WISIONS of sustainability

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PREP

Promotion of Resource Efficiency Projects

Sustainable biofuel production and use
Options for greener fuels

IV. Issue 2006



www.wisions.net

WISIONS

Sustainable Development is Possible

WISIONS is an initiative of the Wuppertal Institute for Climate, Environment and Energy, carried out with the support of the Swiss-based foundation Pro-Evolution, to foster practical and sustainable energy projects.

Sustainable development is possible. Numerous innovative and valuable contributions from different countries, fields and institutions have shown that an appropriate reconciliation of economic, ecological and social factors is not unrealistic utopia. We have made a promising start, but the greatest challenge still facing us in the 21st century is to learn how to use the world's resources more efficiently and in an ecologically sound and socially balanced way.

Progress is being made; however, fourteen years after the UN Conference on Environment and Development in Rio de Janeiro, many people, especially in developing countries, still lack access to resources, clean technologies, and education. At the same time, people's level of resource consumption and means of production remains unsustainable.

To meet global challenges like climate change, water scarcity and poverty, it is necessary to foster projects of potential strategic global importance by supporting them so that they can be implemented locally. Examples of good practice need to be actively promoted to a wider audience.

WISIONS promotes good practice in resource efficiency through its publication of relevant successful projects in its Promotion of Resource Efficiency Projects: PREP

WISIONS also provides consulting and support to ensure the potential seen in visions of renewable energy and energy efficiency can become mature projects through its Sustainable Energy Project Support: SEPS

Photo: PixelQuelle.de

Sustainable biofuel production and use
Options for greener fuels

As fossil energy resources are in decline and the need to become less reliant on energy imports is becoming more and more relevant in political discussions, alternative energy sources are needed. Biofuels are one possible replacement for fossil fuels. Although biofuels still cost more than fossil fuels, their share in terms of use is increasing worldwide. The global production of biofuels is now estimated to be about 35 billion litres per year.

Biofuels can make a significant contribution in reducing the dependency on fossil fuel imports, especially in the transport sector. Another advantage of biofuels is their contribution to climate protection: as biofuels are usually considered to be CO_2 neutral, their use helps to reduce greenhouse gas emissions. Fossil fuels, on the other hand, are a major source of CO_2 emissions. In Europe, for example, transport is responsible for about 21 percent of all GHG emissions that contribute to global warming.

Biofuels are usually used for transport fuels, but they are also applicable for electricity and heat generation. In relation to reducing dependency on fossil fuel imports, the use of biofuels as transport fuels is particularly effective; however, from a climate protection point of view the efficiency could be greater if biomass were also used for generating both heat and electricity in CHP plants.

There is a wide range of appropriate biomass sources and a broad mixture of resulting biofuels. Biomass input for biofuel supply often constitutes waste products from some other activity or process, but biomass can also be grown for specific use as a biofuel. Common liquid biofuels of the so-called "first generation" are pure plant oil, biodiesel and ethanol based on sugar and starch crops. Among the "second generation", synthetic biofuels as biomass-to-liquids are currently the subject for wide-ranging discussion. Last but not least biogas is a possible future option.

However, the promising qualities and potential of biofuels also bring an element of risk – the social and environmental dimension of cultivation has to be taken into account and, in particular, plantation areas could become a problem. A new and growing market for biofuels may provide incentives for over-harvesting and the establishment of plantations; the intensity of agricultural land may rise and this would have major impacts on habitats, biodiversity, water supplies and soils.

Photo: PixelQuelle.de

In this brochure, WISIONS focuses on sustainable biofuel production and use. WISIONS presents successfully implemented projects from Ghana, India, Austria and Indonesia, with the intention of further promoting the particular approaches used by these projects. Using a key number of internationally accepted criteria, the main consideration for the selection of the projects was energy and resource efficiency, but social aspects were also of relevance. The assessment of the projects also included the consideration of regional factors acknowledging different needs and potentials.

All projects that fulfilled WISIONS application criteria were independently reviewed, and four of them, with the potential to make a significant impact on global energy and resource efficiency, are published in the following pages. WISIONS is pleased to present good practice examples from ambitious projects which have been successfully implemented on different continents. All of these projects are appropriate within their local context and have been developed to a level which meets WISIONS selection criteria. Although uniquely designed for a particular setting and problem, the projects presented can be adapted to different situations or can provide valuable information from their implementation phase. Links to the illustrated good practice examples shown in the brochure, as well as a couple of other issue-related good practice projects, are available on www.wisions.net.

The selected projects are not intended to represent the only possible courses of action to take in the area of sustainable biofuel production and use but they do demonstrate promising approaches.

The next PREP brochure, following the same objectives, namely to collect, evaluate and promote good practice examples, will highlight the issue of "Renewable energy in the food supply chain".

Photo: PixelQuelle.de

Village-scale biodiesel-fuelled energy system

Location:
Orissa, India

Project's Aim:
To provide running water in non-grid villages using locally produced biodiesel

Technical Answer:
Establishment of a biodiesel-based water pumping programme

Photo: Pedal-driven Biodiesel Reactor; CT_xGreEn

The organisations CT_xGreEn (Canada) and Gram Vikas (India) are working together to create a biodiesel-based water pumping programme in four village communities in the region of Orissa, India. The project's objective is to provide the communities with water supply and sanitation services by means of an energy system based on renewable resources, which also helps to create local economic opportunities.

Underutilised forest seeds will be collected and native local oil-bearing crops will be grown in order to create a sustainable plant oil source. The vegetable oil can then be extracted and used as feedstock for conversion into biodiesel using reagents/catalysts. The biodiesel will then fuel pump-sets and small-scale power generation sets.

Two installations have already been completed; in Kinchlingi and in the twin villages of Kandhabanta-Talataila the villagers are producing biodiesel from vegetable oil via the process of transesterification using pedal-powered machines. Water pumping fuelled by biodiesel has been in use since May 2004 and biodiesel-fuelled power generation since July 2005.

Photo: CT_xGreEn

BENEFITS

Three of the non-grid villages within the target region now have access to a piped water supply. A further benefit will be the extension of the biodiesel energy system to provide electricity in rural areas, which will commence once the sustainability of the project has been proven for water pumping.

Additional benefits include new livelihood opportunities for the villagers, conservation of indigenous forest trees, cultivation of under-utilised oilseeds in fallow land, and enhanced skills within the local community to operate and manage the biodiesel-based energy system. The project operates according to the

principle that the technology used can, and will, lead to land regeneration.

SUSTAINABILITY

The simplicity of the pedal-powered equipment, together with rigorous operating procedures and partnerships with diesel equipment suppliers, has contributed to the project's success. The technology is presently based in self-help groups, which are run by women and act as savings and credit organisations geared toward activities that generate additional income. A core team of local staff members is being created to support the operational training at village level as well as to train maintenance personnel.

The strategy for the future of the project foresees extending the operations of the pilot plant into a resource centre for biofuel-based livelihood strategies. Later, it could be expanded to offer action-oriented research support to field NGOs and to facilitate the installation and commissioning of new biodiesel units including South-North training sessions and knowledge exchanges, micro-energy research and development, and further collaborative partnerships.

TECHNOLOGY

Biodiesel-fuelled pump sets (3.5-5 HP) and small scale power generation sets (2-3kW) are being structured as a closed-loop package. Vegetable oil extracted from locally grown (and native) oil-bearing crops serves as feedstock for conversion into biodiesel. Alcohol (methanol or ethanol) and lye (sodium or potassium hydroxide) are the reagents/catalysts required to convert vegetable oil into biodiesel. Alcohol and lye are both currently being purchased, but in the near future these will be produced from local biomass.

Photo: Hands-on training; CT_xGreEn

FINANCIAL ISSUES

The core funding for the energy systems (pilot plants plus four village units) was provided by WBDM (World Bank Development Marketplace) in 2003, amounting to US$ 230,000. The water supply systems in three villages were built through bilateral funding (Rs. 202,200) with the village communities contributing the remaining 40 percent of the infrastructure cost. The Swiss Agency for Development Cooperation-Intercooperation (SDC-IC) funded a study on legal challenges (Rs. 190,000).

Support in the community is provided by Gram Vikas. The University of Waterloo and The Working Centre of Kitchener, Canada, have been partners at various stages. The International Development Research Centre Canada, which provided C$ 20,000, and the Social Sciences Humanities Research Canada have recently funded a doctoral research project.

OBSTACLES

The main challenge for the project was to communicate the complexity of managing a renewable energy system to the local communities. Most obstacles were overcome by involving the community in the early stages in technology development and by training barefoot technicians. Developing the pilot plant as a nodal centre for raw material procurement and final product testing, establishing standard operating practices in all installations, working with local equipment suppliers for servicing diesel engines and setting up an efficient information retrieval system are all measures that have helped reduce bureaucratic and technical hurdles.

REPLICABILITY

Training the local youth to provide technology support to the women's groups that operate and manage the biodiesel units in the villages has begun on a small scale. The goal is to increase the number of trained barefoot biodiesel technicians and for them to act as ambassadors for replication in other villages. The pilot plant on the Gram Vikas campus was set up in February 2004 for the design, development and testing of machines and processes, and to train villagers. Performance monitoring of diesel pump sets and gensets are ongoing, along with exploratory discussions with engine manufacturers to ensure warranty coverage.

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More information about WISIONS, application criteria for PREP and SEPS, as well as prior PREP-issues are available at

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