GLOBAL ENVIRONMENT FACILITY (GEF)

PROPOSAL FOR CONCEPT CLEARANCE ONLY

COVER PAGE INFORMATION

Country:
Egypt

Focal Area:
Climate Change

Operational Programme:
OP #6: Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs

Project Title:
Egypt: Biomass Resources and Biomass Energy Technologies for Rural Development

Total Cost:
US$ 15 million

Requesting Agency:
UNDP

Executing Agency:
Egyptian Environmental Affairs Agency, Operational Unit for Development Assistance; UNDP (Cairo)

PROJECT CRITERIA

1. Country Ownership

Eligibility

Egypt is a UN member country and has ratified the UNFCCC on 5 December 1994 and signed the Kyoto Protocol in 1999. As a non-Annex I country, it is eligible for GEF financing through the financial mechanism of the Convention.

Country Drivenness

The Egyptian government is a strong proponent of renewable energy generally, including biomass energy. Egypt has accumulated a considerable amount of experience and expertise with modern renewable technologies as a result of avid national and international promotion of renewables. Egyptian government has endeavoured to explore and exploit its considerable solar and wind resources, making Egypt a showcase for large-scale (multi-megawatt) PV and wind power for grid connected demonstrations – such as those at Hurghada, Zafarana, and El Korimat. The Egyptian government has resolved to implement sufficient renewable energy to supply 5% of primary energy by 2005, under the authority of the New and Renewable Energy Agency.

Specifically with respect to biomass, the significant national interest arises because the biomass resource of this agriculture-intensive country is vast – estimated at 16 million tonnes per year of agricultural residue plus enough dung to provide several million households with biogas. Some research experience with anaerobic digestor technology has been accumulated, (in particular through the efforts of the biogas programme at the Agricultural Research Center), and pilot projects have been implemented through government efforts (El Shrouk Programme, Social Fund for Development), donor efforts (e.g., International Cultural Association), and through some minor GEF Small Grants activities. There has also been some limited experience with briquetting technology and efficient biomass combustion. The current need is to build on the existing experience and develop self-sustaining markets for biomass resource management practices and energy technologies.

In Egypt, greenhouse gas emissions from rural activities amount to some 25% of national greenhouse gas emissions, amounting to approximately 27 million tCO_2 equivalent annually. Moreover, these emissions are expected to grow rapidly in the coming decades, more than doubling in the next 15 years, as rural populations grow and activities become increasingly energy intensive. By establishing self-sustaining markets for biomass energy services in rural areas of Egypt, this project will contribute to the reduction of greenhouse gas emissions in Egypt, as well as help support sustainable livelihoods for rural communities.

This project also relates directly to the core UNDP programme. This is reflected in the fact that many of the ideas on which this proposal is based were generated at a workshop on sustainable energy in Cairo in January 2000 sponsored by the UNDP and the UN Initiative on Sustainable Energy (UNISE). UNISE has undertaken several activities, (projects, reports, and capacity building exercises) which like this proposed GEF project, aim to apply renewable energy in applications that target poverty alleviation.

Country Endorsement

The Director of the Egyptian Environmental Affairs Agency (the focal point for GEF activity) has endorsed the proposal, reflecting the approval and support of the Government of Egypt for this activity. This proposal has been widely discussed and it is fully supported by the participating government institutions, as is reflected in the offer of co-funding for the project development activities.

An endorsement letter signed by the Director of the Egyptian Environmental Affairs Agency (the focal point for GEF activity) can be provided on demand.

2. Program and Policy Conformity

Program Designation and Conformity

The proposed project is directly consistent with Operational Programme 6 of the GEF, directed at reducing greenhouse gas emissions and thereby addressing climate change. All of the proposed project activities are aimed at building capacity, removing barriers, and reducing direct and indirect implementation costs to enabling renewable biomass energy resources and technologies to be more widely diffused into rural markets.

Project Design

The primary objective of the proposed project is to advance the use of renewable biomass as an energy resource, for the purpose of promoting sustainable rural development in Egypt and reducing greenhouse gas (GHG) emissions resulting from conventional energy resources.

The biomass options that will be advanced under this project include:

- Anaerobic biomass digestors: for dung, household sewage, and related high-moisture feedstocks
- Anaerobic biomass digestors: for leafy feedstocks including agricultural residues
- Biomass densification (briquetting, pelletization): for rural enterprise and household applications
- Efficient biomass stoves, furnaces and dryers: for rural enterprise, and household applications
- Biomass gasification: for production of fuel gas for process heat, shaft power, pumping and electricity

These are technologies that have been widely demonstrated in several countries, have clear links with rural energy needs, and provide a beneficial alternative use for biomass resources that currently cause waste management problems.

At least initially, the project will focus efforts in the Governorates of El-Fayyoum and Assuit, which are particularly poorly developed Governorates accounting for about 10% of the rural population, or nearly 700 thousand rural households, have considerable biomass resource potential (together comprising approximately 3 million tonnes of biomass resource), and suffer from substantial unmet demand for energy services.

Despite the combination of vast potential, considerable experience, demonstrated interest, and a large demand, not a single renewable energy technology has yet been widely adopted in rural areas of Egypt, including biomass energy options. Pilot projects have amply demonstrated that there are technically feasible, cost-effective and socially attractive renewable options, but effective market mechanisms have not yet emerged for making these options widely available and broadly accepted. This failure arises, despite the considerable technical experience and expertise in renewable energy in Egypt, due to several market and non-market barriers.

- lack of awareness among potential consumers, suppliers, financiers, and policy-makers;
- lack of capacity for wide-scale manufacturing, marketing, financing, and servicing;
- lack of capacity and training among organisations with community access (NGOs, CBIs);

- lack of a public sector institution responsible for integrating biomass resource activities and rural development programs; and,
- lack of a hospitable policy framework.

This context provides the setting for the proposed GEF project, which aims to help mitigate these barriers and foster a self-sustaining market for renewable energy technologies. The project activities will help build technical, financial, management, and human capacity in the private sector, and therefore help mobilize the private sector to create and respond to present and future rural demand for biomass energy technologies and services. Moreover, the project will help to establish favorable market conditions, policy conditions, and social conditions so that indigenous biomass energy resources and technologies can compete on fair terms with conventional resources and technologies. The project will thereby help to meet demand for energy services that is currently unmet or is met by conventional means that have high social, economic, and environmental costs. Other national benefits include employment generation, reduced regional and indoor air pollution, and foreign exchange savings from displacing conventional fuels.

Baseline Scenario

The situation in the absence of this activity is expected to be characterized by (1) continued and worsening environmental problems arising from agricultural residue disposal and village household waste sanitation problems, and (2) continued under-supply of energy services for rural communities.

Environmental problems in Egypt arising from agricultural residues and household waste are endemic. Currently, roughly 50% of agricultural residues are burned on the field. This has historically led to seasonal air quality problems in rural areas, but has attracted increased attention recently because of adverse impacts on urban air quality. Moreover, stored residue is frequently kept on rooftops, creating a significant fire hazard and providing a habitat for rodents and other pests. Some residue is dumped into canals, especially livestock and household wastes, which creates severe sanitation problems in villages. In El-Fayyoum and Assuit Governorates, approximately 95% and 81% of households do not have access to sewage treatment, which invariably means conditions of poor sanitation and polluted surface waters. In both of these Governorates, management of agricultural wastes is also a major environmental problem.

There is a vast demand for reliable, affordable, environmentally acceptable energy services in rural areas of Egypt. For example, recent studies of electricity consumption found that more than 16% of all households do not consume electricity, and more than one third of households consume less than 50 kWh per month of electricity, suggesting that there is considerable unsatisfied demand. Moreover, many households also resort to inefficient and environmentally polluting combustion of biomass for cooking, giving rise to the well-recognised health problems caused by indoor air pollution. A recent survey in Behera village, for example, revealed that a typical household annually consumes four tonnes of agricultural residues and dung. In El-Fayoum Governorate, an estimated 56,000 households out of 350,000 households do not have access to modern cooking fuels (kerosene or LPG), and in Assuit Governorate an estimated 123,000 households out of 385,000 do not have access. Nationally, an estimated 1.1 million households have no access to modern cooking fuels, and another 4.3 million households do not have reliable access. The rural population, comprising 57% of the total Egyptian population, is expected to increase along with national population growth and with resettlement from over-crowded urban areas to new developed areas. The energy needs of this group are considerable, both for electric power and fuel, creating a great unserved market for sustainable energy resources. Like households, the rural small-scale enterprise sector, in which an increasing proportion of the rural population makes its livelihood, would also greatly benefit from a reliable source of clean and affordable energy for heat, shaft power, and electricity.

It is impossible to predict a scenario that accurately reflects how these statistics will change in the future. However, the conditions they reflect are persistent problems that are highly unlikely to be quickly addressed in a business-as-usual scenario. Concerted efforts to address them through GEF project activity can doubtlessly have considerable positive impact.

GEF Project Scenario

Goals:
The GEF project scenario aims at the following two major goals:
(1) addressing the agricultural residue and livestock/household waste problems, and
(2) providing much needed energy services in rural areas to households and enterprises.

Immediate objective:
To do so, the proposed GEF project aims to reduce the barriers confronting the wide-scale use of renewable biomass energy technologies in rural areas, and to build the capacity of the private sector and other actors to create and respond to market demand for renewable biomass energy services.

Results:
The result of these activities is intended to be a significant reduction in the environmental problems resulting from biomass resource management practices, and an increase in the availability of energy services for rural households and enterprises, specifically in the Governorates of El-Fayyoum and Assuit. While it is unrealistic to designate quantitative targets at this point, it is possible to discuss the potential in quantitative terms.

Currently, the amount of agricultural resource generated in the El-Fayoum and Assuit Governorates is approximately 2.6 million tonnes per year, or which more than half is burned for disposal. If a small fraction of this biomass resource were converted to a higher quality energy resource, a significant portion of unmet energy demands could be satisfied. Consider the conversion of agricultural residues to cooking gas, for example through a gasification technology similar to that adopted in the UNDP-supported biomass energy project in Jilin Province, China. Only 11% of the agricultural residues produced in the two Governorates would be sufficient to provide cooking gas to satisfy all the daily cooking fuel needs of households that lack reliable access to modern cooking fuels (about 27% of the rural households). Similarly, less than 5% of the residues would be sufficient, if converted to electricity at a very modest efficiency of 12%, to enable all unelectrified households to consume electricity at the average Egyptian household level of electricity consumption. A lower-tech route to improved cooking fuel would be through the carbonization and/or densification of agricultural residues, to provide a uniform, denser, and cleaner fuel source, together with the commercialization of more efficient and clean stoves, dryers, and furnaces.

A realistic GEF project scenario would comprise the successful initiation of a market for purchasing biomass resources, converting to more convenient energy forms, and for delivering energy services. It is impossible to define a quantitative target for this market in terms of the fraction of biomass resources consumed, or the fraction of currently unserved households served, or enterprises enabled by modern energy services, it is reasonable to aim for a robust market that is self-sustaining, and eventually grows to meet the energy needs of a significant number of households and enterprises.

Project Activities
The proposed GEF project comprises several inter-related activities:

Provide technical assistance - The project will provide assistance, particularly in the initial phases, in matters such as manufacturing, construction, installation, upholding standards, energy service delivery, maintenance, etc., targeted especially at equipment developers, small biomass energy companies, and after-sales service enterprises.

Extend business support - The project will help to create a supportive environment for the private sector, especially incipient businesses. Elements of such support may include business incubators, public-private partnerships, trade organization, a credible certification process, etc.

Establish a supportive policy framework - such as standards and certification, financial incentives, concessions, parallel subsidies, public sector procurement, a platform for a public-private partnership, etc.

Launch effective delivery mechanisms for biomass energy and establish a self-sustaining market - Ultimately, an economically sustainable, long-term, market-based delivery mechanism will be launched to commercialize biomass energy technologies and respond to the rural demand for energy services. An important element of such delivery mechanisms will be accessible financing for end-users and small biomass energy enterprises. In addition to the central role of the private sector, there may be important roles for NGOs, CBIs and other organizations with community access, lending institutions, and the public sector.

The market-based delivery mechanisms would follow different business models for different products. For minor investments (e.g., stoves for use with improved fuels), the dominant model might be based on small manufacturing and distribution enterprises directly marketing to rural households or selling through village shops. For larger investments (e.g., household-scale biogas digestors), financing would probably be needed either for households through intermediate financiers, or for vendors/construction enterprises through business financing institutions (commercial banks, extension banks, public sector credit sources, etc.) that provide mortgage or lease-purchase contracts. For more capital-intensive investments at the scale of an enterprise or village (e.g., briquetter, gasification system) an energy service company could arrange its own financing, install the system primarily on an equity basis, and operate it through a fee-for-service arrangements with individual end-users. The public sector roles could include outreach, certification and oversight, development of a supportive policy framework, and financial support, in cases where environmental and welfare benefits justify some level of public funding.

Project Development Activities
In order to define the detailed work plan under which the above results will be accomplished, project development activities will be necessary. The project development phase will include the following.

Activity 1: Detailed analysis of rural biomass resources and energy demand
Background scoping work has confirmed that the biomass resource is vast, that important benefits will accompany the adoption of improved biomass resource management strategies, that biomass energy technologies are viable, and that considerable demand for energy services could be met with biomass-based energy. A detailed market assessment and techno-economic evaluation is now needed, to prioritize options and assess the total economic potential for market-driven diffusion.

The profile of energy demand in rural areas of Egypt is exceedingly complex and only partly understood. Yet, understanding energy demand is a critical part of designing a comprehensive programme for promoting renewables. The first task, therefore, is to analyse rural energy demand, including current and projected consumption, as well as unmet needs.

The detailed energy demand analysis will comprise a database including the information listed in the following table. It will be disaggregated, to the extent necessary, by different end-users (e.g., households at different socio-economic levels, enterprises, etc.). The analyses for these community types will rely on existing information sources, and field surveys. Some of the required information is available the community database of the Ministry of Local Development (which has been compiled in part with UNICEF assistance), at the New and Renewable Energy Authority, Rural Electrification Authority, Agricultural Research Centre, National Research Centre, American University in Cairo, and some NGOs.

Participation of community members and other stakeholders will be especially important, especially for determining the unmet demand for energy services, and for identifying key intersections between energy services and employment opportunities. (The participatory elements are discussed further below.)

Community Energy Profile
current energy service consumption (cooking, heating, transport, enterprises, water pumping, etc.)
Conventional and biomass energy resources: availability, consumption, competing uses (electricity, kerosene, LPG, wood, agricultural residues, dung, etc)
energy prices (with and without subsidies)
unmet demand for energy services (as articulated by community members)

It will be important to carry out a background study of the current and potential uses of biomass resources– e.g., the use of residues as a soil enhancer and the nutrient and organic content requirements of cropland from which residues might be harvested, and also the use of residues and dung as a cooking fuel. Other economical uses of residues, such as feedstock for paper, fibre, processed high-nutritional value fodder, etc, must be understood. Of specific interest for the Egyptian context is rice straw, maize stover, sugar cane bagasse and barbojo, wheat straw, and cotton stalks.

According to preliminary estimates, In EL-Fayyoum, approximately 1.25 million tonnes of agricultural residues (primarily rice, maize, cotton, and wheat residues) are produced annually, and about 110,000 tonnes of municipal waste. In Assuit, approximately 1.3 million tonnes of agricultural residues and 160,000 tonnes of municipal wastes are produced. Animal wastes contribute another 20,000 tonnes of waste. Much of this tremendous resource is wasted, and what is not wasted is generally used in inefficient, polluting stoves. Recovering a larger portion of this resource, and utilizing it more efficiently toward serving unmet demand for energy services could have considerable rural development benefits.

Activity 2: Comprehensive inventory of locally relevant renewable energy options, experience, and potential

The second task entails a detailed inventory of biomass-related experiences and resources (technical, manufacturing, etc.) The preparation mission for this proposal included an initial survey of Egyptian renewable energy experience and activities, generally, which inspired this proposal's focus on biomass energy resources and technologies. The proposed project responds to a major existing need, while avoiding overlap with other renewable energy activities (in wind and solar PV, which are both benefiting from proposed or ongoing GEF projects).

However, the experiences and data resulting from past biomass energy efforts have not been comprehensively evaluated and distilled into a set of lessons and recommendations that can benefit subsequent efforts to broadly diffuse biomass energy through markets and policy initiatives. Therefore, this inventory phase will include a thorough analysis of prior efforts with biomass energy in Egypt, and a review of experiences and lessons learned. This analysis will build on any prior efforts of technical research (NREA, ARC, NRC, etc.), pilots and demonstrations (NREA, Social Fund, international bilateral and multilateral donors), and training and capacity building activities (NGOs, CBIs, Shrouk).

Several issues need to be illuminated regarding the degree of success of past efforts to spread construction expertise, financing channels, maintenance infrastructure, and public awareness. An especially important issue is the question of institutional models for community-serving systems, and the prospects for management arrangements that would not exclude households with meagre land-holdings or livestock-holdings.

Elements of the assessment of biomass energy options
I. Techno-economic assessment Ascertain the present and long-term cost effectiveness (or lack thereof) under prevailing economic conditions (considering cost of technology, maintenance requirements, discount rate, prices of alternative fuels such as bottled gas and electricity, affordability of imported capital, and economic value of by-products (such as fertilizer from biogas digestors).
II. Institutional and cultural constraints and barriers Determine necessary operating skills, training and outreach needs, cooperative management requirements (e.g., what degree of community cooperation necessary, if any?), cultural appropriateness (e.g., is there consistency with cooking practices? livestock and agricultural practices?), gender implications (e.g., what are training needs of women? have women's energy needs and resources been accounted for?) , affordability (in terms of ability to pay and willingness to pay of rural households, both through financial payments and labor equity), etc.
III. Policy issues Prevailing agricultural policies regarding prompt disposal of waste residues, energy subsidies (for bottled LPG, electricity, diesel), taxes, import duties, emissions regulations, investments in village sanitation, etc.
IV. Lessons learned from prior activities in Egypt A considerable amount of experience and expertise has been built up in Egypt, as a result of national and international promotion of renewables. This will provide the foundation of subsequent efforts to launch a robust renewable energy market.

The conclusions of this analysis will be a market assessment with two major components:
(i) A quantitative estimate of market opportunities for biomass energy technologies and practices; and,
(ii) A clear explication of the barriers and constraints to broader diffusion in Egypt.

Activity 3: Develop Strategies for Market-based Diffusion

This task will identify the most promising strategies for diffusion of renewable energy technologies in rural areas. It will include the following sub-tasks:

3a) Assessment of assistance needs for private sector

Unlike the situation in many developing countries, the Egyptian market is very large and can support the domestic production capacity for many biomass energy products (and potentially evolve into an export sector). As the most promising options are identified, it will be possible to start identifying the training and assistance that will enable the private sector to carry out its roles.

(i) Technical assistance

The private sector will need technical assistance in construction and maintenance in order to respond to the market demand stimulated by this project. Limited technical assistance activities have been undertaken in some fields, such as biogas digestor construction, with the collaboration of NREA and several NGOs. These types of activities will need considerably more effort, however, if the ultimate objective is to create a critical mass of private sector competitors who are equipped to deliver products that are standardized, high quality, certified, and fully-supported. The technical assistance needs of the private sector will be assessed n this activity.

(ii) Business support

In addition to technical support, it is increasingly recognized in Egypt that private sector actors also need business support. This activity will assess the effectiveness of the incipient business support activities in Egypt and the prospects for tailoring similar activities to the needs of biomass energy enterprises. The following examples of recent business support activities in Egypt will be assessed for their value as models for supporting renewables

enterprises:

- trade organizations (such as the Energy Efficiency Service Business Association, which has been effective in supporting energy efficiency markets)
- public-private partnerships (such as the Energy Efficiency Council, which helps coordinate public policy and private sector activity in energy efficiency)
- business incubators (which provide seed credit, management and financial training, workshop space, etc.),
- one-stop business registration (to help small enterprises satisfy the extensive bureaucratic requirements of government registration),
- product standards and certification (to help enterprises establish consumer confidence),
- assistance with establishing upstream (supplier) and downstream (consumer) linkages, especially in relatively remote areas

(iii) Public sector entity to support market-creation

Some observers in the Egyptian private sector have argued that the renewables industry needs a high-profile, non-commercial, public sector entity to play a role in creating markets. Such an entity should be seen as impartial, credible, independent, and technically informed, so that it can unimpeachably provide outreach and public awareness-raising to broaden the consumer base. It would also provide technical capacity building for the private sector, and be responsible for setting standards and certifying private sector products, services, and guarantees. Some of these services are currently provided by existing public and academic institutes on a limited basis.

3b) Analysis of viable financing options

In almost all contexts, a key concern for creating markets for biomass energy options is the availability of financing. This activity will consider three elements of this issue:

(i) Micro-credit financing for end-users

There are currently a few channels through which households or small enterprises can secure microcredit financing, such as CBIs, the Local Development Fund, and various programmes of the Social Fund for Development. This activity will assess the prospects for initiating new revenue-neutral (revolving) funds and collaborating with the above-mentioned micro-credit funds to enable consumers to secure financing for biomass energy investments. This might include, for example, providing technical assistance for lenders on the value of the renewable energy investments, building their appraisal capacity, and developing schemes for integrating income generation activities with renewable energy investments. (One example of this is the use of crop dryers to enable small farmers to create higher-value products from their agricultural output.)

(ii) Dealer financing for end-users

This activity will assess the prospects for assisting vendors in providing financing to consumers. Typical barriers, such as impossible collateral requirements, lack of credit histories, community credibility, lack of working capital, etc, will be considered in the light of experiences of existing micro-credit schemes. Providing biomass energy through rural energy service companies will also be appraised.

(iii) Financing for biomass energy companies

Financing is also a challenge for the private sector entering when the conventional commercial lenders perceive the sector to be risky and uncertain. This activity will consider ways to address these barriers, perhaps by convening a working group fashioned after the Inner Banking Working Group, which consists of commercial lenders that are potential financiers of the energy efficiency firms and energy efficiency projects. The working group would consider financing issues raised in the energy efficiency sector, and provide a forum for capacity building in the lender sector.

This activity will examine the financing activities that are available through existing international programmes. It will determine how best to take advantage of these opportunities, considering their potential for collaboration generally, and specifically for extending financing in Egypt to private firms or (indirectly) to customers.

3c) Determination of policy options

The policy environment strongly influences the market environment in which renewable biomass energy will compete. This activity will consider policy issues that concern biomass energy markets in Egypt, including the following.

(i) subsidies and other public sector funding

Conventional energy, such as grid electricity and bottled LPG, are currently made available at below-market prices to households, which disadvantages unsubsidized alternatives. Just as importantly, public sector subsidies for non-energy products such as fertilizers, and investments in infrastructure such as public sanitation, can also disadvantage biomass energy options that provide comparable services, such as biogas digestors. This activity will consider policy options for providing comparable levels of financial incentives for biomass energy (and kindred) options, based on energy, social, or environmental services provided.

(ii) other financial incentives

Other financial incentives can prove very supportive of investments biomass energy, such as customs duties relief, tax holidays, and temporary buy-downs.

(iii) concessions

Market consolidation is often needed to acquire the economies of scale that make small-scale renewables cost-effective. One approach that has been proposed in other countries is to grant concessions, whereby companies are given exclusive distribution rights in certain regions, in exchange for a commitment to certain conditions (such as providing services to public spaces like schools and clinics, or poor households).

(iv) procurement initiatives

In the initial phases of a renewables market, government procurement initiatives can guarantee a level of demand that allows manufacturers to invest in production equipment, gain experience, and decrease costs.

(v) risk-reducing assistance and support

Incipient renewables industries can also benefit from measures that reduce the risk or perceived risk associated with the renewables industry, such as diversification of portfolios for lenders, fuel supply guarantees (for biomass), government guarantees.

Activity 4: Assessment of capacity building for implementation

The fourth task of the project development phase will be an assessment of capacity building needs for the institutions involved in implementation of the project. This will include assessing capacity for NGOs and CBIs involved in grassroots renewables activities, financial institutions, public sector agencies, and private sector companies. The need for training materials and events (workshops, meetings, etc) will also be assessed.

The output of the project development phase will be a concrete, implementable workplan for diffusing appropriate, environmentally sound biomass energy technologies, focusing on the technologies identified at the outset, and targeting the Governorates of El-Fayyoum and Assuit. It will:

(i) identify the target energy needs in rural areas and prioritise the biomass resources and energy options for meeting those needs;
(ii) identify the most effective delivery mechanisms for meeting those needs;
(iii) determine the enabling conditions and assistance needs for relevant actors (technical, financial, institutional, and policy); and,
(iv) comprise a detailed workplan for reducing barriers to renewables and mobilizing the private sector by building its capacity and creating hospitable market and policy conditions.

Sustainability

In contrast to many renewable energy projects implemented Egypt, this project is not merely a demonstration of a technology based on one-off implementations. This project is based on market-based diffusion, and will not rely on continued support from GEF or any other international funding source. This is possible because there exist economically viable options for using biomass energy in rural household and enterprise applications.

Replicability

The explicit focus of this project is replication, with the project aiming to create self-sustaining markets for biomass energy technologies in rural areas throughout Egypt. A successful initiative for expanding the use of renewable energy in rural areas can also replicate beyond the borders or Egypt, by providing a model for other countries, advancing the development and adaptation of renewable technologies, and helping to build demand for the international biomass energy technology industry.

Stakeholder Involvement

A participatory process will be established to provide information and input to help identify the most useful applications for disseminating biomass energy technologies with rural development impacts, and to identify the promising opportunities the creating a replicable process. The PDF B phase of the proposed project would initiate a participatory stakeholder process that would continue and evolve throughout the full-size project implementation. Some very effective participatory processes have been established in Egypt in recent years that can serve as a model, or even a platform, for this activity. Good examples include the participatory stakeholder activities carried out within the National Environmental Action Plan, the Comprehensive Development Plan for the City of Luxor, projects of the Social Fund for Development's Community Development division, and the Local Development Fund of the Shrouk initiative.

The participatory involvement will involve stakeholders such as community members in need of energy services, prospective vendors, civil society members (including CBO's and NGO's involved in rural development and energy activities), government actors, and others. The participatory process will aim to:

(i) identify consumers (i.e., communities, households, and small enterprises) that can support a biomass energy market, will receive real benefits, and are the intended beneficiaries of rural development efforts,
(ii) identify and prioritise of locally available and appropriate biomass resources and energy technologies,
(iii) identify means for integrating these biomass energy options with income generating activities, thereby enhancing their economic viability and their contribution to rural development, and
(iv) identify and design effective delivery mechanisms, including financing and after-sales service, that can be economically viable and self-sustaining.

Further details on communities, government agencies, private sector, and aid and multilaterals are provided below.

- Communities - Communities whose needs are to be met by this project will obviously be key participants in a stakeholder process. In addition to direct involvement with the intended beneficiaries, the participatory process will investigate optimal ways to work through Community Development Organizations, which are well-established in many villages (e.g., Bassaissa Community Cooperative Association), NGOs, some of which have been involved in village scale energy interventions (e.g., International Cultural Institute), and others groups that would bring valued perspectives to this initiative (e.g., National Council for Women).

- Government agencies - Several national Government agencies would be valuable contributors to a stakeholder process. The Egyptian Environmental Affairs Agency is the locus of the Climate Change Unit, and the GEF focal point, and as such is an appropriate implementing agency for this project. EEAA has expertise in GHG assessment, acquired through activities such as their cooperation agreement with the US National Renewable Energy Laboratory. The Shrouk Initiative (Directed by Ibrihim Murarram of the Ministry of Local Development) is a very large, Egypt-wide program of rural development. They are involved in small infrastructure investments, microcredit, business incubators, and rural enterprise. The Social Fund for Development is another large Egypt-wide development initiative, which has substantial support from the World Bank and other sources, involved in a range of activities including rural business development, microcredit, and rural investments. SFD has a signed a "Protocol" with GEF on clean energy development. The input of the SFD's Environment and Development division and Community Development Group would be especially useful for this project. (Ithar Khalil of E&D and Hala Omar CDG are experts who have been involved in biogas pilot projects.)

  The New and Renewable Energy Agency is the national nodal agency for renewable energy activity. To date NREA has focused on grid-connected wind and solar energy, the Director (Sami Zanoun) expressed interest to the project team in promoting biomass energy. National research and academic institutions, such as the Agricultural Research Center and the Academy for Scientific Research, might also be involved in the process of reviewing, developing, and indigenizing biomass technologies.

- Private sector - The private sector will be a critical contributor to the stakeholder process, since it is central to a market-viable bioenergy initiative. Developers, manufacturers, venders and operators will be involved. Some initial efforts (e.g., through the Small Grants programme) to develop private sector actors in biogas

and briquetting will be leveraged and expanded. Trade associations and other potential forums for supporting private sector and developing businesses (perhaps fashioned after groups such as the Egyptian Energy Efficiency Service Business Association and Egyptian Solar Energy Society) will also be important stakeholders. Financial organizations (e.g., commercial banks, national agricultural and rural development banks, microcredit institutions such as Shrouk, and SFD) will be engaged, and special financial body may be convened (after the model of the Inner Banking Working Group, which was convened to cooperate on energy efficiency investment issues).

- Aid and Multilaterals - Finally, the relevant international organizations will be involved including, as appropriate, UN organizations (UNDP, UNESCO, UNIDO, and GEF Small Grants Programme), World Bank, bilaterals such as Danida (which has recently completed a scooping survey on biogas in Egypt), CIDA, and USAID.

Monitoring and Evaluation

A protocol for monitoring and evaluation of the GEF project will be developed, including the corresponding set of verifiable indicators. The Protocol will detail a methodology for assessing the success of individual tasks of the full-size GEF project, and for the overall objective of fostering a market for biomass energy technologies. It will include tracking and follow-up of activities, surveying of project beneficiaries, and assessment of extra-project impacts. Milestones (such as numbers of household served, amount of avoided residue burning, etc.) will be defined and used to gauge success. This will also provide a basis for continued refinement and improvement of the project.

The monitoring protocol will also detail a methodology for quantifying greenhouse gas benefits of the GEF activity (consistent with IPCC guidelines and other official guidance from the COP and Subsidiary Bodies), including both avoided fossil fuel emissions and GHG products of uncontrolled biomass-combustion. This assessment will also consider – qualitatively if necessary – of the indirect GHG impacts of the project, as a result of the longer-term and economy-wide influence of this project in affecting market transformation.

3. Financing

Financing plan: In the full project phase, GEF-funded incremental costs will include costs of barrier removal activities for measures identified in the workplan to eliminate or reduce the barriers.

Although it is not possible to calculate at this stage the exact cost of the full project, it is estimated that it will be on the order of $15M, with approximately one-third (~$4-5M) of budget to be requested from GEF funds. Co-funding will be negotiated with the Government of Egypt (possibly to include, among others, Shrouk and NREA), bilateral donors, and eligible multilateral programmes, as well as local beneficiaries in rural communities.

4. Institutional Coordination and Support

Implementation Arrangements

The project development will be coordinated through the National Execution Modality (NEX). The national counterpart for the project development will be the Egyptian Environmental Affairs Agency (EEAA). The EEAA will coordinate the implementation of different project development activities, which will be carried out by relevant governmental institutions, NGOs, and/or individual consultants to be designated by EEAA, in consultation with UNDP/Cairo.

Coordination with other activities and agencies

This proposal has been prepared, and future activities will be carried out, with the input of the relevant Egyptian agencies that are concerned with energy and rural development activities, including the Egyptian Environmental Affairs Agency, the New and Renewable Energy Authority, Shrouk fund, Organization for Energy Planning, and Social Fund for Development. It will also maintain contact with other ongoing activities in support of renewable energy include grid-connected and remote power applications (e.g., the proposed or ongoing GEF projects for wind and solar PV power.)

Project Development Costs

The costs of the project development described in this document are estimated at approximately US$300,000. Co-financing for the project development has been offered from UNDP/EAP, UNESCO, and UNIDO. A separate future submission will be made for approval of preparatory resources from GEF.

References

Renewable Energy for Sustainable Development of Rural areas in Egypt: Opportunities and Barriers, 2000. Mahmoud Saleh (Prepared for UNDP, Sustainable Energy and Environment Division: New York)

The State of Rural Development in Egypt. Essam El-Hinnawi (Prepared for UNDP, Sustainable Energy and Environment Division: New York)

Baseline Survey of the Energy Sector of the Arab Republic of Egypt., 1999. SRC International, ICEMEC, and the Egyptian Organization of Energy Planning. (Prepared for DANIDA: Copenhagen)

Strategic Results Framework, 1999. United Nations Country Office, Egypt.

Annex A - Response to GEF Secretariat Bilateral Review

Q. NREA is asked by Egyptian Government to facilitate RE to achieve supply target of 5% of primary energy by 2005. Focus seems to be on wind and solar. No specific biomass program.

A. They have not specifically identified any renewable form of energy (other than hydro), since they wanted to retain the flexibility of being able to encourage least cost renewable technology, and this is context specific. However DANIDA and GoE are currently discussing the development of a biomass/ biogas strategy. During consultation with the GoE in January 2000 (60 people, ERODO, NREA, ARC, NRC, Min of Health, Min of Ag, fund for social development, and GEF SGP, NGO's/ Private Sector, utilities), NREA in particular expressed their interest in biomass:

- The GoE has pretty good data on agricultural residues (database of Min. of Ag), and recognizes there is enormous potential for energy use from Biomass- Biogas technologies. Over 16 million TOE/year per year in crop residues alone (mainly sugar cane) are generated nationally;
- The GoE has been investing in Biomass/ biogas technology R&D since the 70's;
- They have already invested in a 18 MW biogas electricity plant; and have developed manufacturing capacity in small scale biogas digesters;
- However they now realize that the main impediment to the diffusion of these technologies are socio-economic; policy; and financial (consumer access to capital) based;
- As well coordination problems amongst different GoE agencies: Min of Ag./Min of Health/ EREDO/ NREA etc;
- This is why they are asking for help from the GEF.

Q. Project endorsed by Egyptian Env. Affairs Agency, letter not provided.

A. This is a concept only, and does not require an endorsement letter at this stage, however we will of course provide an endorsement letter at the point we submit the PDF B.

Q. Baseline scenario deals primarily with local environmental problems and energy supply shortages (no global environmental reasoning given).

A. Recent research shows that partial burning of biomass generates more GHG emissions than combustion of fossil fuels. Preliminary estimates indicate a ranging of between 214,800 and 644,400 tonnes CO2 equivalent per year in avoided emissions, assuming total diffusion of these technologies through both Governorates of Assuit and El Fayoum. This is based on IPCC CO2 equivalent co-efficients for crop residue and dung; estimates of household dung and crop residue use in rural Egypt, and the number of households in both Governorates.

We know that the GoE is committed to electrifying rural villages in the least cost manner, but we have no specific data how they planned to electrify the 40,000 households in the two Governorates. In the event it is through grid connection we would expect a comparatively low reduction in GHG emissions of 16,000 tonnes CO2 equivalent, since grid based electricity in Egypt is generated mainly from hydro and gas (with an estimated carbon intensity 0.3kgC/kWh).

Q. Incrementality of GEF support can be assumed, but is not clearly specified.

A. GEF will fund means to improve access to financial capital, policy, and institutional coordination barrier removal activities. Incrementality it will not include any capital investment in the technology itself.

Q. Replication occurs primarily through market mechanisms; no explicit replication activities are proposed in concept.

A. Market diffusion is expected to be the main form of replication. A number of business models have been outlined which would serve as vehicles for replication. These include direct marketing by manufacturers for small capital investment initiatives, such as stoves; for initiatives requiring larger investments consumer-financing options will

probably be needed; and for the most intensive capital investment initiative, energy service companies may be an option. Government support will be an integral part of generating market momentum.

Q. Participatory process proposed to include beneficiaries, private sector, civil society members and government. No institutions or mechanisms specified.

A. Household needs assessments will be utilized during project development phase to identify stakeholder needs and views, particularly cultural constraints to the use of biomass. Participatory mechanisms for project implementation will be developed during project development. A brief stakeholder analysis is included in the concept.

Q. Coordination through National Execution Modality (NEX - what is this?)

A. A mode of UNDP Execution, where a Government Agency is chosen to execute the project. The UNDP Country Office maintains oversight of project implementation, verifies budget expenditures, manages all independent evaluations, and annually reviews project progress with the Executing Agency.

Q. Where are links to other donor efforts, incl. GEF small grants?

A. Other initiatives are summarized below:

- The concept builds on a DANIDA Energy Sector Assessment, and a comprehensive database on crop residues kept by the Ministry of Agriculture.
- DANIDA is in the process of discussing a biomass strategy with the GoE. The proposal will provide impetus for that and lessons for an eventual strategy.
- Anaerobic digesters for orgainc waste (dung and night soil): R&D primarily by the NRC and ARC, to adapt Chinese and Indian designs to local conditions. Technically these now work, but little attentions has yet been paid to socio-economic circumstances, and how these technologies might be disbursed throughout Egypt.
- Biogas (with rice husks): Recent R&D efforts by the NRC are being targeted at small digesters, although dissemination of the technology has occurred.
- Small scale biomass digesters: EREDO (The Egyptian Renewable Energy Development Organization), plans to promote small scale biomass digesters. There is an estimated potential of 1 million units, 800 have already been distributed, of which 80% are estimated to be still working.
- The three Small Grants Programme projects below, two on biogas the other on briquetting, are both focused at demonstrating technologies in specific villages. Neither address the issue of technology diffusion through the market.
    - Building and Dissemination of Biogas Technology at Bassaysa in Sharkia and Bated El Arab in Beni Seuf
        - Building the capacity of the NGO in constructing and maintaining biogas units as well as raising awareness of farmers about the importance of using biogas in the pursuit of protecting the environment. Building and installation of 5 units of Biogas in 3 villages (bayad El Arab, El Tal, Senour). This project is jointly implemented through 2 NGOs, one responsible for the biogas technology, maintenance and installation. The other NGO responsible for the public awareness and dissemination of information.
    - Dissemination and Institutionalisation of the Biogas Technology
        - Establishing 12 units of biogas for producing a new source of clean energy and organic fertilizer. Training 3 technicians on the production of the biogas units. Raising the awareness towards benefits of using the biogas units. Documenting the biogas experience for dissemination among NGOs.
    - Upgrading and Manufacturing of a Unit for Converting Agricultural Wastes into Briquettes to be Used as Fuel
        - The project will manufacture a unit that converts agricultural wastes into briquettes to be used to replace fossil fuel. The units will be used in Kalubia Governorate. The project's objectives are:

1. To convert biomass into a solid fuel (Briquettes) to be used as an energy source that is equivalent to millions of Ton Oil Equivalent/ year. 2. To convert the agriculture waste into uniform shaped briquettes that is easy to transport and store. The briquettes have better physical and combustion characteristics than the initial waste. 3. To kill insects & diseases as well as to reduce the destructive fires risk in countryside. 4. To improve the combustion efficiency of the existing traditional furnaces by using the produces briquettes. 5. To reduce several million tons of CO2 emissions by field burning. 17 labourers will be trained on manufacturing the briquetting unit. In addition, at least 15 persons will be trained in the field on using the unit to produce briquette fuel.