BOILING POINT / 55 / 2008

Boiling Point

A PRACTITIONER'S JOURNAL ON HOUSEHOLD ENERGY, STOVES AND POVERTY REDUCTION

Monitoring and Evaluation

Toolbox
Six Steps to Results Based Monitoring p39

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Leading experts advise on establishing a reliable monitoring and evaluation system p29

A publication of the
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Household Energy Network
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Boiling Point is a practitioner's journal for those working with household energy and stoves. It deals with technical, social, financial and environmental issues and aims to improve the quality of life for poor communities living in the developing world.

Welcome...

To the latest edition of Boiling Point, published under the HEDON Household Energy Network (www.hedon.info).

The journal is produced by Eco Ltd, and has an Editorial Team including Practical Action, GVEP International and Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH. The aim of the journal is to provide accessible information on household energy to practitioners, researchers and users worldwide. We strive to make the journal as accessible and participative as possible, and would ask for your assistance in this by updating your address details and sending us feedback using the personalised web address enclosed with this edition, or providing us with your details by email or post. You can contact us at Boiling Point on boilingpoint@hedon.info.

The theme of this edition is the effective Monitoring and Evaluation (M&E) of household energy projects. While often neglected, M&E is a critical component of any project as it allows a practitioner to measure the success of an intervention, whether in technical, social, economic, environmental or political terms, so that they can learn from the indicator results to improve future work.

We are pleased to welcome Wendy Annecke as theme editor for this edition of Boiling Point. Wendy is GVEP International's Monitoring and Evaluation Manager and her editorial discusses the development of M&E in the household energy sector, including the need for a greater integration of social development and user perspectives into the process.

Editorial Team
Rona Wilkinson, James Robinson, Grant Ballard-Tremeer (Eco Ltd), Lisa Feldmann and Agnes Klingshirn (GTZ), Lucy Stevens (Practical Action) and Wendy Annecke (GVEP International)

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We would like to extend our thanks to Practical Action and GTZ for financial and editorial support toward this edition of Boiling Point. This issue is also kindly supported by GVEP International.

Cover and Editorial photo: Many thanks to the Gaia Association for submitting this photo of project supervisor Maryan Hussein interviewing a Somali refugee woman about stove use, Kebribeyah refugee camp, eastern Ethiopia (Photo: Firehiwot Mengesha)

Editorial

Monitoring and evaluation

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It is encouraging that there is increasing recognition of the importance of M&E in energy for development interventions. In comparison with education, or even the water or health sectors where Monitoring and Evaluation (M&E) procedures are well established, the energy sector has been slow to develop M&E methodologies. In addition the energy sector has frequently neglected the integration of social development and user perspectives into M&E functions, concentrating instead on technical and financial factors. However things are changing. In the early years of this decade interest in energy M&E seemed to be driven primarily by donors who were anxious to be able to provide taxpayers with transparent accounts and the measurable differences that their contributions had made to energy poverty reduction. This concern of donors led to the establishment of the Monitoring and Evaluation of Energy for Development (M&EED) International Working Group in 2004 and the production of A Guide to Monitoring and Evaluation for Energy Projects[1]. Currently it is not only donor organisations who are interested in M&E. Energy practitioners all over the world have come to see the usefulness of systematically monitoring their projects, reviewing their progress and accommodating the changes necessary to achieve the desired results. Practitioners also realise the value of following the progress of a project long enough to evaluate its longer term impact.

Yet for most of us there remains much uncertainty about how to operationalise M&E in the energy sector. Acceptable and comparable methods are still being defined and developed. Shared empirical evidence of the advantages of conducting M&E has been limited. Although there is agreement that M&E should be part of the initial project design and planning, with time and resources allocated to it, in reality M&E is frequently conducted as afterthought with the result that there is not enough money for the bare bones of the process let alone validation, testing and refinement. Even for those who integrate M&E into project planning, there are still many questions which have to be answered about the what, where, how and the resources one should use to do this.

Through its focus on Monitoring and Evaluation, this issue of Boiling Point offers some resolution to the questions, challenges and skills that we seek. There is sage advice and insights from experienced M&E practitioners, a useful toolkit and articles, arguments and guidelines to consider. There is also an innovative feature aimed at including a wider body of readers and expertise: A case study scenario requiring the development of an M&E system was presented to a number of international experts to comment upon, and the rich results reveal how differently M&E may be approached according to the implementer's perspective and on-the-ground conditions.

While the scenario was fairly formidable, there was ready reassurance from the experts that it could be broken down into 'manageable chunks' and that assistance in the form of guides and toolkits is readily available. Jonathan Rouse, Dana Charron and David Pennise, for example, advise on a range of instruments that can be used to measure technical and socio-economic changes and raise the issue of unexpected impacts. M&E has become a central element of the work of the Gaia Association who note in their response to the scenario that 'by evaluating the impact of our work, we build confidence with our donors and most importantly, we maintain a dialogue with our target communities to ensure that we continue to serve their needs as best we can'.

Although this issue focuses on improved stoves, M&E is of course crucial to all development projects. Risø's Development and Energy in Africa (DEA) project (see the GVEP International news pages) illustrates the usefulness of M&E to rural electrification through solar and grid connections, solar water pumping, renewable energy for women and sustainable forestry. Kavita Rai (2005) developed an M&E kit specifically for renewable energy programmes, while my article discusses evaluation in the context of an electricity-to-LPG transition.

In this edition although each article approaches M&E from a different angle, most of the contributions and the responses to the scenario agree on a few critical components of systematic monitoring and evaluation. The first is to have the objectives of the project and each of the stakeholders clear and aligned. Secondly baseline information is necessary in order to have a standard against which to measure change. Many projects begin without such knowledge and have to reconstruct it after the intervention (which is never entirely satisfactory!). The question of control groups, which may be useful with regard to accuracy in measuring change and making comparisons, is raised by Dutta and Jagoe, Bromley and Bruce as an issue of ethics as well as expense, and deserves further discussion. Thirdly

the systematic collection of data; having a plan, allocating tasks and taking responsibility for analysing and reporting is emphasised.

Data collection is an art in itself. Should it be qualitative or quantitative? How much, how often and how large a sample size? These are questions that plague evaluators. Some years ago M&E manuals gave the impression that the only way to measure outcomes was in numbers: percentages of reductions (in say wood users) or increases in the number of improved stoves manufactured. Patton (2002:13) suggests that a pragmatic approach generally works best: if the quantities of wood or electricity households are using has to be measured, use a scale or a meter. If you want to know the calorific value of the wood versus the electricity, perform the necessary laboratory calculations, if you want to know what using wood and/or electricity *means* to households, how it affects them how they think about it and what they do about it, ask questions, listen to their stories, find out about the conditions and experiences. What has become clear over time is that numbers and stories may be equally subject to distortion and interpretation – neither is inherently objective, both can be usefully collected to test and prove a point. As Karabi Dutta explains in her article in this issue, **Monitoring and Evaluation: Experiences from the field,** the end result of an intervention is as much a function of user preferences and behaviour as the technical design of the improved cook stove.

Collecting information and writing reports should not be an end in itself. The purpose of M&E is as a tool for communicating what is happening in the project and, if necessary, deciding how to change it. The challenge is often to know to whom the information should be communicated. Different stakeholders have different interests in the project, and the power to alter plans, budgets or even to acknowledge that the project has not achieved its objectives, does not belong equally to all stakeholders. In addition energy for poverty reduction is rarely integrated into development policies, in part because it has been difficult to provide concrete evidence of the effect of access to modern energy. Monitoring and evaluating reports may provide such evidence, but to date what is lacking in our work is how to use monitoring and impact studies to fulfil their purpose. Even with improved M&E techniques, energy projects do not have impressive track records for being sustainable nor, ultimately, for reducing energy poverty at the required scale to meet the MDGs. But progress is being made and the articles in this issue demonstrate improved methods for reflecting on and doing monitoring. One of the fields in which there is growing experience is in monitoring efficacy and emissions from improved cook stoves. In **So You Finally Bought a Combustion Analyser!** Crispin Pemberton-Pigott from Swaziland takes the reader through the steps necessary to use a combustion analyser to its best advantage, while Ilse Ruiz-Mercado, Nick Lam, Eduardo Canuz, Gilberto Davila and Kirk Smith, in their article **Low cost temperature loggers as stove use monitors (SUMs),** introduce small, rugged, commercially available equipment that could be of significant interest to those involved with stove M&E.

One method that has been designed for use in monitoring development projects is Results Based Management (RBM), a key element of which is the results chain - a causal sequence for an intervention that stipulates the necessary steps to achieve the desired objectives. This issue's toolkit, **Six steps to Results Based Monitoring**, provides readers with useful advice on how to set up an RBM system by identifying all stakeholders, formulating the assumptions on which strategy is based, analysing risks and side effects, choosing observation fields, specifying indicators for measurement and finally implementation. Expanding on the theory of RBM is Verena Brinkmann's article on the application of the method, **Results based monitoring in GTZ cooking energy interventions: A Burden or a Benefit?** Here she highlights some of GTZ's experiences with the system, including positives and negatives, in a number of their stove programmes.

In their thoughtful article, **Monitoring and evaluation of health and socio-economic impacts: Key lessons learnt from the Household Energy and Health Project**, Kirstie Jagoe, Helen Bromley and Nigel Bruce advance the principle of training and collaboration in country teams as one of their key findings. The participants in the DEA workshop in Tanzania (see the GVEP International news pages) also identified building capacity to conduct monitoring and evaluation in the energy sector as a priority. A feasibility study has been conducted and the development of M&E skills will be one of the functions of the M&E facility to be established in Southern Africa with support from GVEP International and other partners.

But M&E should not end with project staff. There is a further challenge that Stephen Gitonga raises in his response to the scenario in this issue: M&E capacity should be developed among all stakeholders including the participants. The kind of capacity that would be valuable to communities would include understanding the demands and expectations of the implementers, and the ability to establish channels of communication with the implementers and funders during the planning and monitoring of the project. Ideally participants should develop their own set of targets to be monitored during the project and should define resulting downstream impacts. These deliberations would provide the basis for reflection on the project itself, and the chance for the participants to answer a key question: was the project well designed to alleviate poverty as they experience it? This may be a time consuming exercise: opportunities for such learning have to be created and the time and resources to do so are seldom available but such a process would contribute towards development and ownership of development in ways which current processes often do not (Annecke 2008). This is a topic we could take up in a special interest group.

Notes and references

[1] A Guide to Monitoring and Evaluation for Energy Projects from the M&EED International working group can be downloaded from the GVEP International website. Available via the @HEDON link below

Rai, K. 2005. Monitoring and Evaluation of the Impact of Renewable Energy Programmes: A Toolkit for Applying Participatory Approaches. IT Power: Hampshire

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Profile of the author

Wendy Annecke has a special interest in gender issues, low-cost electrification, renewable energy and biofuels. She has worked in Africa, India and Latin America in energy research, policy development and planning, specialising in participatory methodologies and qualitative research design. Wendy lives in Cape Town, South Africa and works as GVEP International's Monitoring and Evaluation specialist.

Theme

Monitoring and evaluation of health and socio-economic impacts: Key lessons learnt from a Household Energy & Health Project

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The evaluation of household energy programmes is a complex and demanding task, but also very important and worthwhile. In this article, a team from the University of Liverpool presents a range of issues that arose from a series of evaluation studies, together with an introduction to recently developed guidelines designed to address these issues and allow organizations to obtain the skills, knowledge and tools to evaluate the impacts of household energy programmes.

Figure 1 *Focus group discussion facilitated by a member of Development Alternatives field staff (Photo: Helen Bromley)*

In 2003, the Shell Foundation supported four projects which aimed to develop and disseminate improved stoves to poor biomass dependant rural populations using an economically sustainable approach. The evaluation of these projects was made a pre-requisite for funding. Teams from the University of Liverpool and University of California Berkeley (UCB) were commissioned to support the development organisations during the evaluation process. By 'development organisation', we mean NGOs, and other organisations/agencies that are leading the development and implementation of household energy interventions in low income countries.

The Liverpool team were responsible for the health, social and time-activity impacts evaluation using quantitative and qualitative methods, while the UCB team focused on the effects on indoor air quality and stove performance. The ultimate aim was for the Liverpool and UCB teams to use the experience gained from this work to develop and make widely available, standardised guidelines and protocols for the monitoring and evaluation of household energy programmes.

The findings from the evaluation studies have been reported to the Shell Foundation, and are currently being prepared for publication. In this article, the team from the University of Liverpool discusses the key lessons learnt and issues raised during this project (See Box 1). This is followed by a brief introduction to recently developed guidelines designed to address these issues and to assist organisations in planning evaluation studies, their role in the work, and in acquiring the skills, knowledge and tools to evaluate the impacts of household energy programmes.

What is the place of 'off the shelf' evaluation packages?

For the health and socio economic components of the evaluation of household energy interventions, the goal of developing a standard 'off the shelf' impact evaluation package seems to be neither appropriate nor realistic - for two main reasons.

Firstly, examining the impacts of a household energy intervention on health, women's lives, environment and income generation, etc., is a complex task that requires an in-depth knowledge of the community involved, including features such as culture, climate and environment. This creates a situation where, for example, a questionnaire that has been developed for use in rural

Box 1: Key lessons learnt

- A standardised 'off the shelf' package is not an appropriate or realistic method for evaluating the health and socio economic impacts of household energy interventions.
- With realistic aims, appropriate skills as well as support with monitoring and evaluation, the majority of development organisations can carry out useful evaluation studies
- Detailed evaluation studies should not be carried out until there is good evidence to show that the intervention meets the needs of a majority of prospective purchasers, and that they will be able to use it in the manner intended.
- Matching evaluation research to programme development is a challenge which needs to be recognised and allowed for at the planning stage.
- Different scientific perspectives are useful in understanding and validating the many complex ways household energy can impact on health and wellbeing.

India is unlikely to be useful in that form in an African or Latin American country until it has undergone considerable adaptation to the local setting. In this project, adaptations had to be made to questionnaires and focus group discussion (FGD) topic guides when they were used at different sites even within rural India to allow for differences in, for example, fuel types and the nature of food cooked each day.

Secondly, the aims of the organisation carrying out the monitoring and evaluation are typically diverse and require very different individual projects in order to achieve them (See Box 2). A standardised package would not provide the flexibility to allow for this range of aims.

However, it is also very important to use tried and tested methods where possible, and that there is also merit in retaining common features across studies where relevant to help with comparing the results of work in different countries. Therefore the study design should seek a balance between local relevance and the collection of data that is reliable and comparable with work carried out elsewhere.

What role should the development organisation have in the evaluation?

Development organisations involved in household energy work vary greatly in their aspirations and monitoring and evaluation expertise. However with realistic aims, appropriate skills as well as support with monitoring and evaluation, the majority can make an important contribution to the implementation of useful evaluation studies.

Unless the development organisation has extensive experience carrying out monitoring and evaluation they should seek to establish collaboration with a team, ideally in their own country, who have the appropriate experience and expertise. There are many advantages to collaboration with an organisation from the country where the study is taking place including, having a good understanding of the issues that influence household energy in that area as well as ease of access to the study site thereby keeping costs to a minimum.

The benefits associated with the development organisation taking a lead role in their own evaluation work (with research and planning support), as opposed to an outside research organisation carrying out the whole project, are related to the privileged relationship many development organisations have established with the communities that they work in. This allows them a level of access to homes, people and information that others may not be permitted (Figure 1). This relationship can work either way of course, since the relationship could also be a barrier to hearing people's true feelings or responses may unduly reflect messages that have been a core element of the development organisation's own promotional activity. However, the possible problems associated with this close relationship should not obscure the potential it offers for trust and honesty, nor lead to an assumption that an outside organisation would always achieve greater objectivity and accuracy in data collection.

Box 2: Example aims for a programme evaluation study

- Enable informed decisions on development of a technology, service or programme.
- Promote marketing through better understanding of how consumers' views affect uptake and use.
- Provide evidence of intervention impacts, for example on pollution, health, time, income generation, etc.
- Determine the overall effectiveness, and (with cost information) the economic efficiency of the programme.
- Obtain evidence to influence policy at local, national or international levels
- Meet the growing expectations of donors for evaluation, and improve prospects for future funding

Box 3: Steps prior to a substantive evaluation

- Testing within a laboratory situation (many development organisations have 'laboratory' type facilities that are used to test the stove designs).
- Field-based testing in a few households which are representative of the different cooking practices and fuel options typically encountered in the target population, to obtain feedback from users on acceptability and suggestions for changes. Assessment of the impact on IAP and fuel efficiency should also be established at this stage.
- Evaluation of the usability and community acceptance over a longer time period and across different seasons (especially where seasons has a major influence on stove use), in a larger number of households (in the order of 20-30, at least) typical of the target population.

Evaluation study planning must reflect progress with intervention development

What the development organisation hopes to achieve from their evaluation should be strongly determined by the current stage of development of the intervention, and the approach to delivery and adoption. There is potential for wasting valuable resources and time, as well as the goodwill of the communities involved, if an extensive evaluation is carried out only to find that the adopters are not using the intervention or have adapted it so radically to suit their needs that the intervention no longer does was it was designed to do. Therefore detailed evaluation studies should not be carried out until there is good evidence to show that the intervention meets the needs of a majority of prospective purchasers, and that they will be able to use it in the manner intended for reducing indoor air pollution and improving fuel efficiency. As part of the initial planning of evaluation studies, it is important to assess what is known − and not known - about the acceptability and use in practice of the intervention. By way of example, Box 3 sets out the stages of development and evaluation that should have been completed before undertaking a substantive evaluation of health, social and economic impacts of a medium to large scale sustainable stove programme.

Issues in the design of evaluation studies

Possibly one of the greatest challenges when building an evaluation study around a household energy development programme is to align the design and timing of the evaluation work to the timescale and geographical spread of the intervention adoption process. This requires careful planning at an early stage.

Another critical design issue is the use of comparisons groups. There is no question that the lack of a comparison group does place additional constraints on interpretation of the findings, particularly for health and socio-economic outcomes which are sensitive to many influences.

Figure 2 *Development Alternatives intervention: The two pot Anandi Stove (Photo: Nigel Bruce)*

The inclusion of a comparison group, while desirable, will increase the cost and complexity of the study. The feasibility of using comparison homes (whether these are randomised or more simply drawn from nearby, similar communities that do not have the intervention) has raised concerns about ethics and practice. Development organisations may be uncomfortable conducting surveys and other data collection (e.g. air pollution) among communities where they are not actively carrying out development work, particularly if this extends over the 12 months or more needed for a reasonable follow-up period.

The randomised allocation of homes to an intervention such as new stoves (Figure 2) and control (continued use of traditional stoves) is, from a scientific perspective, the most powerful method for studying the impacts of the new stove, but adds another problematic dimension. The disadvantage is that randomisation typically has to be very actively and closely managed, so that in practice it is very difficult to align this study design with the goal of evaluating a market-based programme, where adoption occurs (over time and geography) in a manner determined by the market and various other factors, such as promotional activity and credit facilities, designed to stimulate that market.

When planning an evaluation study, it is very tempting to 'arrange' the initial adoption for the convenience of the study logistics, and probably to an extent this is inevitable. It is however an issue that needs to be considered carefully at the planning stage, with acknowledgments about the consequences of the resulting decision. Thus, on the one hand, the study needs to be feasible and practical within a reasonable budget and timescale, so it may not be realistic to relinquish completely control over the rate and location of adoption. On the other hand, 'fixing' the delivery, pricing, etc., of the intervention in such a way as to ensure the study is relatively easy to carry out may easily lead to the results having limited relevance to programmes where the goal is widespread adoption through financially sustainable mechanisms.

Approaches to the evaluation of impacts on health and wellbeing

The mechanisms and pathways involved in the household energy impacts on health are wide ranging. These include clearly defined issues such as the effects of high levels of incomplete combustion products on the lungs, burns to young children from open fires, but also much less easily defined health consequences. An example of the latter would include the ways in which a cleaner, better lit environment for a family might increase opportunities for income generation and education, and thereby improve health in both the short and longer terms. As a result, different scientific perspectives that encompass epidemiological and qualitative research methods are useful in understanding these links and consequences. It was found useful to approach this apparently complex set of issues by considering the evaluation of health and wellbeing under four headings. These are shown in Table 1, together with a summary of the most appropriate research methods for each, and some of the implications for the expertise, costs and settings required.

The linkages between the varied effects of household energy interventions

Table 1 *Approaches to assessment of health outcomes of household energy interventions, methods and implications for evaluation studies*

Approach to health outcome evaluation	Appropriate research methods and implications
1. Health impacts of reduced indoor air pollution exposure on disease outcomes including childhood pneumonia, COPD, TB, birth weight, eye disease, etc.	Epidemiological methods are required, with strong study design (randomised trials if possible, or analytic observational − cohort and case control, and sufficient sample size, which in practice will typically be quite large). Studies require detailed and resource intensive case finding methods, including medical examination and investigations. Some of the disease outcomes develop after many years (COPD, cancer, TB, cataract) adding complexity and resource demands. Suitable intervention research settings may be difficult to align with the development of market driven dissemination, although may be more feasible with observational designs (e.g. case control, cohort) where large scale adoption is taking place.
2. Impacts on safety during the collection and use of fuel	Both survey-based questionnaires and qualitative research methods are appropriate and useful. Questionnaires need careful definitions and wording, but assessment generally does not require clinical (medical) examination or investigations. Qualitative methods are valuable for documenting and understanding how, for example, women are at risk during fuel collection, or how burns to children relate to daily activities. Assessment of the safety of interventions should be considered ethically important, and should not be assumed. Inclusion in evaluation studies in development project settings is feasible with appropriate research support.
3. User perceptions of the health effects of indoor air pollution and intervention impacts	Both survey-based questionnaires and qualitative research methods are appropriate and useful, with the latter being particularly useful for documenting perceptions and understanding of how these might (or might not) impact on householder's motivation to obtain, maintain and promote the intervention. It is important to avoid leading questions in both surveys and qualitative data collection, and to recognise the extent to which development activities by a development organisation may elicit responses to please. Inclusion in evaluation studies in development project settings is feasible with appropriate research support.
4. Indirect impacts on health, including through effects on time (especially of women), income generation, and the knock-on effects of other improvements to the home environment.	This is an important but complex area to study, requiring a mix of research methods ranging from quantitative surveys through to participatory and qualitative methods. These need to be combined with reference to theoretical models to help build up and understand inter-relationships, that is, how the various consequences of the intervention can ultimately affect health and wellbeing. While some aspects of these inter-relationships may be generally applicable (e.g. that increased availability of women's time will usually benefit young children's health and welfare), many aspects will be highly context specific. These issues should be considered, but require support and careful planning to ensure realistic objectives and relevance to the setting.

on health are complex by virtue of the many inter-relationships, variable timescales and influences which work in both directions, and so too are the methodological considerations involved in designing studies to demonstrate such impacts. Although the evaluation of health and wellbeing is demanding, it is important that this topic is discussed thoroughly in the planning stages of the study, so that appropriate and realistic objectives are set, suitable techniques chosen, and sufficient resources identified.

Conclusions

The evaluation of household energy programmes is certainly a complex and demanding task, but also very important and worthwhile. Evaluation requires careful planning in advance, taking account of the stage of development of the technology and approaches to promoting adoption, consideration of the information requirements of prospective audiences, and of other factors including local and national trends in fuel availability and use, and policy on energy and development. Development organisations should be encouraged to consider what role they wish to adopt in the evaluation study - whether to take a lead role, take a facilitative role with a collaborating partner from a research group leading the work, or whether to commission the work to an external agency and manage the contract. For some, there is much that can be gained for taking a lead on the development and coordination of the study, particularly if there is a desire to develop capacity for future evaluation work.

On the other hand, the demands and challenges involved must be recognised. The decision should be an informed one and arrangements should be in place for whatever level of research support is required, before embarking on the study. Finally, it is critically important that the evaluation work be appropriate to the stage of development of the intervention and only carried out with prior evidence of efficacy and acceptability. Larger-scale evaluation studies should not be planned until these preliminary assessments have been carried out and the technology and means of dissemination shown to be capable of meeting the needs and circumstances of the target population.

Guidelines

Guidelines written by the University of Liverpool team have been developed to incorporate the lessons learned from this work. They recommend the development of plans for evaluation work in close partnership with a support organisation that has experience of evaluation research in similar settings. The guidelines seek to adapt established research study designs and data collection methods to the particular circumstances and needs of the project to ensure they are appropriate to the experience, culture and expectations of the people concerned.

The guidelines may be downloaded via the *@HEDON* link below.

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Acknowledgments

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Dr Nigel Bruce is a Reader in Public Health at the University of Liverpool, currently involved in research and policy work on environment, health and development. He trained in medicine and public health, and has a masters degree and PhD in Epidemiology. He has contributed to work on the prevention of respiratory illness and other forms of ill-health through the improvement of household environments with research including randomised stove intervention trials in Guatemala, development and evaluation of sustainable household energy interventions in Africa, Central America, India and Nepal, and work on developing research prioritisation methods.

Theme

Focus

A request for information: The WHO systematic review of interventions to reduce household indoor air pollution.

The WHO, in collaboration with the University of Liverpool, is currently carrying out a systematic critical overview of activity, approach and impact of projects and programmes developing and disseminating interventions aimed at reducing domestic exposure to indoor air pollution. In order to ensure the search for programmes is inclusive we are interested in hearing from any organization which has in the past 10 years;

1. Implemented household energy projects and programmes which aim to reduce indoor air pollution and, have carried out monitoring and evaluation that includes some form of IAP measurements and/or personal exposure monitoring.

2. All substantial programmes (dissemination of over 10,000 units) promoting clean fuels such as LPG and biogas. These programmes do not necessarily require to have evaluated IAP and/or exposure measurement to be eligible for this review, on the understanding that there must have been an assessment of the extent to which the clean fuel is being used for main cooking, heating and other tasks previously carried out with solid fuels.

Please forward your information to Kirstie Jagoe at kjagoe@liverpool.ac.uk as soon as possible, and at latest by August 15th 2008. We look forward to learning more about your work.

Theme

Results based monitoring in GTZ cooking energy interventions: A burden or a benefit?

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How does the provision of access to clean and efficient cooking energy contribute to the improvement of economic, social, health and environmental living conditions in developing countries? It is a challenge to demonstrate the contribution of an intervention to development goals. For project teams this requires solid monitoring systems that address the development changes resulting from their interventions. Results Based Monitoring (RBM) is an international method for the monitoring of development results and serves a threefold purpose: to review the achievement of set targets; to steer and re-plan an intervention; and to finally create ownership among various actors. However, RBM also requires time, personnel and funds and so should not be forgotten when planning an intervention's activities and budget. This article reflects GTZ's experiences of applying RBM to cooking energy interventions.

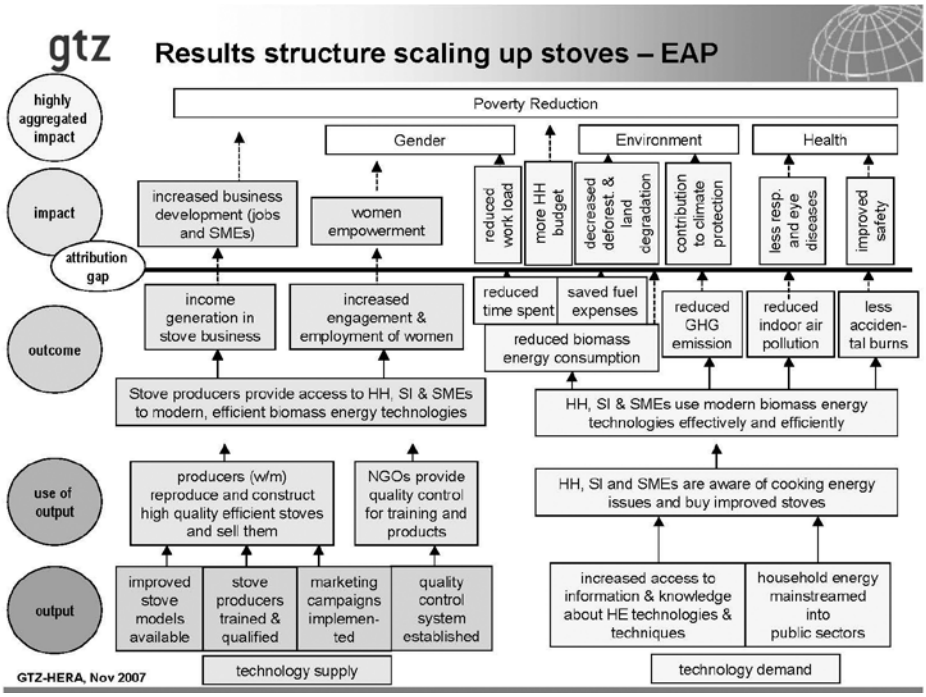

Figure 1 *Results Chains reflecting interventions to scale up efficient stoves in the GTZ EAP Uganda (Figure developed by GTZ HERA 2007).*

Results based Monitoring (RBM) is an international monitoring method developed and agreed upon by the OECD DAC[1] to monitor development results[2]. GTZ has applied RBM in all its development interventions since 2003[3].

A key element of RBM is the results chain. It describes the causal sequence for a development intervention with the necessary steps to achieve the desired objectives – beginning with inputs to implement activities, to generate outputs, the use of outputs by target groups, leading to the outcomes (the objective of development intervention), and finally contributing to impacts.

The results chains of the Energy Advisory Project (EAP) in Uganda are shown in Figure 1 and illustrate the scaling up of improved biomass stove programmes. Two main chains are described here: for stove supply targeting producers and traders; and for stove demand targeting users and the public sector. Along these results chains the main fields of observation are identified and indicators developed for RBM[4].

Outcome based approach and EnDev monitoring

The target of the Dutch-German partnership programme "Energising Development" (EnDev), implemented by GTZ, is to provide 3.1 million people with access to modern energy services between 2005 and the end of 2008. The activities of Energising Development aim at the reduction of poverty by providing access to modern and clean energy services to poor households, small enterprises and social institutions with cooking, lighting, and heating energy as well as small scale power generation in Africa, Latin America and Asia[5].

Until December 2007, the EnDev cooking energy interventions were implemented in 16 different countries, 11 of them in Africa, providing more than 2.5 million people with access to efficient and clean cooking technologies. Every six months the projects report the achievement of the outputs of their activities, the use of outputs by target groups and outcomes, according to their project-specific results chain. This requires a solid monitoring system for each project.

For the outputs of the EAP Uganda work, monitoring was undertaken of a number of trained producers, the quality control system, marketing events, as well as the provision of information to and the knowledge of consumers. With regard to the use of outputs, the production and sales figures, quality and the purchasing awareness of households (HH), social institutions (SI) and small and medium enterprises (SME) were monitored. Finally, in order to assess the outcomes, the EnDev monitoring system measured the number of people with access to modern and clean cooking energy by checking sales figures and construction, as well as correct usage by HH, SI and SME.

Some key outcomes for any intervention are reduced levels of biomass energy consumption and indoor air pollution. While technologies can be selected according to their performance, by testing for efficiency and emissions reductions in both the laboratory and at the project site, a more critical factor is the performance when used in the "real life" conditions of the HH, SI and SME. This aspect is strongly related to the users' ability to achieve the desired operation and so they are given kitchen and firewood management training as part of each cooking energy intervention. GTZ projects also carry out testing in order to monitor performance at the household level. Further outcomes are not monitored as part of biannual reporting, but are nonetheless important for EnDev

donors and so procedures for Impact Assessments have been developed by the EnDev monitoring team, including GTZ HERA[6].

MDGs & Impact assessment

The EnDev cooking energy programmes stimulate impacts that contribute to the Millennium Development Goals (MDGs). Even though these impacts cannot be attributed directly to a GTZ intervention, and thus monitored, a plausible hypotheses on the projects' contributions to impacts and MDGs needs to be provided.

At a suitable period after implementation, when outputs have been provided and used, GTZ carries out Impact Assessments (IA) on the EnDev projects. In these IAs, cooking-specific outcomes such as generated income, women engaged, time and expenditure saved, indoor air pollution, and accident reduction are monitored and compared with the baseline. These outcomes can then be directly linked to a project intervention and their contribution to the achievement of impacts such as increased business development, women's empowerment, decreased deforestation, decreased respiratory and eye diseases, and finally to the MDGs, can be assessed and plausibly demonstrated.

Impact Assessments have been carried out in EnDev interventions in Uganda, Malawi and Ethiopia. The findings are impressive. About 300,000 Rocket Lorena stoves are in use in Ugandan households. Families save 3.1 kg of firewood per day or 1.1 tonnes per year, which translates into annual savings of 26 EUR (euros), equal to an extra month's pay. The IA in Malawi demonstrated that households are using the saved money mainly for household matters (50%) and food (30%) and that they use the saved time mainly for housekeeping (54%) and farming (31%). In Ethiopia 170,000 households are using Mirt stoves for Injera baking. According to consumer ranking, fuel economy is the most important impact, followed by protection from fire/heat, reduced smoke, speed in cooking and better quality Injera. The households reported a saving of 30 EUR per year, with the money being used for food, electricity and education[7].

Further studies are being implemented in EnDev interventions in Kenya and Bolivia. For these IAs different tools and procedures were developed. The following procedure reflects the current IA in Kenya, which started with the formulation of the project's results chains (Figure 2).

The project strategy was analysed and relevant assessment fields for the IA were identified along results chains by the project team and consultants. Result-Indicators were formulated[8] and then converted into questions for the IA tools. Districts, villages and target group representatives were chosen according to a set of selection criteria. Different tools were applied: an interview guideline for local authorities, PRA[9] tools for women's groups and questionnaires for selected users (HH, schools and restaurants) and producers. Interviews were carried out by selected and carefully trained enumerators, in most cases local students (Figure 3).

For the final analysis and assessment, a consultant team was employed. Where feasible, consultants can support the whole process of IA, beginning with definition of crucial indicators and questionnaire development. For the data analysis and assessment a set of guiding questions was made available by GTZ HERA. A high degree of participation of project staff, counterparts and local NGOs, students etc. is helpful and a matter for both capacity development as well as for the creation of ownership amongst all stakeholders. In Kenya, agricultural officers were excited about

Figure 2 *Results Chain developed for Impact assessment by the PSDA Kenya Project team (Photo: The author)*

Figure 3 *Impact Assessment interview in a village in Kenya. (Photo: GTZ PSDA Kenya)*

the enthusiasm of the target beneficiaries with one student who conducted the interviews even starting his own stove business. Such examples show the secondary effect of these monitoring instruments, which might not be expected, but are ultimately beneficial.

Participatory Impact Assessment – an experiment?

In some of the countries where ProBEC operates, IA interviews have been conducted by local stove artisans. In 2004, the stove promoters and producers from Malawi, Mozambique, Zimbabwe, Zambia, Tanzania and Kenya were invited to a ProBEC Workshop on 'Experience Exchange on low-cost Clay and Ceramic Stoves'. For workshop preparation and a better understanding of impacts, these participants were asked to carry out IAs themselves in the form of a short impact questionnaire provided by ProBEC. During the workshop, when discussing the results of the IA with the producers and promoters, some very interesting feedback was given. For many it was the first time that they had talked to their customers about stove usage, difficulties, problems and demands.

The stove producers, builders and promoters considered this assessment as so beneficial that they passed a resolution asking for training in monitoring and IA as part of their regular training programme. By asking the questions themselves they had realised that this increased their awareness of stove quality and improved their marketing skills, and thus their access to customers. In this sense participatory IA can increase the ownership of stakeholders and be complementary to IAs, but one of its limitations is information bias.

Cost-Benefit-Analysis on the basis of IA data

In two other cases IA results provided the starting point for a Cost Benefit Analysis (CBA) of cooking energy interventions. A CBA of the EAP in Uganda demonstrated the economic value of using the Lorena Rocket stove for individual households as well as for the public sector. Similarly for ProBEC Malawi, where more than 4200 institutional Rocket stoves are installed in social institutions like schools, hospitals and prisons, savings of between 12-38% of total catering budgets were made due to avoided firewood costs.

Experiences – pros and cons

Experience shows that the establishment of a solid RBM system is helpful for project management as it makes it possible to assess if the outputs offered are really used, and if this use really leads to an outcome relevant for development. If necessary, the project strategy can be adjusted, additional activities included or further key stakeholders involved. Additional RBM is of use for evaluation purposes and, as has been shown with some examples, for the creation of ownership. The major purposes of RBM are therefore the steering of interventions, accountability and contributions to internal learning and knowledge management.

However, the remaining challenges should also be mentioned. It is important to realise that RBM is not an exercise that can be fully delegated to a consultant who occasionally visits the project. As a management tool RBM is the responsibility of the project manager as well as the whole project team, and as such needs to be included in project as well as budget planning.

RBM is based on a complex model and so creates a lot of discussion among M&E experts. This means that capacity is required for its implementation and all relevant personnel should be well trained and skilled in the subject. In certain situations it makes sense to involve external consultants in RBM, especially when an independent view is required from a third party. This person should have expertise in qualitative and quantitative M&E methodologies, a minimum knowledge about cooking energy, experiences with statistical and analytical tools, and finally, adequate time. Experienced enumerators are helpful for larger samples.

The interpretation of analysed data should be a participatory step and include both consultants and the project team, so that members are able to comment on analysed data and have a greater ownership. Following data interpretation, recommendations should be developed, discussed and agreed upon. A final celebratory step can be the presentation of results and recommendations to stakeholders but care should be taken to prepare this properly by inviting relevant stakeholders to celebrate their own results. This can be a good motivational basis for further activities.

Way forward for GTZ HERA

RBM is a management strategy focusing on performance and the achievement of outputs, outcomes and impacts. The existing RBM system for cooking energy interventions will be further applied, findings will be made available and tools developmed. HERA will continue to contribute to international working groups like the GVEP M&EED, so that we can learn from each other's experiences.

For more information please contact GTZ HERA (hera@gtz.de or directly Verena. Brinkmann@gtz.de)

Notes and references

[1] For further reading see the World Bank's 'Ten Steps to a Results-Based Monitoring and Evaluation System' available via the @HEDON link below

[2] For advice on setting up an RBM system, read the GTZ/Melanie Djedje toolkit on "Six steps to Results Based Monitoring (RBM)" in this issue of Boiling Point.

[3] The GTZ-Community on Results-Based Monitoring and Evaluation. Link available online @HEDON

[4] Read the M&EED Guide which may be downloaded from the online version of the article @HEDON. This Guide proposes a step-by-step approach to building project-specific M&E procedures. Intended for energy access projects that don't already have donor or stakeholder determined M&E methods, the guide was developed by the International Working Group on Monitoring and Evaluation in Energy for Development (M&EED).

[5] For further information about the Energising Development programme see the online link @ HEDON below

[6] In the EnDev Guide for Impact Assessment, available after May 2008.

[7] Reports and tools are available at GTZ HERA; some are available via the @HEDON link below

[8] A list of exemple results indicators is available in the HERA IA tools.

[9] Participatory rural appraisal (PRA) falls under the family of participatory approaches emphasizing local knowledge and enable local people to make their own appraisal, analysis, and plans.

Profile of the author

Verena Brinkmann has a Masters degree in Environmental Sciences and has been working for GTZ since 2003. She was working in Malawi and South Africa on Impact Assessments in different GTZ projects. Currently she is employed by GTZ's Household Energy Programme HERA and one of her main tasks are M&E in interventions in Southern and Eastern Africa as well as Latin America.

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Theme

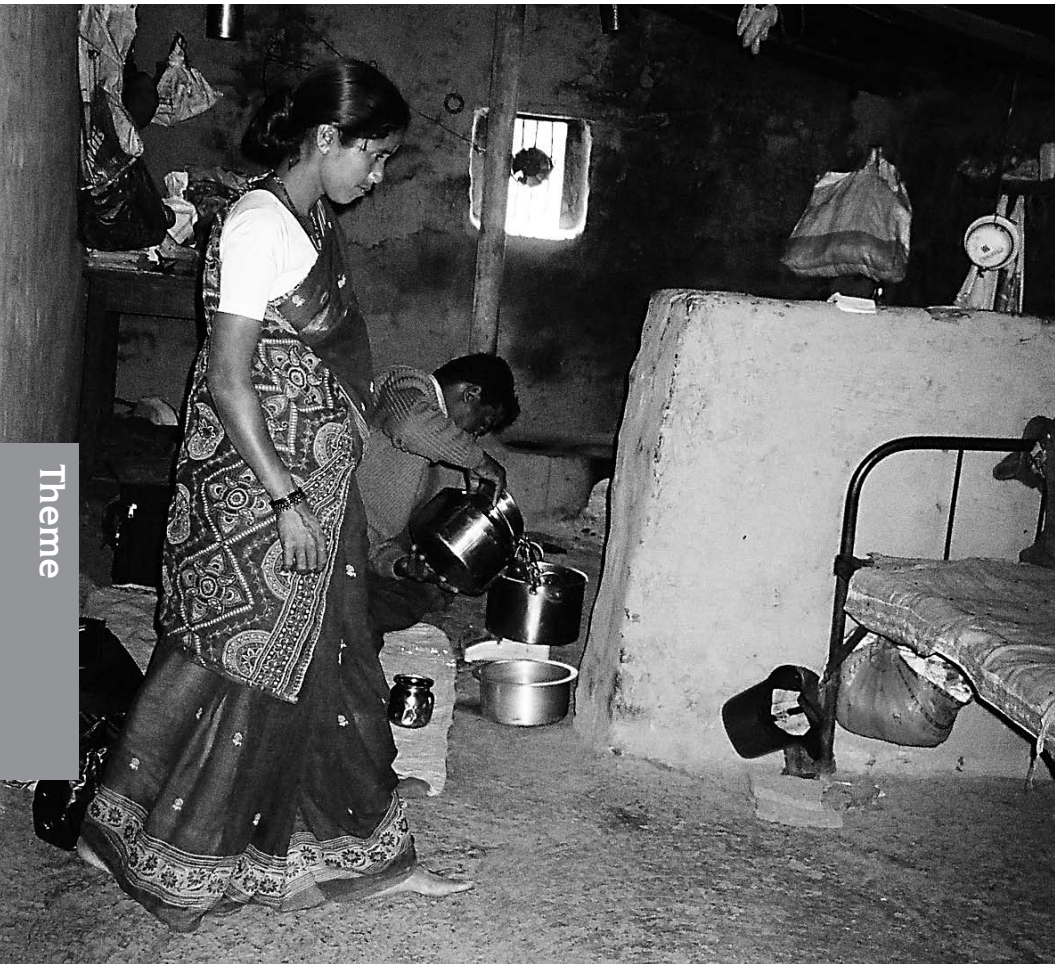

Figure 1 *A field officer installing IAP monitors (photo: the author)*

Monitoring and Evaluation: Experiences from the Field

Author
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Despite the challenges, the importance of monitoring and evaluation remains critical in verifying the benefits of improved stove designs and their use. Over the last eight years the Appropriate Rural Technology Institute (ARTI), has been engaged in the Monitoring and Evaluation of improved cook stove programmes in various rural and urban settings. ARTI's Indoor Air Monitoring team usually follows the 'before and after' study design and the team has three permanent members who conduct all the qualitative studies. The rest of the monitoring team is recruited as per the demand of the study. A brief account of the study designs and methods adopted by the ARTI team are discussed in this article, along with their experiences in the field.

Poor households currently relying on biomass fuels are unlikely to switch to cleaner fuels in the near future due to a lack of affordability. There is therefore a critical need for interventions that effectively reduce exposure to high levels of indoor air pollution (IAP), including the continued development of improved cook stoves (ICS) that substantially reduce emissions, reliably improve indoor air quality (IAQ), and improve combustion. To serve this need, as well as other associated concerns in rural development, the Appropriate Rural Technology Institute (ARTI) was founded by a group of scientists and social workers in 1996 in Maharashtra, India. ARTI's mission is to serve as an instrument of sustainable rural development through the application of scientific and technological knowledge.

The first IAQ monitoring and evaluation (M&E) project conducted by ARTI was in the year 2000. The project was sponsored by MNES (Govt of India) and in the following eight years the Indoor Air Monitoring team of ARTI has worked extensively in rural Maharashtra and also in the urban slums of Kolkata in India. They have also undertaken M&E on an improved stove programme in rural Bangladesh. At present the team is involved in the monitoring and evaluation of the woodstove being developed by Philips, the consumer products company. A more detailed list of M&E projects conducted by ARTI can be found via the *@HEDON* link below.

The monitoring and evaluation of improved stoves consists of two phases. In the first phase, laboratory based stove performance tests such as the Water Boiling Test (WBT) are conducted during the design-stage of the improved stove. In the second phase, field tests provide feedback on the performance of stoves in the hands of actual users in their own kitchens. This can be extremely useful, particularly at the early stages of stove dissemination. After the improved stove has been in use for some time it is beneficial to observe long-term changes in user behaviour in order to gain an understanding of how the stove performs as it ages. Poor field performance at any time can indicate faults in the construction of the stove and poor communication between improved stove designers and users.

Successful study design

There are basically 3 study designs for determining the reduction in IAP in households:

1. Cross-sectional
2. Before & After
3. Before & After with Control group

The cross-sectional design requires the simultaneous sampling and monitoring of a large number of houses for both traditional and improved stoves, in the same geographic area. Since sampling needs to be carried out in houses that may not have necessarily received improved stoves, it creates many social and practical problems during monitoring. However, if the project period is limited then this design can be adopted.

In all ARTI projects, the study design adopted was the "before and after" pattern, except with the Shell Foundation project where a 'before and after with control" study design was used. The latter method is very helpful if health parameters are part of the work, as study periods are often short term (1 to 1.5 years) and the stoves are usually installed in the latter half of the study. As health benefits due to an improvement in indoor air can take a long time to become visible, it becomes difficult for

Figure 2 *Key informant interview with a participant (photo: the author)*

a medical practitioner to understand a change in participants' health within this short span. But if the control group is there (people who were never exposed to an improved stove), then a comparison may be made between the 2 groups that gives a greater confidence in the results.

The more simple 'before and after' study design will still provide a very good comparison of the improvements (if any) which may have been achieved by the introduction of improved stoves in the rural kitchen. It is an entirely field based study conducted in order to understand the actual performance and acceptance of the stove in the rural community. Compared to the other two designs this method requires a smaller number of households to be monitored but needs a longer sampling period. It is also not very helpful if a health study is part of the research, for reasons given above.

The quantitative studies which are conducted in the field under the before and after study design are:

Stove Performance Test

This is a WBT conducted with 2.5 litres of water as this mimics most of the cooking patterns in South East Asia (E.g. boiling rice or noodles). The aim is to understand the performance of the stove in the field and whether the stove provided by the manufacturer is as per specification.

Emission Testing

Particulates and Carbon Monoxide (CO) are monitored by placing special equipment in the kitchen room for a period of 48 hours. The electrical monitors are installed at a specified distance and height away from the stove in order to capture the actual emissions and effects of ventilation for a stove in normal daily use. Emissions are also measured during the Water Boiling Test.

Kitchen Performance Test

This is a 7 day test where a record of the total fuel used by the cook per meal is recorded, in addition to the food cooked and the total number of men, women and children present for the meal. This provides a more realistic stove fuel consumption and the comparative 'before and after' study gives the researcher a clearer picture of the fuel saving achieved by the improved stove. It also makes it easier to convince cooks about the fuel saving benefits of the improved stove.

Controlled Cooking Test

This test can be performed in the laboratory or field, with ARTI preferring the latter. The test involves cooking exactly the same meal, with the same cook, on both the traditional and improved stoves. A record is kept of the time taken, the measured amounts of food and the total quantity of fuel used to cook the meal. This particular test provides a very clear idea of the comparative improvement that has been achieved by the improved stove, in terms of savings in time and fuel as well as the ease with which each item can be cooked on each stove.

Methods – past and present

For ARTI's first project, two villages were selected about a 2 hour drive from the office by car. In total 8 project staff were involved but with no specific duties for each member, except for the project co-ordinator who directed activities. So each day two people were selected to go to the village and remain with the monitoring instruments as it was too risky to leave them unattended. The project staff were provided with survey questionnaires with which to interview households and data entry and monitor preparation was the project coordinators responsibility. The project did experience some problems as too many people were involved and there was a lack of specific responsibilities, which made it difficult to manage the process well. When combined with a project coordinator who was only able to visit site occasionally, there was a lot of confusion and although the project was completed it was unplanned and chaotic.

Based on the lessons learned from the first project and subsequent guidance from by Dr Kirk Smith, Dr Nigel Bruce and their team members under the Shell Foundation project, we have since developed a good monitoring plan.

Planning and designing

The first step is to decide on a study design and sample size based on the duration and budget of the project. Only after several visits to the area are villages or study areas selected and the cooperation of the Local Self Governing body of the village is sought before progressing. They are requested to provide a good, reliable field worker who will help with the day-to-day work. After this households are selected and only those who wish to take part are included in the survey. All the households selected for the study should share some basic common criteria. Details of study design and household selection are available in *Energy for Sustainable Development*, Vol XI No. 2 June 2007 'Design Considerations for field studies of changes in indoor air pollution due to improved stoves (pp71-81).

For monitoring and evaluation ARTI have a core staff of three people, consisting of 2 technicians, who have extensive knowledge of rural culture and social habits, and a project manager who is involved in the village and household selection process. The core staff look after the quantitative study in the field. For shorter-term projects, involving typically 1-2 villages, one field worker is appointed per village. For larger scale projects an extra field officer is made responsible for each study area of 3-7 villages, and their responsibilities include conducting awareness raising programmes, arranging for stove distribution and installation, assisting the field workers in data collection, and processing data before sending it to the programme manager. The field officer is also expected to arrange focus group discussions (FGD) and key informant interviews and also to trouble shoot any problems with the improved stoves.

The data entry work is usually outsourced and ARTI arranges for an expert from outside the institute to conduct the FGD's.

The role of the Project Manager is varied and includes the daily monitoring of staff activities and the on-site supervision of IAP monitoring and stove performance tests. The project manager usually travels to the villages to accompany the field workers 4 days a week, in order to talk to participants and resolve any outstanding problems which they may have. One day a week is kept for desk work, communications, data checking, preparation of reports etc. Other than this at least 1 hour every day is devoted to reviewing the days work and planning that of the next. Data analysis and preparation of the project report are entirely the responsibility of the programme manager but these activities are done after completion of the field work.

Daily informal meetings are held with the core staff to plan activities and resolve any problems, depending on feedback from the field staff who are in constant telephone contact. To save time these meetings are often held while travelling. The field visits are planned so that each study area is visited by core staff at least twice a week, helping to quickly resolve smaller problems such as searching for alternate houses and stove damage. A detailed weekly and monthly calendar of activities is always planned in advance with work being assigned to each staff member, keeping in mind all other work, social functions and holidays. Work is planned on a weekly rather than daily basis to allow for the invariable last minute interruptions to be more flexibly integrated into the schedule.

The instruments used for ARTI project activities are easy to use and sturdy. For current IAQ monitoring the UCB particulate monitor and the HOBO CO monitor or Drager CO Dosimeter are used. In all these instruments there is a data logger so manual data collection is not required and, since the instruments can be pre-programmed, nothing more needs to be done in the field other than instrument placement. The weighing scales, digital wood moisture meter and thermometer used when testing are battery powered digital units which allows for easy reading and use away from grid electricity.

However, in spite of such meticulous planning many problems will still have to be faced:

1. The field officer fails to visit their assigned villages for a period of weeks. A similar case happened to ARTI and this was prevented by regular visits from the programme manager.
2. The field worker is not efficient or does not have the influence in the village as previously thought. The only solution is to change the field worker since this is one of the most important project roles.
3. Participants refuse to cooperate in spite of an oral agreement. New participants have to be selected immediately and the field worker's knowledge of the village helps in quickly locating a suitable household.
4. Participants sometimes tamper with the IAQ instruments. In one extreme case a lady kept the UCB monitor inside a flour tin! Instruments can be an obstruction in the kitchen and so the field worker can inspect the equipment and deal with any problems in their daily visits.
5. The stove model selected by the participant is wrong. This may happen if a participant selects a chimney model in a high rainfall area or a non chimney model in a poorly ventilated kitchen. Field staff can try and change the participants' choice.

Conclusions

A well-designed improved cook stove programme can provide multiple benefits for end-users. However, simply introducing an improved stove does not guarantee that positive outcomes will be achieved. Ultimately the stoves introduced into people's kitchens will have to be adopted into their daily cooking practices and as such the end result of an intervention is as much a function of user preferences and behaviour as the technical design of the ICS. This is where the monitoring and evaluation of indoor air quality and stove performance plays such an important role.

Profile of the Author

Karabi Dutta is the Project Coordinator at Appropriate Rural Technology Institute (ARTI) in Pune, India. She primarily works on household energy and health projects, with a special interest in Indoor Air Pollution. She was introduced to this subject about 8 years ago, and since then it has developed into a passion and a mission to spread the awareness about Indoor Air Pollution and Health.

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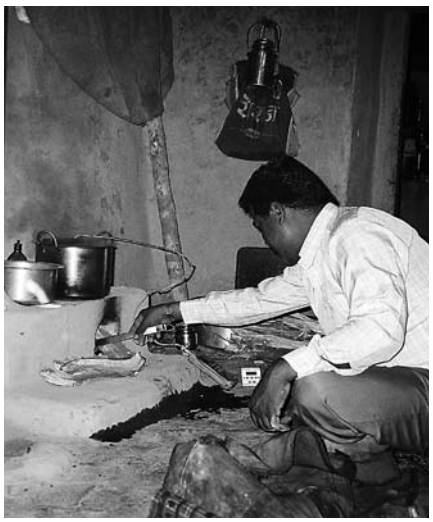

Figure 3 (above) *A water boiling test in the field (photo: The author)*

Figure 4 (below) *The monitoring team travelling to the village (photo: the author)*

Theme

Stakeholders have different interests: The difference between theory and practice of M&E energy interventions

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Monitoring and evaluation (M&E) experts suggest that agreement among stakeholders on project objectives, a baseline study and a programme of consistent data collection, review and analysis are the cornerstones of good practice. This article describes an electricity to LPG intervention where few of these components were in place, and how a subsequent evaluation was implemented. Issues related to stakeholder perspectives of success and baseline information are explored. The purpose is to share the experience and highlight the mistakes made in the hope that this will contribute to developing more transparent and critical M&E procedures.

Energy transition or fuel switching is something most energy for development practitioners are interested in, and many of our energy interventions are aimed at moving users from one fuel and appliance to another, for example from a traditional 3-stone fire to a fuel-efficient improved stove, or a switch to hydrocarbon fuels such as Liquid Petroleum Gas (LPG) or even to electricity. While methods for monitoring and evaluating the transition to improved stoves have been developed, and some studies on switching from biomass to LPG are also available, the transition observed in this report is unusual in that the objective was to switch low-income households who used electricity for cooking to instead use LPG. This was in order to reduce the use of electricity which was in short supply as any energy source may be. The principles of the transition, the pitfalls of assumptions made, the monitoring and the manner in which the socio-economic impact was evaluated are largely similar to any other energy intervention and process and will, I hope, be generally applicable. A full version of the report is available (Annecke et al 2008).

One of the purposes of this paper is to use the electricity-to-LPG case study to highlight the differences between the theory of M&E and the application of good practice on the ground, and what happens in-between. There is space to raise only two main issues: those related to the stakeholder perspectives of success and baseline line information. Another objective is to share the experience and highlight the mistakes made, in the hope that this will contribute to developing more transparent and critical M&E procedures.

Context

For many years Eskom, the South African electricity utility, was one of the largest and cheapest generators and suppliers of electricity in the world. But since 2000 both generation and distribution have come under severe pressure and by the end of 2005 power supply could not keep up with demand. In Cape Town extensive electricity blackouts during February 2006 drew sharp criticism from all consumers and necessitated the development of a 90 Day Recovery Plan (Provincial Monitoring Team, 2006). This plan included aggressive energy saving measures for medium-high and low-income households, but the study is concerned only with the low-income intervention. The assumption was that household demand for heating and cooking from 6pm-9pm every evening resulted in a peak demand and put the electricity supply system at risk (Howells et al, 2005). The objective was to limit low-income households from cooking with electricity during peak times with the target of saving 50MW.

To this end an intervention was designed whereby 100,000 one or two-plate electric stoves (the type most commonly used by low-income households) would be exchanged for 100,000 LPG two-burner stoves with one full 5kg cylinder of gas and four colour-coded coupons per household (the coupons were to be redeemed when the cylinder was refilled for four consecutive months), an instruction pamphlet and individual safety demonstrations. The gas stove and all its attachments were fully subsidized by Eskom and no payment was required.

Due to the urgency of the situation, and as agreed with Eskom, within six weeks of the decision, the gas companies dispatched staff to the townships, including Khayelitsha where this evaluation study was conducted, to implement the programme's activities. The intended results chain is summarised in Table 1 (Indicators, primarily in terms of numbers of stoves exchanged and satisfactory results of the safety campaign, are not included). A sketch of how a more detailed results chain may look is available via the *@HEDON* link below.

In brief, almost 100,000 LPG stoves were handed out, so the hardware exchange targets were met, and LPG sales

Table 1: Intended results chain

INPUT	ACTIVITY	OUTPUT	OUTCOME	IMPACT
Funding for staff, education materials, infrastructure for collection of old stoves, disbursement of new LPGs	Intervention information campaign Organisation for taking in two- plate electric stoves (paper work/storage) Have LPG cylinders and vouchers to exchange	People arrive at venues with documents and electric stoves People take LPG stoves home and use them	Increased awareness and use of LPG in households Cooking time changes	LPG market created Peak period electricity use decreased
	Train officers for education and safety demos	People shown safe use of LPG	LPG used safely and correctly	Willingness to use LPG-fear of LPG overcome

increased but peak demand remained largely unaffected. This was largely due to the way in which the project was implemented.

Stakeholder objectives

Monitoring and Evaluation (M&E) methodologies suggest that one of the first steps in setting up a monitoring system is to clarify that the objectives of each of the stakeholders are clearly defined in order to measure the degree of impact and success. In doing this it became clear that the key stakeholders in this exchange programme had different interests in the results. Eskom wanted to assess whether such an intervention would lead to sufficient reduction in peak demand to make their substantial contribution and support (both financial and infrastructural) worthwhile. The Liquid Petroleum Gas Safety Association of South Africa (LPGSASA) got involved in order to find out whether such a large scale intervention would create the impetus for a market for LPG in Khayelitsha, and the Department of Minerals and Energy was concerned about how 'the community' would accept the exchange programme as a solution to electricity shortages. The intended beneficiaries were not consulted prior to the implementation, so no-one knew what their expectations or objectives were. All stakeholders were interviewed during the impact study and while the different objectives were not mutually exclusive, having a common understanding of each stakeholder's indictor of success would have assisted in more cordial relations, the sharing of information and a more sustainable solution for each.

A baseline study

Another critical component of M&E methodologies is a baseline study to provide status quo information from which to measure the extent of change. There was no baseline study conducted except that the utility knew the peak demand for Cape Town (but did not appear to disaggregate for Khayelitsha at this stage). The evaluators used the load information for different areas to determine peak demand from Khayelitsha, and researched the number of electricity users both in the specific and general area.

Statistics South Africa (StatsSA) collects regular but limited primary data on household energy use. Their statistics over ten years show an overall increase in using electricity for cooking, so that in 2006 88.9% of all households in the Western Cape used electricity for cooking (StatsSA, 2007). Finally the perceptions and memory of participants in the focus groups and the respondents to the questionnaire were probed as to past and current cooking times and changes that had taken place.

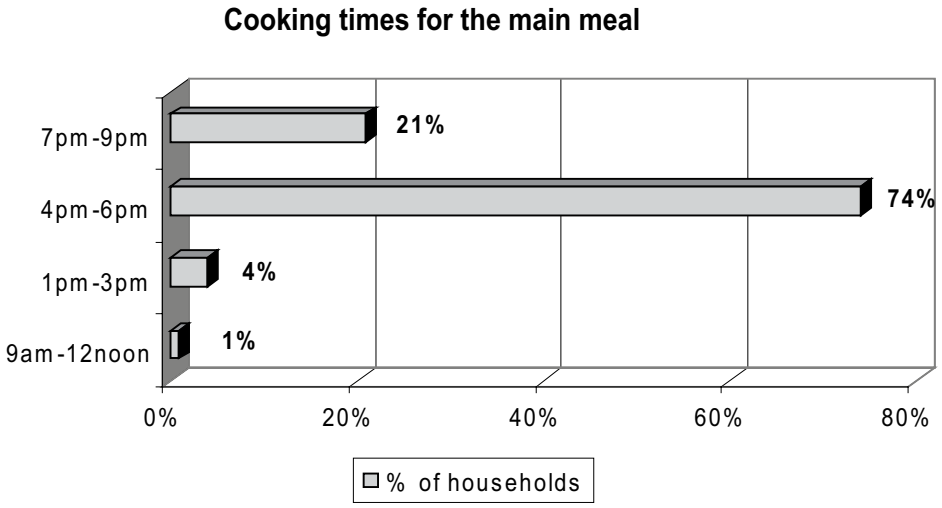

Figure 1 *Cooking times for the main meal in low-income households*

Eskom was correct to assume that over 80% of connected low-income households in Khayelitsha used electricity for cooking, but what they did not verify was cooking times. The demand analysis and impact study showed that the majority of low-income households cooked their main meal of the day between 4pm and 6pm when they had electricity (See Fig. 1). The system peak demand time is between 6pm and 9pm. Thus cooking is largely complete in low-income households before middle and high income households start consuming energy for their evening use. Checking this assumption may have led to re-designing the intervention.

Issues arising

Not having accurate baseline knowledge about cooking times was the first mistake that could have been avoided. Then, once the programme was running, extraneous factors intervened which made it less than viable. One unforeseeable factor occurred two months into the intervention, in July 2006, when it became evident that availability and pricing of LPG would threaten the sustainability of the programme. Internationally the price of crude oil began to skyrocket and, as LPG prices subsequently rose, cooking with gas became more expensive than cooking with electricity. It soon became apparent that LPG would be unaffordable without a long term subsidy which had not been part of the design.

In addition planned and unplanned shutdowns of refineries around the country caused a shortage of LPG (arguably foreseeable). This meant that those households that had handed in their electric stoves could not take advantage of the electricity supply when it came back on stream, and could not get LPG because the supply had run out. These households were thus stranded with no energy services. Many resorted to kerosene or wood use.

Monitoring conditions and accommodating change

One of the purposes of monitoring is to track the progress of a project and if necessary decide how to change it so that errors are not continued or multiplied. Following this practice, the changes in extraneous conditions were observed, and accordingly adaptations were made in the implementation. About half way through Phase 1 it was decided that two-plate electric stoves still had to be brought to the exchange point but owners were allowed to take them home so that they could use LPG or electricity as it was available.

Impact of the programme

One evaluation was conducted immediately after the implementation and one a year later. Standard data collection methods were used including interviews with key stakeholders in the utility, government, the LPG industry, sellers of LPG in the townships, participating and non-participating households and small and micro-enterprises (SMEs). The latter three groups also participated in focus group discussions and 282 households and SMEs completed a questionnaire (Annecke et al 2008). Only the issues raised above, the key assumption about cooking times and stakeholders' expectations are addressed here.

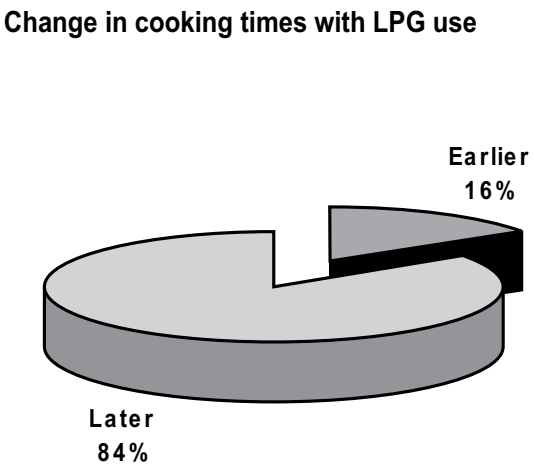

Figure 2 *Change in cooking time with a switch from electricity to LPG use*

Cooking times

It was important to track cooking times since this is the most energy intensive activity in low-income households and we wanted to see if these had changed with the introduction of LPG. The switch to LPG precipitated a later start to cooking times for 84% of the households surveyed (Fig. 2), the reason they gave was because cooking by gas is quicker. If households revert to electricity but maintain the habit of cooking later, this will mean that the LPG intervention will have had an unintended and adverse effect on the peak demand by nudging all households into cooking with electricity at the peak demand times between 6-9pm.

Each of the stakeholders had a different perspective of the success of the project.

Customers' perspective

The idea of exchanging a two-plate electric stove for a new gas cylinder and a two-burner stove caught the imagination of the people of Khayelitsha. No-one wanted to miss out on the idea of something 'for free'. Most people (91% of the respondents) received the correct information and understood exactly what was involved. Queues formed early in the mornings at exchange venues. There was disorder in the ranks as people pushed and shoved to get stoves, security guards and the police were called in to mange scuffles. Those unable to join the queues tried to find other ways of getting a gas stove. Respondents strongly criticized the LPG suppliers for arriving at the venues late in the mornings and not having enough stoves and vouchers for everybody. They suggested a fairer model for distribution and continued subsidies. From the perspective of those who received LPG stoves and could afford to go on using them, this intervention was a success.

Utility's perspective

Only minor savings were made during peak time because the cooking peak with electricity in Khayelitsha occured earlier than anticipated. This could have been determined from load studies or a quick baseline study. On the other hand the energy efficiency messages were successful, with 81% of respondents consciously attempting to save electricity through reducing the amount of water boiled, turning off appliances and using fewer lights for shorter periods of time. The utility was disappointed in the results and in the unreliable supply and rising price of LPG. They withdrew from the programme after Phase 1 (nearly 100,000 LPG stoves had been handed out).

LPGSASA's perspective

The intervention was successful in creating a market for gas where there had been practically none. Stockists were trained and inroads into the market were made. A year later 89% of households who had received LPG were still using them, albeit irregularly. The LPG companies did not put any money into continuing the programme, but have maintained stockists in the township. It remains to be seen whether, with the rising prices of LPG and electricity, the poor are able to continue to use modern fuels.

DME's perspective

The large scale LPG exchange programme in the Western Cape highlighted the need for the regulation of the gas price or at least agreements for the pricing or subsidy for low-income households, as well as agreements on cheaper cylinders to be concluded and decisions about infrastructure for importing gas to be made. These are policy decisions that urgently need to be addressed.

The success of this intervention depends very much on the perspective of the stakeholder; where one stands in the hierarchy of power and decision making. The study highlighted the need to conduct a baseline study, the need for constant monitoring and adaptation especially of unintended consequences, and how evaluations can produced policy recommendations with regard to pricing and availability.

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Low-cost temperature loggers as stove use monitors (SUMs)

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Accurately determining stove use is important in assessing the impacts and dissemination dynamics of improved stoves programmes. It is also a key component in the calculation of emission reductions for trading carbon offsets, understanding changes in fuel use and estimating impacts on indoor air quality. This article outlines the use of small, rugged, commercially available temperature dataloggers as stove use monitors (SUMs). Monitoring results are presented of the first weeks of use of 40 newly built and 10 5-year old improved chimney wood-fired cook stoves in the CRECER project area in the Guatemalan highlands. A gradual increase with time was found in the number of hours that new stoves were used, almost equal to that of the old stove group by the third week of use. When coupled with carbon monoxide monitors placed in a sub group of kitchens, it is shown that some households continue to use their open fire for a number of weeks. This off the shelf technology promises to be of great use to groups interested in the standardisation of methods to quantify carbon emission reductions and other changes due to improved stoves, for evaluating dissemination strategies and for behavioural research.

There is a need for new methods to systematically collect stove use data in order to reduce the reliance on household surveys, which are often resource intensive, rely on householder memory and are subject to bias. In addition, there has not previously been a method to determine the details of use by meal, time, food type etc other than having a permanent presence in the kitchen, which is extremely resource-intensive and disrupts normal household behaviour. This article outlines the use of simple electronic temperature dataloggers that can provide reliable estimates of stove use so avoiding the need for survey information. Because they give precise and unbiased measurements of a simple physical parameter, statistically reliable information is provided using smaller sample sizes than are required for a household survey.

SUMs: stove use monitors

The use of temperature loggers as SUMs underwent pilot testing as part of the CRECER (Chronic Respiratory Effects of Early Childhood Exposure to Particulate Matter) chimney-stove intervention trial in the Guatemalan highlands (CRECER 2008, RESPIRE 2008). The work took place in an area of about 23 villages comprising principally an indigenous (Mayan) population, all initially using wood for cooking in open indoor fires. As part of the studies, selected households were provided with an improved chimney cookstove called the *Plancha*. This report details the period of weeks after the households started to use their *Plancha* stoves.

Thermochron iButtons® were used as SUMs, each costing about $20 and the size of a coin cell battery (about 1.5 cm in diameter, see Figure 1A). These stainless steel sensors record time/date and temperature with 1°C accuracy up to 85°C. Communication with the monitors is by momentary contact with a special probe, and programming and downloading of the data can be easily done in the field with a PDA or laptop computer (Figure 1B). The SUMs store up to 2048 readings, which can be programmed to be recorded at different rates from 1 minute to 4.25 hours. The SUMs' battery life is likely to exceed 1 year in stove monitoring conditions if kept within the manufacturers specifications, after which the whole unit must be replaced as the battery cannot be changed. They are easy to use, unobtrusive, waterproof, and tamper resistant.

Figure 1. *The temperature logger used as SUMs in this study (A), downloading SUMs data after deployment with a PDA and field readout interface (B), SUMs placed in the back of the Plancha stove surface (C) (Photos: I. Ruiz-Mercado)*


Figure 1A


Figure 1B


Figure 1C

Pilot study

The SUMs were programmed to store temperature readings every 20 minutes on a total of fifty *Plancha* stoves, comprising of 40 newly built and 10 older stoves that had been in use for 4-6 years. In the new stoves the SUMs were installed during the final drying phase of construction, when the householders had been warned not to use their stoves. Thus, the monitoring period included the very first usage of each new stove.

Among recipients of the new stoves, 86% had attended hands-on workshops on proper stove use, maintenance and the health effects of indoor air pollution. The SUMs were placed on the tile surface in the back of the stove, near to the chimney base (Figure 1C). This location is the least obtrusive, and the maximum temperatures reached at that location did not compromise the lifetime of the devices. The SUMs stopped recording when their memories were full (approximately 4 weeks) and were downloaded to a PDA in the field within a few days. In a sub sample of households, a HOBO datalogging carbon monoxide (CO) monitor was placed on the wall of the kitchen, using protocols developed for other University of California Berkeley projects.

Results

Figure 2 shows a typical plot of one day's cooking on the *Plancha* stove. Note that three separate meals can be discerned.

Patterns of use

Figure 3 shows the pattern over several days in a kitchen with both a new *Plancha* and a CO monitor. Note the high CO levels through Sunday due to the use of the open fire in the kitchen. The small variations in minimum stove temperature reflect the daily changes in ambient temperature in this highland location. On Monday and Tuesday, the family began using their *Plancha*, as shown by the much higher than ambient temperature. However, they apparently continued to use their open cookfire, as evidenced by the CO readings. By Wednesday households seemed to be using only the *Plancha*, as indicated by the small amount of CO in the kitchen, due to the majority of smoke being vented through the chimney. The pattern and timing of fuel use and meals can also be ascertained by the temperature profile.

Pace of adoption

In order to combine data across households for comparison, "stove use" is defined as the total time that the stove temperature is above 30°C. This seemed

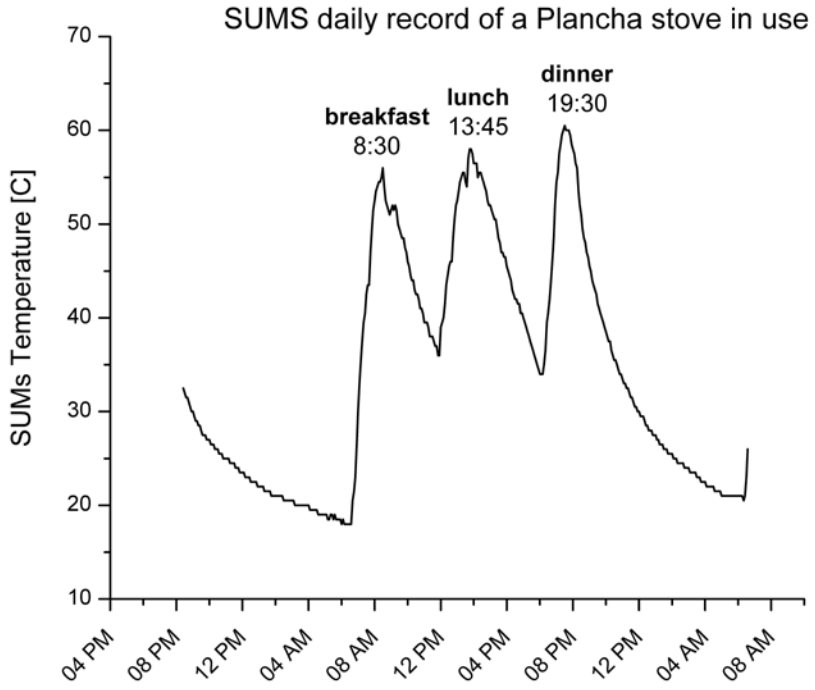

Figure 2. *Typical daily use pattern from a SUMs in a house with a Plancha. The breakfast, lunch and dinner times of stove use can be clearly distinguished.*

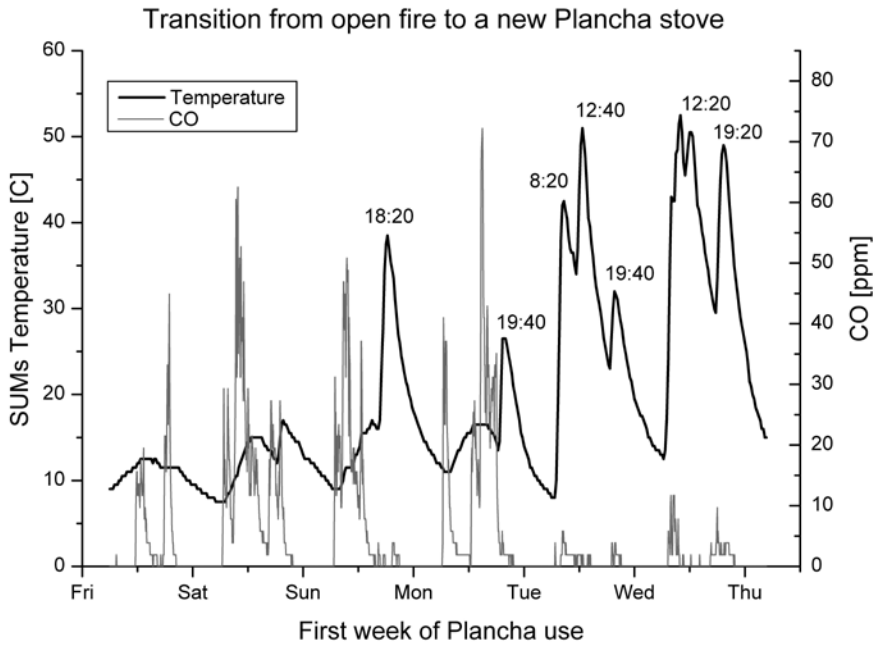

Figure 3. *Average hours of stove use for the newly built and old stoves (n is number of stoves monitored)*

an appropriate threshold at this highland location to isolate diurnal patterns and temperature increases due to other sources of heat in the room from the temperature increase due to combustion in the stove itself.

Applying this stove use definition, Figure 4 shows the daily average hours of stove use over the monitoring period for both new and old stoves. It indicates that use of the new stoves gradually increases over the first few days, stabilising after the first week but not quite reaching the same hours of use as the old stove group. Future investigations are underway to explore this transition by examining, for example, the effect of household size and other factors that may affect stove use.

By separating the monitoring periods into weeks (Figure 5), it was found that a significant increase in the median hours of stove use from week one to week two was observed, followed by a period of greater stability during weeks two to three.

Although the new stoves display a relatively stable period of use in weeks two and three, similar to that of the older stoves, they exhibit a greater degree of variability despite a four times greater

sample size. This suggests that although many, if not most, of the new stove users will adopt the stove quickly after training, there may be a more gradual transition for some users that extends beyond the measurement period. If this is so, there may be a small set of users who might benefit from additional training or other measures. Further research may allow for the prediction in advance of households likely to be in this category based on household characteristics (size, occupation, education, etc.) or pre-dissemination questions about their interest in stoves. Special efforts could then be made to target these households in training or other programmes during dissemination (Rogers 2003).

Conclusions

The surface temperature of the stove away from the cooking surface might potentially be used as a direct indicator of some aspects of stove performance, for example loss of combustion heat into the body of the stove. Here however, its utility as an indicator of stove use is briefly explored, an important parameter for a range of assessments, including usage patterns after dissemination. It provides an unobtrusive, precise, relatively inexpensive, and objective measure, in contrast to telephone surveys, household questionnaires, diaries and other methods. It thus offers an efficient means to test the effectiveness of behavioural interventions on stove use.

In addition, it could provide an objective means to characterise usage over a population of stoves in the context of helping establish the degree to which the reduction of indoor air pollution, greenhouse emissions and fuel use have been achieved. We are now exploring these and other applications. In addition, based on long experience with other datalogging field instruments, we are working to develop efficient and reliable data management and analysis protocols, preferably menu driven using standard software.

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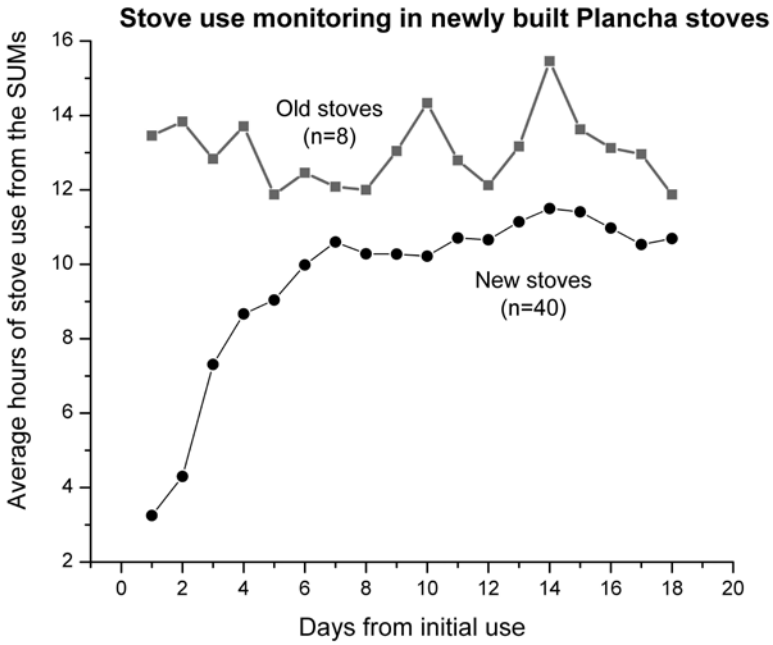
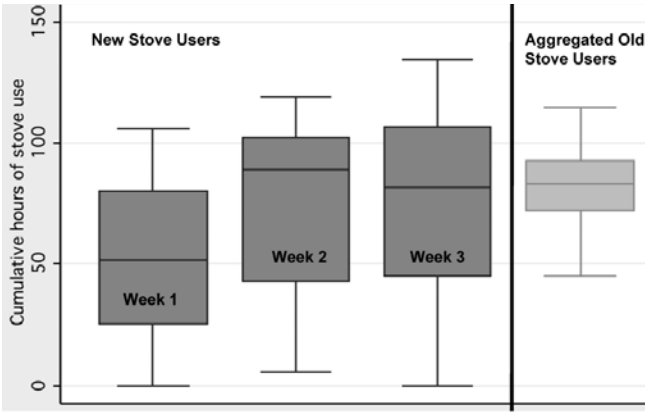


Figure 4. *Gradual adoption of a new Plancha stove as seen by the kitchen carbon monoxide concentrations and stove temperature patterns.*

Figure 5. *Cumulative hours of stove use for 3 weeks of monitoring in new users (n = 40) of the Plancha and old users with 5-6 years of experience (n = 8). Hourly use between weeks was not significantly different within old stove users so an average of weeks 1-3 is presented as a single aggregated column.*

Interpretation of boxplots: The horizontal line within the box represents the median hours of stove use during the week, the upper and lower edges of the box (quartiles) represent hours of stove use at which 75% and 25% of the measured homes fall below, respectively. Points outside the whiskers (no example from figure) are considered outliers.



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Gilberto Davila is the current field supervisor for the CRCER study. He has previously done fieldwork for several joint projects between the US Centers for Disease Control and the Universidad del Valle de Guatemala.

Kirk R. Smith is Professor of Global Environmental Health at the University of California Berkeley and has conducted research on the health, energy, climate, and policy implications of household energy in developing countries since 1978 with current studies in India, Nepal, China, and Guatemala.

General

So you finally bought a Combustion Analyser!

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The goal of many household energy projects is to develop an improved stove with a good combustion and heat transfer performance. This article describes how with a basic combustion analyser, along with a few mathematical tools, a stove developer is well equipped to work wonders in improving a stove's performance.

Developing an improved stove is the primary goal of many domestic energy projects. Most developers know it is not easy to produce a clean burning stove without using emissions measuring equipment like a combustion analyser. But along with having the correct equipment you also need to know how to extract useful information from the raw numbers. A stove developer is looking for better combustion and better heat transfer. A basic combustion analyser along with a few mathematical tools will produce useful information from a surprisingly small number of measurements.

Analysing combustion

Improving combustion has two aspects: burning the fuel completely and minimizing harmful emissions. Similarly, a better heat transfer also has two main factors: getting the heat into the pot or the room, and limiting the amount that is wasted either up the chimney or into the air. The combustion analyser will help with all of these.

First you need to find the level of carbon monoxide (CO) in the emissions, the oxygen (O_2) level and the temperature. These three measurements are key. If you have a scale you can also determine the mass of fuel being burned at the time the measurements were taken and from this calculate the quantity of CO produced when burning a kilogram of fuel.

Carbon monoxide (CO)

If CO or CO_2 is found in the gas flowing from a stove, there is combustion taking place. Detecting CO_2 is more difficult than CO, so simple gas analysers will only measure the latter. It is normally reported in parts per million (ppm) or milligrams per cubic metre of gases (mg/m^3). To convert mg/m^3 to ppm, multiply mg/m^3 by 0.81075. To convert CO ppm to CO%, divide by 10,000.

Example

$$\frac{500 \text{ ppm CO}}{10{,}000} = 0.05\% \text{ CO}$$

Oxygen (O_2)

Oxygen is also easy to detect and is usually reported in percent (%). The air entering a stove can be thought of in two components, the amount required for combustion (the air demand) and the air not theoretically needed to burn the fuel (excess air)

Excess air (EA) is calculated as follows:

$$EA\ (\%) = \frac{[O_2\% - (CO\%/2)] \times 100}{20.95 - [O_2\% - (CO\%/2)]}$$

Summing the combustion and excess air gives the total air supplied, also called the Air Factor, represented by the symbol Lambda, λ. Lambda is excess air plus one.

$$\lambda = \frac{EA\%}{100} + 1$$

Example

If EA = 160%, λ = 160/100 + 1.00 = 2.60

i.e. the total air entering the stove is 2.6 times greater than that required for combustion.

Calculating CO_2

Because the composition of fuels like coal or wood is usually known, the amount of CO_2 in the stack (chimney) sample can be calculated from the O_2 and CO. If there is 20.95% oxygen in the air going into a stove, and 10% in the gases that come out, then approximately half of it has been used during combustion. Some of it will have reacted with hydrogen in the fuel to make H_2O (water). This happens easily so analysers usually assume that all the hydrogen has been burned. Another portion of the oxygen combines with carbon to make CO. So based on the fuel composition, the initial and post-combustion oxygen levels, and the CO level, the rest of the oxygen can be assumed to have been burned to CO_2. Using this logic, a reasonable calculation of the CO_2 level, expressed in %, can be made without measuring it directly, useful if you have that simple gas analyser.

Figure1 *A TSI CA-6203 Combustion Analyser*

$$CO_2\% = CO_2\ Max\% \times \left[\frac{20.95 - (O_2\% + \frac{CO\%}{2})}{20.95}\right]$$

Note: CO_2 Max for Wood is 19.4%

The CO/CO_2 Ratio (CO_R)

A measure of how completely the fuel is being burned can be determined by dividing the CO by the CO_2. Fully combusted carbon emerges as CO_2, partially burned carbon as CO. The better the combustion, the lower the proportion of CO. This calculation can be made with any level of dilution, provided both are determined from readings taken at the same time. As the CO is usually given in ppm and the CO_2 in %, a conversion factor is needed to determine their relative abundance.

$$CO_R = \frac{CO}{CO_2}$$

Example

Suppose the levels are 500 ppm CO, and 10% CO_2

First convert the CO ppm to CO%

$$\frac{500\text{ppm CO}}{10{,}000} = 0.05\% \text{ CO}$$

Then divide the CO by the CO_2

$$CO_R = \frac{0.05\%\ CO}{10\%\ CO_2} = 0.005 = 0.5\%$$

The target of a stove developer is to achieve a CO_R of 2% or less. Very low readings are possible in modern stoves.

Correcting the CO reading undiluted gas concentration

The CO_R is calculated using the readings taken directly from the analyser and can compare the combustion efficiency of different stoves. However it is not correct to make comparisons between stoves using uncorrected CO readings alone. The presence of excess air, as indicated by the oxygen level, means that the CO measurements will be incorrect, with valid comparisons for individual gases only being made using EA-corrected figures.

Example: Compare these measurements from the stack and determine which version of the stove has lowest CO level:

Test 1 CO = 2561 ppm, O_2 = 8.00%
Test 2 CO = 1981 ppm, O_2 = 10.60%
Test 3 CO = 2144 ppm, O_2 = 11.25%

Test 1 shows the EA is 60.19%, so λ is 1.6019. The undiluted CO level is 1.6019 x 2561 = 4301 ppm.

Test 2 shows the EA is 100.50%, so λ is 2.0050. The undiluted CO level is 2.0050 x 1981 = 3972 ppm.

Test 3 shows the EA is 113.62%, so λ is 2.1362. The undiluted CO level is 2.1362 x 2144 = 4580 ppm.

The stove in Test 2 is the cleanest burning, and Test 3 is the dirtiest, something not obvious from the CO reading alone. It is very important to make this correction to obtain the undiluted gas concentration. It makes meaningful comparisons between different stoves and fuels possible.

Particulates

Suppose we want to know the PM 2.5 particulate emission level and how clean the burn is when a stove is used with two different fuels.

Example:
Test 1 CO = 3566 ppm, O_2 = 13.05%, PM 2.5 = 135 µg/m^3
Test 2 CO = 2911 ppm, O_2 = 11.40%, PM 2.5 = 161 µg/m^3

The calculated EA, λ, CO_2 and CO_R levels for the tests are:

Test 1 EA = 159.34%, λ = 2.5934, CO_2 7.15%, CO_R = 4.99%
Test 2 EA = 116.08%, λ = 2.1608, CO_2 8.71%, CO_R = 3.34%

The undiluted PM 2.5 concentrations are:
Test 1 135 x 2.5934 = 350 µg/m^3
Test 2 161 x 2.1608 = 348 µg/m^3

The fuel in Test 2 has a better combustion efficiency indicated by a lower CO_R but they have the same level of PM 2.5 emissions.

Analysing heat transfer efficiency

A combustion analyser can measure the chimney gas temperature and calculate the amount of heat lost up the 'chimney stack'.

The air feeding a stove has to be drawn from outdoors. The initial temperature (T_1) is the outdoor temperature and the final temperature (T_2) is the temperature inside the chimney.

T_2-T_1 = Delta T = ΔT

Stack losses are a combination of gas volume and ΔT.

Recording the temperature in the chimney will not, alone, tell you what the loss is. You need to know, as before, the amount of excess air that is diluting and expanding the volume of emissions from the fire. The combustion analyser will calculate the amount of heat contained in the gases and combine this with the quantity of excess air to produce a percentage heat loss. If the exit temperature was the same as the outdoor temperature, the loss would be 0%.

To determine the loss in Watts, you have to weigh the fuel being burned and determine the heat generated, then multiply that times the percentage of heat being lost. This heat loss feature is helpful even if you are working on stoves without a chimney. Take a sample of gases from the point at which they exit past the pot and you get the percentage of heat being lost at that point. The inputs used are the room temperature, the exit temperature and the Excess Air level. Care must be taken to ensure no air from the room enters the sample being drawn or you will get an inflated Excess Air figure.

For small stoves with a short gas path, the exit temperature will give a general indication of losses: the higher the temperature, the greater the loss. Unfortunately, this is only true in certain cases. For example, if you increase the excess air supply significantly, you may see a drop in temperature but a large increase in heat loss because the extra air is cooling the fire and rushing the heat past the pot in a larger volume of cooler gas.

The thermal efficiency of a small stove is usually lower than a space heating chimney stove. Exceptions to this are some institutional stoves with pots sunk completely into an all-enclosing, insulated body. In such a stove, decreasing the excess air can show a constant or even a decreasing exit temperature and a substantial increase in efficiency.

Figure 2 *A Testo 350 XL Combustion Analyser*

Figure 3 *A Lufft temperature logger*

Using a combustion analyser to track the undiluted gas and particulate levels, the heat loss and the CO_R a stove developer is well equipped to work wonders improving a stove's performance.

Profile of the Author

Crispin Pemberton-Pigott has worked with Appropriate Technologies for 30 years, largely in rural water and manual production equipment. A stove maker for 25 years, he won the Design Institute of South Africa Chairman's Award 2004 for the 'Vesto', a semi-gasifing stove now manufactured in Swaziland at New Dawn Engineering, a producer of labour-based manufacturing systems for rural employment. He is a co-founder of the Eastern Cape Appropriate Technology Unit (RSA), the Renewable Energy Association of Swaziland and the Industrial Designers Association of South Africa. Presently the Regional Technical Advisor for GTZ/ProBEC he is also on the Board of the Sustainable Energy Society of Southern Africa (SESSA) and chairs its daughter organisation, the Association for Renewable Energy Cooking Appliances (AFRECA). He is a member of the South African Bureau of Standards technical committees writing national standards and test protocols for coal, paraffin and gel fuel stoves.

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News

gtz | HERA – Household Energy Programme

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News from GTZ

Here comes the sun – options for using solar cookers in developing countries

Cooking with the sun has repeatedly been seen as a solution to the firewood problem in developing countries. It allows the use of a free, inexhaustible source of energy that not only protects the environment, but also lessens the workload of women and children and reduces the harmful health effects that cooking with traditional biomass fuels sometimes has. Although solar cookers have now been promoted for several decades, a larger breakthrough has not yet been achieved.

A recently published analysis of the differing global approaches to solar cooker dissemination reported both successes and constraints. The main constraints were a lack of acceptance by users (due to stoves not accommodating traditional cooking practice), high costs, and shortcomings in maintenance and after sales services. However, in regions where virtually no alternative fuels are available, and where it fits with existing cooking methods, a solar cooker offers a feasible solution to the problems at hand.

Solar cookers have been especially successful in Tibet and on the Altiplano in South America. In Tibet, solar cookers play a major role as solar irradiance (resource) on the Tibetan plateau is very high by global standards and the cookers can be used for nine or ten months of the year. In addition, the dietary habits of the population also fit the technology as hot water is not only needed for every meal but also to make tea many times a day.

Figure 1. *Solar cooking is taking hold in the Andes where alternative fuels are hardly available. (Photo: GTZ PROAGRO)*

Today, there are some 70,000 solar cookers in use in Tibet, most of them concentrator cookers of the butterfly type.

In most African countries it has not been possible to set up independent local production and so important parts still have to be imported from Germany. Cooking practice and weather conditions, e.g. desert winds carrying dust and sand, have not offered a favourable environment for the dissemination of solar cookers, despite high levels of solar irradiance in many countries. A pilot project implemented by GTZ in South Africa showed that annual wood consumption could be reduced by at most 30 to 40%, due to solar cooker use being limited to days where the sun is shining. Trials where cookers were sold through a loan system have had little success and even in South Africa, with its well-developed infrastructure, solar cookers have not caught on.

To sum up, acceptance is still the problem. In many cases solar cookers cannot be integrated into families' everyday working and domestic lives without further complications. Cooking habits are very much part of the culture of the kitchen, and are generally not easy to change. Where cooking is carried out in the evening, a solar cooker is not a real option. Furthermore, for users there is still a lack of access to maintenance services as well as systematic training on stove use. Experience also reveals that, apart from Tibet, dissemination strategies are no longer directed at poorer segments of the population but instead at the middle class.

Based on the analysis of past efforts, ten basic rules promising the successful dissemination and use of solar cookers are given in the publication. It is important, for example, that solar cookers are promoted where biomass is sparse and difficult to obtain. The target group should not have easy access to other cheap fuels.

Figure 2 *Students in Lesotho enjoy cooking with the parabolic cooker. However, the dissemination of solar cookers in Africa faces difficulties e.g. due to cooking habits. (Photo: Marlis Kees)*

It must be possible to prepare the most common dishes and there must be places within the living area where cookers can be positioned favourably for capturing sunlight and at the same time be safe from theft. Furthermore, affordable cookers must be available locally, and after-sales service and maintenance must be assured. Last but not least, cookers should not be offered as the only solution but in a package with other energy-saving technologies.

An alternative to solar cookers does exist in the form of energy-efficient Rocket Stoves. These improved stoves can compete with, or even beat, solar cookers in terms of their energy-saving potential. Improved stoves when adapted to people's cooking needs are usually the preferred choice of poor families.

The report "Here Comes the Sun – Options for Using Solar Cookers in Developing Countries" was recently published by HERA and is available for download, in both English and German, via the *@HEDON* link at the end of the article. If you would like a hard copy then please email Lisa Feldmann (lisa.feldmann@gtz.de).

Malawi: Study shows benefits of institutional rocket stove

The use of energy efficient stoves in the canteens of institutions and companies shows positive impacts at both micro and macro economical levels. A recent cost-benefit analysis of stoves in Malawi quantified the benefits not only to stove users, but also of the national and global impacts of stove use.

In assessing the investments made in Malawi through the Programme for Biomass Energy Conservation in Southern Africa (ProBEC), economist Helga Habermehl reports that "the promotion of efficient institutional cook stoves is favourable from an overall economic view". Each invested Dollar gives a return of 5.2 US$, when accounting for avoided fuel costs, greenhouse gas reductions and preserved forest reserves over a period of ten years and at a discount rate of 3%.

From 2004 to 2007 institutions such as schools, nurseries, hospitals, orphanages and tea estates bought or built just under 4300 energy saving Rocket Stoves for their canteens. This has resulted in several hundred thousand children receiving at least one warm meal per day. The training of local producers in the construction of Rocket Stoves was conducted by ProBEC, which is implemented by GTZ on behalf of the governments of Germany and the Netherlands. Each stove gets a certificate that proves its quality and a warranty. The main customers are the World Food Programme (WFP), the Scottish school feeding programme 'Mary's Meals' and private schools.

Depending on size, these efficient stoves save between 60 and 80% of the firewood otherwise needed in a traditional open fire. In 2008, the installed stoves will save over 23,000 tonnes of fuelwood, directly saving 662,000 US$ in fuel costs as well as offering economic benefits in terms of the preservation of forest reserves amounting to 362,000 US$. Furthermore, the use of the canteen stoves will reduce greenhouse gas emissions with a total saving of approximately 35 tonnes of CO_2 and 93 tonnes of Methane a year, valued at 256,000 US$. So in 2008, the total economic benefit due to institutional stove use will amount to nearly 1.3 million US$.

The use of Rocket Stoves is profitable for each of the individual institutions - an orphanage that prepares two meals a day in a 100 litre pot saves 680 US$ a year on firewood expenditure. If a 200 litre stove is used twice a day throughout the year, then the net benefit over the stove's 4-year life is 4,200 US$, some 16 times the cost of the stove installation. So depending on cooking frequency and size, the cost of the stove can been paid back by fuel savings in the first three to nine months of use, saving up to 40% of annual catering budgets.

Thus, institutional Rocket Stoves not only pay off on a macro-economic level but are also improving the financial performance of each canteen. "We have enjoyed this stove for three years. Can you see the soot on the kitchen walls? This was from the open fire when our kitchen was filled with smoke. It was hard to breathe inside the kitchen. With the modern stove we are no longer suffering from coughing and sore eyes as before. Work is much more fun! Moreover the college saves over half of its budget for firewood and can use the money to buy books and better food for the students. So the students are happy too!", Cooks at a school in Blantyre, Malawi report.

The Cost-Benefit Analysis was conducted by the economist Helga Habermehl on behalf of ProBEC and GTZ's household energy programme HERA. It is available for download via the *@HEDON* link at the end of the article.

The Regional Energy Advisory Platform East Africa supports energy projects of GTZ and its partners in East Africa – second meeting

"Creating synergies and the exchange of best practice are the foundation principle behind the Regional Energy Advisory Platform East Africa (REAP-EA), and the essential ingredients of it's success", explains manager David Otieno. REAP is a service-provider to existing bilateral and sectoral assignments and its key objectives are to increase the impact and overall efficiency of these projects and initiatives, to explore and realise synergies, and to provide direct support through targeted services. The expertise of GTZ REAP (EA) covers a wide range of topics including carbon finance, the Clean Development Mechanism (CDM) and renewable energy policy advice. Through high-quality support to the East African Community (EAC), renewable energy associations, lobby groups, NGOs and other organizations in East Africa, GTZ REAP has proved itself a reliable and competent partner on energy-related issues in the region.

The second meeting of the REAP-EA took place in October 2007 in Nairobi, Kenya. Representatives from energy interventions

Figure 3 *Volunteers cooking for school kids in Malawi. (Photo: Christa Roth)*

in Ethiopia, Uganda, Tanzania, Rwanda and the host country Kenya attended the meeting. Further expertise was brought in by colleagues from West Africa, Mozambique, Thailand and by sectoral programmes from GTZ head quarters. Several parallel sessions provided time for experience exchange in rural electrification, grid connected electrification, utilisation of bioenergy and biogas, and cooking energy. Further topics discussed were the progress of the Biomass Energy Strategy (BEST) initiative, the latest developments of the Dutch-German cooperation programme Energising Development (EnDev) and the new Bioenergy sector initiative. Another topic of interest was capacity development, more specifically sectoral capacity needs assessment with regard to energy. The latest regional developments in the energy sector were presented, such as private sector participation in East Africa, biogas in Rwanda and CDM projects and potential in East Africa. The cooking energy discussions focussed on sustainability. A set of standard criteria with specifications as prepared by HERA was agreed upon. The first sustainability assessment is now being implemented in Kenya, where household energy interventions have been carried out for about 30 years.

Ethiopia will host the next REAP exchange in 2008, focusing on impact and sustainability assessment as well as exit strategies. For more details see www.regionalenergy-net.com

GTZ shares international award with Ethiopian Ministry of Agriculture and Rural Development (MoARD)

GTZ received the award in early 2007, at the third Biennial Partnership for Clean Indoor Air (PCIA) Forum in India. The energy project of the Ethiopian-German programme for Sustainable Utilization of Natural Resources (SUN) was honoured by PCIA for its commercial strategy for increasing the use of clean and efficient MIRT cook stoves. These stoves use significantly less firewood and reduce indoor air pollution thus improving peoples' health and quality of life.

Handing over the award in November 2007, GTZ pointed out that without the full support of MoARD, the owner of the project, this result would not have been achieved. "Let this award be a reminder of what is possible to achieve and a motivation to work even harder", Amhare Worku from the Ministry said at the ceremony. SUN Energy is currently operating in 215 towns in Amhara, Oromiya and Tigray with about 341 small scale stove production enterprises. Through the market approach more than 140,000 stoves have been sold in the regions of intervention. Samson Tolessa, Manager of the GTZ-SUN Energy project explained, "Selling the stoves rather than distributing them for free proved to be a sustainable and successful way of creating public acceptance for the stove."

Tobacco Rocket Barns successfully introduced to Malawi

In 2005 a new flue-cured tobacco processing barn for smallholder farmers, the 'Rocket Barn', was developed in cooperation between the Programme for Biomass Energy Conservation (ProBEC) and the Malawian tobacco industry, who have now adopted the technology. The new barn reduces wood consumption by over 50% as compared to traditional smallholder technologies, which use more than 15kg of wood to produce 1 kg of finished tobacco. To date 86 Rocket Barns have been built in Malawi, with 500 more to be added this season, paid for by bank loans. A special testing facility has been expanded to include 20 barns to enable continuous research and development. In addition, Rocket Barns are also being constructed in Tanzania and Zambia.

Figure 4 *Rocket Barns cure tobacco more efficiently, Malawi (Photo: GTZ)*

Successful start for improved cook stove dissemination in Bangladesh

Since January 2006, GTZ's Sustainable Energy for Development (SED) programme has promoted the dissemination of improved cook stoves (ICS) in rural households, social institutions and small businesses. Additional financial support is provided through the Dutch-German cooperation programme Energising Development. Most rural households in Bangladesh are highly dependent on biomass cooking fuels such as cow dung, crop residues or scarce firewood resources.

The improved stoves, which are made from clay and are equipped with a chimney, reduce biomass use by about 50% and cut indoor air pollution and related health problems that mainly affect women and children. The dissemination of the ICS is carried out by established local NGOs that possess a sound infrastructure at the village level. The NGOs follow a market-based approach with small short-term loans offered to low-income households.

Up to December 2007, more than 10,000 stoves were disseminated throughout the country and as the experience of households has been very positive, NGOs are now facing a growing demand. Thus, the scaling-up of dissemination activities is imperative and so SED supports the NGOs in activities such as stove manufacturer training and marketing campaigns. The quality of stoves as well as socioeconomic impacts are being closely monitored.

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- Editor profile and latest contact details
- ' Here Comes The Sun' report
- REAP-EA Website
- Malawi CBA report

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News

PRACTICAL ACTION
Technology challenging poverty

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Figure 1 *Jiko stove advertising (Photo: Simon Ekless / Practical Action)*

News from Practical Action

Initial results from a study of energy use patterns in Kisumu Municipality reveal extent of the energy crisis.

In the past year, Practical Action has developed a five-year strategic plan for its work in Eastern Africa. One of the four clusters for our work is the Lake Victoria basin, and in particular its rapidly growing urban and peri-urban areas. Our experience in the region, and our long-standing work on stoves and indoor air pollution there, told us that household energy needed to be a key part of that strategy. There are various reasons, including high levels of poverty including energy poverty, and the threatened environmental conditions of the riparian area and the Lake itself. Deforestation in the areas surrounding the town has been linked to both unsustainable agricultural practices, and the cutting of trees for fuel. In turn this causes siltation of the lake with damaging affects on its ecosystem including the fisheries on which many people depend.

The City Development Strategy for Kisumu (2005) identified energy access for the poor as one of the city's key urban management challenges. In the strategy itself, encouraging tree-planting and promoting energy-saving technologies were suggested as interventions to help reduce environmental impact. There was also support for enforcement of laws and regulations governing nature reserves and green spaces.

In order to understand more about the energy issues for the urban poor in Kisumu, Practical Action carried out a study in February 2008. We interviewed 210 households in low, medium and high income areas; 60 small enterprises, 30 fuel-sellers, and 20 institutions (schools, health facilities etc.). Preliminary findings show that, as expected, the majority of people (89%) continue to use biomass (firewood and charcoal) as part of their fuel mix.

However, fuel sellers highlighted the difficulties they are now facing in sourcing supplies of wood and charcoal. This is partly due to high awareness of a new environmental act placing heavy restrictions on tree felling and charcoal burning. The recent post-election violence in Kisumu has also had an effect. Low income areas were the epicentres of violent confrontation between youths and the police. Lives and livelihoods were lost and people displaced. Movement of people and goods was affected and fuel scarcity increased again. As a result the cost of fuels has increased, with households spending an average of 32% of their income on fuel. For 40% of people, this has meant moving down the 'energy ladder' from gas to charcoal, or charcoal to wood.

There was some encouragement, however, in the spread of improved technologies and awareness about the dangers of indoor air pollution. 84% of charcoal users cooked on improved charcoal jiko stoves and 45% of households said that they were worried about smoke and its health effects. The purpose of the study was to try to identify energy opportunities that might relieve the energy crisis for the poor, and not further damage the environment. Charcoal farming could be a viable option, and there is potential to exploit solar energy and pico-hydro (in the Kajulu Hills). At a more industrial scale there is potential for producing ethanol using by-products from the sugar industry.

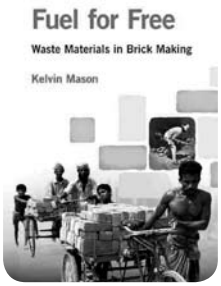
Overall, the study emphasised once again the links between poverty and energy poverty. It also raised questions about the complexity of the linkages between poverty, natural resource management, and energy use; and between urban and rural areas. Tackling energy poverty in this context will not be easy because large-scale changes are needed if any impact is to be felt on both the environment and energy access. However, this is a challenge we hope to start to learn more about and tackle in the coming years.

News from the Washington International Renewable Energy Conference

Practical Action's energy policy adviser, Teodoro Sanchez, attended the WIREC conference from 3-6 March 2008. This was the third ministerial-level conference on renewable energy following those held in Beijing in 2005 and Bonn in 2004. It was well attended, with Ministers from over 80 countries, 246 exhibitors in the trade exhibition and sponsorship from more than 40 companies. On the final day the conference was addressed by the President of the USA, George Bush. It was encouraging to see that renewable energy is gaining an ever-higher status.

Our interest in renewable energy is focused on the broader question of how to increase energy access for the poor. One would have thought this topic would be raised in all three of the key themes: agriculture and rural development (a large focus on biofuels); technology research and development; and market adoption and finance. For all of these, particular tools and approaches are needed in relation to energy for the poor. However, the attention of delegates was focused elsewhere: on themes of energy security, and the threats of global warming. Energy access for the poor was almost completely neglected. Only the session on 'Rural and Economic Development' hosted with the participation of GVEP Interntional and the World Bank, talked about the problem, and this still at a very general level.

Practical Action will continue to lobby and campaign for greater attention to energy access for the poor in the global debate. This conference served to underline how important, but how challenging that task is.



Re-launch of e-net – the renewable energy network for South Asia

www.sa-energy.net

The first new edition of the e-net magazine was published in October 2007 by Practical Action South Asia, based in Sri Lanka. E-net is a networking initiative concentrating on the renewable energy sector and related community-based approaches in the South Asian region. The magazine was first printed in 1997, and since its last issue in 2001 there has remained a gap in information sharing and generation. The network aims to bring together all stakeholders in the energy sector, including practitioners, technology suppliers, consumers and policy-makers. The magazine and online forum are part of this initiative.

Online, once registered, users can post notices, join in with e-discussions, download articles and the magazine, and post requests for, or offers of support with technology. This edition of the magazine includes:

- Case studies on household energy from India (LED lanterns charged from solar panels); Nepal (small wind energy systems); and Bangladesh (biogas).
- An article on electricity reforms currently taking place globally, and their impact on the poor
- An overview of the renewable energy sector in Pakistan
- A tribute to Prof Amulya Reddy – a great thinker and contributor to the renewable energy sector and a strong proponent of community linked rural energy initiatives

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Publication: "Fuel for Free? Waste materials in Brick making" by Kelvin Mason, Practical Action Publishing

www.developmentbookshop.com

This book covers the use of wastes in firing clay bricks via case studies in Zimbabwe, Sudan, Sri Lanka, and Peru. With respect to both livelihoods and the environment, energy efficiency in brickmaking is critical. Not only does increasing energy efficiency serve to reduce brickmakers' fuel costs and hence increase their income, it also reduces the emissions of carbon dioxide and other pollutants per brick produced. This book demonstrates that if energy efficiency is combined with appropriate fuel substitutions (co-firing), then the beneficial effect on both income and the environment can be significantly enhanced. The book addresses issues of energy use, the environmental impact of brickmaking, and the technologies of fuel substitution and co-firing via case-studies of the work of Practical Action. The Peru study investigates the use of coal-dust, coal-dust briquettes, waste oil, rice husks and sawdust. The Sudan and Zimbabwe studies look at using a variety of wastes, including cow-dung, bagasse and boiler waste. The book then explores the possible alternative futures for brickmakers and the need to mobilize political support for energy efficiency and fuel substitution.

Focus

Practical Answers

Practical Answers was created to provide a means of accessing the wealth of technical information held by Practical Action. As well as Technical Briefs and other technical documents, it also includes:

The Technical Enquiry Service supplying, free of charge, technical and developmental information to development workers, community-based organisations, NGOs and other agencies using appropriate technologies to implement sustainable development.

Resource Centres based in the Practical Action offices, are open to the public and hold a distinctive collection of appropriate technology and development literature.

Through Practical Action's international network of enquiry services, we are able to call on the expertise of several hundred professionals in technical, economic, and sociological disciplines to help formulate the answers to enquiries - across our offices we receive and answer approximately 300 enquiries a year.

We always try to supply information of direct relevance to the individual enquirer's circumstances and will take into account the non-technical factors that might have a bearing on the use of the technology. Enquiries can me made online or through any of Practical Action's international offices, see the website for a full list.

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News

GVEP International

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News from GVEP International

GVEP International is the non-governmental organisation established in 2006 by the Global Village Energy Partnership, itself launched at the WSSD in 2002. Since January 2008 we have been particularly busy with the successful completion of 20 GAPFund projects, regional meetings in East Africa, the initiation of the Developing Energy Enterprise Project in East Africa, building a new website, the signature of an agreement with the Ashden Awards, attending the Washington International Energy Conference (WIREC), and the start of a new cycle of projects.

Completion of the GVEP International Action Programmes Fund (GAPFund) is marked by a Group Session in Washington

The GVEP International Action Programs Fund (GAPfund) was set up in 2005 as a small grants programme ($1.35 m) administered through the World Bank (ESMAP), and managed by Winrock International. The fund supported innovative projects across the developing world in the field of rural energy services, from capacity building to feasibility studies. The 20 projects were awarded grants in the US$ 10,000-50,000 range, with a 12 month implementation period.

Having successfully completed the projects, representatives from each met in Washington this February at the World Bank's Sustainable Development Network (SDN) week and discovered that they experienced many similar challenges. Hari Natarajan, GVEP International's South Asia Manager, described the "opportunity for grass-root level implementation organisations to meet, share and learn from each other's experiences" as "symbolising the biggest gain..." of the event. The lessons learned through the GAPFund projects will be published in a comprehensive brochure by GVEP International to assist effective interventions at the grass roots level.

Figure1 *Poster session in Washington DC (Photo: Winrock International)*

Figure2 *A solar panel at an orphanage in Dar es Salaam, Tanzania (Photo: GVEP International)*

GVEP International in East Africa!

To initiate activities in East Africa, GVEP International held partner meetings in early March in Uganda and Tanzania. Attendees at both meetings included a mixture of partners and newcomers, comprising suppliers, micro-lenders, SMEs, project implementers, NGOs, donors and government members. Onyango Joseph from the Rayland Rural Development Organisation told us he 'learnt many things, and met new friends.'

The meetings enabled us to clarify the transformation of Global Village Energy Partnership into GVEP International, and highlight the new products, services, and programmes that will be rolled out over the next few years.

Through open discussions, as well as an interactive sessions on monitoring and evaluation and climate change, the meetings also provided an opportunity for our partners to offer input into how they think GVEP International could be most effective.

Very colourful presentations were given by representatives from GVEP International's regionally located GAPFund partners, TaTEDO (Tanzania), WODSTA (Tanzania), Solar Cookers (Kenya) and the GAIA Foundation (Zambia).

To download these presentations please see the GVEP International website, www.gvepinternational.org.

Figure 3: *Chardust Ltd – an energy enterprise success story in Nairobi, Kenya (Photo: Chardust)*

The Developing Energy Enterprise Project (DEEP)

The regional partner meeting in Kampala was followed by the kick-off meeting of the EU funded Developing Energy Enterprise Project (DEEP). Partners involved in DEEP, which include EATDN, the Aga Khan Foundation's Coastal Rural Support Project in Kenya, IT Power East Africa, Emerging Market Economics-Africa, Practical Action East Africa and Gender and Energy Research and Training, all met on the 14th March to map out the different phases of the programme.

The main objective of DEEP is to 'enable development of a sustainable and widespread industry of micro and small energy enterprises providing energy services and employment in rural and peri-urban areas of Kenya, Uganda and Tanzania.' The programme will be rolled out over the next five years, and aims to achieve the following targets:

- The initiation of 1,800 micro and small East African energy enterprises (MSEs) which have diversified into energy service provision
- 300 business mentors trained and qualified to be employed in rural and peri-urban areas of East Africa addressing and ensuring sustainability issues
- Supported businesses to have employed 1,300 people directly and, through the provision of energy services, enabled the creation of a further 1,300 employment opportunities in the rural and peri-urban communities which they serve
- 12,000 rural and peri urban community members provided with energy services.

The GVEP International led initiative brings together private sector expertise, community mobilisation and business management in the development of private businesses, from their inception as ideas in villages to established energy service providers and employers.

The programme will be run by our local partners headed by a GVEP International East African regional manager. With their expert local knowledge and networks, programme coordinators will be able to assist enterprises to respond to the needs and market opportunities in the area.

DEEP will assist entrepreneurs through training and mentoring to develop business plans and then access the financing necessary to put the plans into practice. Post-investment, DEEP will continue to provide management mentoring services in accounting, strategy planning, marketing and legal issues relevant for businesses to survive and grow sustainably.

Figure 4: *GVEP International's CEO Sarah Adams, right, with Sarah Butler Sloss of the Ashden Awards, left. (Photo: Ashden Awards)*

GVEP International signs a collaboration agreement with the Ashden Awards for Sustainable Energy

In January 2008, GVEP International and the Ashden Awards for Sustainable Energy launched a new programme of collaboration, with the aim of increasing outreach to GVEP International partners and increased support to Ashden Award winners. The Ashden Awards is a scheme offering annual recognition to organisations across the developing world that demonstrate innovative, sustainable local energy access solutions using solar, wind, hydro, biomass, biogas, and other energy efficient technologies.

The agreement with GVEP International includes collaboration on regional activities, participation at events, and information and knowledge sharing. GVEP International will provide follow-up technical assistance to a number of Ashden Awards winners, ensuring long-term sustainability, and potentially offering support to other viable applications.

New website for GVEP International

GVEP International's website has been undergoing considerable redesign, and will be ready for launch in June 2008! Users will have access to extensive, improved data on funding and business opportunities, equipment and service suppliers, other partners and their projects, and will be able to post their own profiles and communicate with other energy stakeholders. A team of 30 GVEP International partners (thank you!) across the globe have helped us test the website to make sure that it is useful to energy practitioners. One of the primary aims of the site is knowledge sharing: the more users interact with the site, the greater this knowledge resource will become for all who are working together to increase energy access.

Read our news at www.gvepinternational.org

From M&EED to DEA to M&E in SSA: An energy M&E facility in Africa hosted by GVEP International

The Monitoring and Evaluation of Energy for Development (M&EED) International Working Group

The Monitoring and Evaluation of Energy For Development (M&EED) International Working Group was initiated in 2004 by a major GVEP Partner, Electricite de France, which put considerable resources into supporting and running the group including the regular hosting of meetings. Other members of the M&EED group included the European Union Energy Initiative, RISØ, UNEP, UNDP, World Bank, USAID, IT Power, ENERGIA, Future Energy Solutions, the Ademe, French Foreign Ministry, REEEP, GTZ, SenterNovem, E+co and others.

In 2006, the M&EED group launched a Guide to Monitoring and Evaluation in Energy Projects which can be downloaded from the GVEP International website (www.gvepinternational.org). The guide proposes a step by step approach to developing specific procedures for M&E in energy projects. The templates that were produced were tested by some of the group members and the guide will be updated as further testing is done and comments on the methods are received.

From 2008 GVEP International will host the M&EED group and activities are being planned that will make best use of the group's expertise. It is expected that members of the group will play an active role in mainstreaming M&E in their own energy projects and will produce their information and materials, as well as providing expert advisory services. The M&EED group will, over time, expand towards a more global M&EED expert base. Questions about the development of this GVEP International service and to join up as an M&E expert write to Kavita Rai at kavita.rai@gvep.org

Risø's Development and Energy in Africa (DEA) Assessment Framework

The DEA Assessment Framework builds on the methodological approach developed by the M&EED working group. The Assessment Framework was designed to identify and quantify the outcomes and impacts of energy projects and was tested in collaboration with six African countries: Botswana, Ghana, Mali, Senegal, Tanzania and Zambia. The Assessment Framework 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.

The method was tested in the six participating countries, comprising case studies of 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), and improved cookstoves and sustainable forestry (Senegal). At the conclusion of the project a workshop was held in Arusha, Tanzania in October 2007. It brought together over 50 regional energy workers from government, NGOs and universities, representing 17 African countries. The participants had different levels of experience in M&E and impact analysis related to energy interventions, but a clear desire was expressed by all of the importance of working together to develop recognised M&E systems and practices.
The workshop's purpose was:

- 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
- to assess the usefulness of the methodology of the Assessment Framework
- to assist in determining a way forward for M&E in energy projects in Africa.

The presentations and discussions were stimulating and indicated an urgent need to build M&E into the project cycle in a consistent way. Knowledge about projects, how they perform as well as their impacts are essential for designing future interventions that succeed and produce the desired impacts, and this knowledge must be available within the countries. However it was widely acknowledged that in-country the levels of awareness of M&E and its usefulness are limited. The participants suggested that while there is evidence of a strong demand for M&E in some quarters there is also the need to build in-country capacity to undertake M&E and to establish networks for regional cooperation. The Workshop concluded with an expressed desire to take M&E forward in Africa. The full report and how the Assessment Framework was applied in each of the different cases is most informative and can be accessed via the @HEDON link below.

GVEP International: An M&E Facility in Africa

Having been a founding member of the M&EED International Working Group, and present at the Arusha workshop, GVEP International heard the call for developing skills and building capacity to conduct M&E in Africa, and responded by commissioning a local energy expert and participant in the DEA study, to conduct a feasibility study for such a facility. His brief included identifying the needs and assessing the expertise and demands that would have to be fulfilled in order to build M&E capacity regionally.

The feasibility study has been completed and it highlights the fact that as awareness grows, and the usefulness of M&E becomes evident, national and regional networks and workshops where energy sector specialists and actors can meet, learn and discuss M&E methods would be useful and would promote the implementation of M&E into the energy project cycle. The next step will be to offer a training workshop for M&E in energy for development projects in October 2008, to be held in South Africa, as we explore ways of possible accreditation for M&E. Depending on the demand for and success of this workshop, we will tailor further courses to meet specific needs and offer in-house training to those who would prefer 'an expert in their office'. GVEP International will support the first workshop, and pending the evaluation will support further activities to develop a robust M&E facility.

GVEP International welcomes your comments on these plans, and an expression of interest in attending the first workshop. Your contribution will be gladly received by wendy.annecke@gvep.org

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- Full GVEP International news online
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- DEA Assessment Framework Report

Meet us *@HEDON*

Case study

Each Boiling Point case study presents a fictional household energy dilemma with advice from international experts

Boiling Point 55: Monitoring and evaluation case study scenario

The meeting earlier that week had brought some very good news for Savita and the rest of the BALA team. Having spent much of the last year assessing whether a new type of efficient wood burning stove was suitable for use in their area, they had just managed to secure some significant funding with which to scale up the project. But now she was sitting at her desk wondering what to do next, with the scale of the task ahead suddenly becoming apparent...

The funders had been quite specific; they would give support for an initial 3 year period with the requirement that 5000 stoves were produced in the first year, 10,000 the next and 20,000 in the third year. The money was coming from a variety of sources, a local Government agency, an international NGO and a private company and each one had a different agenda. They had all specified what they wanted from the programme and she had a list of targets and indicators on a variety of health, social, environmental, technical and economic issues. The whole point of the project was to see if an increase in numbers was possible, in terms of both demand and capacity (including manufacturing, engagement of local financial institutions, support and distribution networks, etc). If successful, the scheme would then receive increased funding to scale up further and roll out the programme to other areas of the country.

Last year's pilot project had gone well, with over 200 households taking part in a field study as well as the stove undergoing numerous performance and safety tests. The stove design needed a bit more work to make it acceptable to users, and the manufacturers seemed capable of producing the quantities they needed, but these weren't Savita's main concerns.

She would need to work closely with her own project team as well as other local organisations, and then she also had to satisfy the many demands of the funders as well as her own organisation's management.

How was she going to design and implement a programme of this size? With all the day-to-day issues she would face, how would she monitor overall progress and also check that the work was going as planned?

> How were they going to tell what users thought of the stove and how often they used it, and what about marketing and after sales – she has been involved with many of these issues before but never all at once!

Savita knew she had to develop a Monitoring and Evaluation system but wasn't sure where to start. In previous work she had tried to develop one, but being honest this had always been a last minute thing and now she was beginning to feel out of her depth...

So in terms of M&E, how should Savita run the various stages of the programme so that everyone is kept happy and how does she prove that the various objectives of the project are being delivered?

Disclaimer: The story presented in this case study is fictitious and as such any characters and organisations within it are not based on real life.

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Case study response

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Congratulations to Savita and her team at BALA for getting this exciting opportunity to expand their work. With these new funds comes the challenge of satisfying the monitoring and evaluation requirements of new partners. Help is at hand from many quarters: no need to panic.

Savita is right to consider both how she will *monitor* ongoing progress, as well as *evaluate* outcomes and impacts. Monitoring and evaluation are two slightly different concepts, though they are often related and complimentary.

- Monitoring is concerned with reviewing progress, for example how production and adoption are progressing, how stoves are performing and being received in homes, and reviewing the distribution system. Monitoring is often undertaken periodically throughout the project.
- Evaluation, on the other hand, is concerned with assessing impacts and achievements related to the project goals. For example, has the stove impacted IAP levels in homes, and what is the environmental impact of the project? Evaluation is often undertaken at set times, e.g. mid-term and/or final.

Donors are often particularly interested in evaluation results, though will wish to see that you have carefully considered monitoring for the integrity of the project. Many of the tools used for monitoring and evaluation are the same, and findings from monitoring can often contribute to evaluation.

Box 1: Seven key planning steps for an M&E system

Developing a monitoring and evaluation (M&E) system this complex may seem overwhelming, but by breaking it down into a series of manageable chunks, Savita will see that it is quite achievable. The following outlines some of the key planning steps to consider.

1. Consider the various areas your donors wish you to monitor and evaluate, namely: health; social; environmental; technical; and economic impacts. Although the funding is dependent on 'production of stoves', the project will only have an impact if stoves are actually *used*. Therefore, Savita would be wise to also monitor adoption and usage of the stoves, as well as market and enterprise development. She may consider adding further areas of interest.
2. Consider the objectives and level of evidence required for each M&E area. Each donor may have particular requirements. For example, the international NGO may require only basic questions on health impact, while the government agency may demand detailed health surveys (and require participants to give informed consent), to guide national planning.
3. Develop indicators for each of the M&E areas, and consider how you will measure these (e.g. indicator: 'indoor air pollution levels'; means of measurement: 'IAP monitoring using CO tube').
4. Select or develop tools for each indicator. Many tools have already been developed by other organisations in BALA's situation, and are freely available. They can be located in various ways: HEDON is a good starting point, and the forthcoming 'Catalogue of Methods' (see page 38) presents a selection covering most M&E areas. Carefully adapt these to your local conditions, and of course pilot them before use.
5. Develop a monitoring and evaluation framework, detailing timeframes, study designs (e.g. before-after), and sampling methods. Plan to gather *enough*, but not *too much*, data in order to ensure credibility of findings and optimum use of resources. Bear in mind that more data collected means more data to analyse.
6. Think carefully about the resource implications of your strategy as it stands. Does your organisation have the necessary skills to administer surveys, conduct focus groups, use monitoring devices, analyse data and report results? If not, consider recruitment, training or forming partnerships.
7. Is your strategy *achievable* and *realistic* within the budget and timeframe? You may now need to make adjustments to your planned activities, the budget and timeframe before your M&E system is finalised.

There is not space to go into detail on all of the M&E areas that Savita will need to address, so we will focus on assessing socio-economic impacts and monitoring indoor air pollution and fuel-use.

Socio-economic impact assessment

Socio-economic impact assessment is about understanding what this stove and project means to people. Although stove efficiency and reduced indoor air pollution levels are important indicators for the donors, hearing from neighbours about convenience and ease of keeping the stove alight may have been what convinced people to purchase the stoves. Understanding these perceptions and motivations can assist you in developing effective marketing messages, and ensuring you design a stove which people want to use.

Assessing socio-economic impacts is not unlike peeling an onion: a skilled investigator will reveal many layers, and by spending time talking to women and watching them cook in smoky kitchens, will likely suffer watering eyes. Time savings and changes in spending habits are important socio-economic impacts, but what are the secondary effects of these: relaxation, income generation, schooling, more food? Or perhaps financial savings have brought no benefit to women and children, and the removal of smoke has filled the house with flies. And what do these *mean* to women, men and children: better nutrition, better opportunities, more confidence or even empowerment? It is very important for investigators to keep an open mind, because users and householders may raise any number of unexpected impacts.

Open-ended and participatory methods are useful tools for investigating socio-economic impacts. I would suggest Savita begins by holding some focus group discussions, ideally consisting of a fairly homogenous group of around 10, to begin exploring these issues.

Specific visual tools such as 'seasonal charts' can be a great way to ignite discussion and debate among participants in group discussions. Seasonal charts consist of a table (as in Figure 1) with seasons denoted as columns, and various activities or experiences as rows. Rows could include: cooking location, type of stove used, household income, expenditure on fuel and so on. The group is invited to indicate seasonal changes for each row using beans or pictures. Seasonal charts can also be adapted for use with individuals who cannot

read: simply use drawings of seasons and activities. In themselves charts can capture much information, but through further questioning and discussion the facilitator can gain invaluable insight into family life, choices and impacts.

Focus group discussions and other open-ended techniques can often reveal much more than just socio-economic issues and impacts, and are an important first step in developing questionnaires. Understanding seasonal variations can also assist in broader M&E planning, for example ensuring IAP monitoring is repeated at comparable times of the year.

Indoor air pollution and health monitoring

Depending on her funders' interests and the cooking practices in her region, Savita may want to monitor the impact of the new stoves on indoor air quality. This will give her a metric that is related to changes in human health. According to the WHO, there is strong evidence that exposure to indoor air pollution (IAP) increases the risk of pneumonia, chronic obstructive pulmonary disease (COPD), and lung cancer, and moderate or preliminary evidence that several other diseases may also be associated with the toxic compounds found in biomass smoke. A key to success in IAP monitoring is matching the study approach and design to the project phase.

As the technology that the programme will promote still needs some design adjustments, we recommend that Savita wait to do a formal field assessment (effectiveness test) until the stove design has been finalised, manufacturing and distribution of the product is well established, and she has fully characterised her audiences. She can then perform a population-based study in homes with stoves that will have long-term relevance.

At the current programme stage, we recommend that Savita conduct an efficacy test using a Before-After study design (monitor IAP levels first while traditional stoves are still being used and then again after the new stoves are installed). An efficacy test will focus specifically on the ability of the new stove technology to reduce indoor air pollutant levels in real-world homes under somewhat controlled conditions. By limiting variation in both the meals cooked and other major factors that can affect IAP levels during the tests, Savita's study will require a relatively small sample size and fewer resources. Of course, she will not be able to draw conclusions about the extent to which the new stoves are used or whether the benefits are scaleable across populations: this will be assessed at a later stage.

A range of instruments can be used to measure indoor air pollution. Typically, particulate matter (PM) and carbon monoxide (CO) are measured as they are considered the most harmful to health, have a long history of being measured and studied (both indoor and outdoor) and are representative of many of the other harmful air pollutants emitted from biomass cooking stoves. One effective and relatively inexpensive instrument for monitoring PM is the UCB Particle Monitor, which can store minute by minute PM concentrations. Two effective instruments for monitoring CO are the HOBO CO Logger (which has minute by minute datalogging) and CO diffusion tubes (which provide one average concentration).

After Savita has collected IAP samples, she will have to process and analyse the data to produce meaningful information. Such processing and analysis can be performed using Microsoft Excel or similar spreadsheet program. So, she will want to ensure that someone on her monitoring team has such data/computing skills.

Fuel use

Another impact that can be assessed relatively easily is fuel savings. Following a simple "kitchen performance" protocol, field workers weigh each household's daily fuel for several consecutive days, first while traditional stoves are still being used and then again after the new stoves are installed (Before-After approach). The weighing can be done using simple, inexpensive spring scales (see Figure 2). Such an effort provides direct evidence on the fuel saving implications of the new stove. Fuel savings is a particularly valuable assessment, as it provides information that is useful for many audiences. For example, fuel savings is important for understanding the value of the stove to the customer in relation to its purchase price. The same metric is critical for documenting carbon and environmental (resource use, forests) savings.

In summary

Fuel-use patterns and fuel savings are important household energy success metrics to be considered with others presented in this response, and throughout this edition of *Boiling Point*. As good consultants, we have told Savita what she already knows: household energy is complex, with a very wide range of impacts. The most nuanced understanding of these layers of impacts comes from a combination of qualitative and quantitative information derived through observation, survey tools and participatory research. We encourage Savita to begin with a broad range of impacts on the table and then narrow the list by considering her funders' interests, her stakeholders' information needs, and her resources. We are confident an achievable fit-for-purpose plan will result, and Savita's monitoring and evaluation activities will be launched.

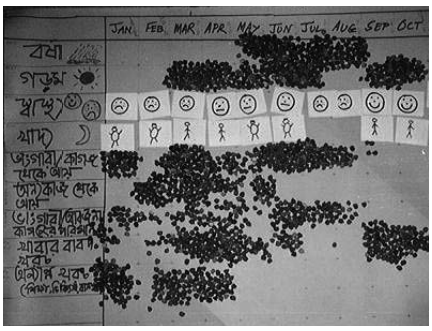

Figure 1. *Completed Seasonal Chart, Bangladesh. (Photo: Jonathan Rouse)*

Figure 2: *Fieldworkers measuring fuelwood in Uganda (Photo: Christen Gray)*

Profiles of the authors

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Although the task of satisfying several donors' requirements may seem daunting, with careful planning Savita and the BALA team can put in place an appropriate and affordable M&E system to meet all of their needs. Thorough M&E has been essential to our work at Gaia Association as it has enhanced our impact on the lives of our beneficiaries and also resulted in increased funding and policy support for our projects. Gaia Association is an Ethiopian NGO working to promote the use of alcohol fuels for household energy in a variety of settings including refugee camps, government institutions, and city housing. We seek to establish the local, sustainable production of both stoves and ethanol fuel to provide low and middle-income urban households in Addis Ababa with a safer and healthier alternative to biomass and kerosene. Since Savita's project and objectives are similar to ours, elements of our M&E model could be applicable to her project. This basic model involves clearly identifying project objectives, selecting indicators and deciding upon the appropriate means of verification.

Define Project Objectives

Based on the outcomes of her pilot study, Savita should define project objectives which should be in line with her donors' demands and priorities. With clearly defined objectives, Savita can then establish an appropriate M&E system, and some of these objectives might include the following:

1. **Scale up of stove sales**: Clear targets have been set by the BALA donors for numbers of stoves to be disseminated during the initial three years. In our first year, Gaia's urban household project will disseminate 2000 CC stoves into low and middle-income households in Addis Ababa. We plan to establish a local stove manufacturing facility, contract a steady ethanol fuel supply from the sugar producers, and spur a market for ethanol cooking stoves, requiring significant follow-up with our business partners and stove users.
2. **Demonstrate project benefits:** See box 1

Indicators

At least one measurable indicator should be identified for each objective:

1. **Scale up of stove sales**: Monthly stove sales numbers, orders and stock levels can be used to accurately indicate whether BALA is on track to meet this critical objective. If stoves are sold in bulk to institutions, keeping track of sales and orders is even easier. Gaia Association plans to contract with the Addis Ababa Housing Authority to install ethanol stoves in newly built public housing blocks which will make monitoring relatively straightforward as they will be concentrated in specific areas.
2. **Health**: IAP levels as well as household health surveys can be used as indicators.
3. **Environment**: Fuel use should be monitored in a sample of households in order to establish changes attributable to the use of the improved stoves.
4. **Social**: Time saved by households, both gathering fuelwood and cooking on the more efficient stove, can be used as an indicator of social benefits.
5. **Technical**: Information on stove usage and problems encountered can be monitored through an after sales service, and questions on stove operation can be included in follow-up surveys. Gaia Association plans to include a unique serial number on every stove to allow for easy tracking of stove use.
6. **Economic**: Income saved at the household level (if fuelwood was previously purchased) could be a good indicator of the economic benefits of the stove programme.

Means of verification (MOV)

MOV are the ways in which the indicators may be measured and understood. Savita must create a timeline with tasks, years, and responsible parties, noting when she will monitor implementation progress, report to her donors and meet with her partners. She should also establish an M&E team within BALA which will be responsible for tracking stove sales and orders and determining the impact of the stove technology in light of the programme's objectives. The M&E team should hire and train enumerators for data collection where needed. Savita should decide on the appropriate MOV for each indicator and then collect progress reports and make regular visits to site to check that the reports reflect the project's actual progress. The following are suggested as MOV for the six indicators listed above:

Monitoring stove sales: If BALA is the stove retailer, they will be in a position to directly access and monitor stove orders, sales figures and stock levels and ensure that the targets are being met. If the stove retailers are independent of BALA, Savita must establish a means of monitoring

Box 1: Project benefits

Health: Demonstrate the benefits of the improved stoves at the household level in terms of improved air quality. This continues to be a primary objective for Gaia Association and many of our donors and as such, we have conducted detailed IAP (Indoor Air Pollution) studies in all of our project sites. Figure 1 shows one of our enumerators installing IAP equipment in a kitchen where an ethanol stove is being used.

Environment: Demonstrating the impact of the fuel-efficient stove programme on the natural environment should be a key objective for BALA.

Social: Investigate the social impact of the programme in terms of the improved status of women and girls, time saved cooking and gathering wood etc.

Technical: Continue to ensure that the stove technology is functioning properly and that a high safety record is maintained. It is crucial that BALA demonstrates that the stoves are actually being used. Gaia Association is working with local producers to ensure that their stoves meet the same quality and safety standards as the previously imported stoves.

Economic: Demonstrate the economic impact at both household and national levels in terms of time and income saved by use of the improved stoves. For example, Gaia Association has shown that significant foreign exchange savings can be generated by replacing imported kerosene with locally produced ethanol for household cooking.

Figure 1 (above). *Gaia Association enumerator, Yonas Abesha installing indoor air quality monitoring equipment (UCB, HOBO and CO tube) in an Addis Ababa kitchen. (Photo: Amdowork Wbetu)*

Figure 2 (left): *Firehiwot Mengesha, Gaia Association Deputy Director interviewing stove user in Addis Ababa. (Photo: Cheryl O'Brien)*

stove orders and sales in each location. The retailers could report their sales and orders to BALA on a monthly basis so that she can track and forecast the growth of the business.

Monitoring IAP: BALA should conduct an IAP study on a sample of households that use the improved stoves. To reduce costs, training in IAP monitoring can be sought from other NGOs conducting similar research in the region and equipment can be borrowed or rented. IAP testing should be conducted both before and after the introduction of the new technology. Gaia Association ran a very successful IAP study in a sample of households in Addis Ababa and in Kebribeyah Refugee Camp. The study demonstrated quantitatively that the ethanol stove technology reduced levels of harmful pollutants to within WHO standards. These positive results led to increased donor funding.

Monitoring Fuel Use: Baseline fuel use surveys can be conducted prior to the commercial scale up of the project to ascertain how much fuel the average household uses for their daily cooking needs. This could involve weighing standard fuel bundles to find out how much households are consuming. Follow up surveys can then be conducted in the same homes after they have purchased the improved stoves, to measure the difference in the amount of fuelwood used. This data can be strengthened by conducting controlled cook tests on the relevant stoves to establish how much fuel is required for preparing a typical meal. Gaia Association have conducted baseline and follow up surveys of this type in all of our project sites to determine fuel use patterns and changes following the introduction of the ethanol-fuelled stove.

Monitoring Time Saved: Qualitative household surveys can be used to find out how much time has been saved cooking and gathering wood and if this saved time is now used for other activities.

Monitoring Stove Use: The M&E team should instruct the surveyors to observe stove use during their household visits and then report any problems or concerns to the M&E team.

Monitoring Income Saved: Baseline and follow up surveys can be conducted to determine household expenditure on fuel (where fuel is purchased) and how this changes with use of the new stove. This data can be corroborated by checking fuel prices in the market, and by cross-referencing using the fuel use survey data. Gaia Association used similar techniques to demonstrate income savings accrued at the household level by switching from fuels such as kerosene and charcoal to ethanol for cooking.

The importance of having a solid M&E system cannot be overstated. The starting point in the planning process should always be a clearly defined set of objectives which reflect the donors' interests in the project and for which measurable indicators may be selected. From there, the most appropriate MOV can easily be decided upon. With such a system in place, along with a timeline and a strong M&E team at BALA, Savita is in a good position to track the progress of her project from various angles. M&E findings can be referred to in planning scale ups, predicting obstacles, modifying project design and securing additional donor support. M&E has become a central element of the work of Gaia Association and an area to which we devote significant time, energy and investment. By evaluating the impact of our work, we build confidence with our donors and most importantly, we maintain a dialogue with our target communities to ensure that we continue to serve their needs as best we can.

Profile of the authors

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Additional case study text provided by the author

Savita would also have to develop a strategy for implementing the M&E system for scaling-up the project. Having previously established the eligibility of her project for accessing carbon finance, she was going to have to negotiate and sign an Emissions Reductions Purchasing Agreement (ERPA) with the small, private company of a friend working in Europe. Her friend's company wanted to buy carbon credits in order to offset their emissions and position themselves as a "green" service provider for environmentally conscious consumers in the Netherlands. Since she will be required to use a pre-approved methodology for calculating emissions reductions, Savita could use this as an opportunity to frame her new M&E system.

Savita's contract with her friend's company would allow her to sell them carbon credits through the voluntary market. Carbon finance has very strict requirements pertaining to the quality of data provided and the frequency with which data is up-dated and analysed. So Savita should use the basic requirements for verification of the carbon credits as the backbone of the monitoring and evaluation (M&E) system she will develop, making sure that the various indicators and reports required by the other funders are included in the new system.

A monitoring system is not the only technical aspect of project implementation. Savita should also use a logical framework analysis, or log-frame, as a planning tool to assure the various objectives of all stakeholders are met. The log-frame provides, in one easy-to-read worksheet, the inputs and aims of the project, the indicators used to measure the achievement of aims, and the outcomes and outputs expected from implementation. A good log-frame can provide a technical guideline throughout the life of the project, for the evaluation of implementation as well as to assess if the project has met its initial aims. Paired with a project timeline, these should be the fundamental documents that will guide the execution of the project.

Based on the log-frame she develops, the M&E system will allow her staff to show donors and stakeholders that resources were well used throughout the duration of the project. The M&E system could consist of the following parts: a baseline survey; periodic monitoring (collection and analysis of data to determine if the project is meeting geographic, scale, and time targets); and evaluation at key programme milestones, including post intervention to allow for the review of intended impacts.

As the monitoring system will require considerable time and resource to implement, Savita should make sure that she has the funding to support it. She will then have to obtain approval from the Government, International NGO and private company who are funding the project before she starts the implementation. After the first year of implementation, the results of the monitoring will have to be verified and certified by an approved independent institution.

Savita should start by designing the baseline survey in order to establish the pre-intervention conditions of stove users in the target and control areas. In order to address the needs for social, economic, health, and environmental data as well as the perceptions of stove users, quantitative and qualitative data will have to be collected from a variety of sources. A sample of relevant indicators include: demand, supply, the number of stoves sold, equipment ratio, fuel mix, fuel source, IAP monitors, stove price, household income, stove use data (for how long does a family use a stove?), shelf life (how long between production and use in the home?), user satisfaction, time saving, money saving, etc.

The baseline survey will allow them to "see" changes in indicator values from project initiation through to completion and beyond. The baseline survey should have as many "layers" of data collection as there are units of required analysis. For example, a donor may need provincial and district level economic, demographic, and environmental data for the geographic region of the intervention. This data is sometimes available from government statistical surveys. Health, fuel, and technology use data will have to be collected at the city, commune or village level (in the case of Cambodia) in order to be specific to the programme targets.

In addition, qualitative data should be collected through various methods of social science research, such as focus group discussions (FGD), interviews, or surveys about preferences and perceptions. Those interested in a complete qualitative baseline survey addressing behaviours and perceptions should plan to implement a knowledge, attitudes, and practices (KAP) survey. Similar to monitoring practice, a KAP survey can be repeated post-intervention to gauge the impact of the intervention (and other influences un-related to the project). It may also be repeated annually thereafter to gauge the sustainability of the knowledge and new practices gained through the intervention.

Once the data is collected it has to be both entered and stored in statistical and/or econometric analysis software such as SPSS or STATA. Analysis of the data will provide the most useful information on the pre-intervention conditions in the target area, and the changes that have occurred since the project began. Baseline studies should be easily replicable and monitoring should consist of the repeated, predetermined, collection and analysis of data from the field. As a result of the latter, Savita may have to offer some kind of incentives to households to ensure the timely reporting of the required data. In order to satisfy the stringent needs of the verifier for carbon credits, she will have to provide data on the number of stoves in use from two different points along the distribution chain: from producer, to distributor, to retailer to user.

But with an effective M&E system in place, Savita will be able to respond to the reporting needs of all the funders, including carbon finance, and she will be able to better manage the progress of project implementation in the field.

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Case study response

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Savita would be wise to include gender analysis as part of her approach to monitoring and evaluating her stoves project. She might be surprised to read this because in a household stoves project the target group is usually women. But gender is about men and women, so what has gender got to do with stoves? Well quite a lot actually.

There is plenty of evidence to show that when household equipment is bought, even equipment for the kitchen, men are involved in the decision making process (see for example, Dutta 1997). So the men within the household need to be convinced about the benefits of buying the BALA stove. Often men and women will also have different selection criteria for a stove, for example, women might want one that is easy to light and gives a cleaner kitchen whereas men may want a stove that gives quicker meals. So the BALA stove will need to meet both women's and men's needs. Another reason for including gender is that it will probably be a requirement of the international NGO, particularly if they are using donor funds. Gender could be included as one of the social indicators Savita has to measure. However, there are also sound practical reasons for paying attention to gender issues. There is a growing acceptance of the fact that ignoring gender in projects is a contributory factor to project failure (Fong and Bhusan, 1996), while paying attention to gender can lead to a better fit of project interventions with the intended beneficiaries and thus create greater management efficiency in terms of delivery (Skutsch, 1998). In other words by including gender analysis in her monitoring and evaluation methodology toolbox, Savita increases the chances of meeting her projec t target.

Help is at hand for Savita. The Department of Technology and Sustainable Development (TSD, University of Twente) and ENERGIA have developed gender analytical tools specifically for use in the energy sector. These tools can easily be combined with existing procedures, in particular, they fit into the project cycle. They differ from other gender analytical tools in two ways. Firstly they make explicit the 'gender goals' for a project, i.e. identifying which gender issues will be addressed, and secondly they assess the gender capacity of organisations involved in project delivery (Skutsch 2004).

The reasons for different stakeholders to get involved in a project, and the outcomes they expect, vary. For example, a typical stoves project, such as BALA's, usually aims to bring improvements to women's lives. However, do all stakeholders have the same expectations about these improvements? BALA might be aiming at improving women's health (reduced smoke) and saving women's time in fuelwood collection (reduced drudgery), in other words the aim is women's welfare. This 'gender goal' is also likely to be held by the international NGO which quite possibly will also be interested in women's empowerment as a result of the project. The NGO may be less clear what they mean by "empowerment" – economic? social? The gender goal of women's empowerment can be viewed with suspicion by some stakeholders and can lead to resistance to projects. It is better to be clear and realistic about what gender goals have been set by the project, so that the target is visible and evaluation of the project can be made on the basis of agreed and accepted goals. All the stakeholders in the project should also be clear about the goals. Reaching agreement can help overcome any resistance and avoid disappointments.

BALA also needs to assess whether or not, as an organisation, it is equipped to deal with a gender approach to project implementation, for example that staff are gender sensitive to cultural issues in the region where stoves are to be promoted (i.e. are women able to attend training sessions at night or at some distance from home?).

ENERGIA's gender-analysis tools consist of a framework with a number of steps. Within each step there is a set of questions that need to be asked in a logical order, and the data can be gathered by a number of methods, including desk studies and participatory approaches. The questions are not meant to be prescriptive and can be adjusted to suit the context. The data collected is then used to complete a number of tables which can then be used to analyse the data, to aid decision making, and to help identify areas for remedial action (for example, increasing women's participation in stove design).

The tools were designed for the planning phase of energy projects, although they have been shown to work for energy project evaluation (Clancy et al, 2007). ENERGIA members who have used the tools report them as easy to work with. There is an easy to follow manual which BALA can use and it's free to download via the *@HEDON* link at the end of this article. The tools provide comprehensive data, although they do need to be adapted for the particular context either to prevent the collection of redundant data, or to ensure the collection of more context specific data. So BALA has some work to do but Table 1 gives some suggestions.

Figure 1. *A focus group meeting in the Philippines (Photo: The Author)*

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Profile of the author

Dr Joy Clancy is a Reader/Associate Professor in technology transfer with the Technology and Sustainable Development Department at the University of Twente in the Netherlands. Her first degree is in Chemistry (University of London) and her PhD was on alcohol fuels in stationary engines (University of Reading). She joined the University of Twente in 1989, since when her research has focused on small scale energy systems for developing countries, including the technology transfer process and the role that energy plays as an input for small businesses and the potential the opening of energy markets offers entrepreneurs through the provision of a new infrastructure service. Gender and energy has been an important factor addressed in this research. Dr Clancy is a founder member and a technical advisor to ENERGIA.

Table 1 *Gender analysis of BALA Stoves Project*

Questions to be asked	Source of data	Work plan for data collection
Identifying stakeholders and gender goals		
Which stakeholders?	Stakeholders should include all agencies involved (such as local Government agency, international NGO, stove producers) and target households, (men and women should be considered separate stakeholder groups)	Preparation phase and fieldwork planning
Gender capacity of agencies?	Assess whether BALA is capable of responding to gender issues in a positive manner. May also consider assessing stove producers.	
What obstacles?	Take advice from key informants regarding the local situation. Be prepared to hold different meetings at different times for men and women.	
What stakeholder goals?	Separate focus group meetings for men and women from target communities to identify motivation for buying a new stove. Other stakeholders' goals can be found from analysing documents or from the discussions around what indicators (see next question).	Consultation and orientation phase
What indicators?	Indicators can be developed by BALA alone or with stakeholders. The latter approach can help clarify the gender goals of the stakeholders.	
Genderised context definition		
What are the criteria of selection for a stove?	This is a market analysis based on gender disaggregated data. BALA should carry out a survey of a representative sample of households – with men and women interviewed separately. The data collected forms a reference source that can later be expanded in focus group sessions for feeding back on stove acceptance.	Sample survey using detailed interviews with households
Who is responsible for decision making about stove and fuel purchase?	This information can be collected in the household survey and followed up in the focus group sessions.	
What priority is a new stove within the household?	This information can be collected in the household survey and followed up in the focus group sessions.	
Genderised appraisal of stove		
Does the stove meet the criteria of men and women?	The answer to this question allows for adjustment in stove design and marketing approaches.	Focus group of users and non-users.
Has the project met the gender goals?	Assessment by the project design team.	Final step in the appraisal.

Case study response

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Savita needs to prepare a full monitoring and evaluation (M&E) framework that will provide all stakeholders, including programme management, field staff, beneficiaries and donors with information on programme status and results. It should help assess the progress of key programme aspects at each stage and the achievement of the overall objectives. The basic framework would involve four steps.

Step one: Constructing the logic

The first step in this process is the careful review of the strategic focus of the programme in light of the interests of donors and beneficiaries, to ensure that the programme satisfies the requirements of both groups. The outcome of this exercise is an overall framework that details M&E at each level and stage of implementation.

At the programme level, indicators must be well formulated and explained as well as broad in nature and aimed at showing the achievement of programme goals and outcomes.

The project level indicators are more specific and aim at showing the achievement of programme outputs and the accomplishment of activities. However, they should also show the achievement of specific project goals and outputs.

The programme level indicators define the overall focus of the programme which follows the logic and requirements of the donors and beneficiaries. The project level indicators assess the process of programme implementation and are critical to the programme management team.

The experience of the GEF Small Grants Programme (SGP) shows that global programme M&E should also include process indicators covering, for instance, aspects of project design, approval, implementation and completion. When developing the framework logic, every M&E activity at each stage should be linked in with the overall programme goal and outcomes.

Step two: Developing the baseline criteria

The second step is to prepare the baseline criteria of programme activities based on the strategic focus. Both monitoring and evaluation require information about the current state of the beneficiaries or locality before programme activities begin, and are usually centred on the strategic focus identified in step one.

This forms the baseline information from which the assessment of impacts can be made and will be of help to Savita in the identification and construction of indicators. Through these indicators, Savita can be in a position to assess the programme progress and accomplishments within the logic constructed in step one. While the baseline information is mapped, specific milestones should be identified that will be accomplished at the various stages of programme implementation. Because of the need to monitor accomplishments while taking remedial measures, the monitoring and evaluation framework that Savita should prepare needs to be systematic, but at the same time allow for unexpected occurrences and results.

Step three: A sustainable system for M&E framework implementation

For an M&E framework to operate effectively, a third step is necessary in the form of a system that ensures the process of activity implementation is being adequately monitored and assessed. At the UNDP GEF SGP a computerised, real-time online system captures M&E activities as they happen in over 100 countries. The system is based on a database which can be operated both online and offline depending on the local situation. The online system is complemented by a reporting system which has obligatory benchmarks and deliverables. The sum total of both the computerised system and the other reporting requirements determines how effectively the M&E framework is being implemented.

The system should allow for the extraction of reports to satisfy both donors and programme management. It should also summarise the achievements of a series of benchmarks and deliverables at specific programme stages, directly from the online real-time database. Because the benchmarks and deliverables are based on the identified baselines they are a core element of M&E and their achievement depends on a focussed, thoroughly coordinated and synchronized implementation of different aspects of the programme activities

Step four: Ensuring a feedback mechanism for donors and beneficiaries

Key to the effectiveness of the M&E system is the ability to give feedback to donors as well as beneficiaries, with the latter often not effectively done. The UNDP GEF SGP has developed a method that intrinsically incorporates a feedback mechanism within the M&E process. It is based on the premise that an effective monitoring and evaluation framework is that which allows the participation of the beneficiaries and gives them the ability to feedback in to the project.

It allows the beneficiaries to ask questions and also give answers related to the important aspects of programme activities. It also enables the programme to build the capacity of the beneficiaries and also enhances understanding between the various project groups. Linked to the feedback mechanism is a jointly developed baseline scenario which, using the indicators, helps the beneficiaries to clearly understand the impact of the programme on their lives.

Enhancement of accountability

Where the beneficiaries are involved in a participatory process, monitoring becomes a continuous activity. It thus ensures that there is both technical and financial accountability during programme/project implementation.

The GEF SGP promotes participatory monitoring and assessment in the design and implementation of Country Programme activities as part of a broader approach to M&E. Apart from building capacity, it enhances the involvement of affected beneficiaries and stakeholders alike, and provides for better correction of mistakes during programme implementation, thus ensuring that lessons are articulated and learned by the beneficiaries themselves. It contributes to building consensus, creating a sense of "ownership" of the process and programme approach, and promotes mutual understanding.

Conclusion

Stove monitoring and evaluation activities include capacity-building and public awareness components that are part of the participatory process of establishing an effective M&E system. It is therefore important for Savita and the programme team to have a good sense of the beneficiaries' perceptions and practices before the programme begins, as they would do for the donors.

The process of participatory monitoring and assessment begins at inception. The GEF SGP experience with climate change and energy programmes demonstrates that early consultation in project design with beneficiaries is as important as consultation with the programme donors. The consultation at this stage involves such aspects as defining problems, potential courses of action, available beneficiary resources, the role of external support, construction of the baseline and beneficiary expectations.

At the programme level, M&E design strategy requires participatory compilation of baseline information and also agreement on the definition of programme concepts (e.g. to define the focus of activities). The beneficiaries and programme management need to reach a consensus on programme objectives and activities and in the process establish an effective monitoring and evaluation plan that includes their roles and responsibilities. Once these aspects are defined, the M&E system can effectively be established, implemented and feedback provided.

Profile of the author

Stephen Gitonga has worked for 16 years in the area of energy, environment and development. He is currently the Energy Policy Specialist with the Sustainable Energy Programme of United Nations Development Programme in New York. Prior to joining the Sustainable Energy Programme, he was the Climate Change Programme Specialist with the GEF Small Grants Programme implemented by UNDP. He also spent ten years with two international development organizations (Intermediate Technology Development Group with offices in the UK, Asia, Latin America, and Africa) and The Bellerive Foundation. During his time at ITDG and The Bellerive Foundation, he was the Energy Programme Manager and the Domestic Energy specialist respectively. Stephen has written over 40 thematic publications on the topic of energy, environment and development

Focus

Coming soon: Evaluating household energy and health interventions: a catalogue of methods - a publication from the World Health Organization (WHO)

As household energy gains a higher profile internationally, governments, donors and NGOs increasingly ask 'What works, and where is the evidence?'

This publication is intended to help organisations systematically monitor and evaluate their household energy interventions to generate credible evidence of success, as well as identify areas needing improvement. It presents a series of established methods for examining the sustainability of adoption and assessing impacts on indoor air pollution, health, socio-economic conditions and the environment.

The methods range from simple questionnaires to complex monitoring techniques: there are tools appropriate for most organisations.

The catalogue outlines the process of developing an evaluation strategy and describes some of the practicalities of study design, ethics, analysis and reporting.

The catalogue of methods will be published later this year. It will also be available online via the @HEDON link below.

Global green energy awards – winners announced

London, June 19th: At an Awards ceremony presided over by Nobel laureate Dr Wangari Maathai, it was announced that the title 'Energy Champion' and a prize of £40,000 has been won by Technology Informatics Design Endeavour (TIDE). Six other international schemes were awarded £20,000 each by the UK-based Ashden Awards for Sustainable Energy, to promote replication and expansion of sustainable energy projects. Visit the Ashden Awards website via the @HEDON link below.

Building on the excellent track record of stove design at the renowned Indian Institute of Science, TIDE commercialises their designs to provide efficient tailor-made woodstoves and kilns which save at least 30 percent of fuel. To date 110,000 workers enjoy better conditions thanks to the 10,000 products they have supplied.

This year's Outstanding Achievement Award went to Grameen Shakti of Bangladesh. The organisation has made a significant contribution to the spread of sustainable energy solutions – to date it has installed 160,000 solar home systems and is adding around 8,000 new systems each month. They have also diversified into the provision of fuel-efficient stoves and domestic biogas systems.

- Brazil, CRERAL: Cooperative uses mini hydro to increase electricity supply on local grid
- China, Renewable Energy Development Project (REDP): Bringing affordable, high-quality solar lighting to rural China
- Ethiopia, Gaia Association: Clean, safe ethanol stoves for refugee homes
- India, Aryavart Gramin Bank: Bank helps customers to buy solar home systems
- Tanzania, Kisangani Smith Group: Blacksmiths develop wood-saving stoves
- Uganda, Fruits of the Nile: Solar drying business links rural farmers with export markets

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Toolkit

Six steps to Results Based Monitoring (RBM)

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The following six steps should help you to set up your Results Based Monitoring (RBM) system. From identifying all stakeholders in the system, formulating the assumptions on which your strategy is based, analysing risks and side effects, choosing observation fields, specifying indicators for measurement up to their operationalisation to data collection – and there you go!

Monitoring is a systematic observation of a given situation and the changes that occur. It may focus on activities carried out by a project or on services being delivered. With the new responsibility given to development actors to achieve envisaged development results the attention has in recent times switched to the monitoring of *results*, not just activities.

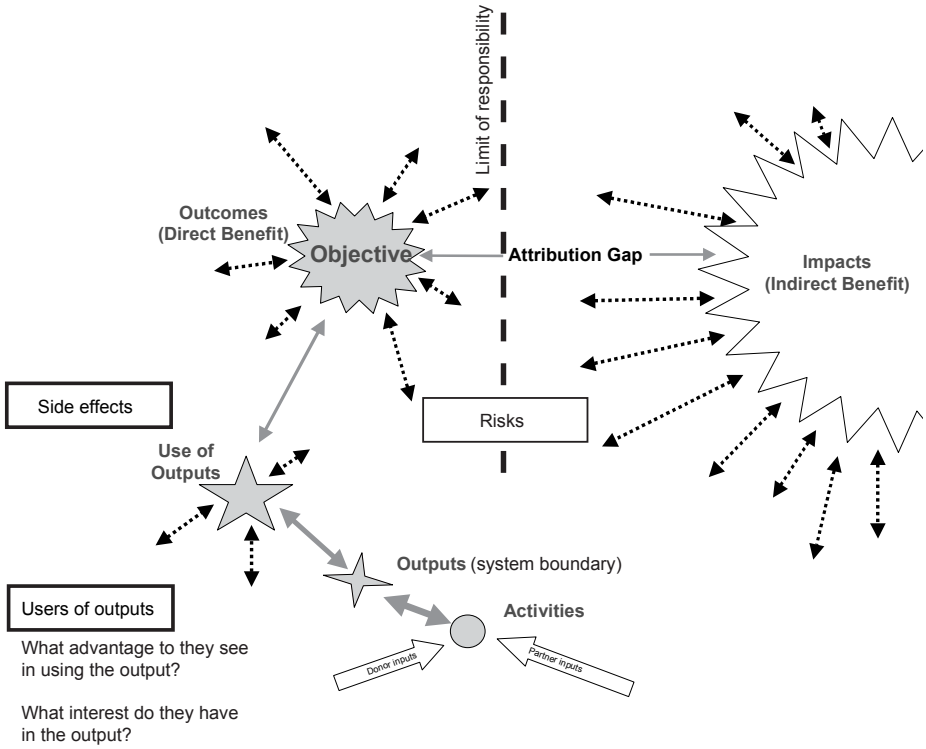
Results are the changes occuring as an effect of a development intervention and they can be attributed to it. They may be positive or negative, intended or unintended. The project's strategy aims to achieve positive results by carrying out activities that produce certain products or services (i.e. outputs) for specific user groups. If those users make use of the services they will change their way of doing a certain thing and experience a change or obtain a benefit (i.e. an outcome) as a result. These outcomes may contribute together with the results of other development interventions to higher development goals (these are impacts). Certainly, the project's impacts cannot be attributed to just one single project or programme – they are beyond the "attribution gap". The Results Model shown in Figure 1 helps to visualise the assumptions of a given strategy.

Two boundaries are of specific interest: the system boundary separating the project system which is under the control of project management from its environment; and the limit of responsibility indicating the level of the goal the project is meant to achieve. Other elements are risks that may have a negative influence on the results chain and side effects that might occur due to unplanned results from the development intervention.

Preferably, the whole monitoring process, from its design to the active data collection and use should be done together with partners and – whenever possible – with target groups. Thus, different viewpoints on the occurring changes can be shared and valued at the same time. The joint development of the strategy contributes to increased ownership for the development action.

There are six steps to setting up a Results Based Monitoring system:

Figure 1: *The Results Model as adapted by GTZ*



Step 1 – Identifying the system boundaries

A project can be perceived as a system which has control on its resources or inputs. With them, it generates services for users outside the system and beyond its control. It is helpful, as a first step, to identify all actors that participate together with the project team in service delivery and to distinguish them from the users of the outputs.

Staff of partner organisations, external experts, NGOs, government institutions, actors from the private sector or even representatives from the users' groups may thus participate in the generation of outputs. They are therefore part of the project system and under its control, because they are paid for their work or because they are bound to a mutual agreement. On the other side of the system boundary are the potential users of the outputs. Whenever they have an interest in using the output or see an advantage in it, they will use it. However, the project cannot control them. They could be from the private sector, from government institutions, from NGOs or among the general population. Some actors might have a double function – contributors to the service delivery and users of the service.

Guiding questions:

- Which actors participate in generating outputs?
- Who are the users of the outputs? What interest do they have in these outputs? What advantage do they see in using them?

Step 2 – Formulating the results chains

The results chains of a project reflect the underlying hypothesis of its strategy and constitute the foundation of the whole RBM system. In an ongoing project one could start with the main products and services delivered. For example, in a typical stove project there might be main outputs for the stove producers (e.g. training), for the stove users (e.g. awareness campaigns), for other NGOs (e.g. training manuals) or for stove dealers associations (e.g. organisational development). For each main output the corresponding results chain would be formulated.

Next, the main activities necessary to achieve the output would be formulated. For example, the main activities for the output "training delivered to stove dealers" could be: a) to develop concepts for technical and business training; b) to conduct training courses for stove producers. It is not necessary to go into details of the sub-activities as this is not part of operational planning.

A useful third step in the process of developing Results Chains is to specify the supposed use of the outputs by the users. For example, the stove dealers may have received good training in new techniques for stove production, but if this knowledge is not applied, then no improved stoves would be produced and no change would occur. However if they implement the new techniques then good quality improved stoves should be produced, leading to them being available on the market. This direct result is at the same time a goal for the project.

Continuing along the results chain will generate further indirect results that might occur in the medium and long run and to which the direct result contributes. These impacts could be a) more improved stoves in use; b) less pressure on natural resources; c) more income for stove producers, and so on. The Millennium Development Goals (MDGs) are part of the impacts.

Guiding questions:
- What are the main outputs?
- Which main activities lead to these outputs?
- What do the users do in a different way when using the output?
- What direct benefit is resulting from this?
- What are the indirect results, to which the direct result contributes?

Step 3 – Analysing risks and side effects

Risks are external factors that may have a significant negative influence on the results chain. They can be influenced (for example by the intervention of other donors, conflict of interests among actors, etc.) or not (e.g. natural catastrophes, global economic developments etc.). As they can hinder the achievement of the project goals, they usually have to be reported to donors or other stakeholders. Project strategy should be designed in such a way as to minimize the negative influence of risks when they occur and limit the unwanted results as far as possible.

Side effects are unplanned results of a development intervention, that might be positive or negative, expected or not. As in the case of risks, they should also be monitored to allow for an adjustment of the project strategy if necessary.

An analysis of risks and potential side effects can help make the stakeholders aware of them and to define alternative strategies.

Guiding questions:
- What are the main risks that might have a negative influence on the results chain? What is their cause? What alternative strategy could be used to minimize their influence?
- What are the potential negative side effects? What is their cause? What alternative strategy could be used to minimize their influence?

Step 4 – Choosing observation fields

Observation fields are those parts of the results chains that need to be monitored regularly in order to know whether the project is on target to achieve its goal. It is important to choose which of the results chain hypothesis, risks and side effects we need to be informed about- it isn't necessary to monitor every part of the results chain!

Guiding questions:
- What results hypotheses are particularly important?
- What results hypotheses are uncertain?
- What parts of the results chains are under negative external influence?
- What negative side effect might occur?

Step 5 – Examination of given, and formulation of new indicators

Indicators are yardsticks that are used to measure results. They indicate what makes a difference, to what degree and until when. They should be precise, specific, realistic and measure a specific aspect of the desired result. Reference values (baselines) are required for any indicator so that the initial situation can be compared to the expected change.

Indicators may be given by the donor, particularly for the project goal (level of direct result). For the lower levels, milestones or process indicators are formulated by the project team for their internal monitoring.

The given indicators should be examined and a clear common understanding developed. For all other observation fields chosen, new indicators are formulated to measure the expected or unwanted change.

Guiding questions:
- What indicators are given?
- What exactly do they mean?
- What should be further specified, changed, and agreed upon?

Box 1: Key terms according to the OECD-DAC glossary

Inputs: are the financial, human, and material resources used for the development intervention.

Outputs: the products, capital goods and services, which result from a development intervention.

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.

Results: the output, outcome, or impact (intended or unintended, positive and/or negative) of a development intervention.

- Where in the results chains do they have an effect?
- What additional indicators are necessary for the selected observation fields?

Step 6 – Operationalisation of indicators, data collection and use

Now the indicators have to be made feasible. It is necessary to decide who will collect what data, how it will be collected, at what frequency and, eventually, at what additional cost.

Also, the users of the data have to be identified to assure future distribution of monitoring results.

Indicator sheets may be created with the specifications of each given and chosen indicator.

Guiding questions:

- What initial value is available for a particular indicator? Where can information be found about it?
- What data / information is needed to measure the indicator?
- How will the data be collected? What method will be used to collect it?
- How often and when will the data be collected?
- Who will be responsible for data collection and processing?
- Who needs the information, when, in which form and what for?
- What additional resources are needed?

Now your RBM is ready to start! You just need to go to the field and collect the data for your observation fields chosen on the basis of your results chains.

And then make use of the monitoring results for your project steering, learning processes and reporting. Have fun!

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Profile of the author

Melanie Djedje holds a M.SC. in Agriculture. She has been working in international development cooperation in various fields for more than 20 years. In the late 1980's, early 90's she was responsible for the GTZ stove project in Niger, West Africa. A couple of years ago she again joined the GTZ household energy programme (now HERA) offering backstopping for various projects in West, East and South Africa. Another main field of activities in the past years has been RBM.

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