Sustainable energy

Economic development based on the burning of fossil fuels is making a major contribution to climate change because their use results in the emission of greenhouse gases such as carbon dioxide and methane. We need to consider all opportunities to generate energy from sustainable or renewable resources.

Many of the world's poorest people have little or no access to energy other than traditional biomass fuels such as wood, agricultural residues and dung. Where people cannot find these fuels, they are increasingly using other materials such as plastics and clothing as fuel, which release dangerous toxins. The use of such fuels causes environmental problems and can impact on people's health and quality of life. In many countries of the South, people want to use the same fuels as people in the North, such as gas, diesel and petrol. However, most of this energy is produced from fossil fuels, which are contributing to climate change (and are also usually very expensive). In this section we look at options available to enable people to access energy in a sustainable way, both in the North and South.

3.1 Energy and development

According to the World Bank:

- nearly 2.4 billion people use traditional biomass fuels for cooking and heating
- around 1.6 billion people have no access to electricity
- four out of five people without access to electricity live in rural areas.

Yet energy is critical for development. Energy is not just required for national, industrial and economic development. Access to energy can have a huge impact on the lives of poor people. For example, electricity allows small businesses to develop within communities. Access to energy also impacts on other aspects of poverty. For example, lighting in the evening means that children can study after dark and achieve higher grades at school. Efficient wood burning stove technologies mean that women need to collect less firewood, and the family's health improves as they are not breathing in wood smoke. The World Health Organisation is encouraging the use of efficient stoves because the smoke that traditional stoves produce is having a major impact on family health. The use of efficient stoves also has a positive impact on the local environment, and gives women more time for income-generation activities and social interaction.

The World Bank estimates that two-thirds of the increase in world energy demand over the next 25 years will come from countries of the South. This is likely to speed up deforestation, which will increase the rate of climate change. Industrial growth through the use of fossil fuels in the North has already made a major contribution to climate change. It is really important that the growing demand for energy in the South and in the North is met by using more sustainable sources of energy whenever possible. Governments at international level have recognised this and under the UN Framework Convention on Climate Change, countries of the North must provide funding and technology transfer for poor countries to develop in a sustainable way

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and become more energy-efficient. For more information about advocating on this issue, see Section 6.

Sustainable energy

Sometimes people confuse the term 'energy' with the generation of 'electricity'. Electricity is just one type of energy. Other types include heating, lighting and vehicle fuel. In the past few decades, electrification of rural communities has sometimes been seen as the answer to their energy needs. However, technological development has meant that there are now other energy systems that can be implemented more quickly and provide communities with heating, lighting and fuels for machinery. Where provision of electricity is required, there are now many options available for generating it within the community from renewable resources. The choice of options should be based on community assessment of their energy uses, needs and opportunities.

There are three key issues to consider in relation to use of energy in a way that is sustainable:

PROVISION – in some places, people do not have access to the energy they need. They should decide whether energy that is generated from fossil fuels or from renewable resources is best for the future of their community.

EFFICIENCY – sometimes people do not use the energy they have in the most efficient way, which puts pressure on energy supplies. This usually requires awareness-raising within the community about the need to use energy efficiently. Community members could be encouraged to use or design equipment that can help them to use energy more efficiently.

CONSERVATION – some of us are so used to having energy when we need it that we may waste it. In some places, people who have electricity, a vehicle or air conditioning may leave them running even when they are not needed. Even if the energy is generated in a 'clean' way, this issue needs to be addressed. The need to conserve energy is a big issue in countries of the North where the most energy is used. Countries of the South should be aware of this issue as increasing demand for energy is met.

3.2 Renewable and sustainable energy resources

In the long-term, technologies that use renewable resources have a much lower impact on climate change. However, although their manufacture, transport and installation does result in some greenhouse gas emissions, their long-term use results in very low emissions.

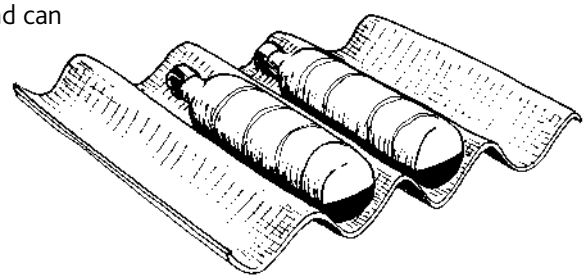
In communities which lack existing energy facilities, renewable energy sources are recommended wherever possible.

In communities where energy is already generated, we should ensure that the equipment is well maintained. When it can no longer be maintained efficiently, or when additional capacity is required, it should be replaced or extended with renewable energy technologies.

Here we look at some options for energy provision that rely on renewable resources. Many natural resources are readily available, such as the sun, wind and sometimes water. While many options exist, we focus here on technologies that are relatively low-cost to set up, operate and maintain and which could meet the kind of needs that poor communities may identify.

Solar water panels

Solar water panels use the sun's energy to heat a fluid which is used to transfer heat to a heat storage vessel or water tank. It can then be used for heating a room or for supplying hot water. Solar panels are relatively simple to make and can be manufactured and maintained by local people if they have sufficient training.



Even simpler solar technologies can be used to disinfect contaminated water for drinking (see SODIS www.sodis.ch).

Solar voltaic panels

'Photovoltaics' is a technology that converts the light of the sun into electrical power. This technology is sometimes expensive and local maintenance can be difficult. However, small lower-cost solar panels are now available that can power a torch, a single light bulb, or a mobile phone (see Light Up the World www.lutw.org and Solar Aid www.solar-aid.org). Low-cost solar-powered refrigerators have been developed, which are of great benefit to health centres for storing medicines.

This technology is developing fast, and flexible, lighter and lower cost panels are likely to become widely available within a few years.

Efficient wood stoves

Improved stoves are well established technologies, readily available and easy to implement. Efficient wood stoves use fuel more efficiently than traditional stoves. They enable burning to take place within an enclosed space with a flue system to remove vapour and gases to the outside. This means that a higher amount of useful energy is obtained from the same amount of fuel. (See Household Energy Network www.hedon.info). Investment in efficient wood stoves is one of the most important energy projects a development organisation can do, because it can make a big difference to reducing deforestation and carbon emissions, and improves human health.

Geoff Crawford Tearfund

Wind power

Wind power should not generally be relied upon for constant power. However, it can be useful for pumping water for irrigation and it can be used to charge batteries to store power for later use. These technologies can be expensive and are most effective in locations with a plentiful supply of wind. Smaller turbines are cheaper, but generate less electricity. Although failures may occur more often than with some other electrical systems, small wind turbines can be easier to repair using local knowledge and skills.

Hydro-electric power

Electricity can be generated by using the flow of a river or stream to rotate a turbine. This 'micro-hydro' technology is not appropriate in areas vulnerable to drought or where most water is needed for consumption and irrigation. It is a well established and reliable technology, and turbines can usually be easily repaired by trained local people. An added benefit of this technology is that power generated at night could be used to pump water to a storage tank in order to supply water to other communities.

Biomass power

Biomass is biological material such as plant or animal waste that can be used as fuel for energy production. Some biomass comes from crops grown specifically for energy purposes, which, if not sustainably managed, can contribute to existing local food insecurity. For example, it could become more profitable for farmers to grow energy crops than food crops. However, biomass can be a useful source of energy if it is implemented in a sustainable way, such as from the residues of crops that have been grown for food. For example, in 'closed loop agriculture', different parts of a plant, such as sweet sorghum, are used for food, fuel and animal feed. Crop and animal waste are then used as fertiliser for future crops.

Bio-digesters

The production of methane gas from the anaerobic decomposition of animal and human waste can provide a very appropriate source of gas for cooking and heating. The methane gas produced is not released into the atmosphere since it is used up as a fuel, so this does not contribute to greenhouse gas emissions.

3.3 Developing an energy project

Energy provision is a new area for many development organisations. If communities identify the need for energy in a needs assessment, we could find out whether there are other existing local organisations that would be better placed to work with the community on that issue. If there are none, we could consider employing staff or local consultants with technical knowledge and experience, or identify local training opportunities. Consider what role the local church could have. Perhaps the local church could demonstrate technologies to enable the community to choose what would be best, such as installing solar-powered lighting in the church building, or the church could provide a maintenance and repair service to community members.

When considering carrying out an energy project in a community, it is important to ask community members exactly what they need energy for. This will help to identify the technology that would be of most use. For example, people may ask for a diesel generator, but they might identify the main benefit as having light in their homes so their children can study after dark, or they can charge mobile phones and use them to look for work. Solar lighting is likely to be

much more sustainable and cost-effective over time to install and use than the purchase of a diesel generator.

The need for energy provision and its intended uses will vary among men, women and children, so it is important to gain everyone's views. Encourage community members to decide priorities on the basis of what would have the most benefit for the community as a whole. For each energy need, ask whether there are alternatives such as changing the time of day they carry out an activity or in the way they do it, so that energy is not being supplied unnecessarily. Also encourage them to consider the benefits of energy for health, income-generation, educational improvement, gender issues, the local environment and social and cultural issues. Find out if energy is one of the community's greatest needs. If there are more urgent issues to address, such as flooding or drought, these should be addressed first.

Once community members have decided their priority energy need, present a number of technological options for them to compare, if there are more than one. Consider the renewable resources available locally and ensure that their use will not have a negative environmental impact. For example, a river may be diverted, lined or obstructed to generate hydro-electric power, which could affect animals and fish. Activities may need to be introduced, such as installing channels for fish so their breeding route is not interrupted. Consider how easy and low-cost it would be to buy or make the equipment, and whether local people can be trained to maintain and repair it, providing local livelihood opportunities. Also consider indigenous technologies and whether these can be adapted in any way to improve energy provision. Find out about projects that have been carried out in other communities. There may be some useful learning about the technologies that were used and how sustainable the work was.

In order to decide whether a project is appropriate, find out about local or national government plans to expand energy provision. Discover whether these plans apply to the local community, and when and how likely it is that they will be achieved. Funding and support may be available for certain technologies, but if these technologies are offered to the community, accepting them must be based on their relevance and appropriateness, not because they are free.

Here is a list of key questions that will help development organisations to consider what energy projects would be appropriate for a community.

- What are the development needs of the community? Will any of the priority needs require energy provision?
- Which needs, if met, will result in the greatest impact on the community in terms of health, income-generation, educational improvement, gender equity, the local environment and social and cultural issues?
- What appropriate technologies are available that can meet the priority energy need? Could indigenous technologies be improved?
- What are the costs of each technology in terms of their installation, operation, maintenance and repair?
- Could the technology be made, installed, maintained and repaired by local people? Could this project be developed into a livelihoods programme to supply the technology to the community and neighbouring communities?

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- Will the project be environmentally sustainable? (See Section 5)
- How can the church be involved to ensure the project is sustainable and genuinely meets community needs?
- What are the risks associated with the project?

CASE STUDY

RESTORING ENVIRONMENTAL SUSTAINABILITY IN RWANDA

Ninety per cent of the people who MOUCECORE work with depend on agriculture and livestock for their livelihoods.

MOUCECORE carried out a needs assessment. Poor farming practices, infertile soils due to soil erosion, land slides and flooding were mentioned as the major causes of inadequate food supplies and low income among community members. Deforestation was also felt to be a key issue contributing to local climate change and environmental degradation. Firewood is the source of energy for over 90 per cent of the Rwandan population.

MOUCECORE trained Church and Community Mobilisers, one from each local church, in basic environmental good practice. Their training included terracing, making contour barriers, collecting rainwater, intercropping trees with crops and developing tree nurseries.

Mobilised community members were organised in small groups with the spirit of helping each other in digging and terracing land. Around 2500 group members are now involved in these activities. As a result:

- soil erosion and run-off has been reduced. The rain no longer washes away the fertilisers added to the garden, leading to better yields.
- rainwater collected in the fields helps crops such as coffee and bananas to grow well.
- people are using alternative sources of energy to burn bricks in order to stop cutting down trees.

A useful first step if the community or project want to move forward, would be to carry out a feasibility study that would research costs, appropriate options, import costs, transport to site, installation issues and commissioning. It should also look at maintenance, service and repair costs (including sourcing of spare parts), and other operational costs such as fuel and labour.

Ongoing issues to consider are what prices should be set for the power, how much income might be generated, not forgetting to include ongoing cost recovery to provide funds for servicing and replacement. How will decisions be made to ensure the whole community benefits and not just a few powerful individuals?

Are there ways of engaging with the private sector to encourage them to set up an energy project – rather than the church or development organisations pursuing this option? Investigate whether the church could then offer to support the private sector in targeting particularly needy social groups. This could make all the difference about whether and how the private sector development goes ahead.

In addition to providing energy to communities, development organisations could also become involved in advocacy work, to encourage national governments to hold wealthy countries accountable for providing funding and technology transfer for energy provision. For more information, see Section 6.

REFLECTION

- **What sources of energy do people use in the communities in which we work?**
- **Are these energy sources sustainable?**
- **Have community members mentioned energy in needs assessments? If so, is this an area that we should explore?**