Department for International Development (DFID), UK

KAR programme (Project R7665)

P0411

Energy Services for Rural Institutions (ESRI)

Energy Service Advisors: Guidelines for Energy Management and Improved Energy Services at Rural Institutions

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August 2002

ENERGY FOR SUSTAINABLE DEVELOPMENT

Summary

Health and education institutions in rural areas of developing countries need energy to support their core activities. This may be in the form of diesel for transport, kerosene or electricity for lighting, and wood based fuels for heating and cooking. In order to support the ongoing development of core services of these institutions, improved and more modern forms of energy are needed.

Meanwhile, many hundreds of thousands of schools and hospitals in Africa and throughout the developing world suffer from energy problems. Rural institutions face an increasing demand for energy services with very little access to specialist energy knowledge. A real need exists for rural institutions to find appropriate energy solutions but very few skilled service options are available to them. Without such support, many institutions operate extemely inefficiently, wasting scarce financial resources. Consequently, their ability to deliver core services is seriously undermined.

However, local knowledge and ability does exist in disciplines that are related to energy management. Technical and managerial skills are present in the staff of the institutions themselves and within the local community. By harnessing the ability of these individuals and organisations, there is an opportunity to develop energy solutions which blend demand-side management, energy efficiency measures and careful investment in new, appropriate technology.

With support from appropriate stakeholders and a positive policy environment, there is scope for energy services to be improved on a sustainable basis through use of locally based Energy Service Advisors (ESAs). In principle, such advisors would work within a local business framework, providing advice on the various types of energy issues faced by the institutions.

There is a variety of options for such an operation to be put in place and this depends on the country and local context. In these guidelines, the variety of energy issues facing such institutions is presented. Three models are then described as generic operational frameworks. Examples are given based on the cases that have been piloted in Kenya, South Africa and Uganda .

Over the past 15 years, energy efficiency and management in rural schools and hospitals have not been a major concern to development agencies so there is very little up-to-date, relevant documentation. This Guidelines document on the provision of decentralised energy services by ESAs seeks to partially fill this knowledge gap.

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Abbreviations

ac	alternating current
CHAK	Christian Health Association of Kenya
dc	direct current
DfID	Department for International Development
DOE	Department of Education (Government Department)
DOH	Department of Health (Government Department)
ESA	Energy Services Advisor
HCTS	Healthcare Technical Services (Kenya)
ICT	Information Communications Technologies
ICT	Information and Communications Technologies
KCS	Kenya Catholic Secretariat
LPG	Liquid Petroleum Gas
NGO	Non-Governmental Organisation
PV	Photovoltaic (Solar)
PVQ	Pre-Visit Questionnaire
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

1. INTRODUCTION

1.1. SCOPE OF DOCUMENT

This document is intended:

- To outline the key energy management issues that face health and education services in rural areas of developing countries;
- To provide guidance about the opportunities and issues associated with the development of rural Energy Service Advisors (ESAs) in developing countries in order to tackle energy management issues.

The focus of the document is to identify how the relatively novel concept of Energy Service Advisors can contribute to the delivery of sustained energy management services, drawing on project experience in Kenya, South Africa and Uganda. Much of the material presented is applicable to diverse developing country environments.

Note - this document does not intend to duplicate technical information that is available elsewhere, for instance full details of energy management intervention options, school and clinic building design and other such specialist energy topics. Instead, illustrations of typical scenarios and references to these are available in the appendices.

1.2. TARGET AUDIENCE

This document is targeted at all organisations in the development community associated with improvement of the management and efficiency of rural institutions in developing countries. Principally these will be international and local stakeholders related to the education and health sectors such as:

- National Government Health and Education Departments in developing countries
- National Government Departments of Energy in developing countries
- International Development Agencies (eg The UK government's Department for International Development, Canadian International Development Agency, The United States Agency for International Development, Directorates of the European Commission etc.
- Organisations with an interest in the financing of energy business establishment. These include UNDP, The World Bank, The Shell Foundation and UNEP's African Rural Energy Enterprise Development programme (AREED)
- Rural Energy Service Utilities and Concession holders
- Development Consultancies
- Research Institutes

1.3. WHY ESTABLISH ENERGY SERVICE ADVISORS?

It is clear that there is a core focus of attention in rural areas of developing countries by donors, investors and government agencies. This core focus is on the delivery of water, health and education services. Generally, this means the development and implementation of school curricula, the training and retention of teaching and medical staff, and the provision of water infrastructure and maintenance services. It is a natural tendency that rural energy services, as a supporting element of these core services, rank as a secondary issue. However, the final delivery of core services can often be critically affected by poor energy services through:

- Disproportionately high financial burden of heating, lighting, electricity
- Low quality or absence of lighting in school buildings, eroding the opportunity for out-of-hours study, evening classes or community use
- Unreliable availability of equipment through intermittent supply or lack of electricity – audiovisual, refrigeration, laboratory.

However, there are local skilled individuals in rural areas, for example physics teachers, technicians, and administrators. These people and their skills have the potential to be diversified and applied to energy management. Further, the economic savings generated by improved energy management can be sufficient to offer a business case for energy service provision, particularly in relation to alternative options, like the provision of these services from administrative centres, which can involve significant transportation and high costs.

It is therefore very appropriate to examine and assess the options to access these local skills and determine the viability of converting them into sustainable entities, operating at an appropriate technical level and based in the community. This document outlines some of the options to achieve this.

After reading these guidelines the reader should understand that there is potential to improve quality of life of rural people through the use of Energy Service Advisors (ESAs). The reader should:

- Have an improved awareness and understanding of rural energy related issues;
- Understand that improving energy services at institutions and associated staff situations is beneficial to their core service provision;
- Be interested to support sustainable business ventures involving ESAs of one or more of the different types explored through this project;
- Have developed knowledge on how to go about setting up and supporting ESAs

2. SCOPING ENERGY SERVICE NEEDS AND SOLUTIONS

In considering whether to establish or support an Energy Service Advisor type intervention in to rural health and education institutions, several key issues need to be considered. It is preferable to break this down into steps, which are discussed in 2.1 to 2.3:

- Clarify the types and sizes of rural institutions
- Identify the target market and what can be achieved
- Consider existing organisations that can provide energy services

In taking these steps, it will become clear whether an ESA approach is appropriate. It will also identify on what basis the ESA approach applies and will support the choice of ESA model.

2.1. CLARIFY THE TYPES AND SIZES OF RURAL INSTITUTIONS AND THEIR ENERGY SERVICE NEEDS

There is a huge range in energy provision and appliances between "first world"-type institutions and the poorest rural schools and health outposts. The latter may use no energy at all, apart from natural solar energy and human energy. Both extremes exist in many developing countries, although rural institutions tend to be more seriously disadvantaged.

One approach for determining the scale and quality of energy service is to divide needs into broad categories, for example in rural education:

1. **Energy for basic school needs** – food preparation, water supply, shelter, warmth, cooling, and security;
2. **Energy for basic school functions** – lighting, text reproduction, communications, teaching aids, media ; and
3. **Energy for a full range of school functions** – more advanced energy demands such as laboratory, ICTs, cleaning appliances etc.

The energy service support targeted by ESAs falls into the category of moving within level 1 or from levels 1 to 2. This is because meeting energy needs at level 3 is generally unaffordable in off-grid rural institutions.

The kinds of problems and opportunities at different sizes of institution are illustrated in Table 1 below.

Category & Service Offered	Main energy needs	Energy Source	Issues	Opportunities
Mobile health post (catchment <1000 people)	Space heating (in cold zones) Vaccine temperature control (in warm zones)	None or paraffin heater Insulated boxes with ice-packs	Physical discomfort, smell, fumes, paraffin poisoning Risks of unreliability of cold chain	LPG heating Active refrigeration of vaccines
Rural Clinic (serving <10,000 people)	Telecommunication (telephone and radio) Vaccine refrigeration Lighting (indoor, medical, portable and outdoor security lighting) Water heating; Cooking Transport; Water pumping; Sterilisation Incineration TV/radio/Hi Fi (for staff) Refrigeration (for staff)	Grid electricity Stand-alone diesel electricity Stand-alone acPV electricity LPG Wood; Paraffin Dry cell batteries Rechargeable batteries Candles	Lack of awareness Lack of access to information No direct financial control of clinic budgets Poor metering and control Use of inefficient appliances – incandescent lamps	Greater awareness Improved access to information Access to grid electricity Access to off-grid electricity Use of solar water heaters Improved utilisation of existing energy services
District Hospital	Standard hospital requirements Also have large residential population (patients and hospital staff resident) Sometimes water pumping, sewage disposal needs / incinerators	Grid electricity Coal-fired boilers Incinerator LPG for catering Significant transport fuel needs Diesel Gensets	Significant potential for energy savings expected Generally poorly metered Inadequate (or patchy) energy management plans or systems Limited maintenance regimes Capex constraints	As Rural Clinic above. Can be the domain of professional engineering energy consultants.
Private doctors and dentists	As per clinics	Usually located in towns with grid electricity	Excluded from the ESRI programme	Excluded from the ESRI programme
Traditional healers	Telecommunications	None or grid electricity	Excluded from the ESRI programme	Excluded from the ESRI programme

Table 1: Typical health institutions. Energy needs, sources, issues and opportunities

2.2. IDENTIFY THE TARGET MARKET AND DECIDE WHAT CAN BE ACHIEVED

It is critical to define which rural education and health institutions present the best opportunities for energy related interventions that are of a nature and scope that can be tackled by an ESA. From Table 1 above it is clear that there is a broad range of technical and management levels that need to be addressed.

Important information, fundamental to the decision making process about the target market and what can be achieved includes:

- Inventory of country initiatives, programmes and plans by central government of direct and indirect consequence to energy services (eg rural education, health, electrification, water, and communications strategy)
- Assessment of high and low level institutional capacity to respond to demand-driven energy service provision
- Inventory of institutions under consideration – type, size, quantity, location (market size)
- Identification of generic opportunities – demand side management, energy efficiency and renewable energy. (what is easy to do, can be done on a repeat scale)
- Guidance on the identification of energy needs of target, present and future
- Guidance on maintenance needs

Generic opportunities for improvement are very significant. As an example, demand side management – eg running of generators only when needed combined with using alternative energy sources, like LPG cooking instead of electrical cooking in Box 1 example B – is a very significant generic opportunity. It does, however present challenges where the management can have vested interests in energy supply, for instance fuels, especially wood, supplied by staff friends or relatives.

Energy efficiency is also applicable to most institutions. Large scale energy efficiency benefits in the case of hospitals will be tied to planned improvements or facility improvement plans as most equipment is either old, run down or oversized and expensive (in some countries, equipment may comprise donations from overseas)

Following a full assessment of the above issues, it should be possible to identify:

- Existing strategies in place to deal with energy service provision
- Determination of which institutions are to be targeted (large/small, etc)
- Identification of opportunities of scale (ie planning on a regional level)

A Communications: Energy and Maintenance

One of the most important services for rural institutions that require energy is to have reliable communications, particularly in the case of clinics and hospitals.

In a clinic visited in South Africa, three different ICT technologies were in use, but even then reliable communications were not always available. The clinic was equipped with a two-way radio to facilitate direct to hospital communications.

However, the lead-acid battery used to power this radio was charged off-site, leading to long periods when there was no battery on the premises. Appropriate solutions include a dedicated solar panel/charge-controller for this battery, or a trickle charger, connected to the diesel genset (which runs for about six hours a day).

Also, the telephone, powered using solar panels, was out of order. Lastly, an emergency communications system set up to communicate directly with the police (also powered by a small solar panel) was also not considered worth using. The staff were resorting to using letters carried by visiting doctors to report to the hospital superintendent that their diesel genset was not functioning.

This example illustrates the importance of establishing maintenance provision for systems that are installed.

B Generator Use: The Okondweni Clinic, Maputoland

This clinic comprises two staff houses, and a central building with consulting rooms, stores, dispensary and a four-bed delivery ward. At the time of the audit, the main energy supply was a large (27kVA) diesel genset. The clinic and staff houses were wired with conventional mains wiring, with many electrical appliances. The vaccine refrigerator was of the electric 'hold-over' type, able to maintain a low temperature, provided that the diesel genset was run for about 6 hours a day. Most cooking was done using the electric stoves.

This approach to energy supply provides a 'grid equivalent' service to the staff and clinic. However, genset failure (as at the time of the audit) leads to severe difficulties. No electrical equipment could be used when the genset was not working. The running costs of such an installation are extremely high.
If remaining off-grid, changes could include:

- replace electrical thermal appliances , eg electric cookers with LPG appliances (or solar water heaters)
- use a battery bank and inverter/charger, allowing the diesel generator to run efficiently
- the battery bank/inverter would allow low power appliances (and energy efficient lights) to be used at all times
- replacing incandescent bulbs with more efficient fluorescent lights in high use areas
- reduce the size of the generator (although economically, this may not be worthwhile)

Box 1: Health Sector Case Studies, South Africa

2.3. CONSIDER THE ROLE OF EXISTING ORGANISATIONS PROVIDING ENERGY SERVICES

2.3.1. Service offering of existing organisations

Prior to entering a new business or development related venture, it is clearly important to understand who the other role players are, and to identify opportunities for collaboration, potential conflicts of interest, competition, or duplication. There are several different types of relevant organisations, Table 2 below. Their relevance to rural energy services for institutions and the generic implications for the establishment of ESAs is shown[1].

Organisation Type	Relevance to rural institution energy services	Implications for ESAs
Health and Education Service Managers	Responsible for budgets, but may not have a good understanding of energy issues, management and 'value-for-money'	Potential clients; ESAs are affected by the decision making authority and what interests they have in better energy services. There may be vested interests (eg informal energy supply agreements).
Health/Education Engineering Service or maintenance departments	Play a key role in selection of existing equipment and energy options. Typically responsible for maintenance activities.	Potential clients. However, may be threatened by ESA options. May feel ESAs are unnecessary. May also be better skilled than ESA. ESA must add value. Possible to select ESAs from this group. May have vested interests.
National or regional Utility	May supply grid and end-use advice, including large scale initiatives. Often involved in grid/off-grid decision making	Depending on local regimes, may have vested interest in higher energy consumption. Alternatively may have existing energy advisory service in operation. Competitor or potential collaborator
Diesel/Gas/fuel wood suppliers, including agents of the oil majors	Contracts, formal and informal, to supply energy products. Very limited service provision beyond supply.	Vested interest in seeing higher levels of consumption, but also respect client needs and wants. Associations like PASASA in South Africa have fuel companies as members, offering safety advice for instance.
NGOs	Support delivery of appropriate solutions	There are few examples of NGO energy specialists. However, health/education NGOs may provide support, collaborative capacity building and/or access to funding.
Technical Consultancy Firms	Involved in procurement and specification of energy supply options to DOH, DOE. Typically remote from rural institutions.	If scope of work large enough and technical enough, they may be better suited to rendering service. They could however also serve as excellent collaborator, provider of information

Table 2: Organisations providing energy services to rural institutions

There is a limited range of organisations which offer genuine energy services in rural areas. Usually, organisations which are relevant to the provision of energy services have little or no mandate to address energy from the institution's perspective. Furthermore, the distribution of these organisations across the country is patchy and the level of their presence is variable. Interventions that do occur are often driven by prescriptive national programmes, rather than consultation or collaboration with institutional management.

The groups illustrated in Table 2 exist in principle in all countries. However, the extent to which these parties are actively involved in promoting improved energy services varies widely between countries. It

[1] In the ESRI Country Reports a more specific list of actual organisations is presented illustrating the extent and nature of activity.

must be recognised that the eventual choice to use an ESA approach and the choice of ESA model will relate to the dynamics of the existing management and decision-making structure of the institutions. It will also relate directly to their corresponding energy and technology, service, and fuel providers.

2.3.2. Options to facilitate use of existing organisations

In 2.3.1, we discussed the generic organisations offering energy related products and services. Their services may vary from design advice and supply of energy consuming hardware to energy intervention advice. Additionally, most large consumers of energy will have in-house technical teams, who with some training should be able to carry out their own energy assessments (audits and surveys) with little external assistance. The potential value of such technology companies or in-house service providers is significant.

However, independent specialist audit and survey activities (taking stock of the present) and the ability to recommend general energy solutions may be unavailable. Possible ways to facilitate the use of existing organisation to provide an energy advice service are:

Training and technical support to existing in-house teams

Working with existing in-house technical teams can substantially reduce the level of input required and corresponding costs in providing energy service advice. To make the most effective use of an external ESA, it is necessary to identify the information and support that the ESA needs.

Collaboration with existing equipment and utility suppliers

Working with utility supply companies and suppliers of energy consuming hardware is a possible way to facilitate energy service advice. Companies interested in providing equipment can be involved in the energy needs and current utilisation assessment before recommending actions. Utility suppliers are interested in customer satisfaction and can offer significant technical support within their own programmes. This approach has potential conflicts of interest due to the vested interests of suppliers.

3. OPTIONS TO DEVELOP ENERGY SERVICE ADVISORS (ESAS)

In section 2 we have identified the fact that there is a wide range of energy service need and energy service access that should be assessed. The results of that assessment will provide guidance about the target institutions and the organisations which are likely to offer collaborative opportunities. The principle of the ESA is to fill the market niche for independent energy service advice. Once this niche has been well defined, it is possible to consider the scope of service offering of an ESA and selection of an appropriate business model.

3.1. SERVICES - AUDITS, ENERGY MANAGEMENT, ENERGY ACTION PLANS

This section discusses a variety of services which could be offered by ESAs. Some of these services – energy audits at institutions, and broader-scope energy information workshops for staff of these institutions – have been tested during the ESRI project. Others could develop later, according to demand. Key questions are:

- the demand for these services
- their effectiveness and perceived benefits
- sustainability (including financial sustainability and sustainable social relationships)
- the availability of back-up expertise and contacts, where required
- quality monitoring

Service offerings to be considered are:

- Energy audits at rural institutions: – This involves looking closely at existing energy uses, with a view to finding possible improvements. Outputs include advice on interventions to be implemented in house or by third parties.
- Energy audits plus first-line trouble-shooting and repairs: – Involving useful provision of basic interventions, but with associated repercussions of responsibility and quality assurance.
- Extending the scope to household energy needs: – Based on the fact that institution employees are concerned about energy in the home, and that energy education can cross fertilise to relevant energy awareness and practice at work.
- Helping to develop energy action plans: – on the basis of energy auditing, an energy action plan is developed offering the most appropriate interventions. This involves a level of understanding of finance, technology and management.

3.2. ESA BUSINESS MODELS

3.2.1. Option A – Institutional ESA

This option assumes the existence of a fairly well established network of associated institutions with a relatively motivated and well resourced association management team. The institution acts as a catalyst and is the operational framework for the ESA. Effectively, the institution is the ESA itself and uses the skills and opportunities brought by existing staff. It is in a position to organise for training of the ESA team, supports the findings of the ESA and is in a position to mobilise finance to allow energy interventions to occur.

The Advisor him/herself is employed for other technical roles within the framework of the institution, thus the role as an Energy Service Advisor is balanced against the other skills needs and work demands of the institution.

The technicians typically expected to work within this type of programme are trained hospital technicians or suchlike and have a good understanding and practical experience of energy issues within their trade. Theoretical knowledge of energy issues may be limited.

The schematic in Figure 1 presents the framework of the institutional ESA.

There are nine principal types of health facilities in the Kenyan public health system, from rural dispensaries to the national referral, teaching and research hospitals. Overall, there are 481 hospitals, 601 health centres and 3,273 health sub centres and dispensaries. Christian Health Association of Kenya (CHAK) and the Kenya Catholic Secretariat (KCS) provide over 40% of the total health care. The institutional ESA model was tested with CHAK and their Healthcare Technical Services (HCTS) project in 2001-2002. ESA services are integrated into the HCTS service offering.

An example of the opportunity afforded by this model is the interventions achieved in Chogoria Hospital, in the Mount Kenya region. This hospital's resources include theatres, laundry unit, wards, workshops, mortuary kitchens, restaurant and admin block. The annual energy bill was approximately £32,000. Survey findings by the ESA revealed potential annual savings of £3,800 or 12%. The hospital has reported savings with firewood and boiler costs 50% and 30% down respectively[1].

Box 2: Case study, Institutional ESA, Kenya

The institutional model is stable and practical. Institutional associations of this kind exist all over the world and have the option of employing this model to meet their goals. Other advantages include:

- Existing operational structure and access to an existing client base
- Access sector networks, business infrastructure (IT and other tools of trade) and support
- Experience with energy end–use appliances, understanding of sector standards (health, education)
- Existing mainstream work to keep the ESA in "business"

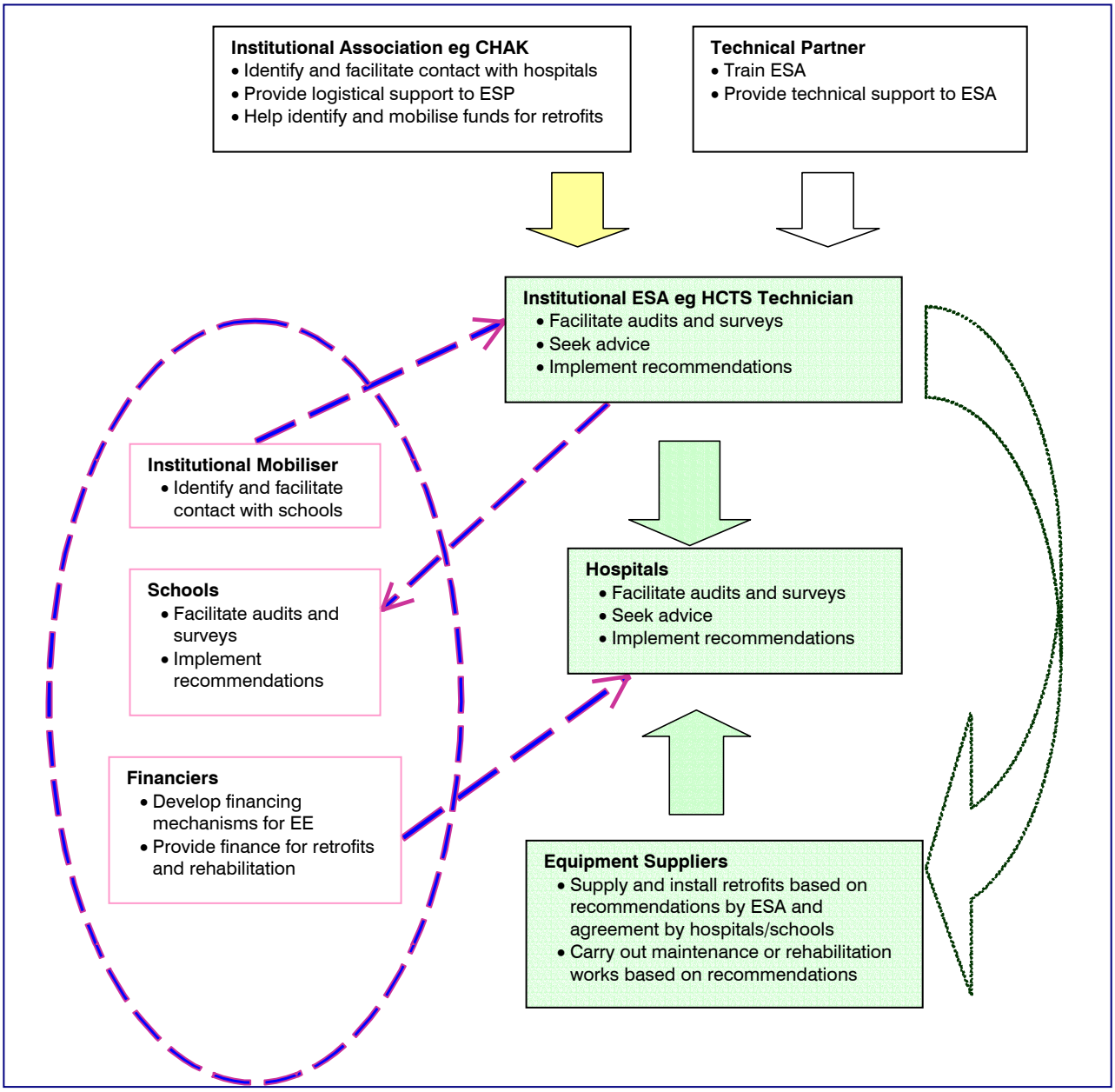

Figure 1: Schematic of the institutional ESA model

3.2.2. Option B – Customer training agent

Rural Energy Utilities (such as that being operated by the Nuon RAPS JV in northern KwaZulu-Natal, South Africa) have been receiving considerable regional interest as a model for energy service delivery in Africa. Such companies are also expected to improve access to thermal energy services by rural households. Considerable emphasis is placed on the need for these utilities to operate commercially and sustainably.

Some of these Utility companies are establishing 'Energy Stores' in rural areas, staffed by local people, and seeking to offer a range of energy related services. The job description for these staff includes marketing of the utility services; assisting in PV installations; revenue collection; maintenance; and customer liaison.

These staff, supported by the Utility management, can be a valuable resource for local education and health institutions, as well as for the communities at large. In so doing, they can also improve relationships between the Utility and communities, local government and institutions. This can have direct and indirect benefits for the utility, perhaps the most important being in terms of marketing to households, but also as a contribution to Utility social responsibility aims.

The institutional arrangement tested in South Africa is illustrated in Figure 2 below.

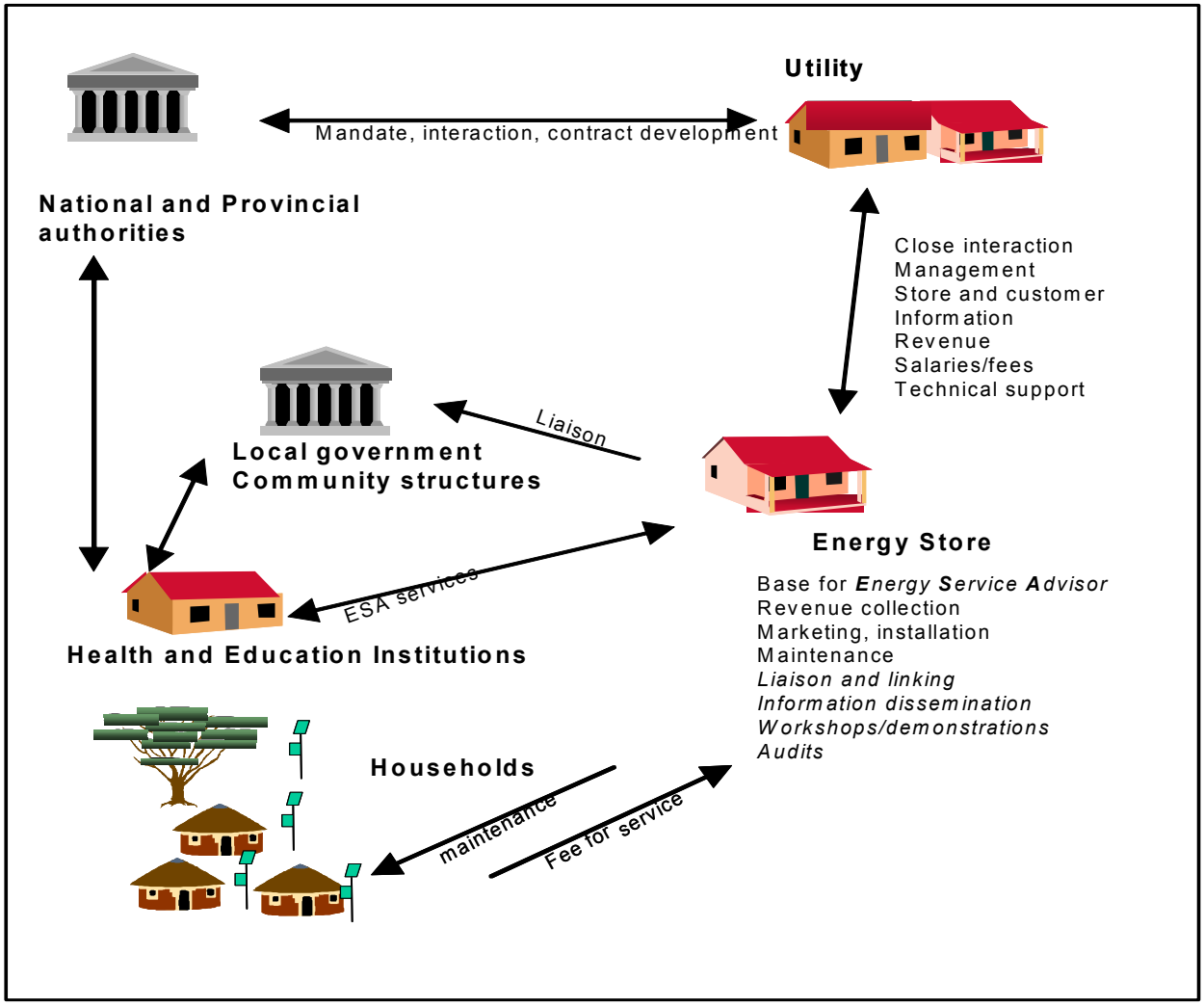

Figure 2: Context for the Energy Service Advisor as part of a rural Energy Services Utility

The model developed and tested in South Africa focused on:

- Educating selected Energy Store Staff, such that they are better placed to act as ESAs to rural health and education institutions.
- Developing the concept of the ESA as a link person between the Utility, the rural institutions (and communities), local level government and decisions makers. Through the Utility there exists potential to establish links to National and Provincial Departments of Energy, Education and Health.
- Training selected Energy Store staff to conduct energy audits at rural institutions, with a view towards raising energy awareness, and developing energy actions plans for these institutions.

- Providing training, and encouraging the Energy Store Staff (and working with them) to run workshops/information seminars for staff at rural health and education institutions.

Additional details are available in the ESRI South Africa Country Report.

3.2.3. Option C – Independent Advisor

Mr. Samson X is a primary school teacher in his mid 40s. He lives and works on the outskirts of a provincial capital in Southwest Kenya. In addition to teaching, Samson has also been involved in development work with an NGO, as a result of which he was able to buy a secondhand motorbike, an item most rural school teachers in Kenya are unable to afford.

When Samson heard there was to be training on energy for rural institutions, he obtained permission to attend. He participated in two training workshops for Energy Service Advisors, each of which lasted 3-4 days, during which he learned more about energy sources and consumption and conducted an energy audit of a local secondary boarding school under supervision.

After the training, Samson used his motorbike to visit schools in his area and talked to the headteachers and their staff about their use of energy. Since the training ended, he has visited 10 schools and has conducted energy audits for four of these. He charges between KSh. 2,500 - 7,000 (GBP 22 - 60) per audit, the level of the fee depending on the size of the school, the financial resources of the school, and Samson's own expenses, eg travelling to and from the school.

Samson would like to extend his ESA activities into the health sector and has received an enquiry from a local hospital who are interested in having an energy audit carried out. However, in order to be able to do a hospital audit, which involves different machines and a wider range of equipment than is found in the average school, Samson will require further training.

Box 3: Case Study - Independent ESA

The independent advisor is at the same time the most challenging and the most exciting of the alternatives suggested. There are significant problems associated with operating a service based organisation in a sector which is poorly understood by potential clients.

However, where there is entrepreneurial spirit and a willingness to apply new knowledge, potential is significant Box 3). Supply and demand side issues must be dealt with for this model to be successful.

This model assumes that the individuals (who themselves are consultant-type ESAs) are in full time employment. They have extra time available for other activities, especially during weekends and school holidays and can use this time to carry out energy audits and advice work.

Figure 3 presents the model of the independent ESA, which has been tested in Kenya with individual physics teachers from secondary schools. In contrast to the institutional model, there may be a good understanding of energy fundamentals and basic concepts, but relatively little practical experience. Advantages include of the model include:

- Understanding of the school system
- Access to an existing client base
- Time availability, especially during school holidays
- Understanding of sector standards (education)

Principal disadvantages of this model include a missing operational structure and lacking experience or familiarity with energy equipment being used in institutions.

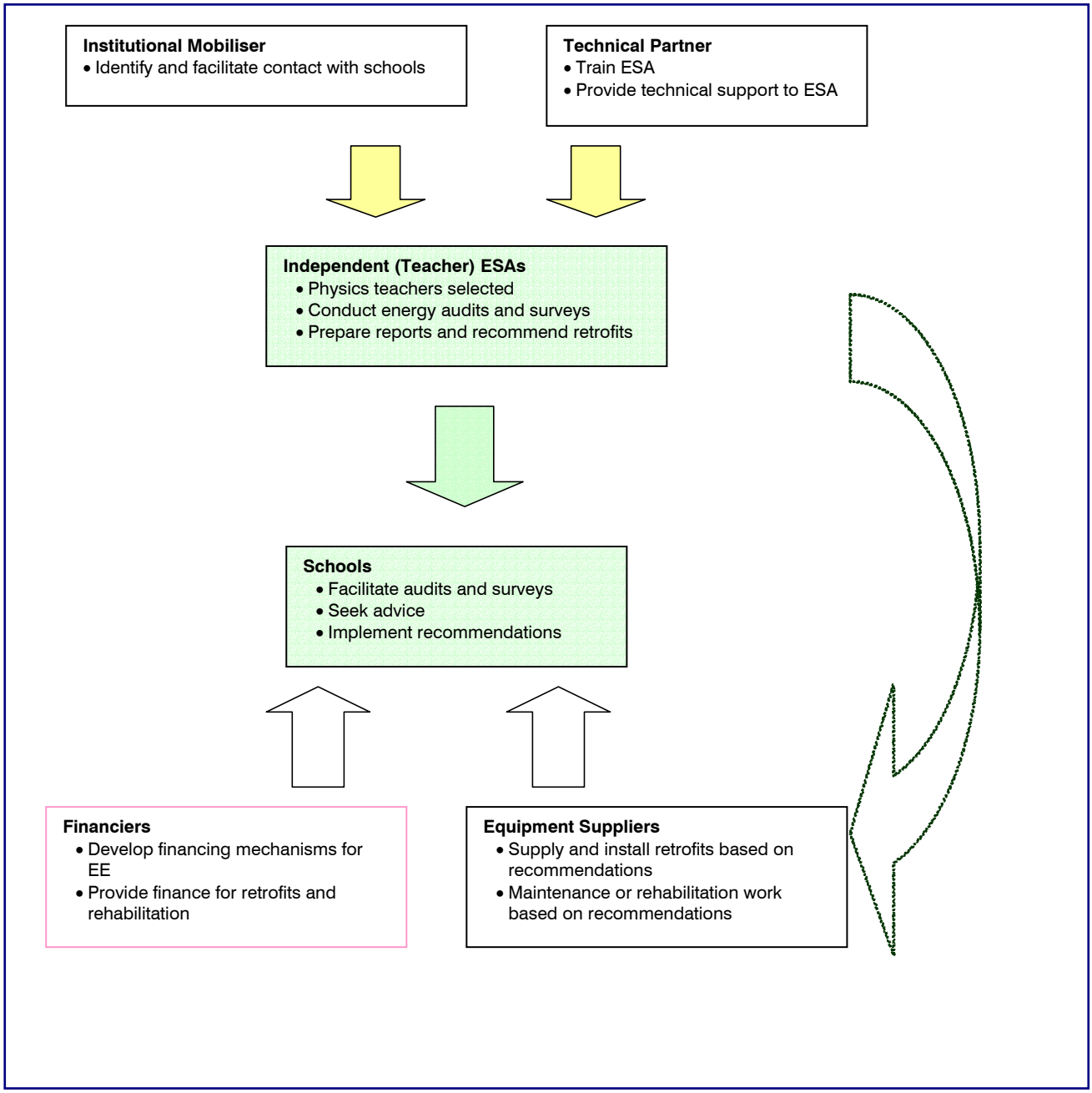

Figure 3: Schematic of the independent ESA model

3.3. RELATIONSHIP BETWEEN ESA AND CLIENT INSTITUTION

3.3.1. Client relationship

Of primary concern to the ESA is how to interact with the target clients – the institutions themselves. Expectations of different institutions about how to approach an issue such as energy services can vary quite widely. In some rural institutions, management capacity is very good, and the ESA must be able to provide quite significant added value for a business relationship to develop. In other applications, institutional management capacity is relatively low, which undermines the opportunity to effect change, let alone achieve sustainable commercial interaction involving success fees, for example.

In models A and B of section 3.2 ("institutional" and "training agent"), there is the basis for a ready-made relationship due to the nature of the "parent" organisation, such as a technical association or utility. In model C ("independent"), the ESA units must be trained and supported by a third party in order to stimulate the market for rural energy service (see Box 3).

3.3.2. Institutional Budgets for Energy

Institutional energy budgets vary by type and size. Hospitals generally tend to have larger budgets compared to those of schools. Also, the size and level of hospital and school will determine the energy budgets.

According to the results of energy audits[2], annual energy bills for hospitals range between GBP 1,000 to GBP 60,000, while those of schools range between GBP 700 to GBP 8,000. Fully equipped hospitals complete with emergency units and operation theatres have the highest energy bills, while amongst schools cooking bills rank highest. Some institutions pay the majority of the institutional budget on energy and water services.

Institutions set their energy budgets based on historical trends. In fact, they sometimes do not have defined energy budgets, but pay bills as a perceived necessity. There is frequently a lack of understanding of positive interventions that would reduce the energy budget burden.

Setting budgets is a first step in setting up energy management frameworks and bringing energy consumption under control. The ESA has a role in realising this opportunity for perceptual change.

3.4. OUTLINE OF ESA FINANCIAL IMPLICATIONS

The following items form a basis for understanding the financial issues associated with operating an ESA-type concern. See ESRI Country Reports for more details (Appendix A)

Costs

- ESA Training costs
- Resources required to run ESA type activities – in particular awareness-raising workshops
- Infrastructure – access to office space, communications, etc
- Logistical support and transport institutions to deliver ESA seminars, audits and meetings
- Networking costs
- Materials – training material, information leaflets.
- Staff time

[2] ESRI results in Kenya

Income

- Income resulting from ESA activities – paid by institutions
- Additional standard business – if the ESA is housed in a utility or other energy related business unit.
- Additional project related income – through an understanding of the institutional market, ESA parent organisations may be able to attract project funding.
- Social and political income – for associated utilities, NGOs or associations

Setting up ESAs that will operate in a sustainable fashion is a challenging prospect. As energy management is a new phenomenon in the developing world and especially in rural institutions, and given that the idea is relatively difficult to establish on a commercial basis, it is important to ensure that those involved have sufficient resources to conduct ESA business.

4. TRAINING MATERIAL

Table 3 outlines the suggested typical training topics that should be considered when considering the development of an ESA programme. The training materials incorporate issues ranging from technical energy know-how to management and delivery of interventions. Further details on this training material are referred to in Appendix A; links to download this training material and access to much more extensive information is available at the project website: http://www.esri.energyprojects.net

Day	Module	Resource Material
1	**OR1**: Registration & Distribution of Training Materials **OR2**: Course Introduction and Project Background **EAS 01** Energy Use in Rural Institutions	Training Handouts
	EAS 02 Intro to Renewable Energy Resources **EAS03** Energy Management	Photograph Guide - Energy supply options
	EAS 04 Energy Use and Needs Assessment	
	EAS05 Awareness Creation and Sensitisation	Rural Energy Supply Matrix
2	**EAS06** Legal Basis of Institutional Governance Group Activity: Marketing Strategy: Stakeholder Profiles	Energy Audits and Surveys: CIBSE Application Manual
	EAS07 Energy Audit and Survey Methodologies	Energy audit and Survey Procedures
	Group Activity: Model Audit and Survey	Sample Energy Audits
3	**EAS08** Practice Audit and Survey	PVQ Data Sheets Survey Notebook
	Group Activity: Audit and Survey	
	Group Activity: Data Analysis and Reporting	Energy Audits and Surveys: CIBSE Application Manual
4	**Group Activity:** Recommendations and Reporting	
	EAS09 Energy Action Plans	Energy Action Plans
	EAS10 Monitoring and Evaluation	
	Group Activity: Follow up Strategies	

Table 3: Sample Course outline for the ESA training

5. LESSONS LEARNED

The models that have been developed have already been piloted in Kenya, South Africa and Uganda during 2000-2002. This process has provided useful lessons, critical to the success of such an initiative. A whole spectrum of stakeholders and activities need to be examined. Below are some of the key issues, which apply to all models unless specified otherwise.

Institutional support is important. It is clearly easier to market the service, travel to sites, prepare report and share notes if institutional support is available. Independent ESAs will find it difficult to cover travel costs, which are significant in rural areas. Experience to date shows that the success rate of ESA practising after training is 100% for Option A ("Institutional ESAs") in contrast to approximately 30% "independent" ESAs, Option C.

Planning and timing. Even though resources and expertise may be available to carry out audits and surveys, few were carried out as planned, the main reason being "shortage of time". Since the first priority is to keep hospital equipment, running, little focus is made on actual audits on site. This indicates that the subject should be incorporated into their work programme. Independent ESAs have a similar problem: time availability (during school holiday), often conflicts with availability of the school administration.

Payment to ESA and awareness – Independent ESAs (Option C) will experience extreme difficulty in getting paid for their services. Managers are used to paying for hardware rather than for advice. One common factor experienced is that well informed administrators did not have problems paying for the service. It can therefore be said that with increased awareness, payment for energy advice services to the ESA will be more acceptable to the mangers.

ESA capability – In general, ESAs whose experience is grounded in practical technical disciplines will be more suited for the work than other ESA backgrounds. This must be balanced against the very clear advantages that come with entrepreneurial spirit and management skills. This selection criterion also depends on the model type. Potential factors limiting the performance of ESAs are: time management, finances for logistics (report preparation, stationary etc), knowledge of appropriate energy supply options, costs, and supplier details and contacts, overseeing implementation of recommendations, and installation skills for retrofits.

Reporting and other documentation may be considered a barrier to change since it is often associated (in rural institutions) with additional bureaucracy and work. Interestingly, low and no-cost interventions can happen with little or no documentation. There are significant issues tied up in this, concerning the prospect for thorough surveying, auditing, planning, and intervention, since records are so crucial for energy management.

Demand side management and energy efficiency are generic opportunities that will be applicable to most institutions. These present serious challenges in the case of schools where the management may have vested interests in the supply of energy (fuel wood sometimes supplied by friends or relatives of the management). Hospitals tend to be more professionally managed in this respect and keen to implement change. Large scale energy efficiency benefits in the case of hospitals will be tied to planned improvements or facility improvement plans. Renewable energy options will be applicable to off-grid locations and in case of on grid institutions where cooking is biomass fired.

Planning at regional or association level will be effective at reaching the institutions. A countrywide ministry level approach is preferable, but demands finance and support.

Financing ESA and sustainability – Given the low awareness and understanding of energy issues among institutional management, to kick-start the energy management activities, it is essential to provide financial support to initial audits as a market priming activity. Once institutions appreciate the

value of energy service, it has been shown that ESAs can achieve self-sustainability. Consequently institutional associations may mainstream audits and energy management as part of core activities.

The ESA piloting process in has determined a set of preferred personal characteristics, below. Although the ESA staff profiles clearly depend on the ESA model selected, the ESA approach is likely to have a higher chance of success if these types of skills can be found:

- **Good people skills** - able to relate well with people at different levels, eg hospital director and maintenance operative, provincial director of education and school cook
- **Entrepreneurial spirit -** able to see business opportunities, to prioritise promising markets and to pursue these energetically
- **Science background** - a good grasp of the basic laws and practical applications of science, in particular physical science
- **Well organised** - able to plan effectively his/her work schedule and to be flexible as the need arises
- **Practical nature** - interested in, and with a basic understanding of, how machines and appliances work
- **Quick to learn** - able to absorb new information quickly, eg about the equipment in institutions, and to speak convincingly about this new data
- **Access to clients** - living within easy access of, and with either own transport or good public transport to reach, a concentration of potential client organisations
- **IT skills** - low/medium level skills in word processing and spreadsheet programmes, and access to a computer and printer to produce reports
- **Good work reputation** - if working as an ESA as a "second job", needs a flexible timetable, sufficient free time and the support of his/her boss
- **Public speaking skills** - confident in presenting information in a convincing manner and answering questions at meetings of, say, 200 people
- **Knowledge of the sector** - familiar with the sector, eg education or health, that he/she is going to target, and able to use this to help establish a good rapport

Box 4: What makes a successful ESA?

Appendix A: References

A1 Relevant URLs

http://www.agama.co.za	Agama Energy (Pty) Ltd website.
http://bulgariaplan.energyprojects.net	Bulgaria Local Sustainable Energy Planning project
http://www.dfid.gov.uk/	Department for International Development, UK
http://eaa.energyprojects.net	Energy Alternatives Africa Ltd website.
http://www.edrc.uct.ac.za	General website of Energy and Development Research Centre.
http://www.esd.co.uk	Website for Energy for Sustainable Development Ltd. (ESD) Includes links to project websites and relevant organisations
www.energia.org/	ENERGIA is an international network on gender and sustainable energy
http://www.etsu.com/dfid-kar-energy	Department for International Development's (DFID's) Energy website
http://www.etsu.com/energy_voices	Facilitating the Establishment of Rural Energy Service Companies (RESCOs) AEA Technology Environment – ETSU
http://education.pwv.gov.za	Website for the RSA National Department of Education. Includes statistics generated by the EMIS (Energy Management Information Systems) programme.
http://www.esri.energyprojects.net	Website of this ESRI project.
http://www.eurorex.com/ugtoges/	Users Guide to Off-Grid Energy Solutions
http://fuelsubstitution.energyprojects.net	Fuel Substitution - Examining the Impacts on Traditional Fuel Suppliers – Kenya, Uganda, Ethiopia
http://igadrhep.energyprojects.net	The IGAD Regional Household Energy Programme – Somalia, Uganda, Kenya, Sudan, Eritrea, Ethiopia, Djibouti
http://povertystoves.energyprojects.net	Improved Household Stoves and Poverty Reduction – Kenya, Uganda, Ethiopia
http://polandplan.energyprojects.net	Poland Regional Sustainable Energy Planning Project
http://www.raps.co.za	Website for RAPS Consulting. Includes links to Nuon RAPS Utility.
http://www.seedlinks.org.za	Website of the SEED (Sustainable Energy, Environment and Development) programme. Includes rural energy information materials as downloadable files.

A2 Training Materials and Information

ESRI Project: ESA training materials.

Documents and supporting information available at http://www.esri.energyprojects.net

Energy Information Kit (draft)

Compiled for the Department of Minerals and Energy (+27 12 317 9000) by the Energy and Development Research Centre (+27 21 650 2831)

ElektroWise materials

ElektroWise (+27 800 002079) is an Eskom programme focused on disseminating information on the safe and efficient use of electricity.

BONESA materials

Available from BONESA (+27 12 427 2720).

Soul City booklet: *"Using Energy in the Home"* Published by Jacana Education, ISBN 1-874955-74-3. Copyright Soul City (+27 11 728 7440)

PASASA materials

Available from the Paraffin Safety Association of South Africa (+27 21 424 3473).

LPGas Association materials

Available from LPGASA (+27 11 886 9702).

Rural Energy Resource Pack: pilot modules

Produced under the Rural SEED Project, available in draft from the Energy and Development Research Centre (+27 21 650 2831, SEED@energetic.uct.ac.za).

A3 General Relevant References/articles

DFID, UK, '*Energy Services for Rural Institutions (ESRI) Kenya Country Report 2002*'

DFID, UK: '*Energy Services for Rural Institutions (ESRI) South Africa Country Report 2002*'

DFID, UK: '*Energy Services for Rural Institutions (ESRI) Uganda Country Report 2002*'

All available at the project web site: http://esri.energyprojects.net

DFID, UK:, '*Improving efficient woody biomass energy production and utilisation Final Summary Report 2001*'

DFID, UK, '*Poverty Reduction Aspects of Successful Improved Household Stove Programmes Final Summary Report 2001*'

DFID, UK, '*Commercial Production of energy-efficient biomass stoves for the commercial and institutional sector. Manual for Producers, Promoters and Users 1999*'

Banks DI, Willemse J and Willemse M, '*Energy Services to rural areas: an integrated approach*', Rural Area Power Solutions, Pretoria, August 2001.

Borchers M and I-M Hofmeyr, '*Rural electrification supply options to support health, education and SMME development*', Energy and Development Research Centre, University of Cape Town, August 1997.

Cowan W, '*Improved energy for rural schools: guidelines to assist planning choices*, Energy and Development Research Centre, University of Cape Town, December 1998.

Department of Health, '*Annual Report, 2000-2001*, Pretoria.

Gordon A, 'Facilitating education in rural areas of South Africa: the role of electricity and other sources of energy', Energy and Development Research Centre, University of Cape Town, August 1997.

Motif Creative Arts, Nairobi, '*Renewable Energy in Kenya*', 1987, 130 pp. (2nd Printing, December 1989). Recommended by Kenya Ministry of Education as a source book for local universities, secondary schools and polytechnics.

'*Making Energy Efficiency Pay in a Poverty Setting*', Presentation to the World Bank's Rural and Renewable Energy Thematic Group, November, 1997.

'Prospects for Off-Grid Electrification – The Role of Auto-Generation, Liberalisation and New Economic Policies for Rural Electrification in Emerging Economies', presentation at the UNESCO-sponsored "Energy Prospects in the 21st Century", Harare, Zimbabwe, March 1998.

'Integrated Energy Planning and Development of National and Regional Energy Action Plans', National Energy Forum, Varna, Bulgaria, June 1997.

'Photovoltaics to Meet Decentralised Energy Demand: The Role of Small and Medium Enterprises in International Markets', Freiburg, EuroSun, September 1996.

Appendix B: Example of Available Training Material

EAS 01: Energy Use in Rural Institutions **Time:** 45 minutes x 2.

Objectives:

- Participants will have an understanding of energy use in rural institutions and how lack of energy affects institution performance.
- Participants will be able to discuss energy planning issues in rural institutions, with relevance to renewable energy.
- Participants will be able to match common energy system with important rural institutional applications.

Visual Aids and Hand-outs:

- Rural energy use matrix to be supplied to participants
- Potential applications of various energy technologies

Time	Main Points	Method	Details
10 min.	Introduction to energy in rural institutions	Lecture/ Discussion	Open with controversial statement about energy (ie What form of energy is most important to rural institutions?). Get trainees to understand that there are many forms of energy and that institutions require various energy types.
20 min.	Energy priorities	Discussion/ Exercise	The instructor should ask the trainees to list the most important energy-using applications in rural institutions in order of relative importance. These should be tabulated on the board. Encourage the trainees to think about all energy uses. The instructor should facilitate and make sure similar applications are listed under similar categories (ie faxes and telephone: communication).
5 min.	Most important energy uses	Discussion	The 5 most important energy uses, as tabulated by votes, should be listed in a column on the left-hand side of the board. If anyone (or the instructor) can think of other crucial energy uses that have been forgotten, these should be added.
10 min.	Sources of Energy	Discussion	In a row across the top of the board, sources of energy (petroleum, grid, wood, dry cells, etc.) should be listed. Indirect sources (ie generator) can be listed separately. At the end of this, the instructor should draw a grid between the energy uses and sources (see energy use matrix).
5 min.	BREAK		

EAS 01: Energy Use in Rural Institutions (continued)

Time	Main Points	Method	Details
25 min.	Energy Use Applications & Sources	Discussion/Q&A	The instructor should go through each of the energy applications and identify which sources of energy can be used to power them. For example, lighting could use kerosene, grid electricity, solar PV, but not wood. If the cost of powering an application is expensive, this should be noted ($$), and if it is unreasonably expensive (ie it would be unreasonable to cook with PV) then it should be rejected. The class should decide on these, but the instructor can over-ride them if necessary.
20 min.	Summary of Matrix	Discussion	The instructor should go through the matrix and highlight the important issues it raises. It will be obvious the grid can power everything, but then the grid is not available to most rural folk. In the absence of the grid, there are only a limited number of choices. (Ie lighting can only be done with gen-sets, PV or kerosene). Get the group to agree on the best non-grid choice for each. Also, at the end of the exercise, the group should understand the limitations of each form of energy. The class should also be made aware of several general divisions of energy resources, namely: • traditional energy (wood & charcoal) • transport (petroleum) • grid power • off-grid modern energy
			CLOSE

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