* : reduction in time spent on certain community tasks **Productive use** outputs : • *Productive activity* : number of new or improved activities (activity impossible before such as telecom / improved activity such as use of new tools). Inventory of new machines and new uses. • *Direct employment* : number of jobs created • *Diversity of supply (free, limited, blocked, …)* : number of hours of supply per day, limited or free end-use • *Safety (fires, electrocution, …)* : reduction in number of fires, electrocution, … • *Method of energy production* : reductions in frequency of fuel spillages, perceived or measured smoke emissions • *Continuity of service and voltage stability* : number and/or duration of blackouts and % variations in voltage • *Energy expenditure (with equivalent service)* : variations in cost of energy with equivalent service or end-result • *Time saving* : reduction in time spent on certain productive tasks

<table>
<tr><td rowspan="4">Issues and problems associated with the output</td><td colspan="2">The table below contains a list of issues or problems in quantifying or qualifying the output. Some of these issues or problems may be pertinent to the project.</td></tr>
<tr><td>Potential issue or problem</td><td>Points to be attentive to in an M&E scheme</td></tr>
<tr><td>Quantification</td><td>For some observable outputs quantification is difficult due to lack of time and means, or impossible for intrinsic reasons. Examples are social relationships, education, comforts, …
Solutions to overcoming this problem exist but need to be recognised by stakeholders to have any value. Here are some of them :
• Use of a proxy
• Use of a standardised qualifying vocabulary
• Reference to a previous study recognised in the field of RUE or equivalent
• Use of illustrative quotations from interviewees</td></tr>
<tr><td>Typology of output</td><td>The borderline between domestic, collective and productive uses may be hazy. In such cases this typology need not be applied.</td></tr>
<tr><td></td><td>Qualitative/Quantitative methods for evaluation</td><td>There isn’t a « good » method or a « bad » one. In periurban areas the density of population facilitates the collection of data, but sampling will be an important issue. Access to the field may be difficult for security reasons.
As in any data collection process, sampling may be used. However special attention must be paid to the issue of representativity. A “sample” that is chosen by a project stakeholder or a local authority may not be representative. Also dispersion of the population may mean that there is heterogeneity in social and ethnic contexts.
The professionalism and experience of the survey team is the only way to minimise this risk.
In any case a serious quantitative survey requires considerable means.
Qualitative data can be collected by local NGOs having a good knowledge of, and access to, the field ; these factors may be much more important than the survey methods themselves.</td></tr>
<tr><td></td><td>Centralised data collection</td><td>La collecte et la ré exploitation de donnés publiques (lorsqu’elles existent !) seront souvent plus pertinents que le lancement d’une enquête quantitative spécifique.
Some data may be collected from a centralised source, such as a statistics bureau, a ministry, or a local authority or from the local utility.
It should be borne in mind that in many countries data pertaining to periurban maybe relatively inaccurate because of security issues.</td></tr>
</table>

Outcomes and Impacts

Energy services are transversal in nature: economists consider them to be "technical factors of production" that contribute to producing other goods and services. Thus, the M&E scheme for an energy project will probably cover, at the outcome or impact level, non energy products or services.

Identifying the outcomes and impacts of a project.

The following table indicates some of the observables which may result from RUE projects, in order of increasing difficulty of observation. Note that the classification of these results as "outcomes" or "impacts" in the four layer model will depend on the project's logframe, and on the context of the project. The Millenium Development Goals are used a reference for the outcome/impact terminology.

Observable	MDG or similar objectives impacted
32. Number of clients connected or volume of sales	all MDGs, poverty reduction (access to modern energy)
33. Penetration of the electrification in percentage of households (administrative, real)	poverty reduction
34. Diversity of supply (free, limited, blocked, …)	poverty reduction (access for the poor)
35. Legalisation (through billing)	governance (status, citizenship, tenureship), poverty reduction (access to services, increase in real estate value)
36. Collective uses (schools, clinics, town halls, religious buildings, street lighting …)	education, health, governance, security
37. Domestic comfort (lighting, TV, appliances, ….)	quality of life, gender relations
38. Productive activity (new or improved activities) and direct employment	poverty reduction (income), capacity building
39. Safety (fires, electrocution, …)	health, poverty reduction (material wealth, cost to the community)
40. Method of energy production	environment (GHG, soil pollution, air quality, …), health,
41. Continuity of service and voltage stability	quality of life
42. Increase in real estate value	poverty reduction (creation of wealth)
43. Distribution of poor beneficiaries amongst households	poverty reduction (access for the poor)
44. Energy expenditure (with equivalent service)	poverty reduction (negative impact ?)
45. Frequency of illness (such as respiratory problems)	Health
46. Social relationships	governance, gender relations
47. Time saving	health, gender relations

Approach by Uses

From a practical perspective, observables can perhaps best be considered via the **uses** of electricity. The tables that follow summarise the major possible uses, and the observables they give rise to, as well as some suggestions for interpretation.

They are segmented into **domestic**, **collective** and **productive** uses. The overall observable "presence of electricity" heads the tables.

An evaluator may first have to eliminate those uses he is sure not to find and/or he has decided not to investigate.

General Observable : Presence of electricity	**Suggestion for Interpretation**
	Criteria for eligibility to other projects in the area
	Allows a change of status such as the legalisation of the housing
	Adds to the attractivity and growth of the area
	Affects the real estate value of the housing
	Considered as an entry into modern society

DOMESTIC USES :

Energy use	**Observable or quantifiable indicator**	**"Interprétation" and corresponding indicators**
Number of electrified households		
Lighting	1. Number and type of lighting points in households	Household lighting budget modification (directly : 5, 6, 7 or indirectly : 1, 2, 3, 6)
	2. Average number of hours of use	Lighting quality improvement (1, 2, 3, 7)
	3. Presence of other lighting sources	Additional income generated (4)
	4. Activities using electric lighting	Education (4) : improved possibility for home education
	5. Average monthly expenses (for each type of lighting)	Indoor air pollution reduction (4,9)
	6. Average monthly expenses before electrification	
	7. Number and type of lighting sources used before electrification	

Refrigeration	1. Number of electrified households using refrigirators (%)	Reduction (or not) of household's food budget (possibility to by in bigger amount with smaller expenses, but additional expenses on fridge's usage) (2, 3, 5, 6)
	2. Type and number of appliances per household (capacity, volume, w/out freezer, new or second hand)	Food product choice enlargement (4, 5)
	3.Non-electric refrigirator usage and associated expenses	Generation of additional income (8)
	4. Daily time pattern of refrigirator usage	Living standards improvement (4, 5)
	5. Household product choice befeore and after the access to electric refrigiration	
	6. Refrigirator usage for income generation (for example, cold drinks commerce) and amount of revenue generated	
Video and audio usage (TV, radio, Hi-Fi, video)	1. Number of households with TV	Informational access
	2. Number of appliances per household and their type	Comfort improvement
	3. Time pattern of equipement usage (daily time spent for TV)	
	4. Educational usage examples (audio lessons, educational TV programs, pre-recorded educational video programms)	
	5. Local and national news access before and after electrification	
	6. Films' renting or buying expenses	
Cooking	1. Number of households using electric cooking appliances	Cooking budget modification (2,3)
	2. Frequency of usage and usage time	Comfort improvement (2, 3)
	3. Usage of other cooking methods and associated expenses before and after electricity access	
Water heating	1. Number of households using electric water heating	Household budget modification (2)
	2. Frequency of usage and usage time	Comfort improvement (2)
Small domestic appliances	1. Number of households using small domestic appliances	Comfort improvement (2, 3)
	2. Type of appliances used (particularly - ventilators)	
	3. Traditional techniques used for the same domestic tasks	
Information technology	1. Number of households having a computer	Informational access (2, 3)

	2. Number of households with Internet access	Modification of the budget for communication
	3. Typical tasks of computer usage	Additional income generated (3)
	4. Computer usage budget	
Individual water pumping	1. Number of households having an individual electric pump	Comfort improvement
	2.Other water sources presence	Water budget modification
	3. Quality of water pumped with respect to other sources	Health and sanitation improvement (2, 3)

COLLECTIVE USES :

	Uses of electricity			**Suggestion for Interprétation**
COLLECTIVE USES	**Type of collective use**	**Use**	**Observable or quantifiable indicator**	
	Hospital	Lighting	1, Nbr lamps	Quality of patient follow-up Quality of medical activity Comfort of presence in the facilities for patients and staff
			2, Location of lamps	
		Computing	3, Nbr computers	
			4, Uses for computers	
		Medical equipment	5, Nbr electrical equipment	
			6, Type and use of equipment	
		Refrigeration & freezing	7, Nbr of equipment	
			8, Use of equipment	
		water heater	9, Use of hot water	
		Heating	10, location, type and frequency of use of heating	
		Ventilation/air conditioning	11, Nbr and type of equipment	
			12, Use of equipment	
		water pumping	13, Nbr and location of water outlets	
	School	Lighting	1, Nbr lamps	Quality of teaching Quality and quantity of work done by pupils New possibilities in teaching methods
			2, Location of lamps	
			3, Nbr of hours of teaching	
			4, Type of teaching	
		Computing	5, Nbr computers	
			6, Uses for computers	
		Audio-visual	7, Nbr and type of equipment	
		teaching equipment	8, Nbr and type of equipment	
	Public lighting	Public lighting	Nbr lamps	Safety and comfort outside

	Pumping	drinking water	Nb pumps / nb taps	Fewer illnesses du to bad qulity water
	Administrative buildings	Lighting	1, Nbr lamps	Improvement in administration and management of information
		Computing	2, nbr and uses	
		Audio-visual	3, uses	
	community buildings	Lighting	1, nbr and uses	Better community services, more comfortable, access to new services
		Computing	2, nbr and uses	
		Audio-visual	3, nbr and uses	
	religious buildings	Lighting	1, nbr and uses	Comfort
		other equipment (speakers…)	2, nbr and uses	
	collective telecommunication relays	Telephone	nbr and uses	Access to media Access to market information for certain goods (cost, stocks, …)
		Internet	nbr and uses	
		Television	nbr and uses	
		Radio	nbr and uses	

PRODUCTIVE USES :

	Type		Use	Observable or quantifiable indicator	Suggestion for Interprétation
PRODUCTIVE USES	Agriculture and animal husbandry	Pumping	Irrigation	1. Capacity and use of pump	Improvement of the quality of products sold, time of conservation, productivity (1 , 5, 6) Possibilities in diversification of products (1, 2, 3, 5, 6, 7, 8)
		Cereal transformation	Mill	2. Frequency of use	
			Removal of grain cases	3, Frequency of use	
			Conservation	4, type of product conserved	
		Conservation of fresh produce	Conservation of meat	5, type of product and finality of conservation	
			Conservation of fruits and vegetables	6, type of product and finality of conservation	
		Transformation of other produce	Drying	7, type of transformation and possibilities of sale	
			Cooking (jams, sauces)	8, type of transformation and possibilities of sale	
	Production	Machines	Small handcrafts	type of machines and utilisation	Increase in quality, productivity
			Cooperatives		
			Factories		
	Retail	Regriferation, freezer	drinks, fresh produce	1, type of products refrigerated or frozen	Fresh produce better conserved Possibility for

		Lighting	2, number and use of of lamps	diversification in retail trade (fresh drinks, Internet,..) Attractivity of the outlets (7) Sale of products by correspondance
		Computing	3, number of computers	
			4, uses for computing	
		Communication	5, Type of equipment	
			6, Uses for the equipment	
		Audio-visual	7, Type and uses for equipment	

4. Improved Biomass Stoves

Introduction to the improved stoves M&E module

This "improved stoves" module is associated with the Monitoring and Evaluation for Energy and Development (M&EED) "Guidelines" document, and is part of the M&EED toolbox.

It is intended as a support tool for project teams developing project specific Results Based Management (RBM) procedures for a household energy project. RBM is a management strategy focusing on performance and achievement of outputs, outcomes and impacts.

RBM is of increasing importantance. For stove projects it is a necessity to provide the evidence of scaling up household energy technologies; of the respective behavioural changes for firewood saving; of political awareness and of political consideration. The major tasks for RBM are therefor steering of the intervention, accountability and the contribution to internal learniung and knowledge management.

Inputs → Activities → Outputs → Outcome → Impacts

This document refers to the internationally agreed OECD DAC categories[1]. This provides the joint RBM basis for all donors and implementors in development.

Results chain: The causal sequence for a development intervention that stipulates the necessary sequence to achieve desired objectives – beginning with inputs, moving through activities and outputs, and culminating in outcomes, impacts, and feedback. In some agencies, reach is part of the results chain.
Inputs: The financial, human, and material resources used for the development intervention.
Activities: Actions taken or work performed through which inputs, such as funds, technical assistance and other types of resources are mobilized to produce specific outputs.
Outputs: The products, capital goods and services which result from a development intervention; may also include changes resulting from the intervention which are relevant to the achievement of outcomes.
Outcome: The likely or achieved short-term and medium-term effects of an intervention´s outputs.
Impacts: Positive and negative primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended.

The M&EED "Guidelines" document has a more detailed description of the OECD DAC categories.

This document is organised into a section for each of these steps.

[1] OECD-DAC (2002): Glossary of Key Terms in Evaluation and Results Based Management.

Introduction to improved stoves projects

Around 2.4 billion people world-wide rely on the use of traditional biomass (including fuel wood, charcoal, dung, and agricultural residues) for cooking, baking and heating. In many cases, cooking is done on a “three-stone-fire” (or “open fire”), a basic technology that can waste up to 90 % of the energy input. This means that a household has to consume relatively large quantities of biomass in order to satisfy its energy needs. In areas with biomass scarcity (such as the Sahel countries), this is becoming a severe problem both for the households (who have to spend an increasing amount of their time and money for their energy supply) and for the remaining natural resources.

In addition, open fires tend to cause a lot of smoke emissions, due to low combustion temperatures. The emissions are hazardous to the health of cooks and other household members, especially if cooking is taking place indoor. In general, women and children are most affected. This indoor air pollution causes serious health problems such as respiratory and eye diseases and is estimated to be responsible for the death of about 1.6 million individuals each year.

Improved stoves are specially designed technologies that reduce heat losses and therefore use biomass energy more efficiently. Experiences with improved stoves have shown that – depending on the stove model - biomass energy savings of up to 80 % compared to traditional stoves can be achieved. This represents a considerable improvement for households in terms of time and money spent on biomass energy. Health hazards through indoor air pollution decrease and pressure on forests is reduced.

Improved stoves and ovens represent also an interesting option for large-scale biomass energy consumers such as schools, hospitals, prisons, breweries, bakeries, or brick makers. Especially for small businesses, these stoves are an option for decreasing the costs of production, becoming more competitive and creating additional income and jobs.

According to almost three decades of experiences, household energy interventions should be based on the following three pillars[2]:

- policy and strategy development
- scaling up of improved cooking technologies (e.g. stoves) and techniques
- increasing sustainable cooking fuel supply and enabling fuel switch

The respective interventions lead to an increased access to modern cooking energy cluding the previously mentioned impacts and finally contributes to the achievement of the internationally agreed Millennium Development Goals (MDGs).

With regard to monitoring and evaluation of improved stoves projects, it is essential to establish a solid **baseline**, i.e. a thorough analysis of the situation before project implementation. A baseline study is an analysis describing the situation prior to a development intervention, against which progress can be assessed or comparison made.
This household energy baseline could comprise information such as:

- Fuel availability in the household and area of the intended beneficiaries (collected; purchased; both; seasonal differences);
- Cooking practices (type of food; frequency of cooking; indoor/outdoor cooking location);
- Fuel consumption (type of fuel; amount of fuel; seasonal differences);
- Traditional stoves (purpose of use; type of fuel used; fuel efficiency; advantages for users; purchased/owner built; price; raw materials);
- Women's workload (time spent on building/maintaining the traditional stove, providing fuel, cooking; responsibilities for cooking/fuel provision; other work areas);

[2] Three Pillar Scaling up Model developed by GTZ HERA, 2006

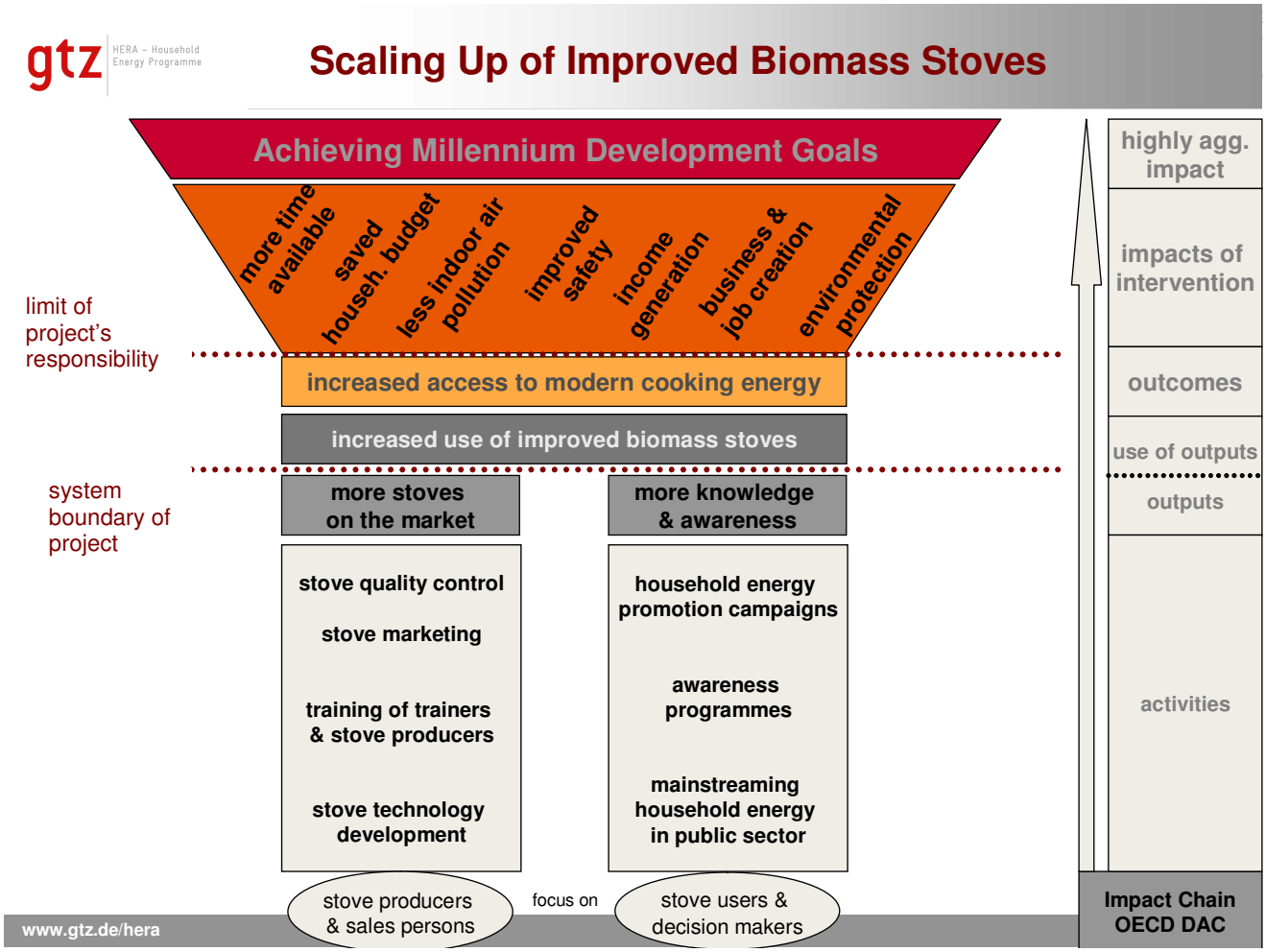
- Households (average size; availability of cash income; control over household expenditure);
- Fuel shortage (awareness within households, especially those controlling household expenditure; interest in new technologies);
- Producers/production (number of potential producers; income level; raw material; average production skills; successful existing products; interest in new products);
- Distributors (distribution network/shops; interest in new product, existing distribution channels of comparable products);
- Household Energy Policies (importance of household energy in national planning);
- Cooperation (activities of other organizations or projects in the field of household energy).

This baseline is essential for planning but also for monitoring the changes that have been brought about by the improved stoves project. A sound and reliable baseline is therefore necessary for effectively demonstrating the impact of the project.

Results chain

The result chain shows the causal sequence for a development intervention that stipulates the necessary sequence to achieve desired objectives – beginning with inputs, moving through activities and outputs, and culminating in outcomes and impacts. In some agencies the "use of outputs" is added as part of the results chain[3].

source: GTZ HERA 2006.



This impact chain reflects in particular the scaling up of improved biomass stoves. (The other two intervention pillars are not arranged in an impact chain yet.) Scaling up focusses on two groups of people/beneficiaries: the stove producers and sales person on one side and the stove users and decision makers on the other side.

Input is not mentioned here, nevertheless it stands for the provided resources (money, personnel, material), which are used for the development intervention.

Activities particularly targeting the stove producers and sales person are stove technology development, training of trainers & stove producers, stove marketing and stove quality control. Activities targeting stove users and decision makers are mainstreaming household energy in public sector, awareness programmes and household energy promotion campaigns. (Further activities are possible, like e.g. establishment of a credit scheme, but not necessary for any sustainable approach.)

The **outputs** are here summarized in: more stoves on the market and more knowledge & awareness. These can be subdivided, since every activity has an output. Improved suitable stove

[3] Result chain, developed by GTZ HERA, 2006.

technologies are available, trainers and stove producers are well trained, stove marketing is established and stove quality control is functioning well – this meets in well established production and promotion and more stoves on the market. Household energy is mainstreamed into the public sector, awareness programmes and household energy promotion campaigns are reaching the target groups – this results in well informed and motivated customers and user as well as decision makers and thus more knowledge and awareness.

Between the output and the use of output lays the theoretical system **boundary of the project**. Up to here it is the project which has full responsibility. Thereafter the success is influenced by the targeted groups.

The **use of output**, increased use of improved biomass stoves, depends on the future users, the surrounding project environment and the producers and sales persons' activity. However supportive structures are supposed to be established by the project.
The **outcome** of all interventions therefore is the increased access to modern cooking energy.

Another boundary, which is marking the **limit of a project's responsibility**, is theoretically found between the outcome of a project and the impacts. As impacts are positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended, they are consequences but not within the projects responsibility any more. Here we find the **impacts** like more time available, saved household budget, less indoor air pollution, improved safety, income generation, business & job creation and enviromental protection (just to mention the major impacts).
These impacts of scaling up improved biomass stoves are finally contributing the the MDGs as **highly aggregated impact**.

Inputs

Improved stoves projects use the following inputs: financial, human, and material resources used for the development intervention. These include personell, project material as well as infrastructure.

Activities & Outputs

Project activities usually include the following activities:
On the stove producers and sales persons side:

- Design of appropriate improved stove technologies;
- Training of trainers and producers;
- Stove marketing
- Stove quality control

On the stove users and decision makers side:

- Mainstreaming household energy in public sector
- Awareness creation programmes;
- Household energy promotoin campaigns

In setting up a Result Based Monitoring System (RBM), it is necessary to construct develop indicators for the most activities, respectively for the outputs of the activities. The following fiches may be useful in establishing the RBM scheme at the activity/output level. Since this monitoring approach reflects the impacts, it is not necessary to monitor the activities, but rather the outputs, outcomes and impacts of the activities. Therefore the following fiches are reflecting the outputs of the project activities.

Indicators allow to measure the achievement of certain targets and impacts. Formally an indicator is a „quantitative or qualitative factor or variable that provides a simple and reliable means to

measure achievement, to reflect the changes connected to an intervention, or to help assess the performance of a development actor"[4].

<table>
<tr><td>Name of output</td><td colspan="2">Appropriate improved stove technologies are designed and available</td></tr>
<tr><td>General nature of output</td><td colspan="2">The development of appropriate improved stoves is usually an output of research activities, some of which are also undertaken in the context of improved stoves projects. At the same time, appropriate improved stoves constitute an input for projects that aim at the dissemination of improved stoves. The main component of this input is technical knowledge. For the development of appropriate stoves, the price of the stove and affordability, and the availability of stove materials are also needed. Furthermore the stove should meet the requirements of the end-users.</td></tr>
<tr><td>Who brings the output</td><td colspan="2">This output is provided by research institutions, improved stoves projects (including past projects or those taking place in other countries), non-governmental organisations and private businesses, even within the partner country.</td></tr>
<tr><td>Options for indicators</td><td colspan="2">• Different types of stoves are available and described in detail (efficiency, durability, price, etc.); stove design and manuals are available
• The stoves are appropriate: they are affordable, durable and efficient, comfortable, modern and referring to habits of users.</td></tr>
<tr><td>Issues and problems associated with the output indicators</td><td colspan="2">The table below contains a list of issues or problems in quantifying or qualifying this input. Some of these issues or problems may be pertinent to your project. The corresponding solutions are described in more detail in the annex.</td></tr>
<tr><td></td><td>Potential issue or problem</td><td>Possible solution for establishing an appropriate M&E scheme</td></tr>
<tr><td></td><td>Good relation between innovation/improvement (e.g. energy efficiency) and local applicability</td><td>• Include local participants in design and development of improved stoves
• Use test groups</td></tr>
</table>

Name of output	**Trainers and stove producers are trained and have respective technical and busines skills**
General nature of output	This output refers to capacity building (technical and business skills) for small businesses. Training in business skills is essential for all projects that aim at commercial dissemination of improved stoves.
Who brings the output	Financing for training is usually provided by the improved stoves project. Producers will contribute if they see an economic opportunity in the market. The training sessions are executed either by project staff members or by training organisations or experts that are contracted by the project. They might be further qualified by the project.
Options for indicators	• Number of trainers and producers trained on technical and on business skills; • Level of understanding of trainers and producers for technical (stove production) and business skills (distribution, marketing, awareness); • Number of trainings carried out by new trainers • Number of stoves sold by the producers.

[4] OECD-DAC (2002): Glossary of Key Terms in Evaluation and Results Based Management.

<table>
<tr><td rowspan="4">Issues and problems associated with the output indicators</td><td colspan="2">The table below contains a list of issues or problems in quantifying or qualifying this input. Some of these issues or problems may be pertinent to your project. The corresponding solutions are described in more detail in the annex.</td></tr>
<tr><td>Potential issue or problem</td><td>Possible solution for establishing an appropriate M&E scheme</td></tr>
<tr><td>Identification of target group for training</td><td>• survey existence of metalworkers, blacksmiths and ceramic workers in a given area (disaggregate into semi-industrial or handicraft)</td></tr>
<tr><td>Quality of training</td><td>• perform interviews with potential stoves producers before the training session; identify training needs
• distribute feed-back sheets at the end of training session (or directly ask participants for their opinion)</td></tr>
</table>

Name of output	**Marketing of improved cook stoves is established**
General nature of output	This output refers to marketing capacities and skills of producers and the project. The product improved stoves should be a market product and this requires marketing.
Who brings the output	Marketing is either arranged by the projects or by the producer. Intentionally the producer should market his own product and thus contribute to establish a market for stoves. But in many cases the producer is at least supported by the project, in terms of training.
Options for indicators	• Number and quality of marketing campaigns carried out by the producers

Name of output	**Stove quality is guaranteed by quality control**
General nature of output	With quality control, the product has to keep a certain standard. If a mechanism of quality control is established, the consumers as well as the producers of good quality are protected.
Who brings the output	Quality control should be initiated by the project and can be implemented by a local organisation.
Options for indicators	- quality standards are developed and monitored - labels are existing and applied - person or institution is responsible for quality control

<table>
<tr><td>Name of output</td><td colspan="2">Awareness is created within the society
Through household energy awareness campaignes and awareness programmes</td></tr>
<tr><td>General nature of output</td><td colspan="2">This output refers to raising the awareness for the benefits of improved stoves among the potential users and is therefore critical for the success of the project. Feed-back from potential users during awareness creation should be carefully collected and evaluated in order to improve the design of the project.</td></tr>
<tr><td>Who brings the output</td><td colspan="2">Financing for awareness creation is usually provided by the improved stoves project. Awareness creation campaigns are undertaken either by project staff members, by local partners or stove producers themselves (or by external experts that are contracted by the project). In some cases, government agencies take part in larger awareness creation activities.</td></tr>
<tr><td>Options for indicators</td><td colspan="2">• Number of people aware of the improved stoves and their benefits
• Awareness of producers and sales persons, people know where to purchase the stoves
• Number of campaigns and type of promotion (radio, market-demonstration, TV, etc.) carried out.
• level of understanding of buyers/potential users of stoves about its advantages</td></tr>
<tr><td rowspan="4">Issues and problems associated with the output indicators</td><td colspan="2">The table below contains a list of issues or problems in quantifying or qualifying this input. Some of these issues or problems may be pertinent to your project. The corresponding solutions are described in more detail in the annex.</td></tr>
<tr><td>Potential issue or problem</td><td>Possible solution for establishing an appropriate M&E scheme</td></tr>
<tr><td>Difficulty in mass campaigns to measure number of households reached</td><td>• Estimate number of participants</td></tr>
<tr><td>Difficulty in measuring link between awareness creation and purchase of improved stoves</td><td>• Where possible, note down name and address of households that have been reached by awareness creation
• Ask households what has influenced their decision to purchase an improved stove</td></tr>
</table>

Name of output	**Household energy is mainstreamed into public sector**
General nature of output	
Who brings the output	
Options for indicators	• Number of institutions involving themselves in stove dissemination and household energy activities • Number and type of joint activities • responsibilities taken over fully by departmerntal and other partners

Outputs summarised

Name of output	**more stoves on the market**
General nature of output	The general output should be that producers start producing improved stoves and that producers or distributors start the promotion and sale of the improved stoves.
Who participates in producing the output.	• Project staff • NGOs and research organisations active in the field of improved stoves • Stoves producers and promoters
What to measure *(All measurements should be compared with a baseline that has to be developed at the beginning of an improved stoves project)*	○ *Increase in the production of improved stoves* ○ *Increase of sold improved stoves* ○ *Life cycle and price of improved stove* ○ *Costs for production, including input costs* ○ *Costs for promotion, including transport and marketing* ○ *Sustainability of project*
Options for units of measure	Number of improved stove producers in a given region x number of improved *stoves produced/or sold* in a given period of time in comparison with baseline scenario (and estimation of percentage of stoves sold plus given as gift)
Options for indicators	- number of (improved) stove producers - number of distributors or selling points - number of improved stoves produced and sold - income generated by producer - number of additional employees
Issues and problems associated with the output indicators	The table below contains a list of issues or problems in quantifying or qualifying this output. Some of these issues or problems may be pertinent to your project. The corresponding solutions are described in more detail in the annex.

Name of output	more knowledge and awareness within the society	
General nature of output	The main output of improved stoves projects is neither an energy service nor an energy vector. Improved stoves projects focus on providing an already existing energy service (i.e. thermal energy for cooking or heating) more efficiently and with less harmful emissions. They are therefore more related to the family of energy efficiency projects. The general nature of this output is the acceptance of improved stoves, which lead to purchase and use.	
Who participates in producing the output.	• Project staff • NGOs and research organisations active in the field of improved stoves • Households using biomass for cooking or heating	
What to measure (All measurements should be compared with a baseline that has to be developed at the beginning of an improved stoves project)	1. Increase in the use of improved stoves 2. Increase in efficiency for improved stoves 3. User acceptance of improved stoves, including technical and social difficulties 4. Sustainability of project	
Options for units of measure	Number of households using improved stoves (including frequency of use) Amount of fuel wood needed to cook average meal	
Options for indicators	• Increase (in %) of households using improved stoves (including frequency of use) • increasing public support, public campaignes and activities by partner organistations	
Issues and problems associated with the output indicator	The table below contains a list of issues or problems in quantifying or qualifying this output. Some of these issues or problems may be pertinent to your project. The corresponding solutions are described in more detail in the annex.	
	Potential issue or problem	Possible solution for establishing an appropriate M&E scheme
	Purchase power of costumers	• If needed credit system should be in place

Outcomes and Impacts

Energy services are transversal in nature: economists consider them to be "technical factors of production" that contribute to producing other goods and services. Thus, the RBM scheme for an energy project will probably cover, at the outcome or impact level, non energy products or services.

Identifying the outcomes and impacts of a project.

The following table indicates some of the possible goods or services which may result from improved stoves projects. Note that the classification of these results as "outcomes" or "impacts" in the four layer model will depend on the project's log frame, and on the context of the project.

Output	Use of outputs	Corresponding outcome	Impacts
more stoves on the market	Increased use of improved biomass stoves	Increased access to modern cooking energy	- more time available - saved household budget - less indoor air pollution - improved safety - income generation - business & job creation - environmental protection
more knowledge & awareness			

In developing the RBM scheme for your project, you should choose the outcomes which are most important to your project's stakeholders, and for these outcomes, you will choose an indicator which provides adequate information on the project's success. The choice of indicators must take into account the cost and difficulty of developing the necessary information. (See discussion in the M&EED Guidelines on "pertinence, rigor and cost".)

On the basis of this choice, you may use the following form to create appropriate "output" indicator fiches for your project.

<table>
<tr><td>Name of outcome</td><td colspan="2">Income and employment generation through improved stoves production</td></tr>
<tr><td>General nature of outcome</td><td colspan="2">This outcome has to be measured against a baseline scenario. Monitoring this outcome can demonstrate the impact of an improved stove for the health of its users.</td></tr>
<tr><td>Who participates in producing the outcome.</td><td colspan="2">• Project staff
• NGOs and research organisations
• Households using improved stoves
• Improved stoves producers and promoters</td></tr>
<tr><td>What to measure</td><td colspan="2">1. Income generated through sale of improved stoves.
2. Jobs created in production and promotion of improved stoves.</td></tr>
<tr><td>Options for units of measure</td><td colspan="2">1. Additional income for stove producers and their assistants in local or international currency due to assistance provided by the project (= increase in profit for entrepreneurs; increase in profit for raw material suppliers; increase in wages for assistants)
2. Number of new jobs created in the production and promotion of improved stoves + number of jobs created in the provision of raw materials for improved stoves – number of jobs lost in other areas (e.g. charcoal sellers) due to activities of the project</td></tr>
<tr><td>Options for indicators</td><td colspan="2">• Number of stove producers
• Number of distributors</td></tr>
<tr><td>Links to national development goals or to the MDGs</td><td colspan="2">• Reduction of poverty
• Economic development

• MDG 1: Eradicate extreme poverty and hunger</td></tr>
<tr><td>Issues and problems associated with the outcome indicator</td><td colspan="2">The table below contains a list of issues or problems in quantifying or qualifying this outcome. Some of these issues or problems may be pertinent to your project. The corresponding solutions are described in more detail in the annex.

<table><tr><td>Potential issue or problem</td><td>Possible solution for establishing an appropriate M&E scheme</td></tr><tr><td>much effort to measure smoke reduction</td><td>• exemplary measuring of smoke reduction – recalculate this according to regular use of stoves</td></tr><tr><td></td><td></td></tr></table></td></tr>
</table>

Name of outcome	**Reduction of fuel consumption (fuel wood, charcoal, agricultural residues…)**
General nature of outcome	This outcome has to be measured against a baseline scenario. Monitoring this outcome can demonstrate the impact of an improved stove both on the welfare of its users and on the protection of natural resources.
Who participates in producing the outcome.	• Project staff • NGOs and research organisations • Households using improved stoves
What to measure	1. Fuel consumption during a given period of time 2. Time spent on ensuring fuel supply 3. Money spent on ensuring fuel supply
Options for units of measure	1. Units for measure have to be differentiated according to the type of fuel(s) used (e.g. wood fuel, charcoal, dung, agricultural residues…). According to the type of fuel, the unit for measuring consumption would differ as well. It makes sense to apply units that are used at local market when purchasing the fuel (e.g. kilograms, bundles, bags, donkey loads…). It is important to verify if the fuel consumption is actually sufficient to cover the cooking energy needs of the household. 2. Time spent on ensuring fuel supply should be measured in hours per period of time (e.g. hours per day). Consideration has to be given to seasonal variations and fuel switching (e.g. use of agricultural residues after harvest). It makes sense to specify which members of the household are involved in fuel supply. This information can be used in order to evaluate gender impacts of improved stoves projects. 3. Money spent on ensuring fuel supply can be measured in local currency + international equivalent (US-Dollar or Euro) spent by a household on cooking fuel during a given period of time (e.g. US$/year). It is helpful to relate this figure to the monetary income of the household (e.g. 10% of annual income). Also, the decrease in fuel expenditures has to be put in relation to the costs of the stove. The resulting payback period (i.e. savings per time unit divided by stove price) has to be lower than the lifetime of the stove.
Options for indicators	• Amount of fuel wood used to boil 3 litres of water • Part of income spent on fuelwood
Links to national development goals or to the MDGs	• Reduction of poverty • Protection of natural resources • MDG 1: Eradicate extreme poverty and hunger • MDG 3: Promoting gender equality and empowering women • MDG 7: Ensure environmental sustainability
Issues and problems associated with the outcome indicator	The table below contains a list of issues or problems in quantifying or qualifying this outcome. Some of these issues or problems may be pertinent to your project. The corresponding solutions are described in more detail in the annex.

Name of outcome	**Reduction of indoor air pollution**
General nature of outcome	This outcome has to be measured against a baseline scenario. Monitoring this outcome can demonstrate the impact of an improved stove for the health of its users.
Who participates in producing the outcome.	• Project staff • NGOs and research organisations • Households using improved stoves
What to measure	1. Emissions from improved stove (considering technology and fuel) 2. Exposure of household members to emissions
Options for units of measure	1. Particles of up to 10 microns in diameter (PM10) are most commonly measured. An alternative would be measuring all (total) suspended particles (TSP). Recent evidence suggests that the very smallest particles – up to 2.5 microns in diameter (PM2.5) – are the most dangerous. Concentrations of particles are expressed as the weight of particles (in micrograms, µg) per cubic metre (m^3) of air, thus $\mu g/m^3$. Typical 24-hour mean levels of PM10 in homes using biomass range from 300 to 3,000+$\mu g/m^3$. While using an open fire the PM10 level can reach 20,000 $\mu g/m^3$ or more. Yet the US-EPA standard for average daily (24-hour) PM10 is 150 $\mu g/m^3$ (which should be exceeded only once per 100 days). The annual average should not exceed 50 $\mu g/m^3$. Most 'western' cities rarely exceed these standards. 2. Exposure to smoke emissions can be quantified by measuring smoke particles inhaled during a certain period of time. Alternatively, one could measure time spent indoor while the stove / fireplace is being used. For exact data, distance to cooking area and ventilation have to be considered as well.
Options for indicators	• Concentration of smoke in the house during cooking • Concentration of carbon monoxide • Concentration of air pollutants
Links to national development goals or to the MDGs	• Improvement of public health • Increase in life expectancy • MDG 3: Promoting gender equality and empowering women • MDG 4: reduce child mortality • MDG 5: improve maternal health

Name of outcome	**Reduced forest degradation**
General nature of outcome	This outcome has to be measured against a baseline scenario. Monitoring this outcome can demonstrate the impact of an improved stove on the forest degradation.
Who participates in producing the outcome.	• Project staff • NGOs and research organisations • Households using improved stoves
What to measure	1. Forest cover 2. Availability of (alternative) fuels
Options for units of measure	1. Trees / ha 2. ha / km2 3. Minutes 4. Amount of fire wood available with certain distance of village
Options for indicators	1. Number of trees per ha 2. Forest areas 3. Time needed to walk to area for collected fire wood 4. Availability of fire wood
Links to national development goals or to the MDGs	• Improvement of public health • Increase in life expectancy • MDG 7: Environmental improvement

Name of outcome	**Time saved**
General nature of outcome	It is assumed that the improved stove request less fire wood and less time for cooking. The nature of the outcome would be time available (especially for women) to undertake other activities
Who participates in producing the outcome.	• Project staff • NGOs and research organisations • Households using improved stoves
What to measure	1. Time saved because less firewood is needed 2. Time saved because less time for cooking is needed 3. New activities undertaken
Options for units of measure	1. and 2: Minutes per day 3: Number of activities
Options for indicators	• Decrease of time needed to collect firewood (men vs women) • Decrease of time needed to cook households meals (men vs women) • New activities undertaken (emphasis on education and income generating activities)
Links to national development goals or to the MDGs	• Reduction of poverty and hunger • Increase in life expectancy • MDG 1: Reduction of hunger and poverty • MDG 2: Education • MDG 3: Promoting gender equality and empowering women • MDG 4 – 6 : Improved health

Organisational and institutional considerations

Monitoring of stove producers could be perceived as control on behalf of public authorities (tax collection). Therefore, sales figures are likely to be understated. On the other hand, producers might exaggerate in order to please project staff and to avoid admitting poor business performance.

Similarly, households or small businesses that are dissatisfied with their improved stove or oven might not be willing to admit that they are not using it in order to please project staff. This outspokenness is also a cultural issue that can vary between countries and regions.

Summary of Output – Outcomes and Impact

	Elements in your causal chain diagram **„What to measure?“**	Indicators	unit	source	Data collection methods
Outputs	stoves	- # stoves produced	- stoves	- stoves vendors	- inventory records
	use of stoves	- # stoves sold	- stoves	- stoves vendors	- sales records
	use of stoves	- frequency of use - maintenance of stoves - replacement of stoves - efficient cooking technique	- N/A	- households	- survey
	employment	- # personnel employed (permanent vs temporary) (women vs men) - - # full time jobs	- personnel - - jobs	- stoves vendors - stoves vendors	- interview / bookkeeping vendors - interview / bookkeeping vendors
	Behaviour change	- promotion by users (advertising the advantages to neighbours and relatives) - frequency of use	- N/A - N/A	 - households	- focus group discussion - interviews
	Tree growing	- # of trees planted - alternative fuels available	- number of trees - availability of fuels	- forest areas	- survey
Outcomes	Reduction of fuel consumption	- fuel expenditure - fuel storage - amount of fuel consumed - amount of fuel sold - average cooking time	- currency - space - amount - amount - hours	- households - households - households - fuel vendors - household	- survey / interviews - survey + observation - survey (CCT, KPT) - interviews - survey / observation
	reduced indoor air pollution	- amount of fuel consumed - incidence of respiratory diseases - air quality measurements - eye irritation/infection	- amount - incidence	- household - hospital / hh - households - hospital / households	- survey / interviews - hospital records - survey (simple tests) - survey / interviews

	Time saved	- amount of fuel consumed - time spent on fuel collection (fuel availability) men vs women) - average cooking time (men vs women) - saved time used for other activities (men vs women) - time spend tending the food (men vs women)	- amount - hours - hours - activities - activities	- households - households - households - households - households	- survey / interviews - survey/focus group / interviews - survey/observation / interviews - survey/focus group / interviews - survey/focus group / interviews
	Reduced fuel expenditure	- fuel expenditure - amount of fuel sold (variation in fuel prices)	- currency - amount	- households - fuel vendors	- survey / interviews - interviews
Impacts	Perceived quality of life	- # social activities (men vs women) - leisure time (men vs women) - status (men vs women)	- activities - hours	- community - households	- participatory, interviews - survey + interviews
	Improved health MDG (4-6)	- sick time (men vs women) - nutrition changes - improved (child) health (water boiled, nutrition, # warm meals) - preventative health care (clinic visits, bathing, water boiling etc.)	- days - nutritional value	- households - households	- survey/clinic visits - survey / interviews
	Reduction of poverty and hunger (MDG 1)	- income from direct employment - fuel expenditure savings - alternative use of money saved (savings, household, goods, ...) - time for reproductive activities	- currency - currency - currency - activities (type)	- households - households - households - microfinance institutions - households	- survey / interviews - survey / interviews - survey / interviews - data microfinance institutions - survey + observation
	Environmental improvement (MDG 7)	- forest cover - time spend on collection	- ha / km^2 - km		- satellite surveys - survey + observation, interviews
	Gender relations (MDG 3)	- decision making power - purchasing power (control over hh budget) - who cooks - who gathers fuel - who benefits from ICS	- n/a - % - % - % - %	- households - households - households - households - households	

	Education (MDG 2)	- more time for education (girls vs boys) - time for adult education (men vs women)			

5. Institutional Support

Introduction to the institutional support M&E module

This "institutional support" module is part of the Monitoring and Evaluation for Energy and Development (M&EED) "Guidelines" document, and is part of the M&EED toolbox.

It is intended as a support tool for project teams developing project specific M&E procedures for an institutional support project.

This document refers to the **Inputs → Activities → Outputs → Outcome → Impacts** terminology of the OECD. Your project may use other terminology in its logical framework. Note that the distinction between categories depends on your project's context. For instance "water pumping" may be considered to be an output, an outcome, or perhaps even an impact, depending on a particular projects context. The document is organised according to this terminology.

Background to institutional support projects

It is commonly accepted that institutional weaknesses and problems are at the heart of many, or even most, difficulties encountered by development projects. This general statement is particularly true for energy service projects, for several different reasons:

- Energy services have important positive and negative externalities, from a development as well as from an environmental point of view. Thus, market forces alone do not orient market actors towards optimal energy solutions. In particular, short term profit and risk criteria make investment in energy infrastructure for poor rural areas unattractive for private operators. As a consequence, public authorities must act in order to create a business environment favourable for this type of project.
- Successful energy service value chains generally require the participation of many different stakeholders. Public intervention facilitates their participation.
- The long payback times for energy infrastructure often make public financial intervention, or at the least an element of public risk guarantee, inevitable.

As a consequence, many Overseas Development Assistance (ODA) financed projects aim at institutional support:

- Energy sector reform.
- Training for energy policy makers.
- Multi-sector multi-actor approach to integrating energy into development strategies.
- Energy planning.
- Creation of policy oriented information systems.

An example of institutional support projects is given below.

Example : MEPRED project summary

The fundamental barrier which MEPRED plans to attack is that currently, in most Sub-Saharan African countries, the provision of energy services does not receive sufficient support from public authorities, both national and international, because energy is absent or inadequately treated in national development strategies.

The fundamental objective of MEPRED is thus to **"mainstream" energy for poverty reduction and economic development into national development strategies and programmes, and specifically into EU development assistance activities.** MEPRED applies a "multi-stakeholder multi-sector approach", taking into account the specificities of the national situation: history, society, culture, natural resources, existing infrastructure. This approach will create the conditions for **building public-private energy partnerships** essential to achieving the goals of national development strategies.

The concrete goals of the proposed action are to:

1. Identify, through the multi-stakeholder multi-sector approach, the energy services essential to national/regional development and poverty reduction strategies, in areas such as water, health, education, gender equality, rural development.
2. Make propositions for integrating energy into development strategies (CSP/NIPs, PRSPs ...) so that EU and international ODA can support provision of the energy services necessary for achieving national development goals and poverty reduction. Identify institutional support and investment programmes to be submitted to EU ODA instruments: European Development Fund (EDF), bi- and multi-lateral agencies.
3. Develop economic and financial models for energy service delivery.
4. Propose the institutional actions necessary to maximise the contribution of local energy resources (notably biomass and hydropower) to poverty reduction.
5. Develop adequate institutional mechanisms to assure that energy service provision meets the needs of poverty eradication and national development.
6. Carry out the training and capacity building urgently required for the above activities.

In summary, MEPRED will **identify and prepare the ground for both institutional programmes and for sustainable energy infrastructure investments**, to be submitted to the EUEI and the European Development Fund. The action is thus firmly rooted in two domains of EU policy:

- energy policy: supporting job creation, energy security and environmental protection, both within the beneficiary countries and in the EU;
- development policy: achieving the EUEI objective of providing energy for poverty reduction and sustainable development.

Inputs

Institutional support projects usually use some or all of the following inputs. In developing a project specific M&E scheme, it is useful to construct indicators for the most critical inputs. The following fiches may be useful in establishing the M&E scheme at the input level.

Input = stakeholder participation

Name of input	Stakeholder participation
General nature of input	Institutional commitment.
Who brings the input	Stakeholder time can be contributed by: • public authorities, at the national or local level; • energy service providers: electricity utility, petroleum distribution company, representatives of charcoal producers • representatives of energy users • other elements of civil society. Stakeholder participation can also be funded by a project.
Options for units of measure	• Time spent, in person days • Stakeholder commitment, in the form of statements, decrees, letters, etc. that contribute to an institutional process. • Meetings organised and held. • Institutional support for data gathering.

Input = expertise

Name of input	Expertise
General nature of input	Institutional.
Who brings the input	Expertise can be contributed by: • public authorities, in particular the participation of technical experts from ministries or public agencies; • energy service providers, often an electricity utility. Expertise of local or expatriate experts is often funded
Options for units of measure	• Time spent • Reports or studies produced

Input = data

Name of input	Data
General nature of input	Institutional

<table>
<tr><td>Who brings the input</td><td>Institutional processes often require data on:
• energy needs, for specific activities (education, health, water, agriculture, craft production, industry ...)
• energy resources (water, available biomass, wind, fossil fuels ...)
• institutional resources (capacity of local organisations, analysis of laws or regulations, ...)

This data can be:
• donated by stakeholders who have it at their disposal, may in
• purchased by a project
• collected through a stakeholder or project supported process.</td></tr>
<tr><td>Options for units of measure</td><td>Data. The project logical framework will generally describe the nature of data required.</td></tr>
<tr><td>Issues and problems associated with the input</td><td>The table below contains a list of issues or problems in quantifying or qualifying this input. Some of these issues or problems may be pertinent to your project.

<table><tr><th>Potential issue or problem</th><th>Possible solution for establishing an appropriate M&E scheme</th></tr><tr><td>Accuracy of data</td><td>Project procedures may include specific activities to cross check data, for instance by comparing different sources for data.</td></tr><tr><td>Adequacy of data processing tools</td><td>Terms of reference will generally describe the requirements to be fulfilled by data handling tools.</td></tr></table></td></tr>
</table>

Input = information handling tools

Name of input	Information handling tools
General nature of input	Institutional
Who brings the input	Technical tools (computers, software, etc.) are often funded by projects, but may put at the disposal of a project by a stakeholder.
Options for units of measure	Technical description of equipment or software.

Input = logistics, travel

Name of input	Logistics, travel
General nature of input	Institutional
Who brings the input	Most often paid for by projects, sometimes contributed by local authorities or stakeholders.

Options for units of measure	Monetary value.

Outputs

Output = Multi-sector multi-actor process

Name of output	A multi-sector multi-actor process to identify energy service priorities.
General nature of output	Institutional support
Who brings the output	The multi-sector multi-actor process almost always depends on inputs from: • National public authorities, notably from the energy sector (Ministry of Energy), from energy using sectors (Ministries of Health, Transportation, Agriculture, ...) and from the authority responsible for overall development planning (Ministry of Economy, National Authorising Officer, ...) • Energy related service providers: electricity utility, petroleum distribution company, representatives of charcoal producers • Energy users. Other elements of civil society may participate: NGOs, women's groups, financial institutions, environmental groups, ... The process may require expert help in the form of the presence of technical assistants, or specific studies commissioned to inform the process. ODA agencies often bring support to the process in the form of financing or technical assistance.
Options for units of measure	Inputs to a multi-sector multi-actor process could be measured by some of the following: • Number of meetings held, meeting minutes • Person-days spent in meetings, interviews, field investigations • Consultant time, reports produced. • Study trips, travel costs. • Money spent to support any of the above.

Output = Information system

Name of output	Information system
General nature of output	Knowledge tool for institutional use. Information systems can comprise, for instance: • GIS, geographic information systems • Energy use or energy production surveys or statistics systems • Household energy use surveys • Energy source surveys (for instance to catalogue wood fuel, wind or hydropower resources)
Who participates in producing the output.	Building an information system generally requires two types of inputs: • Data, provided by stakeholders (for instance participants in a multi-sector process), by national authorities or by experts/consultants. • Technical support and expertise to treat, analyse, organise and store data. Information systems often use computer tools, requiring specific IT skills. These inputs may be brought by national authorities, by civil society/stakeholders or by the project team.
What to measure	• Pertinence of the system: does it meet the requirements of users or stakeholders? • Performance: does it deliver the types of information needed? • Usability: do local users master the system? • Viability: is there a long term viable process defined for maintenance and operation (updating data, including software modifications, producing reports, adding new types of data or functions)
Options for units of measure and for indicators	• Pertinence: compare achieved content of the system with the information needs of stakeholders. • Performance: enumerate types of pertinent queries, and determine if the system responds to these queries. • Usability: categorise level of mastery by local users • Viability: qualitative evaluation of the viablility of maintenance, operation and financing of system.

Output = Proposal for policies, strategies or for institutional reform

Name of output	Proposal for policies, strategies or for institutional reform
General nature of output	Institutional. This might be: • a national energy strategy, or elements relative to energy to be included in sectoral strategies • an analysis of energy needs and priorities, in the light of

	development objectives • proposal for modification, creation or strengthening of organisations or structures • a draft text of an energy sector law • proposals for modification of fiscal regulations, customs tariffs, ...
Who participates in producing the output.	• Public authorities • Stakeholders • Experts on the specific area
What to measure	• Institutional support for the reform/proposal • Stakeholder approval
Options for units of measure and for indicators.	Institutional and stakeholder support/approval for a reform or proposal can be appreciated through written comments, signature of documents, interviews, etc.

Output = Training or capacity building

Name of output	Training or capacity building
General nature of output	Institutional.
Who participates in producing the output.	• The persons or institutions that receive training or capacity building. • The source of expertise (trainers, educators, specialists) who transfer knowledge, know how or experience.
What to measure, units, indicators	• Reality of training, measured by person days of participation in training • Acquisition of knowledge, know how, measured by demonstration of acquisition through practical application, or alternatively by tests • Pertinence of training, measured by results of work accomplished after training.

Outcomes and Impacts

Energy services are transversal in nature: economists consider them to be "technical factors of production" that contribute to producing other goods and services. Thus, the M&E scheme for an energy project will probably cover, at the outcome or impact level, non energy products or services.

Identifying the outcomes and impacts of a project.

The following table indicates some of the outcomes and impacts that may result from institutional support projects. Note that the classification of these results as "outcomes" or "impacts" in the four layer model will depend on the project's logframe, and on the context of the project. The use of the terms "outcome" and "impact" proposed below is in fact rather specific and unconventional.

Output	Corresponding outcome	Impact	Possible Indicators
Multi-sector multi-actor process	National consensus on priorities for energy services	Integration of energy into national development plans	Modification of PRSP, CSP/NIP Allocation of national or ODA resources to energy projects
Information system	GIS -> Identification of priority zones for energy service provision	Investment plans	Launching of projects or programmes
Proposal for policies, strategies or for institutional reform	Legislation on rural energy	Creation of a rural energy agency	Launch of a rural energy programme
	Participative forestry management scheme adopted	Creation of local forestry management organisms	Number of ha under participative management
Training or capacity building	Better trained personnel in national energy regulatory organism	Better energy sector regulation	Entry of new operators into energy service provision

In developing the M&E scheme for your project, you should choose the outcomes which are most important to your project's stakeholders, and for these outcomes, you will choose an indicator which provides adequate information on the project's success. The choice of indicators must take into account the cost and difficulty of developing the necessary information. (See discussion in the M&EED Guidelines on "pertinence, rigor and cost".)

National consensus on priorities for energy services

Name of outcome	National consensus on priorities for energy services
General nature of outcome	Institutional
Who participates in producing the outcome.	Public authorities Stakeholders Civil Society
What to	Adoption of a public document on priorities or strategies for energy services

measure, indicator	
Links to national development goals or to the MDGs	Compare strategy/priority document with national development strategy

GIS -> Identification of priority zones for energy service provision

Name of outcome	Identification of priority zones for energy service provision
General nature of outcome	Institutional
Who participates in producing the outcome.	Energy using sectors Energy ministry/agency/company
What to measure	Existence of prioritisation of energy investments, using GIS data, notably on needs and available energy resources.
Links to national development goals or to the MDGs	Does the prioritisation take into account development priorities, as defined in national strategy?

Legislation on rural energy

Name of outcome	Legislation on rural energy
General nature of outcome	Institutional
Who participates in producing the outcome.	Legislature Legislative assistants Energy sector stakeholders
What to measure	Existence of proposal for law Adoption of law
Links to national development goals or to	Examine introductory paragraphs of law, for argumentation linked to national development strategy.

the MDGs		
Issues and problems associated with the outcome	The table below contains a list of issues or problems in quantifying or qualifying this outcome. Some of these issues or problems may be pertinent to your project.	
	Potential issue or problem	Possible solution for establishing an appropriate M&E scheme
	Determining if a law is adequate or appropriate	Long term solution is to evaluate the impact on the rate of expansion of access to energy services.

Participative forestry management scheme adopted

Name of outcome	Participative forestry management scheme adopted
General nature of outcome	Institutional
Who participates in producing the outcome.	Public authorities responsible for forestry Legislature
What to measure	Public adoption or beginning of implementation
Links to national development goals or to the MDGs	Links to goals for sustainable management of resources, or for rural development.

Better trained personnel in national energy regulatory organism

Name of outcome	Better trained personnel in national energy regulatory organism
General nature of outcome	Institutional
Who participates in producing the outcome.	Persons trained Trainers Training organisation Resource persons or organisations
What to measure	Certification or diplomas of trainees Application of acquired knowledge or know how

Links to national development goals or to the MDGs	Relation of content of training and the needs which flow from the regulatory scheme adopted by the country.

The variety of possible downstream results from institutional support projects is immense, as can be seen from the examples cited above. Other possible downstream results could be:

- Integration of energy into national development plans
- Investment plans
- Creation of a rural energy agency
- Creation of local forestry management organisms
- Better energy sector regulation

Including gender goals in energy projects and developing appropriate indicators

Gender Equality is listed as Millennium Development Goal 3. Subsequently major development agencies such as DFID and the UNDP have made explicit the contribution of energy to meeting the goal of gender equality and have suggested measures for assessing the gender aspect of energy projects. Ideally *all projects* should be gender sensitive, and *all indicators* should be gender sensitive. At a minimum this means that all data collected should be disaggregated by sex, and that the goals of the project should include contributing gender equality. Having set a contribution to gender equality as a goal, this should be monitored and evaluated as part of the project process. Exactly how and why this should be done is explained below, with further readings provided in the bibliography.

Why include gender as a consideration in energy projects and programmes?

1. Because Gender Equality is MDG 3 and in order to achieve it, all development projects and programs will have to see how 'their' sector investments can contribute towards gender equality.

2. Because men and women have different energy needs. This is largely as a result of their different roles and responsibilities in the household and in society. Energy for cooking, cleaning and child-care are the obvious examples for women's needs, but women's equally important and often less obvious energy needs include energy for water pumping (for household and irrigation), energy for labour intensive tasks such as husking and milling, and energy for home-based enterprises which are usually run by women. Similarly men may ague that they need energy for power tools or leisure activities.

3. Introducing new forms of energy may have quite different and sometimes unintended impacts on men and women, and even exacerbate the subordinate position of women. Skutsch (2005) gives the example of mechanized ploughing and planting by men which increases the area under cultivation, but it also increases women's work of weeding and harvesting. Similarly it has been noted that electric lighting, which enables increased working hours, may mean that women (who generally work longer hours than men and sleep less), have their work days extended unbearably. It is for these sorts of reasons that the impacts of energy interventions on men and women should be monitored.

4. Energy interventions may be part of a deliberate strategy to improve the status of women, either through enhancing their production and income-generating skills, or through improving their education, or through including women in planning the project so that it benefits them optimally or as decision makers in the project, or in a host of perhaps small but important ways. Currently evaluators are frequently called upon to measure the gender impact of a project after it has been completed. This is not ideal, because measuring gendered impacts when gender goals were not part of the project, means measuring changes have happened incidentally. The changes may be fortuitous; they may have served women and men well, but claiming positive changes which are incidental to the project, is not as strong as meeting explicit goals. Thus it is better to build gender equality into the project goals.

A Toolkit has been developed and is the most thorough manual available on why and how to include gender in energy projects, and how to M&E the gender impacts thereof (Skutsch 2005). The Toolkit suggests that to incorporate gender successfully in energy projects, the following points should be remembered:

- The gender goals of energy projects should be explicit and measurable.
- Goals should be defined by all the stakeholders including men and women of the community
- Welfare, productivity or other goals are as legitimate as equality. The definition of the goals of the project should be the first step in any gender analysis
- Gender analysis should be carefully done, and consideration given to other categories such as class and age which also affect access
- Stakeholders' capacity to understand and handle gender issues may need to be developed
- All work activities (such as pounding grain) should be reviewed to capture all energy needs
- Access to equipment and appliances should be investigated because it is often gender specific
- Indicators are needed to measure the impact of energy services in relation to gender goals
- Data-gathering methods need to relate directly to these indicators

Another useful checklist which can be used for including gender concerns in small energy projects was drawn up by the Inter-agency Taskforce of Women, Peace and Security and can be found on their website. A welcome inclusion in this checklist is transport, which is usually beyond the scope of energy projects but is a significant issue for women.

Since the MDGS are intended to set overall international priorities for sustainable development activities, and to ensure that poor people are included in the benefits of development, the Toolkit (see below) suggests that it is useful to consider developing project-level indicators linked to these targets, and that linking some general performance indicators to the MDGs for energy-related projects might include:

Goal 1: Eradicating extreme poverty and hunger

- Number of poor households that are project beneficiaries. Number headed by men/women
- Income-producing opportunities associated with the equipment. Used by men/women
- Actual income increases due to project. For men/women
- Financing available for acquiring the equipment. Used by men/women

Goal 2: Achieving universal primary education

- Effects of project on primary school enrolment, attendance and performance. For boys/girls

Goal 3: promoting gender equality and empowering women

- Overall increase in women's incomes
- Increase in non-agricultural employment and incomes of women

- Effect of project on time spent by women in household activities
- Effect of project on total daily workload of women
- Ownership of productive equipment by women
- Increases in decision-making power of women in household, community, government
- Literacy and skills training for men/women

Goals 4, 5 and 6: Improving health

- Reduction in indoor air pollution
- Improvements in health clinic facilities and services
- Changes in the number of visits to health clinics

Goal 7: Ensuring environmental sustainability

- Less use of wood /transition to modern fuels. Forest land preserved
- Increased access to clean/pumped water
- Impact of project on sanitation
- Reclamation of eroded agricultural land.

Goal 8: Good governance

- Transparent participation in decision making

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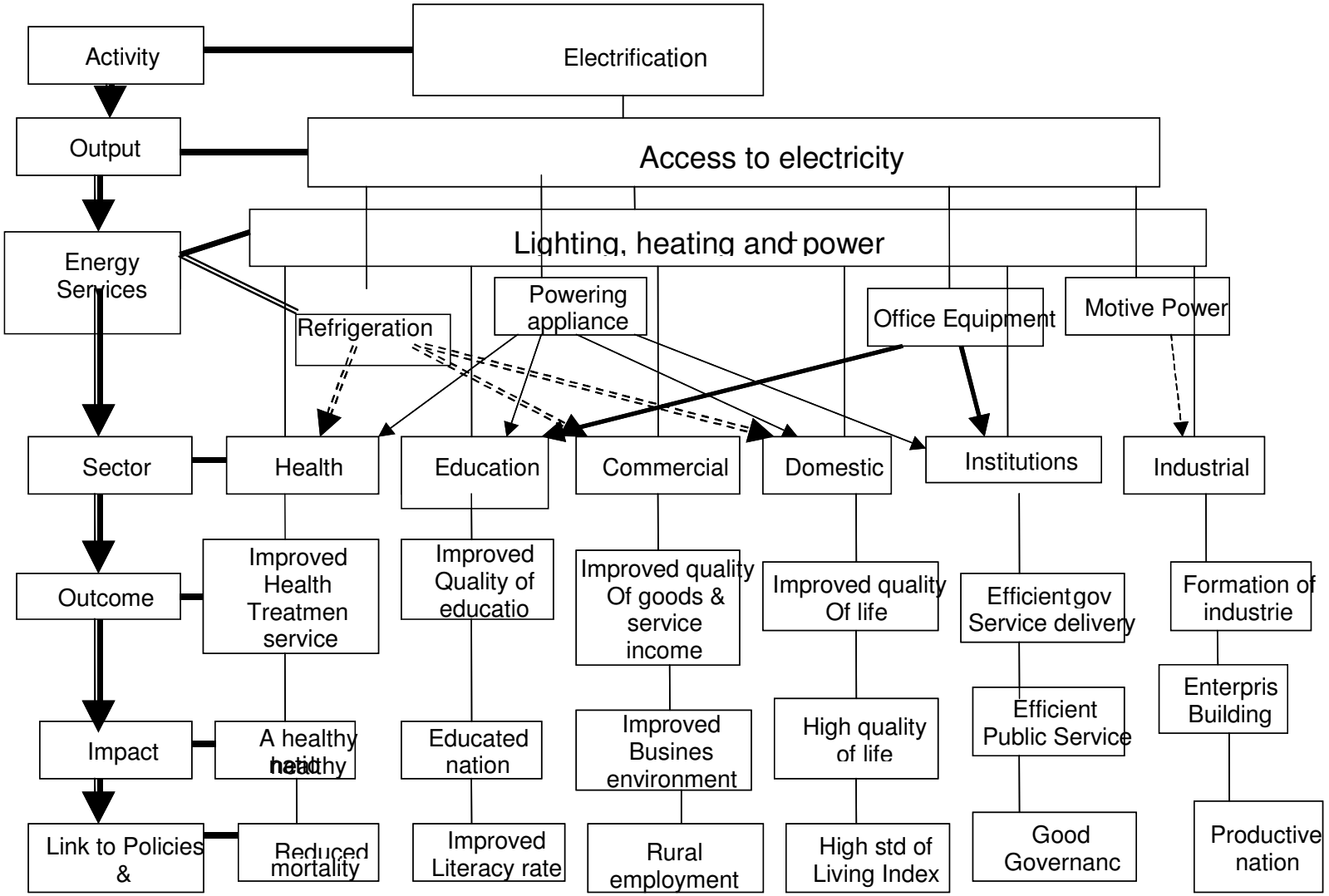
Annex 1: Causal chain examples

This annex contains examples of causal chains, developed by project teams participating in the M&EED group.

- **rural electrification.** The Rural electrification causal chain was is developed by the EECG Consultants in Botswana for a case study in the village Manyana, as part of the European Commission IEEA COOPENER project "Development and Energy in Africa" (DEA). The project is coordinated by UNEP Risø
- **improved stoves.** The stoves chain summarizes the analysis prepared by ENDA for case studies on four locations in Senegal, as part of the European Commission IEEA COOPENER project "Development and Energy in Africa" (DEA). The project is coordinated by UNEP Risø.
- **institutional support.** The institutional support chain was developed in the context of the MEPRED project, funded by COOPENER, GTZ, ADEME and DGIS, working in Burkina Faso, Mali, Niger, Sénégal, and with the ECOWAS regional organisation.


Activity
Electrification
Output
Access to electricity
Energy Services
Lighting, heating and power
Refrigeration
Powering appliance
Office Equipment
Motive Power
Sector
Health
Education
Commercial
Domestic
Institutions
Industrial
Outcome
Improved Health Treatmen service
Improved Quality of educatio
Improved quality Of goods & service income
Improved quality Of life
Efficient gov Service delivery
Formation of industrie
Impact
A healthy
Educated nation
Improved Busines environment
High quality of life
Efficient Public Service
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Link to Policies &
Reduced mortality
Improved Literacy rate
Rural employment
High std of Living Index
Good Governanc
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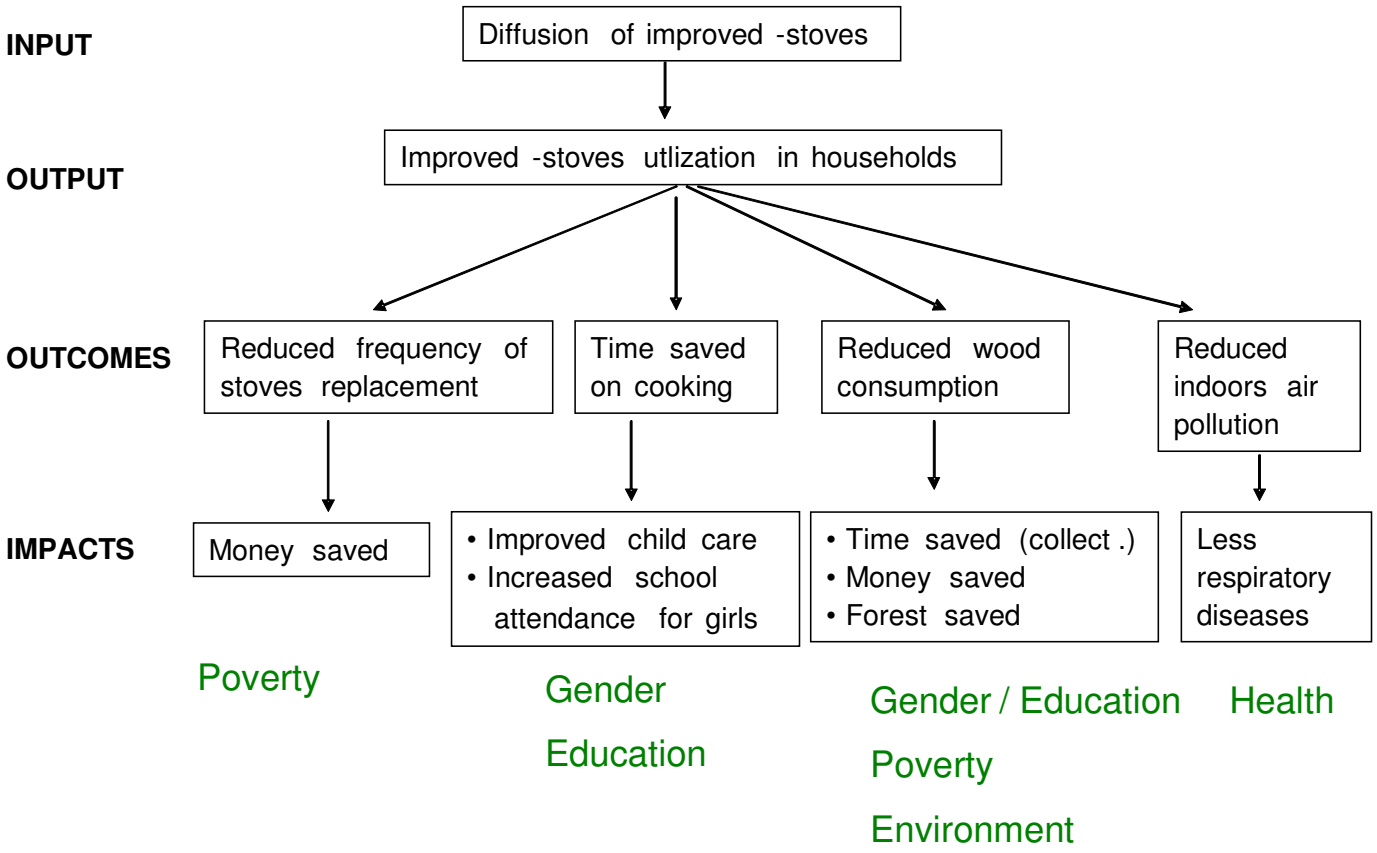
INPUT
Diffusion of improved -stoves
OUTPUT
Improved -stoves utlization in households
OUTCOMES
Reduced frequency of stoves replacement
Time saved on cooking
Reduced wood consumption
Reduced indoors air pollution
IMPACTS
Money saved
• Improved child care
• Increased school attendance for girls
• Time saved (collect .)
• Money saved
• Forest saved
Less respiratory diseases
Poverty
Gender
Education
Gender / Education
Poverty
Environment
Health

Causal Chain for the MEPRED institutional support project