Intelligent Energy Europe

COOPENER

DEA
Development and Energy in Africa

Contract no. EIE/04/201/s07.43094

DEA

Development and Energy in Africa

Intelligent Energy – Europe (IEE)

Type of action: COOPENER

Key action: VKA11.1

Assessment Procedure Guideline

Start date of the project: 1 May 2005
Duration: 30 months
End date of the project: 31 October 2007

Gordon A. Mackenzie, Risø National Laboratory, Denmark
gordon.mackenzie@risoe.dk
tel: +45 4677 5171
Project website: www.deafrica.net

RISØ DTU ECN Energy research Centre of the Netherlands

EECG KITE ...Innovating Energy Solutions... MFC enda TaTEDO CEEZ Centre for Energy, Environment and Engineering Zambia Limited

Authors: Sten Dieden with Emiel J.W. van Sambeek (ECN) and Gordon A. Mackenzie
Title: Assessment Procedure Guideline
Department: Systems Analysis (SYS)

DEA Report number: Risø 5.1
July 2007

Abstract

This document is part of the COOPENER project "Development and Energy in Africa (DEA)" initiated on 1 May 2005. The report covers project Work Package 5.

The 30-month project is implemented by Risø National Laboratory (Technical University of Denmark – DTU[1]), Denmark as project coordinator, in collaboration with the Energy Centre of the Netherlands (ECN), and in partnership with six African Centres:

- Botswana: EECG
- Ghana: KITE
- Mali: Mali Folkecenter (MFC)
- Senegal: ENDA-Energy
- Tanzania: TaTEDO
- Zambia: CEEEZ

The overall objectives of the DEA project are:

- that national energy policy is better informed to take into account the complex linkages between energy interventions and social and economic development, and
- that energy interventions are better designed to contribute to real development needs, especially poverty alleviation and income generation, and otherwise achieving the Millennium Development Goals.

The immediate objectives of DEA are:

- to establish and apply an Assessment Framework for evaluating development and poverty impacts of energy interventions, and
- to engage in a dialogue with energy policy makers and other stakeholders on the basis of the framework, with a view to incorporating these issues in energy policy.

The Assessment Procedure (or Assessment Framework as it has been termed in other DEA documents) described in this document is the methodological core of the DEA project. The guideline describes in practical terms how to approach the task of conducting an Impact Analysis of an energy intervention. The methodological approach, termed the DEA Assessment Framework, has been based heavily on findings and recommendations in the recent literature related to impact analysis. In particular, the 4-level approach developed and adapted through the international M&EED group has been an essential component of the AF.

The procedure described in practical terms here, along with the closely related Monitoring and Evaluation methodology developed by the M&EED group, can hopefully contribute to more widespread use of such monitoring and evaluation tools within the energy and development world, as well as contributing to better understanding of the linkages between energy and development. Ultimately, such understanding, embodied in new and efficient ways of increasing the provision of energy services to the poor, linking to the other essential development sectors like health, education, water, agriculture and industry, with an optimum use of scarce resources, can make a contribution to the achievement of the MDGs.

From 1 January 2007, Risø National Laboratory, the Danish Institute for Food and Veterinary Research, the Danish Institute for Fisheries Research, the Danish National Space Center and the Danish Transport Research Institute have been merged with the Technical University of Denmark (DTU) with DTU as the continuing unit.

Contract no.:
EIE/04/201/s07.43094

Groups own reg. no.:
1215139

Sponsorship:
European Commission
Intelligent Energy Europe
COOPENER Programme

Cover:

Pages: 37

Energy for Development (EfD)
Systems Analysis Department
Risø National Laboratory
Technical University of Denmark
P.O. Box 49
DK-4000 Roskilde
Denmark
Telephone +45 46775171
gordon.mackenzie@risoe.dk
Fax +45 46321999
www.e4d.net

Contents

Preface

Access to energy is an essential input in the process of development and poverty alleviation. Better understanding of development-poverty-energy linkages, and embodiment of this knowledge in an operational tool, can contribute to increasing the development and poverty alleviation impacts of energy interventions.

Development and Energy in Africa (DEA) is a project under the European Commission's Intelligent Energy - Europe programme COOPENER. Ultimately DEA aims to "support decision makers with the implementation of more sustainable energy policies, …" in line with the key action VKA 11.1 of the COOPENER programme. The project aims to do this by identifying and quantifying, where possible, the elements of concrete energy interventions that contribute to sustainable development (SD) and systematising this in an Assessment Framework which can enhance policy to promote energy for sustainable development.

The principal aims of the Development and Energy in Africa (DEA) project are (i) to identify and examine the developmental impacts of energy innovations and actions linked to improving energy access and poverty alleviation and (ii) to use the information obtained to improve on-going and future energy interventions through the energy policy makers and institutions in the countries concerned. The Project is aimed at national energy- and development-policy makers, initially in the six participating African countries (Botswana, Ghana, Mali, Senegal, Tanzania and Zambia), but with a view to wider application in Sub-Saharan Africa. The project is also relevant for international and national energy, development and environment practitioners.

DEA has developed an Assessment Framework (AF) to identify and quantify the outcomes and impacts of energy projects, in close collaboration with centres in the six participating African countries. DEA also works closely with the International Monitoring and Evaluation for Energy and Development (M&EED) Group established by GVEP, EUEI, UNEP, DFID, GTZ and other institutions. The AF uses a 4-level causal chain approach to structure the energy intervention in terms of inputs, outputs, outcomes and impacts. Indicators are selected at each level and the assessment process identifies appropriate sources and methods to evaluate the indicators.

Six case studies have been carried out in the participating countries, comprising:

- rural electrification by grid connection (Botswana and Ghana)
- rural electrification by solar ESCOs (Zambia)
- solar water pumping and agriculture (Tanzania)
- renewable energy for women (Mali)
- improved cookstoves and sustainable forestry (Senegal)

The DEA Regional Workshop in Arusha, Tanzania, to be held in October 2007 is the final event in the 30-month DEA project which started in 2005. The workshop's purpose is to present and discuss the results of the project in a broader context to stakeholders from the six target countries as well as from other African countries. Representatives of bilateral and multilateral donors, NGOs, and participants in other COOPENER projects in Africa are also encouraged to attend.

Acknowledgements

The DEA Assessment Framework described in this document builds on the methodological approach developed by the international Monitoring and Evaluation of Energy for Development (M&EED) working group facilitated by GVEP. The present authors wish to acknowledge their gratitude to all the members of this group for their assistance, collaboration and encouragement, and in particular the acting CEO of GVEP International, Sarah Adams, and the other principal authors of the M&E Guide: Wendy Annecke, Edgar Blaustein, Arthur Jobert, Evgeny Proskurnya, Christophe Nappez, Verena Brinkman, Els Huntjens, Maartje op den Coul, Kavita Rai, and Marlis Kees.

Helpful advice and input on the methodology of field studies was received from Maartje op den Coul of SenterNovem (the Netherlands) and Dr Yizenge Chondoka of the University of Zambia.

The Assessment Framework owes its operational relevance to the six partner centres in Africa who have applied the methodology in the case studies, developing, extending and modifying it to suit local conditions and insights. The close interaction throughout the DEA process has been instrumental in this process, and we acknowledge particularly the input and collaboration of Peter Zhou (EECG, Botswana), Solomon Quansah (KITE, Ghana), Ibrahim Togola and Pierre Dembele (Mali Folkecenter), Sécou Sarr and Jean Pascal (ENDA, Senegal), Gisela Ngoo and Emmanuel Michael (TaTEDO, Tanzania) and Lilian Zulu and Professor Francis Yamba (CEEEZ, Zambia) and the other colleagues at these centres.

Finally, the development of the framework owes much to inputs from former and present colleagues at Risø National Laboratory: Fatima Denton (now Programme Leader of Climate Change Adaptation in Africa, Dakar, Senegal), Wilson Wasike (now at the Kenya Institute for Public Policy Research and Analysis (KIPPRA)), Miriam Hinostroza, Ivan Nygaard, Nicoline Haslev-Hansen and Niels-Erik Clausen.

1 Introduction

Like most development projects, energy interventions aim to promote the development of economic, social and environmental conditions in developing countries. Project teams are often faced with the need to demonstrate that a contribution to such development has been made. Hence, the need arises to plan for the assessment of the project's impact. The proposed procedure is a step-by-step approach to building project-specific impact assessments for small- and medium size energy interventions. The procedure has been developed and applied by the DEA project team in collaboration with the Monitoring and Evaluation of Energy for Development international working group ("the M&EED group").[1]

The user-side of energy services in developing countries is complex and characterised by a high degree of diversity. The diversity originates in varying availabilities and costs of energy from various sources and manifests itself not only in differing end-uses, but also in differing mixes and levels of fuels consumption for similar purposes. Energy consumers (households, enterprises, and institutions) also differ in their abilities and willingness to invest in new technologies, as well as in their energy-related preferences, traditions and behaviours. Consequently, energy supply and demand patterns are often specific to regions, districts, settlements within districts, and to users within settlements. Energy impacts on livelihoods must thus be considered within this total context (Hulme, 2000).

The complex and varied circumstances that we wish to study requires that our research methodologies are devised to deal with the specific context at hand. With this document, we aim to supply some guidance to the Impact Assessment (IA) study approach. One benefit of this methodology is its high degree of flexibility and adaptability to differing circumstances. The need for specificity in study-designs however, sets a limit to how much detailed advice can be provided by a general guide like ours. The purpose of this introduction is to show why this limitation exists and to provide an idea of the detail of advice that we can provide.

An IA exercise can be thought of as undertaken in two stages; a design stage and an implementation stage. The design components of an IA study encompass a conceptual framework, a selection of data collection methods, and a research plan for the implementation stage. Implementation involves the collection of data, data analysis and drawing of conclusions, and dissemination of results to stakeholders. All IAs share a general, underlying conceptual framework whose specification begins by addressing the following questions:

- What are the objectives of the assessment?
- How is the information to be used and by whom?
- What level of reliability is required?
- How complex is the programme, what type of programme is it, what is already known about it?
- What resources (money, human and time) are available?

[1] This document draws on the M&EED group's "Guide to Monitoring and Evaluation for Energy Projects" GVEP (2006). The M&EED Group is facilitated by the Global Village Energy Partnership (GVEP). Readers are advised to download a copy from http://www.gvep.org/gvep_c.aspx?id=146.

The answers to these questions also affect the exact choice of data collection methods and the actions within the research plan. The conceptual framework typically has three main elements;

- a theoretical model of the expected impacts of an intervention
- a specification of the level or unit for the IA (e.g. individuals, households or villages)
- a specification of the types of impacts of interest (e.g. health, income or education)

The choice of units or level for assessment is made on the basis of a model of the project's impacts. The types of impacts are likely to vary from intervention to intervention. Consider for example three different projects that generate irrigation, lighting and refrigeration services, respectively. In the first case one could hope for impacts in the form of increased agricultural production, in the second extended work or study hours, and in the third improved vaccination facilities. However, even with a clearly specified focus, the challenge remains to decide upon the specific, variables with which to measure achievements or changes associated with the intervention. (Hulme, 2000).

Turning now to the data collection methods, for the assessment of intervention impacts the investigator would apply an "impact assessment tool", defined as "a mechanism of obtaining the answer to certain questions or revealing certain information about impact that we are looking for". Quite naturally all studies must pursue rigor, irrespective of their specifics approaches are based on quantitative and/or qualitative methods. IAs are not fundamentally different from other research, in the sense that it is the search for answers to research questions, which determine the appropriate mix of research methods or tools.

A key issue in selecting methodologies or tools is to approach the research topic with flexibility and with a good grounding in the issues to be investigated. Given the typically scarce resources (money, time, staff, etc.) available for an IA, the data that can be collected is often very limited. Resources can therefore be saved by first undertaking desk studies and qualitative research, so as to determine which (quantitative) indicators most accurately reflect the type of impacts one wishes to assess. The tools selection process therefore also involves a close look at the kind of data a particular approach will produce and to consider how that data should be processed and analyzed (Simanovitz, 2001).

To summarize, there are several issues that affect the design of an impact assessment:

- the study's objectives; its content and type of information compiled for a specific audience and purpose.
- the model of the intervention and its impacts
- data collection methods selected with consideration of the above and of
    - the cost and financial resources at hand
    - the human resources available and respondents' characteristics, motivation and representation
    - ambitions with respect to influencing policy and future practice

These considerations translate into the following ten steps in an impact assessment procedure:

Design stage

1. Identify the stakeholders of your project and their IA needs
2. Define/delimit the intervention and your focus on the intervention
3. Illustrate the project and model its conceivable impacts
4. Choose indicators for each element of the results chain
5. Specify the appropriate data collection methods for each link
6. Construct a research plan and discuss it with your stakeholders

Implementation stage

7. Collect data
8. Analyze the data
9. Draw conclusions and write report
10. Present the results to your stakeholders

The choice of which data collection methods are used in the study depends on a number of circumstances which become clear in the design stage. The methods chosen to analyse the data, and the conclusions reached, in turn depend on the data collection methods which have been used. Finally, the way in which results are presented to stakeholders is also very specific to each individual case.

All of these circumstances vary from study to study, and they begin to manifest themselves in the design stage of the assessment procedure. This document therefore focuses on the design stage. With respect to implementation, it is generally assumed that the user will have the necessary fieldwork experience and insight, or will be able to access such expertise. We strongly recommend the use of this guide among a small group of individuals with differing, but if possible overlapping, insights in the fields of energy supply, fieldwork methodology, and livelihood generation on the specific location at which the intervention takes place. In our experience, the synergies in group work are invaluable to the IA exercise.

In principle, each of the steps in the assessment procedure's design stage will now be treated in a specific section with recommendations, where applicable, for further reading. Chapter 2 introduces the concepts and illustrations used for the theoretical modelling of impact assessment studies. The chapter is somewhat abstract and we return to the more practical facets of modelling in Chapter 5. Two types of considerations affect the focus of the modelling. Firstly, Chapter 3 discusses the identification of the project's stakeholders which is crucial for prioritising the kind of information to be provided by the study. Chapter 4 is a guide to delimiting the system boundaries of the project, i.e. what lies within the project to be studied and what constitutes the overall context or background. The ability to exclude certain aspects allows further definition and narrowing of the focus. Chapter 5 returns to the theoretical modelling concepts and discussion of complexities in the attribution of causality. The selection of indicators is the topic of Chapter 6. Chapter 7 discusses the general aspects of assigning data collection methods, and the final Chapter 8 is a step by step introduction of how to build a research plan. The selection of data collection methods is not treated in any detail. Because of the context specific factors affecting this choice, the topic is beyond the scope of this guide, although a number of suggestions are included for further reading on the topic.

References and recommended reading:

Hulme (2000)

GVEP (2006)

Simanovitz (2001)

2 Modelling project impacts: theoretical concepts and illustrations

This chapter aims to provide an introductory of the underlying concepts and theoretical frameworks used in impact assessment studies. It is useful to think of impact assessment as a branch of *project evaluation*. A formal definition of such an evaluation is "the systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation and results". The aim of an evaluation is to "determine the relevance and fulfilments of objectives, development efficiency, effectiveness, impact and sustainability". Finally, the information provided from an evaluation should be credible, useful and enable the incorporation of lessons learnt into decision–making processes (DAC-OECD, 2002).

When considering causality running from energy to development, it is convenient to use the term *chain*. Two such chain metaphors are discussed below. The first, the *impact chain*, illustrates the aim and fundamental assumptions of IA studies. The other, the *results chain*, is a device for systemizing and disentangling hypotheses about linkages between energy and development. This chain is used in order to identify separable, observable "links" between factors brought in by (or to) the intervention and eventual, downstream effects on living standards. The primary objective of this chapter is to provide a familiarity with these separable links - or *elements* - of the chain, so as to enable the user to construct his/her own chains. Before turning to each of the chains, we discuss the general issue of modelling impacts from energy interventions.

2.1 Energy projects – why model their impacts?

The assessment of economic, social and environmental impacts of energy interventions is highly complex and context-specific. The identification and attribution of impacts of energy projects present significant challenges compared with projects in other sectors like water, agriculture, health or education. In assessing energy impacts we must consider that:

- Energy does not in itself, for example, quench, feed, house, or clothe people. Rather, energy services facilitate and improve the provision of water, food, housing or clothing. Consequently, the chain of causality that leads from energy to improvements in people’s lives is often longer and more complex than for other projects.

- Energy services can bring about improvements in several aspects of life. Electricity, for instance, can be applied in activities such as pumping water, refrigeration of vaccines and/or welding of metals. Thus, IA for energy projects faces the challenge of measuring improvements in more than one area.

- End-users’ choices of energy sources for specific services are subject to many considerations, such as prices, traditions, the sustainability of provision and the income of the end-user. Hence, the attribution of impacts to energy provision requires awareness of these determining factors which may vary over time.

- The productive output of any process that requires energy services also depends on all the conditions that affect the specific type of production. For instance, production often requires that many other inputs, such as appropriate raw materials, precipitation, maintenance skills and transportation to markets (if existing and functioning), are also available. Thus, the attribution of impacts to energy provision also requires awareness of other factors that affect production and, where applicable, marketing outcomes.

- The positive impacts of access to energy may often become manifest many years after the project ends. Thus, reliable IA for energy should measure impacts beyond the project life cycle. This makes the documentation of conditions at the beginning of the project important, since it provides a picture of the status quo or a baseline from which to measure progress as well as insights into how energy would be used among end-users.

Referring back to the definition of “evaluation” above, and taking these complexities into account, there is a particular need for a thinking-aid for how to deal with energy interventions. This involves considering and systematising the whole “cycle” of an intervention from the various inputs right through to the ultimate consequences. Between these two extreme points, the inputs and the consequences of the intervention, there is a series of causes, effects and processes.

It is important to distinguish between two concepts related to impacts; assessment and monitoring. Impact Assessment (IA) has a wide focus but encompasses only a single data collection occasion, while Impact Monitoring (IM) has a narrower focus and involves the repeated collection of smaller amounts of data. In the latter case, data collection is often integrated as a process into other routine field staff activities. While this guide deals almost exclusively with IA, the role of IM should not be downplayed. The occasional “snapshot” obtained from IA is, hardly ever sufficient to yield information about sustainable impacts. IM, on the other hand, provides convenient, continuous information which can improve learning and understanding as well as ultimately, if properly designed, ensure that impacts are also managed, not just assessed (Simanovitz, 2001).

As a first step in the account of theory, we present the “result” and “impact” chains for the modelling of interventions. The impact chain illustrates the overall objective of an evaluation. In later sections, we shall return in more depth to the notion of “impact” as something distinctly different from “outcome”. In connection with this first chain, we shall however let “impact” assume its intuitive, everyday meaning, similar to “effect”.

Another commonly applied modelling tool is the results chain, which illustrates a causal sequence between factors brought into an intervention and its objectives. The results chain places the intervention and its effects in a context of “outside” influences that are not controlled by the intervention. In this setting we allow the notion of “impact” to take on a deeper meaning. Since the elements of the results chain also form the basis for many other evaluation concepts, an intervening subsection between the two models introduces some of the key concepts in evaluation.

2.2 The impact chain

Behind virtually all development interventions lies an assumption that the effort will induce changes in human actions towards the achievement of some desired outcome. In the impact-chain model we refer to individuals, enterprises, households, populations, or policymakers jointly as “agents”. Some agents will have been subject to – or experienced – the intervention in question, while other agents have not. We assume that some kind of “variables” exist whereby the agents can be related to the intervention’s desired outcome. Such variables would be key characteristic of the agents, their behaviour, or their circumstances, which would be affected by the intervention. In the case of an intervention to facilitate water access, such a characteristic could be the time spent by households to collect water. The objective of impact assessments is thus to capture difference in the values of those key characteristics, between the outcomes on agents that have experienced the intervention and those that have not. Hence, one could compare the time spent on water collection in two villages, only one of which had experienced the water intervention. The impact chain is illustrated in Figure 2.1.

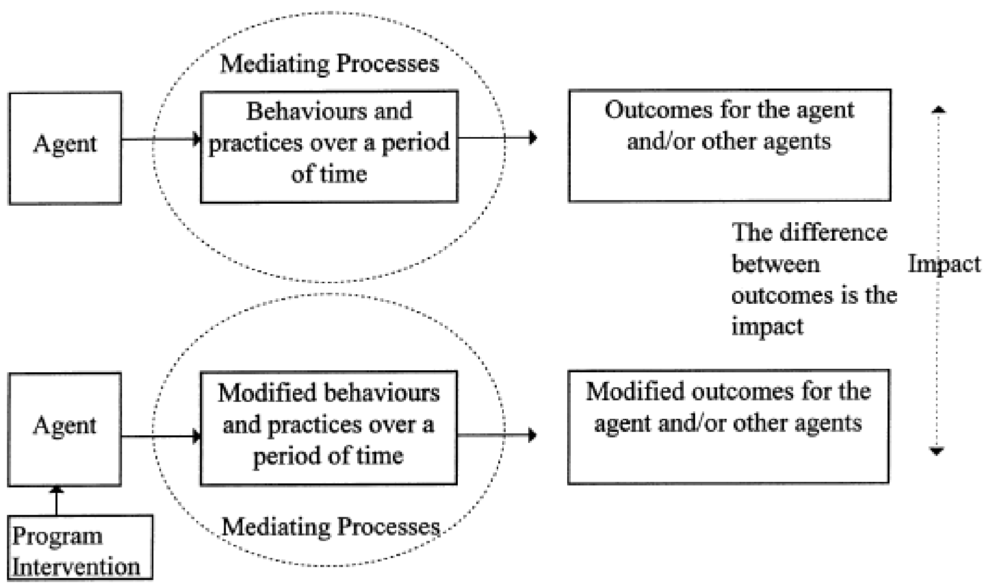

Figure 2.1 The impact chain [source Hulme (2000)]

The conceivable link(s) between energy and development are many and – as we saw in the introduction to this chapter - complex. This makes the empirical verification of causality between energy and the illustration's impacts a highly demanding task. Consider the improved access to energy in the fields of health or education. The ability of staff to utilize electrical light or operate appliances could have significant beneficial consequences in both fields. However, if we were to measure those consequences by improved child health or pupils' marks, we must take into account the possible variations across time or space in availability of for example medicines, instructional tapes or videos as well as in teaching or curing aptitudes. Those factors may very well affect the results of the improved energy access.

Below we will elaborate in some more detail on how the consequences of an intervention become more difficult to attribute to energy, the further downstream from the intervention, where other factors come into play. In the illustration, the same phenomenon is represented by "mediating processes", whereby long-term changes in agents' behaviours or practices are thought to be affected by specific characteristics of the agent and his or her specific economic, physical, social and political context. It is worthwhile to consider also that variations in contexts may affect both the agents that have experienced the intervention and those that have not. Returning to the example of the intervention to improve water access, increased rainfall may have affected the distance to running water sources in both villages. Without a record of such changes, the impact attributable to the intervention may become biased.

2.3 The results chain - elements and key evaluation concepts

A results chain can be thought of as a set of hypotheses of the linkages between an energy intervention and its possible impacts. The chain makes our assumptions about those linkages explicit. It begins with 'inputs', moving through the other "strategic elements", 'activities' and 'outputs', and culminates in 'outcomes', 'impacts'. (In some agencies, 'feedback' and 'reach' is part of the results chain.) Related to a development intervention, the strategic elements of the results chain are individually defined as:

- *Inputs*: the financial, human, and material resources used
- *Activities*: actions taken - or work performed for the mobilization of resources - in order to produce specific outputs
- *Outputs*: resultant products, capital goods and services, as well as resultant changes relevant to the achievement of outcomes.
- *Outcome*: The likely or achieved short-term and medium-term effects of an intervention's outputs. Not a strategic element itself, an effect is a "change intended or unintended due directly or indirectly to an intervention"
- *Impacts*: produced long-term effects that may be positive and/or negative, primary and secondary, direct or indirect, intended or unintended.

The chain can conveniently be visualized with its "strategic elements" as a set of arrows arranged in a direction of causality from left to right. By deconstructing the chain into several levels and gathering proof of the linkages between each level, the plausibility can be assessed of a proposed link between energy interventions and observed social, economic and environmental changes ((GTZ, 2004), Hulme (2000), DAC-OECD (2002)).

Outputs, outcomes, and impact are also jointly referred to as *results*, which give rise to the related term results monitoring. Such monitoring signifies "a continuing function that uses systematic collection of data on specified "indicators" to provide […] indications of the extent of progress and achievement of objectives and progress in the use of allocated funds." In Chapter 4 we will discuss the selection of indicators. For our current purposes, the formal definition of an indicator is "a quantitative or qualitative factor or variable that provides a simple and reliable means to (i) measure achievement, (ii) reflect the changes connected to an intervention, or to (iii) help assess the performance of a development actor" (DAC-OECD (2002)). In terms of the impact chain model above, an indicator would be a measurable key characteristic of the agents, their behaviour, or their circumstances, that can be related to the intervention's desired outcome. The operational objective of the assessment is thus to capture differences in indicator values between agents that have experienced the intervention and those that have not.

2.4 Illustrating a results chain

It is useful to draw a visual diagram of the results chain leading to the expected effects of the intervention. As discussed in more detail below and in later sections, even in quite simple projects a given link of the causal chain can give rise to several causal relationships. Probably the best approach to characterizing a project in terms of the causal levels is an iterative procedure, switching between drawing a causal diagram and verbally describing the characteristics of the various links. Generally, the quality of the diagram improves with the amount of detail

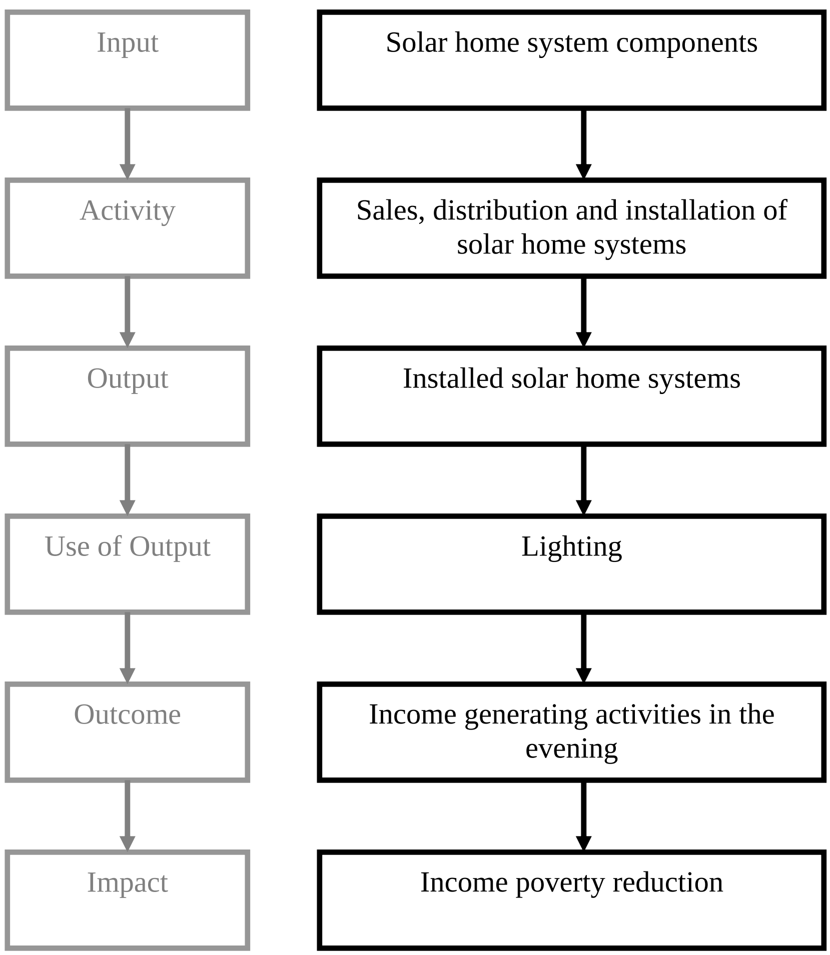

Figure 2.2 A simple results chain for a solar home system project

It is also very useful to construct the causal diagrams in a group exercise with the stakeholders. This facilitates communication on the expected development changes due to an energy intervention, the different interests of the stakeholders and also the coordination of their inputs to the assessment. Furthermore, the impact assessment gains ownership of the stakeholders by directly involving them in the assessment design.

In addition to the above four levels, the M&EED group suggests the use of activities - between input and output - which describes what a project does. Another commonly applicable level is the “Use of Outputs” which describes the usage of Outputs by target groups or intermediaries. An example of a simple results chain for a solar home system project is illustrated in Figure 2.2.

References and recommended reading:

Hulme (2000)

3 Identify the stakeholders

In order to ascertain the relevance of a well-designed, project-specific IA scheme it is important to identify the information needs of the project's stakeholders. Such stakeholders may include:

- domestic public authorities
- stockholders, financial partners
- donors
- donor country public authorities
- beneficiaries/users/clients
- project management team
- the project’s internal management team
- women’s groups
- community based organisations
- researchers in academia
- the IA team – the “assessor”

For each of the stakeholders or groups of stakeholders, it is important to know:

- what kind of information they want
- the intended use of this information
- how they would like the information to be communicated to themselves and other stakeholders

The IA needs of some stakeholders may be described in grant agreements or in procedure manuals. It is therefore advisable to first study such documents and then follow up with discussions, in order to arrive at a precise idea of what the required information is. If the stakeholders want to understand how the project contributes to national development policy objectives, further information may be found on these policies and their objectives in national development strategy documents, such as a Poverty Reduction Strategy Papers (PRSPs) or international objectives relating to the Millennium Development Goals (MDGs).

A project's development objectives may also be outlined and defined in project documents. The IA process should measure the success in meeting those objectives. One aim of the discussions with stakeholders is also to ascertain consensus on the project's development objectives. An assessor also needs to be aware that, behind a project's concrete explicit objectives, there may also exist assumed and/or implicit, unwritten objectives. Such objectives may only come to light through discussions. Since implicit or unwritten objectives may be used by some stakeholders to determine the project's success, it is important to reveal and become aware of these objectives at an early stage.

Previous assessments, if any exist, should be studied. Any gaps in the earlier assessments may be filled by the current assessment. Alternatively, if evidence on certain impacts is found to be weak in previous assessments, then more attention may be paid to this in the current impact assessment.

Many impact assessments have also been used in academic papers and literature. It is therefore worthwhile to search the academic literature for papers on energy interventions similar to the one in question. For example, much has been written about the effectiveness of solar home system programmes in many countries worldwide. The literature on these programmes may help to determine the focus of the assessment or to identify indicators for the assessment.

Looking on to the application of the IA results, it has to be recognised that impact assessment studies in the past have often had limited influence on subsequent decision-making. The following are means that may be attempted to address this problem. (See also Hulme (2000), the recommended reading for Chapter 1.):

1. Impact assessors need to devote more time to the use of their studies and devise dissemination strategies aimed at decision-makers, with short, user-friendly documentation combined with appealing presentations (and strategic cups of coffee!).

2. Considerable thought must be put into the timing of findings. Impacts on policy and practice decrease with the length of time between data collection and presentation of the findings. The Global Development Network has examined characteristics of research that successfully influenced energy policy in five African countries (Karekezi et al. 2006). Among the important factors were timing – policy is most receptive to research input at early stages of formulation – and relevance to broader policy issues, such as macroeconomic or poverty reduction strategies. While beyond the scope of this survey, the UK Overseas Development Institute (ODI 2006) has undertaken considerable on Research and Policy in Development (RAPID), with thematic foci on how policy-makers can best use research, how researchers can best use their findings in order to influence policy; and how to improve the interaction between researchers and policy-makers.

3. The people often best positioned to affect the performance of interventions are programme managers. The influence of impact assessments on this category of stakeholders is likely to increase with their sense of co-ownership of findings.

The latter can be enhanced through paying careful attention and incorporating their ideas into the design of impact assessment studies.

References and recommended reading:

Karekezi et al. (2006)

ODI (2007)

4 Delimit your focus on the intervention.

In addition to the needs of the various stakeholders, certain information must be assembled and digested in order to devise IA schemes in the format of a four-level results chain. As will become clearer below, the final categorization of project features into the levels of the results chain depends crucially on where one chooses to define the start and/or end points of the causality flows to be modelled with the chain.

Thus, there needs to be a clear idea of what constitutes the "intervention" and what does not. In that process, two questions regarding each intervention are relevant:

- Does the intervention provide energy, or improve the utilization of energy, with the intention to meet one specific purpose or several purposes?
- Does the intervention involve the provision of energy, or improved utilization of energy, through one or through several types of technology?

In this context we may think of an intervention as being of "low complexity" if it is intended to meet one objective with one technology. On the other hand, if a project involves several technologies in order to meet several purposes, we may call it a "high complexity" intervention. It is also conceivable that the intervention is not undertaken with a specified purpose, in which case the stakeholder dialogue is even more important. Figure 4.1 aims to aid the identification of an intervention's complexity. The figure shows four kinds of projects of differing complexity. An intervention may involve one or several types of technological inputs, and the intervention may be undertaken for one or several purposes. In both aspects, the "several" option is illustrated with two types of technology and/or two purposes.

In rather abstract terms, an intervention can be identified as resembling one of the four in the illustration by its purpose, the investigator is led to consider the usages (outcomes) of the energy services (output) that are associated with the intervention's purpose and the extent to which the technology (input) brings about such services and usage in the context of the intervention

Alternatively, if the technological input of an intervention is known, the investigator is encouraged to identify the sort of energy services (output) that are likely to be derived from each technology (input) and their potential usage (outcome) (example b). We return to the topic of conceivable uses of energy for specific purposes in the section on assignment of indicators.

Some examples of projects with differing complexity are:

- *Single technology, single purpose* – wind-driven water pump with sole purpose for irrigation
- *Single technology, multi-purposes* - rural solar PV charge stations offering battery charging services for cell phones, battery operated lamps, and other battery operated electronics
- *Multi-technology, single purpose* – Solar PV and diesel powered water pumps for rural irrigation
- *Multi-technology, multi-purposes* - grid electrification provides lighting, communication, and entertainment for homes, irrigation for agricultural sector, lighting and refrigeration for health sector and lighting for schools.

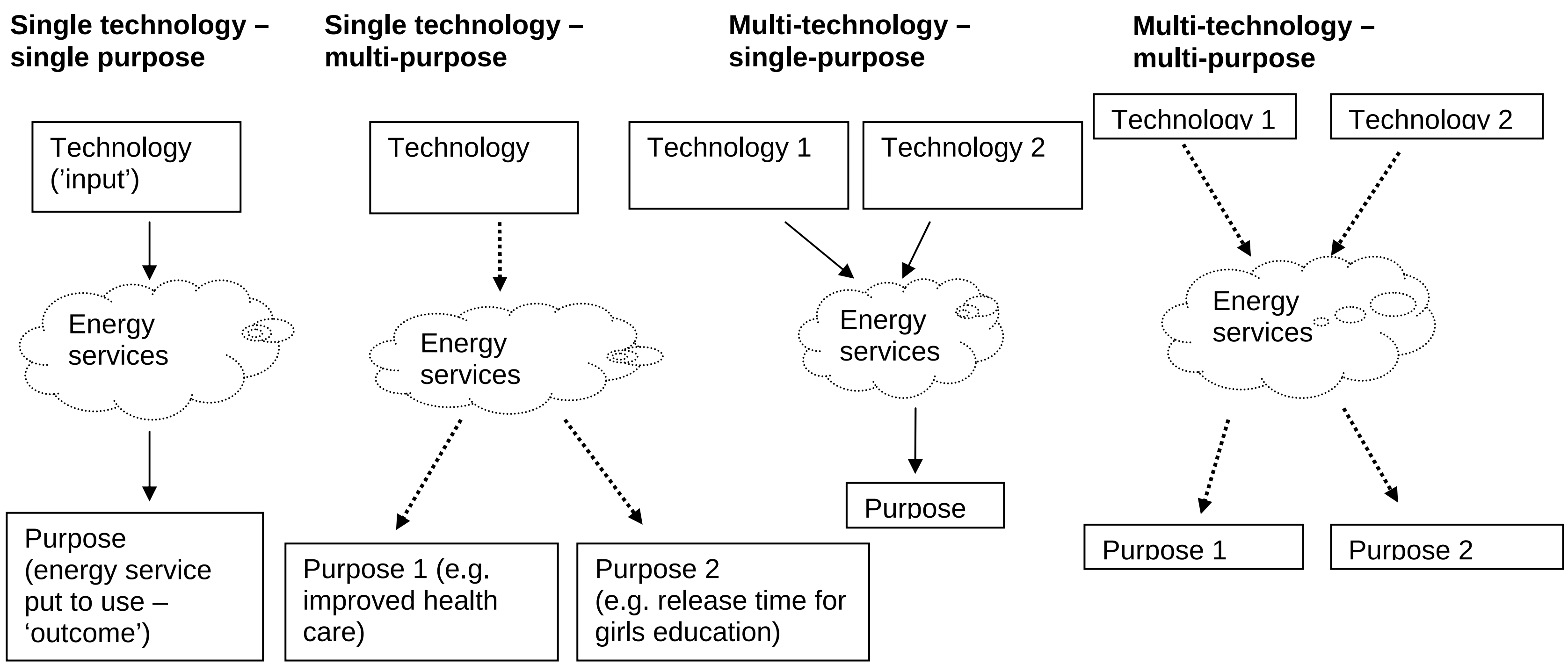

Figure 4.1 Energy interventions as distinguishable by multiplicity of technological input or of purposes

5 The results chain revisited – identifying the elements and causality issues

For the aid of project evaluation the M&EED group has developed “Thematic Modules”. These modules are conveniently built from templates for the links of the results chain. The templates are used here to show the appropriate questions to ask at each step of the design stage. In this chapter we concern ourselves with the identification of the links and issues of causality that eventually form each conceived hypothetical relationship.

Name of Input		
General nature of input	Classify the type of input. For instance an input may, depending on the technology, be: • **Material**, e.g. : *solar panels, diesel engines, in defining the modalities for competitive bidding for concessions* • **Social**, e.g.: *assistance in poles, hydraulic works* • **Financial or economic**, e.g.: a *grant or debt funding for a technology specific financing mechanism, for instance grant and loan to establish a rural electrification fund.* • **Institutional**, e.g.: *support setting up village associations for managing a local mini-grid.*	
Who brings the input?	The Input may be brought by the project itself, by another development project, by public authorities, by private actors, or by a combination of these, e.g.: A mini-hydro electrification project may depend on water works to be built independently of the project	
Objectives and units of measure	For example: kW capacity, kWh, TEP, tons, households connected	
Issues associated with the input	**Potential issues or problem**	**Points to be attentive to, preferably solutions**
	EXAMPLES: ▪ Maintenance ▪ Limited energy production ▪ Pollution ▪ Use of local natural resources ▪ Changes in economic conditions ▪ Lack of benchmarking ▪ Theft	

Table 5.1 Inputs template

5.1 Inputs

Table 5.1 above provides a template for characterizing the inputs. There are at least four general classes of inputs; Material (both technical and capacity), Financial or Economic, Institutional and Social. One or several types of input may go into a given project.

It is useful to keep track of who, which organization or authority brings and/or is responsible for the maintenance of the various types of Inputs. This information is useful not least in the context of responding to the impact assessment. Again, in a setting where skills are scarce, it is beneficial to keep track of individuals' names, since specific knowledge may be vested in particular persons upon which rests the responsibility for development effects further downstream. Since consequences of the project may depend on the amounts of input, one may want to measure those amounts and capture the units of measurement of each type of input. (It may however be difficult to measure skills or judicial support.) The units of measurement are also useful for conceiving of indicators, a topic to which we will return in Chapters 6 and 7. Finally, it is obviously an advantage to try to foresee and list potential complications associated with each input, as these could jeopardize the whole intervention and need be examined. Projects may require several of these templates.

It is important to be highly specific when entering inputs. For instance it is not advisable to write just "water" or "water from a creek". Rather specify "water from the 'Clearwater' creek which runs four hundred metres east of the village". The rationale for this amount of detail is that much time and frustration may be saved by first investigating the state or availability of input. Staying with the creek water, if every link down a results chain crucially hinges on the availability of the water, a high priority on the assessor's agenda is to investigate the availability of water from the creek. In the absence of the creek water, the search for present outputs, outcomes or impacts in this case is likely to be in vain. For similar reasons, one may wish to be specific also with respect to types, brands or versions of input, all of which may yield different consequences. This could be the case, for example, if malfunctioning parts have mistakenly been replaced with spares of a different make.

5.2 Outputs

The process of describing the outputs of an intervention is similar to the process of describing its inputs. Table 5.2 provides the template for describing the Outputs. The differences between this template and the previous one are small, but the contents help us ask the proper questions. Outputs are often energy services or carriers. Appliances or devices produced or improved on site may also be classified as outputs.

It is also convenient to consider the user groups of the output goods or services. As an example of how to take into account differences uses of Output we show two causal trees for a rural electrification project in Figures 5.1 a and b. The first illustration shows a starting point for the process, whereas the succeeding one is a much later version that takes into account different uses of electricity in different sectors of an African country.

<table>
<tr><td colspan="1">Name of Output</td><td colspan="2"></td></tr>
<tr><td>General nature of output</td><td colspan="2">The output is often an energy service or an energy vector. Three common classes of use are
(i) Domestic,
(ii) Collective (e.g. schools, clinics or street lighting)
(iii) Productive.</td></tr>
<tr><td>Who participates in producing the output?</td><td colspan="2"></td></tr>
<tr><td>What to measure</td><td colspan="2">Apart from the actual output, it may be useful to measure some factors internal or external to the project, which influence the success or the project in question. Such factors may be meteorological conditions or prices of goods that influence energy production. For instance the price of LPG may influence a charcoal /wood stove project.</td></tr>
<tr><td>Options for units of measure</td><td colspan="2"></td></tr>
<tr><td>Options for indicators</td><td colspan="2">Name possible indicators and their associated measurement protocols. (The detail pertaining to indicators will be discussed in Chapter 6.)</td></tr>
<tr><td rowspan="3">Issues and problems associated with the Output</td><td colspan="2">List of issues or problems in quantifying or qualifying the output.</td></tr>
<tr><td>Potential issue or problem</td><td>Possible solution for establishing an appropriate M&E scheme</td></tr>
<tr><td></td><td></td></tr>
</table>

Table 5.2 Outputs template

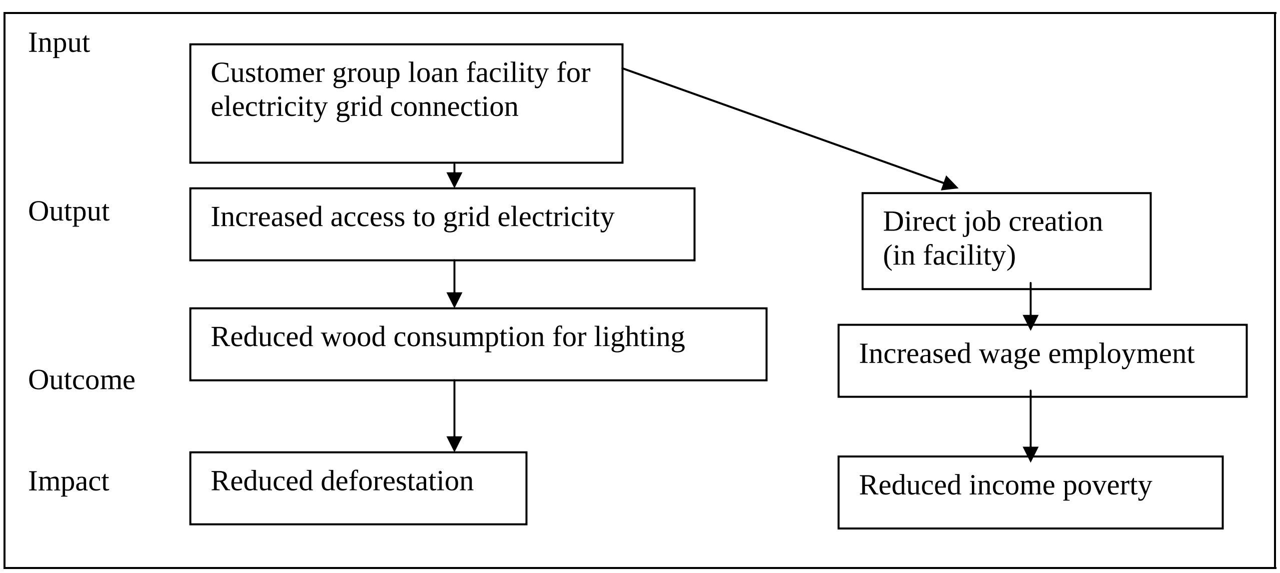

Figure 5.1a Initial rural electrification diagram

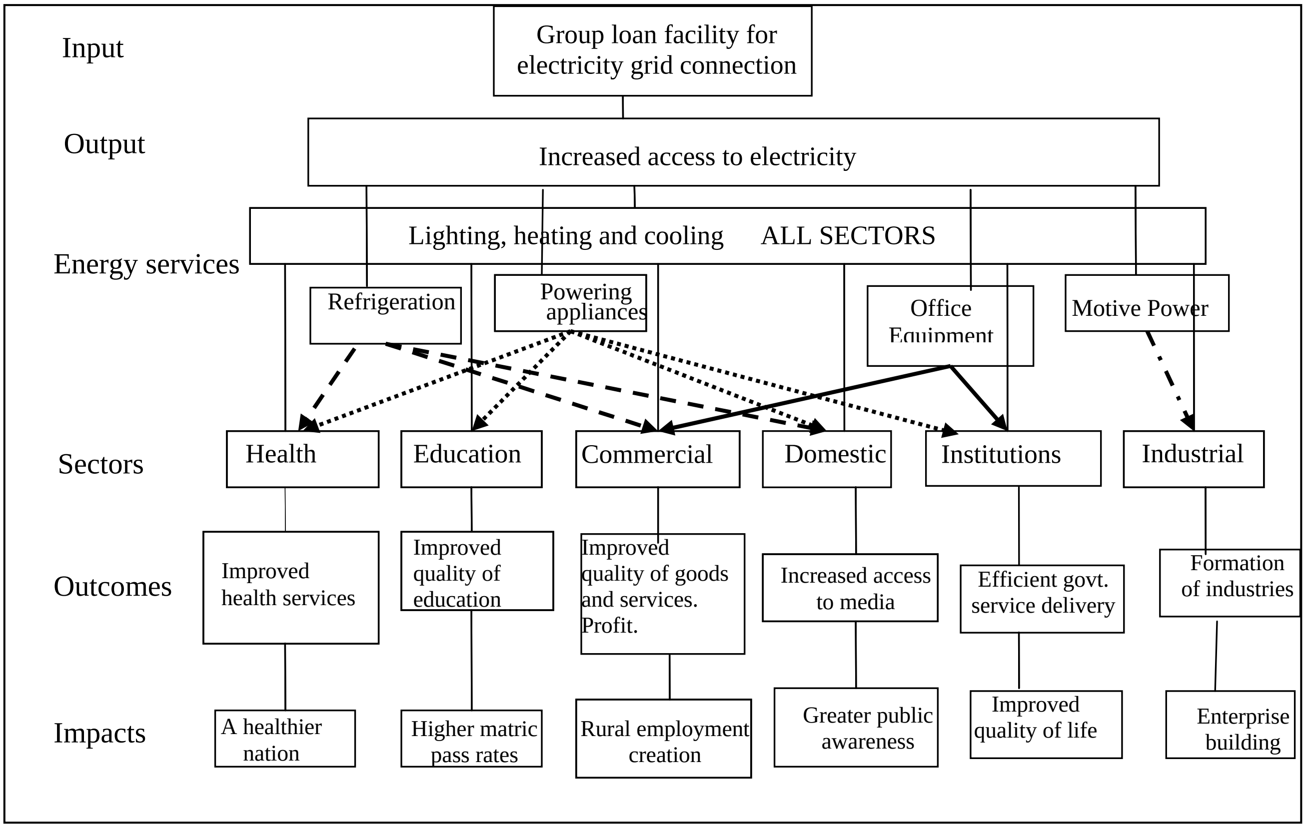

Figure 5.1b Final rural electrification diagram.

5.3 Identifying outcomes

What do the beneficiaries of the project use energy for? We hypothesise that, by improving the quality or availability of energy for these – and/or other – purposes, the living standards of the beneficiaries are affected. Here it is assumed that the final beneficiaries of the intervention are households and their members. We therefore let the "development impacts" to be assessed correspond to the living standards improvements experienced by households, as a consequence of the intervention. (If the final beneficiaries were firms the suggested linkages would differ. However, the key message here is the need for a detailed understanding of how energy services are utilized among beneficiaries.) It is implicitly assumed that the household's living standards are affected through its generation of income, through public or communal services, and through its domestic activities. The household is assumed to generate income through wage employment or through production of goods and services – whether for sale or for own consumption - in farming or other business activities. Some conceivable means by which energy services could feature in the domains of households' living standards generation are illustrated in Figure 5.2.

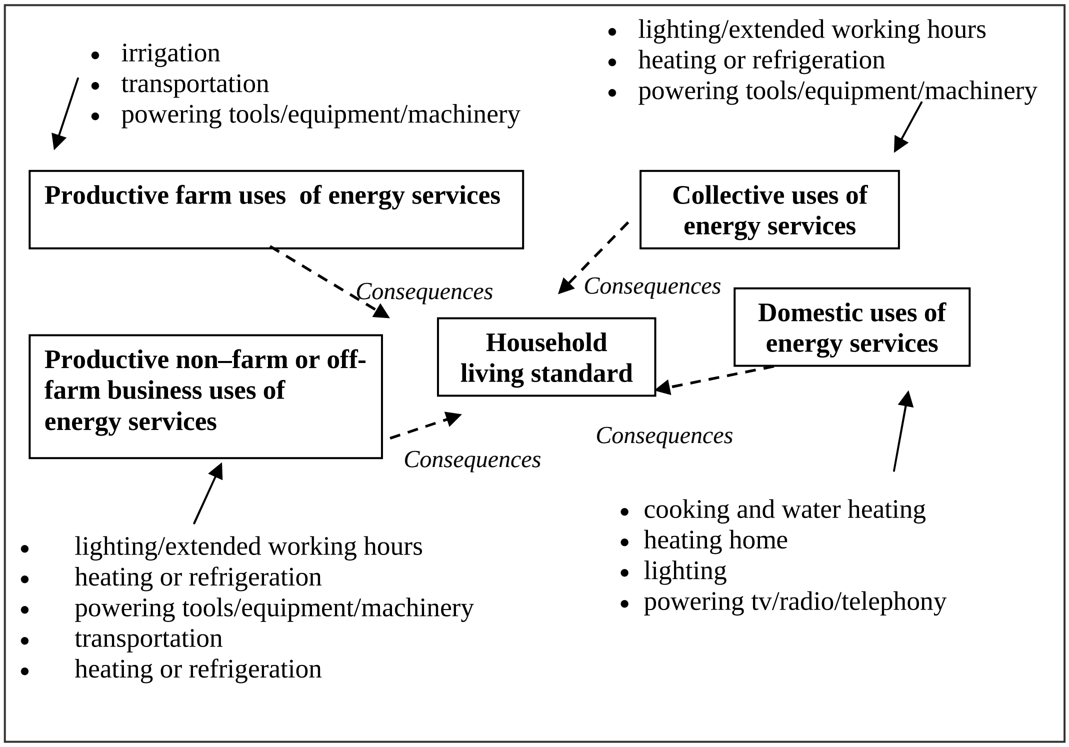

Figure 5.2 Examples of energy services utilization which have consequences for household living standards

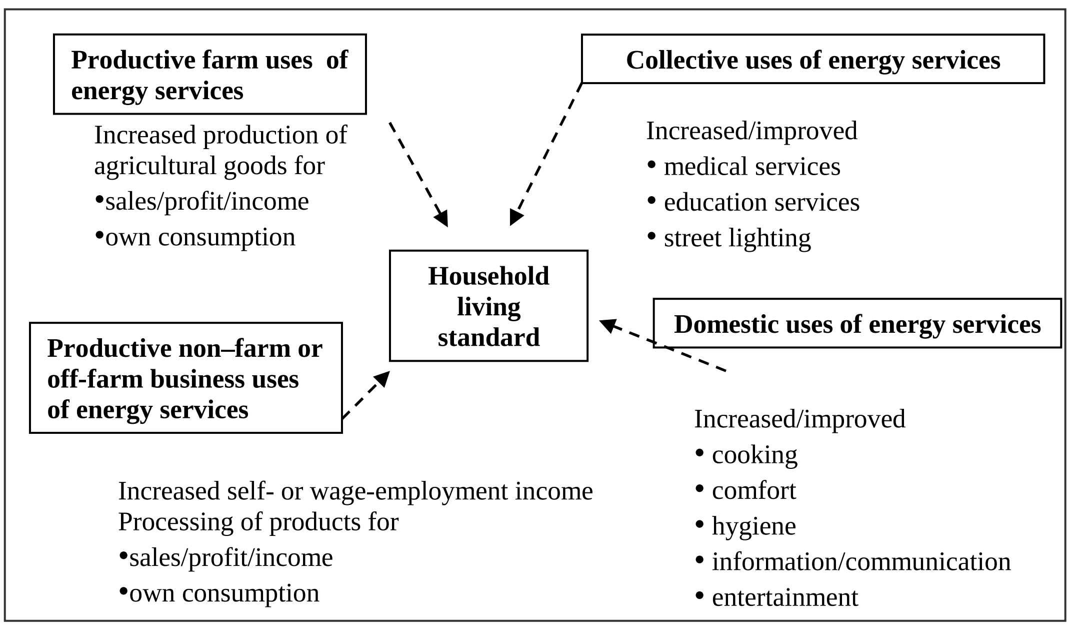

Figure 5.3 Examples of consequences for household living standards from the utilization of energy services

In reality the distinction between what is a farming activity, small-scale business, or domestic activities may be blurred. This could, for example, be the case when grains are milled to flour with a power-driven grinder, where the end-use of the flour may be for both domestic purposes as well as for sale. However, the end-use of the flour may not be identifiable at the milling stage. For assessment purposes it is however probably more important to first register that energy is used for grain milling and, secondly, that the flour milling is for both domestic and productive purposes. The exact extent to which milling is done for either purpose is of less importance here.

Finally, at the outcome or impact level, the impact assessment scheme will cover consequences in the form of non-energy products or services. The consequences will vary with the type of intervention and the kinds of energy services utilized. Some conceivable consequences of improved energy services in the different living standards domains are illustrated in Figure 5.3.

5.4 Causal complexity

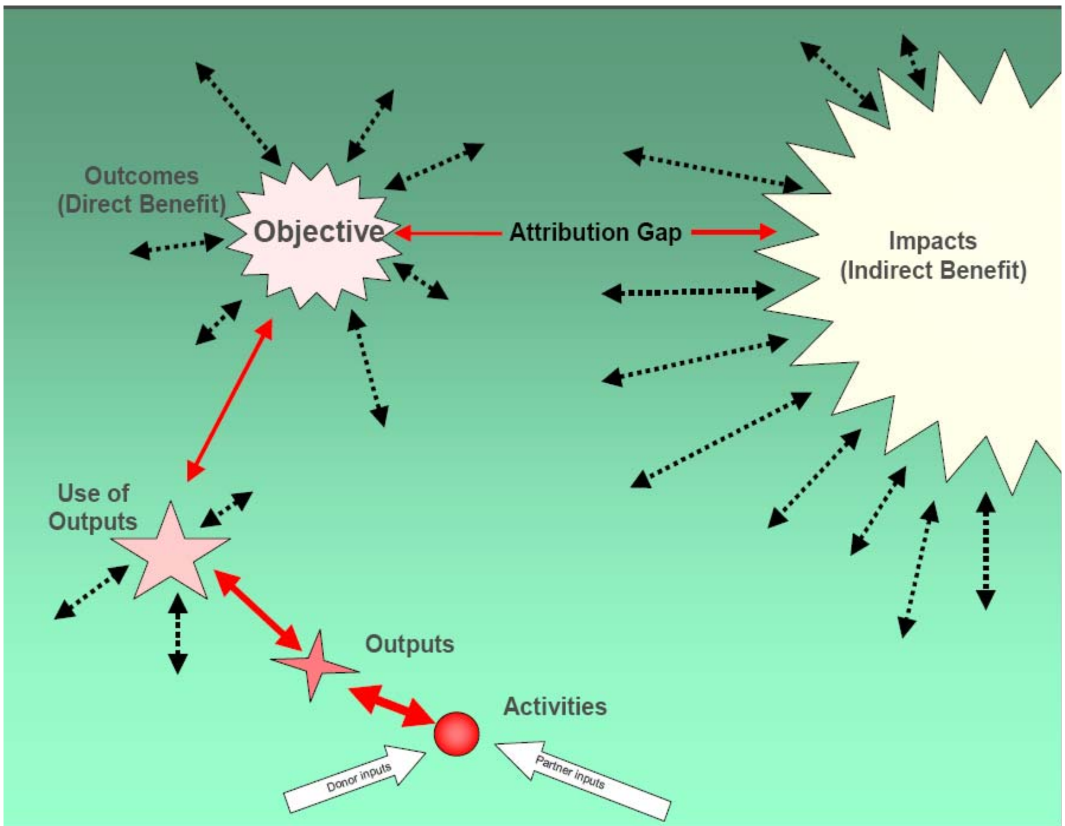

Figure 5.4 The results chain with "use of outputs" as an element between outputs and outcomes [source GTZ (2004)].

Figure 5.4 shows the links of the results chain in a complex "real-world like" context. We proposed above that the results chain could be visualised as a set of arrows from left to right in the direction of causality. However, causality in the context of this chain should not be confused with a linear sequence of causes and effects. By assumption, the links of a results chain model lead from Inputs, which various partners bring to project activities, to outputs and the use of outputs. Attribution of results to the energy intervention up to these levels is relatively easy in most cases. It is much more difficult to verify empirically a project's claim to development, with observed development changes as direct benefits from its outputs (GTZ, 2004). Generally, project results – and, as mentioned, in particular the long-term – downstream, indirect results, will depend on actions and conditions outside of the project's control. As one moves towards the levels of outcomes and impacts, results that are quite distant from the project's activities, the influences increase from circumstances beyond the control of the project. An "attribution gap" widens up, quite possibly to an extent where improvements in socio-economic or environmental conditions may no longer be observably related to project outputs.

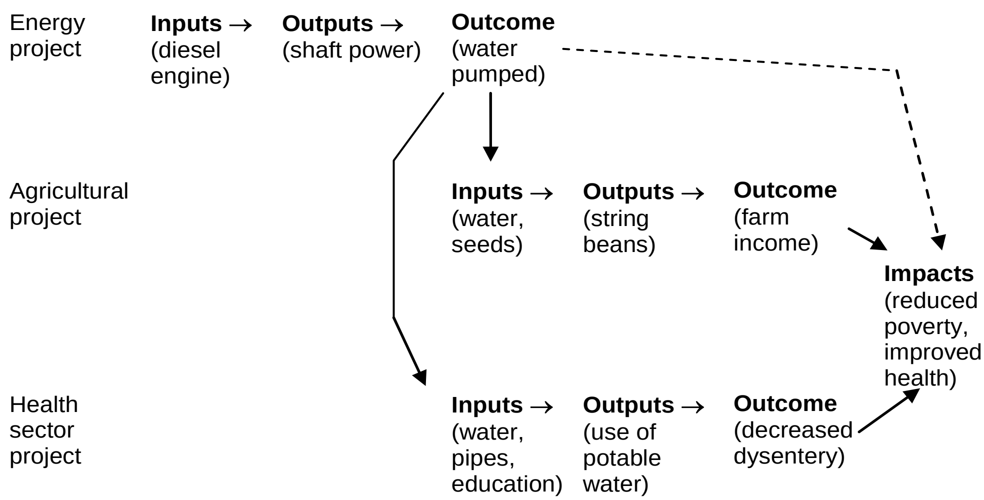

Figure 5.5 Results chains in interaction - outcome from an energy project as input into other interventions

Often the ultimate reasons for interventions are indeed impacts generated beyond the outputs or use of outputs levels. However, it may only be rarely possible to identify a causal relationship that explains how such indirect benefits came about. The investigator needs to be aware of this "attribution problem". Nevertheless, it is important to keep in mind development results that, especially in aggregation, would indicate progress towards achieving the Millennium Development Goals or the country's Poverty Reduction Strategy. On the other hand, it is often necessary to allocate (usually scarce) impact assessment resources towards what are seen as realistic and feasible goals.

The attribution complexities are further illustrated in Figure 5.5. Causality can disperse in different directions and an effect from one intervention may be a cause of further effects. Input in the form of a diesel engine, brought by an energy project, yields shaft power for the extraction of water as output. The pumped water is an output of the energy intervention, but serves as one of several inputs into an agricultural project, which could yield an impact in the form of higher incomes. A parallel health project aimed at reducing dysentery also utilizes the pumped water as an input alongside pipes and education to promote the use of potable water. In combination, the three interventions may bring about development impacts in the form of improved living standards. In interpreting the figure we may be well served to imagine also contextual influences from

- ground water levels and diesel availability on the water output
- weather conditions on agricultural production
- access to agricultural markets and prevailing prices on crop revenue and farm income
- spare or replacement parts and repair skills on water pipe maintenance

Each of these four influences form part of the context of the separate projects and may seriously complicate the attribution of development impacts to the diesel engine. As some remedy, we propose that where appropriate, draw on local, project or context specific knowledge to identify and take note of relevant outside circumstances, conditions or influences.

References and recommended reading:

Cabraal (2005)

Mulugetta et al. (2005) *(in addition to much other very useful information provides an account of the "Sustainable Livelihoods" model of household livelihood generation in developing countries.)*

6 Choosing indicators

After constructing the chain and identified the links of interest, the time has come to find ways to measure the changes that the project has incurred. The direct changes or outputs may be easier to measure than outcomes or impacts. As mentioned, development projects sometimes aim to contribute to large national objectives such as improving health or gender equality. On the one hand, it may be required to conceive of measurable indicators that describe these larger, "macro" goals. On the other hand, indicators have to be found for the more concrete or "micro" level inputs or consequences that you have identified.

A useful step in identifying indicators for the different elements in the causal tree is to think of a number of research questions for each element. These are in fact the key questions that need to be answered, and they are specific to the link with which they correspond. The questions can also relate to linkages with other sectors. Further, the questions should provide some idea of where or with whom the information rests.[2] In choosing indicators for the links of your results chain the following criteria should be kept in mind:

- pertinence to the project
- interest for project stakeholders
- ease and cost of measurement or data collection
- the possibilities for triangulation between sources of information

[2] The formulation of research questions can also help in the designing questionnaires and implementing data collection methods. For example, in designing questionnaires, the research questions are adapted to questions that can actually be posed, and the questions can be formulated specifically to the different sources.

Indicators need not be numeric. They may be qualitative. In some cases, information stored as pictures, videos or voice recordings of "anecdotal" information may be the most pertinent indicator formats. In other cases behavioural change or attitude may be an indicator. The rightmost section of Figure 6.1 provides examples of indicators for each level of the solar home results chain from Chapter 1.

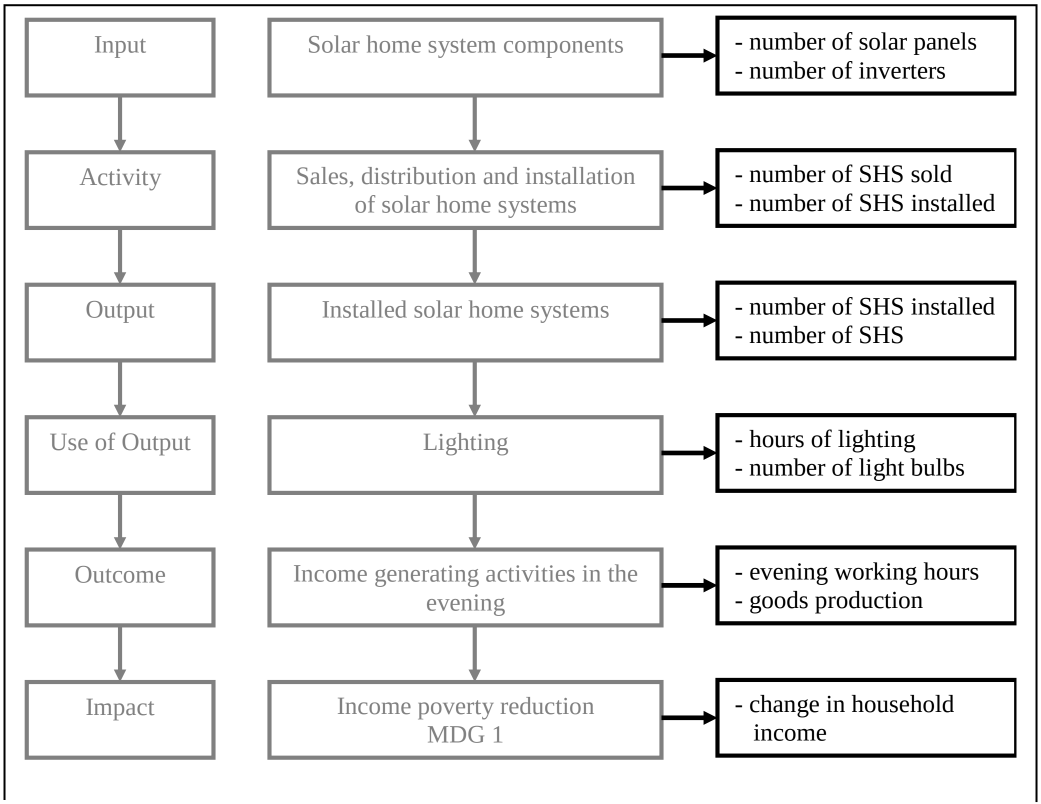

Figure 6.1 Examples of indicators with units of measurement

In addition to the links and national development objectives already considered, there are many cross-cutting issues which may be important to the sustainability and success of the project. It is advisable that the following transversal issues are adequately treated, taking into account the needs of the project and stakeholders:

- gender dimensions and equality; the different impacts of your project on women, men and children of different gender
- discriminatory impacts on community subgroups (according to poverty status, religious affiliation or ethnicity)
- long-term viability and project replicability: economic/financial, technical and environmental sustainability - including the impact on GHG emissions, biodiversity, wildlife, forests, and harvests.
- social and cultural acceptability of your project activities
- revenue-creating activities, job creation
- end-user satisfaction
- training and capacity building
- local ownership and participation
- outside conditions, not under the control of the project, but which influence project results.

References and recommended reading:

Rai (2005)

The suggested readings for Chapter 5 are also relevant here.

7 Assign data collection methods

In the Introduction section we made a case for the particularity of each intervention. This implies that each project has to be approached with specific methodologies. While fieldwork expertise may be transferable across research themes, the best mix of data collection methods depends crucially on the context at hand. However, it cannot be emphasized enough that the assessment depends crucially on the quality of the collected data. Each indicator is measured using one or more data collection methods. These may be, for instance:

- Physical measurement (satellite data on forest cover)
- Data extraction from public statistics (school attendance or agricultural production)
- Interviews
- Extraction of accounting or administrative data of a public or private organization (ESCO customer records)
- Focus groups and other participative methods
- Household or firm surveys

A long range of participatory data collection and knowledge creation methods exist that can be applied to impact assessment studies. Each of those as well as the quantitative methods has a different pattern of strengths and weaknesses. (A more detailed account of impact assessment tools is found in Simanovitz (2001). Rai (2005) provides a fuller account of participatory approaches for impact studies of energy programmes.)

The data that can be collected in IA studies is however, often very limited. It is therefore important to first undertake qualitative research so as to determine which indicators provide the most accurate reflection of the type of impact information that one wishes to gather. The tools selection process therefore also involves a close look at the kind of data a particular approach will produce and considerations of how that data should be processed and analyzed. A common mistake is to select indicators based on an insufficient understanding of the processes one seeks to assess. The starting point in any impact assessment is therefore preparatory analysis (Simanovitz, 2001).

The key methodological challenge is to choose of a mix and combination of methods, rather than to pick one, unique method. The choice is obviously subject to considerations of resources available and the context at hand. Nonetheless, a trend seems to be towards efforts to combine the advantages of representativity, quantification, and attribution in sample survey approaches, with participatory approaches' abilities to uncover processes, capture the diversity of perceptions, views of minorities and unexpected impacts. At one extreme end of the range of methodological mixes one could find those used to “prove” impact for policy or major investment purposes. At the opposite extreme could be to independently corroborate the impact and strengthen implementation aspects of a small-scale programme. In the first case the mix would probably entail a large scale, longitudinal sample survey, supplemented by triangulation from the other methods. In the latter case, a mix of rapid appraisal and small-scale survey would likely suffice (Hulme, 2000).

On the respondent side, the issue of how to persuade respondents to spare the time for an interview, and provide accurate and honest answers, is an important one. Different strategies are needed for programme beneficiary and control group respondents. As a rule of thumb many researchers suggest that interviews should be concluded within one hour and that one and a half hours should be seen as the absolute maximum for an interview.

Beneficiaries usually accept that being part of a programme comes with “answering questions”. The quality of the data still depends on the respondents’ understanding of why they are being interviewed and the opportunities to ask questions before the interview. In dealing with control groups, motivation may become an issue, especially if longitudinal data is collected. A first interview has some novelty and amusement value. However, for longitudinal studies, the provision of some reward to interviewees should be considered to promote data quality and for ethical reasons. Finally, participatory processes often stimulate respondents by their inherent social interaction. However, in conducting these kinds of exercises, care must be taken to observe who has turned up and who has not come to the meeting. Additional focus groups or interviews of non-attendees are often required (Mosse (1994), Mayoux (1997)).

References and recommended reading:

Rai (2005)

Simanowitz (2001)

O’Sullivan and Barnes (2006)

Hulme (2000)

Mayoux (1997)

Mosse (1994)

Appendix Ch 7 – field work advice

While we refrain from going into further details of field work in this document, we would like to sensitize the reader to the multitude of considerations that should be made. In doing so we draw here on notes kindly supplied by Dr. Chondoka of the University of Zambia's School of Humanities and Social Sciences.

Before you plan to go into a community to carry out interviews, consider the following:

- Obtain a letter of introduction from your sponsor/boss to be given to the area leader where you will do the interviews
- Have enough writing paper and pens and pencils
- Where possible carry a camera or a tape recorder
- Carry a Laptop with a Flash diskette plus a few floppies (or a memory stick)
- A bicycle/vehicle will make you mobile
- Bring a few minor items such as foodstuff and minor clothes as token of appreciation to the host political or local authority
- Bring a small radio and plenty of batteries if there is no electric power
- Pack malaria tablets or mosquito net, torch/lantern, candles, paraffin (kerosene)
- You may also need empty audio cassettes

You, as a researcher should:

- Dress simply, not in suites, but casual and neat or presentable. Be like the subjects you wish to approach.
- Use simple language if speaking in English
- Go to Church or Mosque and pray with the locals, even if you have never been inside of such places of worship.
- Mingle with people once in a while, especially if you are staying long
- Don't get involved with the respondent or anyone in the area intimately - but as you go do carry protection.

Once in the field do the following things quickly

- Introduce yourself to the host telling him about your mission and please present the token items you brought for him/her
- Identify the place where you will be staying.
- Rent a house and employ someone to assist you with preparation of food, warm water to bath and cleaning of the house
- Let your host identify the elders in the community and know them quickly, pay them
- a social visit
- Identify one elder who will be with you all the time, take him as your research assistant

Interviews in rural areas are better done in the afternoon than in the morning when people go to the field to work. When undertaking interviews take note of the following:

- Use an interpreter or if you know the language do it yourself
- Interview each gender separately (most often, beginning with the male gender)
- Then interview both genders together
- Identify a few influential individuals with whom you will have in-depth interviews in their homes at a later stage
- If female, make sure that you have another female nearby to avoid being misunderstood by the husband or boyfriend, and vice-versa

Depending on the levels of education of the local people, interviews should be face-to-face with you, the researcher, writing down the responses. Questionnaires are not good in the field as some rural people are not literate or are semi-literate. They may feel insulted or that you are laughing at their low level of education. In the worst case, illiterate or semi-literate individual may ask someone else to fill in questionnaires for them.

8 Fill in the research plan

In this Chapter we present a stepwise method to create a basic research plan. It is assumed that the investigator has identified (i) the causal links to be studied, (ii) relevant indicators, and (iii) the most appropriate data collection methods. These could be stored in the format of Table 8.1 Experience shows that a graphical illustration (such as a causal tree) of the causal links is often useful to support further thinking.

Table 8.2 represents the first step in converting Table 8.1 into a research plan. From Table 8.1 the columns have been rearranged to shows a list of the various sources and the elements each source should provide information on. The first column identifies the source of information, the second the kind of methods to be used and the third displays the kind of information sought.

Having completed Table 8.2 and before going to the next step, it is wise to reflect on the list and check or discuss whether:

- The amount of information expected from each source is realistic in terms of content and amount
- Most of the information elements are fed by more than one source, at least the important ones. The results become more reliable by triangulating between different sources and looking at issues from different perspectives.

If required, the matrix can be adapted accordingly.

Results chain elements	What to measure?	Indicators	Unit	Source	Data collection methods
Inputs	Solar home system components	- number of solar panels - number of inverters	- solar panels - inverters	- ESCO records - ESCO records	- interview/desk study - interview/desk study
Outputs	Access to electricity	- total number SHS installed - SHSs technically operational - households paying for service	- SHS - SHS - households	- ESCO records - SIDA - ESCO records - ESCO records	- interview/desk study - evaluation report - interview/desk study - interview/desk study
	ESCO employment	- jobs - income	- jobs (hours) - Kwacha	- ESCO - ESCO - employees	- interview/desk study - interview/desk study - interview/survey
Outcomes	Use of electricity	- number of appliances per household - types of DC appliances	- appliances - N/A	- households - technicians - households	- survey, focus groups - interview - survey, focus groups
	lighting fuel consumption	- volume of fuel purchased - fuel expenses	- litre/week - Kwacha	- shops - households	- interview - survey
	business hours	- avg. daily business hours	- hours	- shop keepers	- interview
Impacts	Communication	- cell phone charging/availability	- cell phones/household	- cell phone co. - households	- interview/desk study - survey/observation
	Economic opportunity	- employment generation - new businesses - time available	- employment status - Kwacha/household - hours	- households - households - households	- survey - focus groups - survey

Table 8.1 Examples of solar home project causal links, with indicators, units of measurements, data sources and data collection methods

Source	Methods	Indicators
ESCO	interview, desk study	number of systems sold
Technicians	Interview	number of systems installed

Table 8.2 Connecting data sources, data collection methods and indicators

The next step in the research plan is to determine for each source what percentage of the research population will be approached for the research in order for it to be representative (sampling). This does not apply to sources like reports, archives etc, but mainly to human sources. Relative large samples will result if the research needs to be statistically representative. It is difficult to give standards for sampling in this case, but depending on the size of the research population the sample will vary between 5%-35%. Some examples of sample sizes used in previous case study research and evaluations are shown below:

- Source: people employed through a project
  Size of research population: 10 (persons employed)
  Sample: 2-3

- Source: household surveys
  Size of research population: community of 500 HH
  Sample: 30-40 HH surveys

- Source: household Focus Groups
  Size of research population: community of 500 HH
  Sample: 2-3 Focus groups, 6-8 participants each, homogeneous groups (men, women, youth separately)

- Source: teachers
  Size of research population: 25 teachers
  Sample: 3-5 teachers

For case study research it is unlikely that random samples will be used; rather a stratified sample will be used. This means that in order to maximize the spread there should be for variety within the sample, for example between males and females, or between senior managers and regular employees. In choosing the sample, a control group may be included, i.e. a group of people, not part of the project, or who did not experience the intervention. This is only realistic if resources are available to address a considerable group; otherwise it is merely useful for illustrative purposes. Furthermore note that in order to get a sample of two out of ten it may be necessary to approach 200% (four persons) in order to get two actual respondents, due to availability problems. As a result of the sampling exercise may be a data collection overview in the research plan which would now look like Table 8.3.

Source	Method	Sample size	Respondent specification	Resources needed	Duration
ESCO	interview	1	project manager		
Technicians	interview	2	1 new, 1 experienced		
Household	Focus group	3 x 8	1 group women, 1 men, 1 youth		

Table 8.3 Sources, methods, sample size, respondent specification

The overview in Table 8.3 provides the basis for data collection planning, which could take the form of Table 8.4

What	When	Who	Remarks
Preparation			
Finish and agree on research plan			
Desk study			
Design questionnaires			
Recruit respondents			
Recruit research assistants (if needed for surveys)			
Prepare focus group discussion (if applicable)			
Elaborate data collection planning			
Data collection			
Continuation desk study			
Interviews (if applicable)			
Focus groups (if applicable)			
HH surveys (if applicable)			
Observation			
Documenting preliminary findings			
Updating people involved in research on preliminary findings			
Analysis and Reporting			
Data analysis			
Report writing			
Discussing draft report			
Finalising report			
Communicating results			

Table 8.4 Overview of research planning.

The final objective of the assessment procedure's design stage, the research plan, is depicted in Table 8.5.

Link	Elements in your results chain diagram	Indicators	Units of measurement	Source	Data collection methods	Respondent specification	Sample size	Resources needed	Duration	Person responsible for data collection	Date for data collection
Inputs											
Outputs											
Outcomes											
Impacts											

Table 8.5 The empty research plan - outline

9 Conclusions

Access to energy is an essential input in the process of development and poverty alleviation. Better understanding of development-poverty-energy linkages, and embodiment of this knowledge in an operational tool, can contribute to increasing the development and poverty alleviation impacts of energy interventions. The core activity of the DEA project has been to develop such an operational tool, and to illustrate and test its use through a number of relevant case studies.

The present document describes in practical terms how to approach the task of conducting an Impact Analysis of an energy intervention. The methodological approach, termed the DEA Assessment Framework, has been based heavily on findings and recommendations in the recent literature related to impact analysis. In particular, the 4-level approach developed and adapted through the international M&EED group has been an essential component of the AF. A number of theoretical and methodological issues have been described in the document, but for a thorough discussion the reader is referred to the original literature, and indeed to the Literature Survey document of the DEA project (Dieden et al. 2007).

This Assessment Procedure Guideline is primarily a practical guide for those who wish to carry out assessments of the outcomes and impacts of small and medium-scale energy interventions. The procedure has been tested in practice through the six DEA case studies, and the results are to be seen in the respective case study reports, summarised by Zhou (2007). The Assessment Procedure is not a static method, but a collection of steps which may be followed in a systematic way, with room for user adaptation and enhancement, to carry out the often complex task of assessing “what difference” any given energy intervention has made. In the real world, resources for carrying out impact analysis are almost always severely limited. Moreover, an essential component of an impact assessment – the baseline or reference situation – is often lacking, because the intervention was implemented without taking into account that an impact analysis might be carried out in the futures.

The procedure described in practical terms here, along with the closely related Monitoring and Evaluation methodology developed by the M&EED group, can hopefully contribute to more widespread use of such tools within the energy and development world, as well as contributing to better understanding of the linkages between energy and development. Ultimately, such understanding, embodied in new and more effective ways of increasing the provision of energy services to the poor, with an optimum use of scarce resources, can make a contribution to the achievement of the MDGs.

10 References

Cabraal, R.A., Barnes, D.F. and Agarwal, S.G. (2005) *Productive uses of energy for rural development*, in The Annual Review of Environmental Resources, 2005. 30.

DAC-OECD (2002). *Glossary of key terms in evaluation and results based management*

Dieden, S. Sten, Chia-Chin, C., Haslev-Hansen, N., Hinostroza, M. and Mackenzie, G.A. (2007) *DEA Literature Survey Report,* Risø DEA Report 2.1, Risø National Laboratory/DTU, May 2007

GTZ (2004) *Results-based Monitoring, Guidelines for Technical Cooperation Projects and Programmes*, Unit 04 Corporate Development, OU 042 Internal Evaluation.

GVEP (2006) *Guide to Monitoring and Evaluation for Energy Projects*. Monitoring and Evaluation in Energy for Development (M&EED) International working group, December 2006 http://www.gvep.org/WorkArea/showcontent.aspx?id=1628

Hulme, D. (2000) *Impact Assessment Methodologies for Microfinance: Theory, Experience and Better Practice in World Development*, 28 (1), 2000.

Karekezi, S., Kebede, B., Kimani, J. and Muthui, J. (2006) *The impact of research on national energy reform strategies in Eastern and Southern Africa*, Global Development Network (GDN) Bridging Research and Policy Project http://www.eerc.ru/details/download.aspx?file_id=10017

Mayoux, L. (1997) *Impact assessment and women's empowerment in microfinance programmes: issues for a participatory action and learning approach*, mimeo, Washington, DC: Consultative Group to Assist the Poorest (CGAP),

Mosse, D. (1994) *Authority gender and knowledge: theoretical reflections on the practice of participatory rural appraisa*l, Development and Change 25:3, *(cited by Hulme (2000))*.

Mulugetta, Y., Doig, A., Dunnett, S., Jackson, T., Khennas, S., and Rai, K. (eds.) (2005) *Energy for Rural Livelihoods: A Framework for Sustainable Decision Making*, Practical Action, 2005.

ODI (2007) A large number of useful references on the "Research and Policy in Development" Programme may be found at http://www.odi.org.uk/RAPID/ , Overseas Development Institute, London, 2007.

O'Sullivan, K. and D.F. Barnes, D.F. (2006), *Energy policies and multi-topic househo*ld surveys - guidelines for questionnaire design in living standards measurement studies, World Bank, Washington DC, 2006

Rai, K. (2005) *Monitoring and evaluation of the impact of renewable energy programmes: A toolkit for Applying Participatory Approaches*, IT Power, 2005.

Simanowitz, A. *A Review of Impact Assessment Tools – a guideline for Improving the Impact of Microfinance on Poverty*, Action Research Programme, Institute of Development Studies, University of Sussex, http://www.ids.ac.uk/impact/publications/guidelines.html