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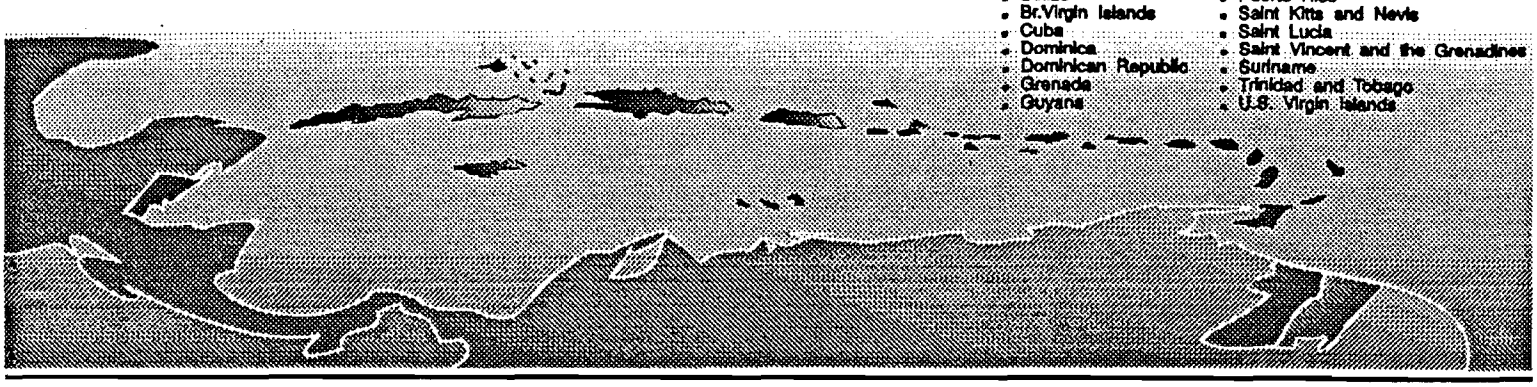

- Antigua and Barbuda
- Aruba
- Bahamas
- Barbados
- Belize
- Br.Virgin Islands
- Cuba
- Dominica
- Dominican Republic
- Grenada
- Guyana
- Haiti
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CCST/UWICED/UNESCO Workshop on Investment Funding for Renewable Energy and Energy Efficiency Projects in the Caribbean
Kingston, Jamaica
17-19 January 1996

REPORT OF THE CCST/UWICED/UNESCO WORKSHOP ON INVESTMENT FUNDING FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY PROJECTS IN THE CARIBBEAN

UNITED NATIONS
ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN
Subregional Headquarters for the Caribbean
CARIBBEAN DEVELOPMENT AND COOPERATION COMMITTEE

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Kingston, Jamaica - 17-19 January 1996

The CCST/UWICED/UNESCO Workshop on Investment Funding for Renewable Energy and Energy Efficiency Projects in the Caribbean was held on 17-19 January 1996, in the Wyndham Hotel, Kingston, Jamaica. The main objective of the workshop was to bring the major actors in the development and implementation of renewable energy and energy efficiency projects together in an effort to define appropriate mechanisms for funding these projects.

Representatives from the electricity utilities, governments, non-governmental organizations, suppliers of renewable energy and energy efficiency technologies and services, the donor community and development organizations attended. They sought to build on progress made since the CCST/UWICED/UNESCO Caribbean High-Level Workshop on Renewable Energy Technologies, held in Saint Lucia, in December 1994. Since that workshop, a number of electric utilities had demonstrated interest in demand-side management, at least one wind-energy project had been implemented and feasibility studies had been conducted on biomass energy production in Belize.

Participants came to the following general conclusions :

(a) Governments needed to play a more active role in providing appropriate policy frameworks which include the provision of incentives for energy efficiency and renewable energy use. In particular, the concept of integrated energy planning for least cost energy supply by utilities needs greater recognition, which should be fostered by government policy directives. Other areas requiring attention by government policy include cogeneration and pricing of energy and incentives for electricity production from wind energy.

(b) In order to access funding available from the donor community, there needed to be greater collaboration among the key actors in renewable energy in the Caribbean. A comprehensive approach to energy efficiency and renewable energy development should be taken, and embodied in the form of one or more substantial regional projects.

(c) A regional institution with responsibility for energy efficiency and renewable energy development was necessary to cover all aspects of this activity, in particular, identification of projects and programmes, technology appropriation and transfer, and support and advice for governments on technical and policy questions.

A total of 18 preliminary project outlines were drafted and presented in the areas of energy information, solar and hydro power, wind energy, geothermal energy, energy efficiency and institutional development. These projects sought to address the issues raised during the meeting, and were intended for further refinement with a view to implementation.

The workshop discussions addressed the following topics:

(a) Financing mechanisms, donor funding options and requirements;

(b) Development and implementation of renewable energy and energy efficiency projects in the Caribbean;

(c) Country activities and requirements for renewable energy and energy efficiency projects; and

(d) Priority projects.

Opening remarks

Opening remarks made by Navin Chandarpal, as Chairman of the Caribbean Council for Science and Technology (CCST), acknowledged progress in the area of renewable energy and energy efficiency in the Caribbean. However, he emphasized the need to identify and explore appropriate mechanisms for funding further initiatives. He stressed the need to understand the implications of renewable energy use, and stated that the present workshop was important in bringing a collective approach to elements which had not yet been properly addressed. These included identification of barriers to implementation, difficulties faced by investors and governments in implementing projects and experience sharing. Rational policies were seen as a first step in providing sound basis for greater involvement of all sectors. He identified several factors affecting the funding of energy projects. These included a lack of a positive policy by governments on financing for projects using alternative sources of energy, differences in scales of projects, funding requirements and financial returns. He stated that different perspectives hindered the formation of the partnerships necessary for implementing these projects, and expressed the hope that at the end of the workshop some of these difficulties would have been explored and solutions proposed.

The present exercise, he said, built on the previous workshop, and presented an opportunity to capitalize on the fact that governments were already sensitized to the need to go into larger scale projects for renewable energy. These had their roots in environmental considerations and could also be based on financial incentives in the form of savings on imported fuels. In closing, he thanked the other sponsors of the meeting, UWICED and UNESCO, for their cooperation in this CCST initiative.

Professor Bishnodat Persaud, Director of the University of the West Indies Centre for Environment and Development (UWICED), spoke of his organization's involvement in the area of renewable energy, referring to a number of studies undertaken under UWICED's renewable energy programme. He took an economic approach to renewable energy use, stating that while financing was important, there needed to be a continuing examination of the economic implications of energy use in general, and of renewable energy use in particular. In some countries, as much as 10 per cent of their foreign exchange spending was on energy. Other reasons for taking renewable energy more seriously included the conclusive report of the Intergovernmental Panel on Climate Change on the certainty of climate change and the polluting effects of fossil fuel use. While renewable energy technologies were viewed as costly to install on a large scale, the cost became competitive if avoided environmental costs such as the impact on biological resources and disease spread were included. The operating costs of renewable energy technologies were also much lower. Subsidies for importing these technologies were suggested as a means to increase their use, while market failures in the form of subsidized electricity costs needed to be addressed.

The policy framework was seen as being key to addressing these issues and the financing problem. He acknowledged the existence of funding opportunities from the donor community, but stressed that local sources such as the Caribbean Development Bank (CDB) needed to place greater emphasis on renewable energy use. He identified a gap in the range of financing available for renewable energy projects in the form of smaller projects such as solar water heating, and saw a potential role for regional venture capital companies for minimizing and spreading risk. The need for a pipeline of projects which could justify special institutional arrangements for financing was highlighted. Other factors which would contribute to greater success in implementing renewable energy projects included addressing problems of high capital costs (in Jamaica, for example) and encouraging movement from family businesses to more corporate bodies (achievable through equity capital facilities).

Dr. Winthrop Wiltshire, United Nations Educational, Scientific and Cultural Organization (UNESCO) Subregional Representative and Advisor in Science and Technology, noted the good working relationship existing between UNESCO, UWICED and the CCST, and the events which had led to the present workshop to deal with the important issue of financing. He briefly reviewed the process leading to the World Solar Summit, to be held in Zimbabwe in September 1996, in which countries had been requested to send priority projects for consideration. Recalling the previous workshop held in Saint Lucia, he noted the need for greater benefit from such discussions, and the need to document the success and failures of renewable energy projects. In this respect, he highlighted the work of the Caribbean Energy Information System (CEIS).

The issue of policy remained important, he said, drawing attention to the Model Energy Policy for the Caribbean drafted at the Saint Lucia workshop, and the fact that the economic considerations of energy use were not fully addressed by existing policies. In dealing with policy considerations, the real issue was how to get the politicians to recognize the worth of policy as imperatives for action with a clear strategy for implementation. There was need to sensitize key players in the ministries such as the permanent secretaries. Finally, there was need to link investors with the needs, and identify approaches to making renewable energy central to the energy aspect of the development process. In this respect, he noted the proposal for a renewable energy centre in Jamaica, which could contribute to this goal.

Overview of energy initiatives in the Caribbean

Mr. Donatus St. Aimee, Secretary of the CCST, gave an overview of energy initiatives in the Caribbean.

He noted the smallness of the countries of the region, their relatively insignificant contribution to global warming and the resulting situation that the region was seen as unimportant for resource allocation by donors. Collaborative approaches to the energy question, therefore, became more important in reducing the burden on national communities and budgets, and presenting a good case for project financing. In this respect, he called on CCST focal points to be more aggressive in their duties at the national level to provide some measure of coordination that could facilitate regional projects.

In outlining past initiatives relating to energy he reminded delegates of the Renewable Energy Action Plan (REAP) project funded by the United States Agency for International Development (USAID) and the CDB in response to the oil shock of the 1970s. This project had unfortunately lost momentum after the shock was over and the technologies introduced proved not to be as successful as expected. He suggested that the underlying causes of the failures may have been the lack of

interest in the externally propelled project and the immaturity of the technologies promoted at that time.

A meeting organized by the Institute of Energy for French-speaking countries (IEPF) held in Saint Lucia in 1987 was a first attempt at reexamining energy questions in the small States of the region following REAP. Although the meeting was limited in participation, it highlighted the need for conservation and management measures to be introduced in these States in order to reduce the energy bill. Two projects were agreed upon for the region, but financing was not obtained.

Since the global conference on the environment in 1992, numerous meetings had been held in the region regarding the question of energy, especially renewable energy, giving a more environmental slant to the debate rather than focusing on economic considerations. The United States Export Council for Renewable Energy (US/ECRE) held at least two meetings between 1993 and 1995 and has now established an office in Trinidad and Tobago to promote technology transfer and business.

It was pointed out that the University of the West Indies had initiated work in renewable energy at an early stage, and continued to do so. Research in solar crop dryers, solar stills, solar water heaters, and to a lesser extent biogas digesters, were the main areas of work, although some work was presently being done on wind and hydro energy sources.

Probably the most successful meeting in terms of collaboration and problem identification was a meeting held in Saint Lucia, 5-9 December 1994, under the auspices of the CCST, UWICED and UNESCO. At that meeting participants came from the public and private sectors, developers of technology, the utilities and the financing community. The meeting reviewed efforts so far and provided interest groups an opportunity to hear each other's concerns and arrive at mutually beneficial positions.. It is from this meeting that the call was made to address the financing situation relating to renewable energy and energy management in the region, having agreed that the ground work had already been laid and that the time was opportune for revisiting REAP.

Financing mechanisms, donor funding options and requirements

Ms. Lynn Goldfarb of Goldfarb Associates of Portland, Maine, **Mr. Joseph Ben Dak**, Principal Adviser of the Technology Group of the United Nations Development Programme (UNDP) in New York and **Mr. Jean-Marc de Commarmod**, Executive Director of the Energy Institute for French Speaking Countries (IEPF), looked at different types of mechanisms for financing energy efficiency and renewable energy projects.

Financing and incentives for utility-driven projects and programmes

Ms. Lyn Goldfarb focused on utility-driven projects and programmes in promoting energy efficiency and renewable energy use (see Annex 1). She supported the idea that the most effective means of minimizing capital and environmental cost associated with energy development was the adoption of a comprehensive national energy policy that integrated both supply and efficiency options into an overall strategy to meet energy service needs. In order to achieve this, she stated, each utility must be required to determine the appropriate, least cost reliable resources for delivering electric services, either through greater efficiency of current uses, or increasing supply. In selecting new supply, she said, renewables must compete with more traditional resources.

She addressed the topic in two parts: establishing the need for and designing energy efficiency projects, and financial mechanisms for DSM projects.

The first step was to establish the potential for energy efficiency resources. Energy efficiency programmes required policy, legislation and regulation which facilitated least-cost planning, renewable resource use and cost effective demand side management. She suggested nine tools and issues to be considered in designing and implementing policy, legislation and regulation for capitalizing on the technical potential. The utility would need to determine its future energy and capacity needs, and so develop an integrated resource plan. This would require several kinds of projected data. Once requirements are identified, they could be matched against existing resources and the potential for energy efficiency, and the necessary renewable strategies and DSM activities identified.

She identified well-designed bidding processes as potentially effective means of achieving a least or low-cost service. In such processes, federal/national law required utilities to buy power from non-utility generators through a bidding process. Long-term contracts were made with bidders whose prices were equal to or less than the cost of new utility generation. She outlined considerations for maximizing the benefits of such programmes.

Financing DSM programmes

In designing financing mechanisms for DSM programmes as part of the integrated resources strategy, she stressed that several working examples existed whose experiences could be drawn upon. Regarding financing the participation of the consumer (financial incentives), as a general guideline, she suggested that financial mechanisms should be few, broad and comprehensive, and deliver integrated technical solutions to specific target audiences. Other requirements in designing financial incentives were identified. One important consideration was the appropriate level of financing, which she said depended on the customer's perception. Customer perceptions depended on the sector to which the customer belonged (commercial, industrial or residential).

Several sources of financing for these programmes were discussed. These were rebates, direct utility installation, loans, shared savings, leasing, partnerships with Energy Service Companies (ESCOs), bidding, rate incentives, government bonds. In application of these tools, and in planning for energy efficiency and renewable energy in general, participants were urged to recognize the importance of flexibility.

Discussion

The following issues were raised during the discussion;

Need for partnership between utilities and hotels for cogeneration

In the smaller islands, the tourism sector used substantial quantities of the national energy supply, but often were not on the national grid, and therefore of little interest to utilities. The opportunity arose for cogeneration, but there was need to make this option more attractive to utilities which would require partnership between hotels and utilities, and provide appropriate policy and legislative frameworks.

Need for a competitive environment

Participants indicated that there was need to develop a competitive environment to take advantage of the benefits of the bidding process.

Structure of demand

It was noted that the structure of demand existing in Caribbean counties sometimes resulted in an inefficient allocation of resources. Example was given of the high cost of rural electricity supply. It was noted that strategies identified were not applicable to all countries due to their different structures of demand. For example, the shared savings mechanism was found to be successful in the commercial sector, but not in the residential sector.

Financial considerations

It was stated that existing price mechanisms for electricity supply facilitated inefficiencies in production and use. Strategies were therefore required to change or counteract the effects of these price mechanisms. In Jamaica, a special case was presented by the high rates of interest.

Utility perceptions

High energy costs made it prudent for consumers to investigate energy efficiency as an option, but this was not as attractive to utilities which had to recover the costs of their capital investments through consumer electricity use. The point was made that the attractiveness of DSM programmes to utilities really depended on their stage in the capacity enhancement cycle. An important role was identified for government in taking policy decisions to provide incentives for utilities to include DSM and renewable energy programmes as part of an integrated planning approach.

The donor funding route

Mr. Joseph Ben Dak looked at the role of the donor community in financing energy efficiency and renewable energy projects in the Caribbean, and identified some of the trends, undertapped sources of funding and the routes which should be taken by the Caribbean in seeking to access donor funding.

He highlighted the situation of diminishing donor funding allocated to the Caribbean subregion. This was attributed to the perception that the Caribbean lacked coordination, and to the small size of the population. To deal with these problems it was necessary to agree on a comprehensive programme on renewable energy and energy efficiency for the Caribbean. He challenged Caribbean countries to pursue relevant forms of economic development which would promote a higher standard of living. Production of energy from new sources should be linked to productive activity. In this respect, he referred to the concept of unique products, which was gaining increasing support, and which was related to the uniqueness of the local conditions in each country. Moves in this direction would also attract the type of investment necessary from the private sector. The political dimensions of this would need to be addressed. The scope and levels of political involvement at all levels needed to be enhanced, particularly at the forum of the United Nations Secretariat, where important decisions regarding funding allocation were made.

He identified sources of donor funding in the United Nations System which were undertapped - the United Nations Revolving Fund for Natural Resources Exploitation, the United Nations Technology Group, and the funds available through Technical Cooperation Developing Countries (TCDC) programmes, particularly since the expertise existed in the region. Renewable energy development models supported by the United Nations Fund for Science and Technology for Development were also mentioned. He anticipated more funding for large projects in the order of US$500,000 to $750,000.

In additional comments, Mr. Ben Dak brought the following to the attention of the meeting:

(a) The GEF facility was most important for funding projects between US$200,000 and $300,000. In seeking funding from this source, it was necessary to decide on the priorities and communicate them clearly.

(b) A regional institution was necessary to promote the use of available funding in a coordinated fashion.

(c) The Association of Energy Engineers (AEE) was potentially useful in a number of ways, including lobbying, technology spreading and innovation, and linking energy technologies to the production sector.

Mr. Jean-Marc de Commarmond reviewed his organization's activities and experiences and made some comments and suggestions.

The IEPF dealt with all aspects of energy use in a comprehensive manner centering around training on a regional basis, an information programme with two newsletters which dealt with solar energy and energy efficiency and exchanges of expertise and demonstrations, mostly in the area of renewable energy.

He spoke of IEPF's experience in promoting energy efficiency in government buildings and the problems encountered, particularly where financing was concerned. While one or two countries had allocated resources for energy efficiency programmes and only sought technical assistance, most countries requested financing of their programmes, without any chance of recovering the savings earned because of constraints on national budgets and accounting systems. Other mechanisms such as shared savings were not appropriate for the government environment. Financing from the private sector was often difficult to obtain due to weak links between government and the private sector.

The IEPF therefore currently attempted to concentrate on the private sector, hotels and large corporate bodies, as well as fostering energy efficiency activities in the small engineering companies. These were seen as the only ways to develop and build on training and technology transfer. In this respect, he endorsed the view that the AEE would be particularly useful in promoting energy efficiency.

He stated that recent improvements in the political climate in Haiti presented new opportunities for promoting energy efficiency. He proposed a regional programme for energy efficiency which carefully considered local conditions, and urged support for the activities of the Latin American and Caribbean Council of the Association of Energy Engineers, proposing that the experiences brought to light in this forum would be useful for the African and Indian Ocean countries.

Development and implementation of renewable energy and energy efficiency projects in the Caribbean

Presentations were made on geothermal energy, wind energy and energy efficiency.

Geothermal energy

Dale Morgan, Professor at the Earth Resources Laboratory at the Massachusetts Institute of Technology (MIT), informed the meeting of the results of a recent series of consultations held with key persons in governments dealing with geothermal activity in their countries.

The stages of geothermal energy exploitation were identified as :

1. Reconnaissance
2. Exploration
3. Drilling/Tests
4. Design
5. Construction and production

Stage 1 had been completed in all islands, Stage 2 in some countries, Stage 3 in Saint Lucia and all five stages in Guadeloupe. It was estimated that US$30 million per island was required to complete all five stages.

Geothermal exploration was increasing globally due to renewed competitiveness. In the Caribbean, while potential was good, major obstacles in the form of political interference or ineffectiveness, and finance, particularly in implementing stages 1 to 3 existed.

The four islands visited were Nevis, Dominica, Saint Lucia and Montserrat.

In Nevis, he received a request for exploration of identified resources, and indications of enthusiasm on the part of Government. He estimated that the island was about 20 years away from energy production. In this case the potential for linking Nevis and St. Kitts and selling the excess capacity existed. Some work had already been done in the reconnaissance phase by an Italian company.

Dominica represented the highest potential found. A partnership had been formed between the Government and a Canadian company and a company set up to sell equipment to the Dominica Electricity Company. He noted that there existed the possibility that mistakes made in Saint Lucia might reoccur in Dominica, since funds were channeled through the Government. He proposed that foreign partnership as a financing mechanism needed careful examination.

While potential was obviously good in Montserrat, and some imaging work had been carried out, he suggested that imaging down to 20km in three dimensions with the primary purpose of assisting with disaster mitigation plans would have the potential benefit of providing images of areas of geothermal potential in high resolution.

Saint Lucia had made five attempts to explore and drill, but no production had been achieved to date. The problems identified were the lack of expertise, and poor communication with the

electricity company. Expansion of capacity of the electrical utility was planned for the end of 1996. If this was allowed to occur, then there would be no hope for geothermal energy use on the island for a long time. Approximately US$2 million was needed to initiate activity. He stated that investment funding for this would not be difficult to access, since most of the large geothermal fields had already been explored, so there was great interest from overseas geothermal companies. However, activity needed to be driven by the Government.

Wind energy

Mr. Ian Mays examined the potential of wind energy in the Caribbean. The best sites lay on the eastern coasts of Caribbean islands, where the wind speed reached up to 8m/s. Looking at the European situation, he noted that much of the projected increase in energy consumption was expected to be met through wind and solar energy, to produce 2 per cent of European energy needs by 2005. He reviewed some of the statistics regarding wind energy production in Europe, and noted the benefits of wind energy use, particularly for the environment.

The two basic requirements of successful wind energy use were identified as being economic viability and environmental acceptability. Examining the distribution of the cost areas making up the total cost of wind energy, such as capital and operation and maintenance costs, he stated that generally speaking, if the external costs (e.g. environmental degradation) were included in the cost of traditional fuel use, wind energy was much cheaper.

In order to ensure that wind energy was economically viable, there was need to introduce equality into the electricity market. There were two ways to do this; one included the internal and external cost of generation in the cost of energy from all sources, and the other provided renewables with environmental credit.

Market stimulation methods included tax incentives, premium power purchase rates and grant aid. Tax incentives, he said, were a powerful tool which had worked well in India. Premium power purchase rates could be implemented by publication of rates by the utility, or be implemented competitively, which would bring prices down. Grant aid could be given via bids to enable selling of power from wind energy at premium rates.

Looking at the Caribbean situation, he saw the major benefits from the avoided fuel costs and the marginal avoided cost of investment. Usually there was a gap between the marginal avoided cost of investment by the utility and the price required to recover their investments. This gap could possibly be closed through tax incentives and through legislation.

The approach to implementing the policy framework to support wind power development should start with the application of pressure to the politicians, which would create support of the development of strategic policy which first dealt with public utilities and then private utilities.

He identified the major factors of the cost of wind energy - capital cost, the capital recovery factor (a function of the investor resources required, the bank interest rates and amortization of prices), the energy yield and the operation and maintenance costs. The major costs were expected to decrease in the future. Financing options included equity, "build and operate" and Debt/Mezzanine/Equity (bank providing financing while investing in shares in the venture). The latter option was becoming attractive to local communities in Europe.

One attractive feature for farmers was the possibility of leasing land out while maintaining farming activity. He reviewed the activities involved in setting up a windfarm. The considerations which became particularly relevant in an small island situation were identified as: availability of sites, seasonal and diurnal variation of speed and demand, capacity of the system employed, strength of the system, transportation, erection and maintenance facilities. He stated that for the Caribbean the wind speed and the electricity demand were quite well-matched.

Energy efficiency - The association of energy engineers

Members of the Latin American and Caribbean Council of the Association of Energy Engineers Johann Gathmann and Andre Escalante (Chair), looked at the energy service industry, the AEE and its Latin America and the Caribbean (LACC) Council, the objectives of the LACC and obstacles to energy conservation development. Mr. Gathmann provided the Venezuelan perspective to AEE activities, which, in its initiating stages, primarily involved information dissemination.

The tools required to ensure success of the Energy Service Industry were identified as: national energy policies, the legal framework, financial instruments, local expertise, training and education, information and communication.

The benefits of the AEE lay mainly in its networking and communication function, particularly in the forum of the Latin America and Caribbean Council, through which exchange of technology experiences was possible. The Council had been formed to link the AEE national chapters in the region, provide training, education and certification of energy professionals, promote the recreation use of energy and facilitate networking and information sharing. In the wider Caribbean, six chapters had been formed in Jamaica, Puerto Rico, Barbados, Trinidad and Tobago and Venezuela. In this way, use of energy efficient technologies was promoted through information sharing and energy service companies.

Obstacles to energy conservation development were identified as: subsidized electricity costs, high interest rates, trade barriers, a lack of energy policies, lack of communication between the users, producers and policy makers, a lack of standards, utilities, insufficient education and training. Some of these problems could be addressed through training and development of an energy culture among the region's professionals. The AEE proposed to carry this out by developing local energy associations after the AEE Chapter model in islands where they did not exist, and by organizing Energy Management Seminars.

This activity would be targeted at the development of energy service companies which, it was suggested, should base services on performance contracting. This was an arrangement whereby finance and guaranteed savings were provided for the client, and was seen as being extremely important to success. Relationships between service providers and client should therefore be viewed as long term in nature. The project's costs, schedule, management and potential funding sources which included international donor agencies, fees for participation and industry/utility sponsorship for the chapter development and energy seminars were reviewed.

Other projects which were underway included the UWI Natural Gas air conditioning, UWI Hospital cogeneration, UWI St. Augustine M.Sc. In Energy Engineering, and a proposal for the Natural Gas air conditioning of Port of Spain.

He concluded that there was a need to develop an energy efficiency industry as quickly as possible, and suggested that training was one of the more effective ways of developing this. The AEE chapter development programme would sustain the activity by supporting trained personnel.

Discussion

Problems in implementing geothermal projects

In all governments, there was a lack of technical staff which could assist the role of the government as a counterpart in geothermal energy production. Problems in the cases of Guadeloupe and Saint Lucia were partly attributed to engineering difficulties, while in Dominica, politicians were unable to decide where the plant should be placed.

Regional project for exploration of geothermal resources

The CARICOM representative drew attention to the activities of the CARICOM Secretariat in the area of geothermal energy. While his view was that initial explorations for geothermal energy potential should have been conducted on a regional basis, local resistance to the regional approach had been encountered. There was general support for a coordinated exploration effort. Financing for such an effort could be achieved through the donor agencies. In order to obtain political support, a presentation on the concept could be made to the OECS. However, one participant cautioned that there was need to determine the viability of geothermal energy in the small island situation, the risk, the social factors involved and the comparability of the energy cost with that from other sources.

Reliability of wind energy systems in the event of a hurricane

Concerns were expressed about the reliability of the wind turbines and towers reliability in hurricanes. Although Mr. Ian Mays assured that very good reliability was obtainable with current technology, insurance which might be necessary above these wind speeds was sometimes difficult to obtain, depending on the local situation.

Utility participation and incentives for energy efficiency

One participant proposed that a regional project be formulated to promote the ideas of energy efficiency in utilities. A partnership between governments and the AEE chapters was seen as potentially useful in promoting an energy efficiency culture. The CEIS could play an important part in the communication aspect. Sales revenue losses from energy efficiency programmes could be reimbursed by government, thereby making such programmes more attractive to utilities.

Technological adaptation

Concern was expressed that much of the energy efficiency technology was developed for use in the North American market, and therefore presented the problem of not being compatible with frequencies on some islands. The networking function of the AEE was suggested as a way to share experiences and spread technological solutions to these types of problems.

Role of governments in promoting energy efficiency

The view of at least one government was that energy was becoming the responsibility of the private sector. However, it was agreed that governments, in general, did not recognize their role in

providing policy frameworks and directives, and supporting utility promotion of energy efficiency. It was suggested that the AEE could be important in lobbying governments to take action where necessary. One government representative noted that governments were also cautious about these types of initiatives because of their lack of in-house expertise.

Country activities and requirements for renewable energy and energy efficiency projects

Presentations were made by representatives of Barbados, Guyana, Jamaica and Saint Lucia (see annexes 2-4). The following discussion raised the following issues:

Utilities, DSM and alternative energy sources

Participants discussed the problems encountered by Barbados Light and Power (BLP) in initiating a Demand Side Management Programme. It was suggested that Government did not recognize its role in facilitating such efforts. Involvement needed to be secured at the early stages, in the provision of incentives to the utility. Wind energy development required government policy and incentives, particularly to ensure appropriate pricing.

It was stressed that the interest in alternative energy sources by utilities greatly depended on whether an expansion in capacity was imminent. It was suggested that in order to coordinate regional action, it was necessary to identify those utilities nearing their maximum output. This information was already available from CARILEC.

Energy pricing

The problem of pricing was seen to be a Caribbean-wide problem. A study of this could possibly be undertaken through the GEF. The representative of BLP stated that the price that they were willing to pay was the avoided operating cost. Governments needed to be convinced that there were other costs which could be incorporated.

The gap between the price that the utility was willing to pay and the price that the supplier needed to obtain could possibly be filled in three ways: (1) increasing the rate base by passing the cost on to the consumer (2) through Government, by the provision of tax incentives; or (3) through the GEF. Rate recovery through the consumer would be impossible in some cases where the rates were set by law.

Roles of government and private sector

Policy frameworks required that government policy makers and utilities collaborate closely. A role for the private sector in lobbying Government for alterative energy use was identified. The private sector also presented opportunities for funding from unconventional sources.

Cogeneration

Cogeneration was identified as one the largest growth areas in Latin America, and Brazil had recently enacted legislation legalizing and regulating it. There was need to address this gap in legislation in Caribbean countries.

Priority projects

A number of project proposals were presented.

Mr. Lloyd Marsh of the Association of Energy Engineers (AEE), in Jamaica, presented an energy management proposal for Negril. The background of the project lay in his experience and interest in the development of energy management culture in the hotel industry. He outlined a profile of Negril, Green Negril objectives, the measurable goals of the project, the budget, the management approach and obstacles to the implementation of the project. The major objective of the project was to implement conservation measures in Negril's hotel industry so as to promote energy efficiency through the demonstration effect.

Professor Dale Morgan made a brief presentation on a proposal for a Caribbean Institute for Alternative Energy, Research Development and Policy. The Institute was proposed to act as a forum for consensus and collaboration on the energy development needs of the Caribbean, and to effectively utilize and disburse or allocate scarce financial resources. Its work would ideally centre on a priority action agenda for energy development, which would address the different renewable sources of energy, and include as an important component appropriate scientific and engineering energy research. Possibilities existed for a United Nations led initiative in partnership with other organizations including the Massachussetts Institute of Technology.

William Hinds introduced his proposal for a regional project for funding under the Global Environment Fund (GEF), The Renewable Energy Capacity Enhancement Project (RECEP). This project, he stated, addressed the major priorities indicated by the GEF literature, and developed in the format recommended by the GEF. Various aspects of the GEF funding mechanism, as well as the GEF project development cycle were reviewed. The project sought to enable SIDS of the Caribbean to meet their obligations under the United Nations Framework Convention on Climate Change and reduce emissions of green house gases via education, training and public awareness programmes. Activities would include the determination of financial viability of renewable energy technologies.

Dr. Raymond Wright briefly reviewed a proposal for a Renewable Energy Centre which he had jointly developed, on behalf of the Petroleum Corporation of Jamaica, with UWICED. Its objectives included the stimulation of private sector involvement in training and in the utilization of new renewables, and promotion of the establishment of joint-venture manufacturing installations for the production of renewable energy systems locally.

The general consensus was that while various mechanisms for funding of renewable energy projects existed, there was need to develop a comprehensive scheme of projects which addressed the priority needs of renewable energy development in the Caribbean. Working groups were formed to formulate project outlines to form such a scheme for funding. Preliminary projects outlines were drafted in the following areas (see appendix 5) :

(a) Energy information
(b) Hydro and solar power
(c) Wind energy
(d) Geothermal energy
(e) Energy efficiency
(f) Institutions
(g) Capacity enhancement

It was agreed that progress required identification of an institution with responsibility for coordination of activities in energy in the region. This concept, the meeting was informed, would find support from donor agencies, particularly for the appropriation of technologies.

The scope of the proposed Renewable Energy Centre in Jamaica was discussed. While the Centre was proposed to focus on the Jamaican energy needs, the possibility for its area of responsibility to become more broadly spread existed. The existence of other relevant organizations such as the Institute of Energy Engineering at the University of the West Indies was noted, and the importance of involving these organizations in discussions regarding institutional development and capacity building stressed. Possibilities for collaboration with external organizations existed - demonstrated by the MIT-Government of Argentina initiative in establishing a centre for joint research and development.

In the interim, computer-based communication, particularly through the Internet and the ECLAC Ambionet, presented a medium for cost-effective collaboration and coordination which should be explored.

The meeting endorsed the view that some of the key players such as CARICOM, UWICED and the CCST should meet to formulate an adequate response to these concerns.

It was agreed that follow-up to the meeting should include closer networking of interested parties to further elaborate on the projects. The CCST would play a coordinating role and spearhead efforts to obtain financing for the project identified. Also important was the integration of these activities with other programmes, such as the Programme of Action for Small Island Developing States. Participants emphasized the need to formulate a regional energy project to access funding which was available for substantial projects, while seeking other ways to implement smaller proposals.

CLOSURE

On behalf of the sponsors, Dr. Winthrop Wiltshire expressed his pleasure at the progress of the meeting in identifying priority projects. However, he was of the view that political support was the key factor for success in the follow-up activity. He assured participants of UNESCO's continued support to the promotion of energy efficiency and renewable energy use, and thanked participants for their contributions to the meeting.

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APPENDIX 1

FINANCING RENEWABLE ENERGY AND ENERGY EFFICIENCY PROJECTS

LYNN GOLDFARB

INCREASING ELECTRIC ENERGY AVAILABILITY

While preparing my presentation for today, I found myself in a quandary. I know that I was asked to speak with you because of my success in overseeing several diverse energy efficiency financing programs while at Central Maine Power Company and because of that utility's experience in acquiring renewable resources from non-utility generators. However, I found myself wanting to focus first on two related issues. One is the context in which energy efficiency and renewable sources make economic sense for a nation or a utility. The other is the role resource bidding plays in the acquisition of alternative energy resources.

Given my desire first to precede my talk on financing mechanisms, with a discussion of the appropriate roles of energy efficiency and renewable resources, I was pleased to find a monograph published in 1991 by The International Institute for Energy Conservation entitled, *The Least Cost Energy Path for Developing Countries: Energy Efficient Investments for the Multilateral Development Banks.* According to author Michael Philips:

> The most effective way to minimize the potentially overwhelming capital and environmental cost associated with energy development is to adopt a comprehensive national energy policy that integrates both energy supply and energy-efficiency options into an overall strategy to meet energy service needs, opting first for those options with the lowest capital and environmental costs.

I concur with Mr. Philips' conclusions, and I urge all of you to accept and act upon the following

premise. To achieve the expansion of energy services at the lowest economic cost throughout the Caribbean region, lenders--be they multilateral development banks, government agencies or private sector participants--must insist that integrated least-cost energy planning be adopted by the recipient entity. Each utility must be required to determine the appropriate, lowest cost, reliable, resources for delivering electric services, either through significantly increasing the efficiency of current end-uses or increasing supply. In selecting new supply resources renewables must compete with more traditional resources.

We know from the multitude of utility programs in the United States and Western Europe that investment in energy efficient technologies and renewable resources can be significantly less expensive in providing electricity to meet growing demand than equal investment in new power plant construction.

ESTABLISHING THE POTENTIAL OF ENERGY EFFICIENCY RESOURCES

Now, let us look at demand side resources. If you a just getting started in this arena, a good first approach is to list all the potential DSM technologies available and viable in the region. These will range from day lighting to integrated energy management systems, from simple lamp replacement to entirely new lighting systems and from motor replacements to variable speed drives. Then you need to established the technical potential for savings, of both capacity and energy, for each technology. Next it is extremely important to reduce the technical potential to what we called the market potential. No one should be so optimistic as to suggest that every potential kilowatt will be saved through implementation of all of the available technologies. As a rule of thumb, I would suggest that market potential for DSM measures, depending on the

technology, is between 30 and 60% of technical potential. This assumes that certain market barriers will not be overcome or are sufficiently expensive to overcome so that the technology will no longer be low cost. In small communities with municipal utilities some programs have reported higher participation and penetration rates.

THE ROLE FOR POLICY, LEGISLATION AND REGULATION

In may smaller countries and emerging economies, environmental and energy policies have not yet been established. The bad news is that there are no policies. The good news is that there is an opportunity to established policies which require least cost planning, encourage both renewable resources and cost-effective demand side management and protect one of this region's greatest assets--your environment. What issue should be considered in developing public policies and the necessary legislation and regulation to implement these policies? I would suggest the following:

- Energy efficient building codes
- Mandated least cost utility planning
- Economic incentives for implementing environmentally friendly technologies and/or reducing existing pollutants
- Tax incentives for energy efficient and environmentally benign construction in access of mandated codes
- A nominal tax on all electric utility bills with revenue dedicated to funding utility renewable resource and efficient technology programs
- A levelized playing field for rate basing supply side and demand side resources
- Prudency review criteria for renewable resources investments
- Evaluation protocols and determination of appropriate cost effective tests for DSM programs
- Cost recovery mechanism for DSM expenditures

GETTING STARTED

Let's assume that public policies are in place. Utilities will then find the following elements

necessary in order to develop an integrated resource plan:

- Reasonable and reliable short and long term load forecasts
- Financial forecasts including rates of inflation and cost of capital
- Projected costs for construction of new utility-owned generation
- Projected generation costs for fuel, operating, and maintenance expenses based on reasonable assumptions
- Projected sources and costs and reliability of renewable resources
- Availability, reliability, costs, load impacts and market potential of energy efficient technologies

Once a utility determines its future energy and capacity needs, then it can set realistic goals for these new resources. This is the point at which the kW and kWh needs over time must be matched against the data from the technical and market potential analysis. Once resource needs are determined, then it is possible to determine which renewable strategies and DSM activities will produce the needed resources. Selecting the resources that can most effectively and cost efficiently meet the energy and/or capacity need of the utility needs is the key to the successful implementation of a least cost plan.

AIM FOR THE RIGHT TARGET

This may seem simplistic, but it is important that utilities aim for the right targets in implementing renewable resource and energy efficiency strategies. By this I mean, match the needs with the capabilities of the resource. If you need peaking capacity, find the resource best suited to providing peaking capacity. If you need energy at peak hours, select a DSM strategy which will reduce on peak usage. Additionally, if you require large blocks of energy and capacity go after those resources that will require the least effort to achieve that largest gains. I have always thought it ironic that most utilities in the States focused on residential energy savings in the early days of

DSM. Sophisticated marketers rarely approach the smallest customers with the least potential first. But that is exactly what we did in Maine. Instead of concentrating on our seven largest customers, the major paper mills that represented about 20% of our sales, we focused initially on 180,000 residential customers whose water heating needs represented 12.5% of our sales. It does not take a rocket scientist to tell you that it is a lot easier to talk electricity savings with seven paper mill managers than with 180,000 residential customers.

ONE COMPANY'S EXPERIENCE

As I mentioned in my opening remarks, I believe well designed bidding programs can be a most effective means for obtaining renewable resources at least cost prices. This places the burden of financing, design, and construction on the supplier and not on the utility. Non-utility generators operating as free enterprise entrepreneurs are often able to construct facilities more rapidly and deliver power at well below traditional utility costs. If you haven't noticed, electric utilities executives tend to be the most risk-adverse animal known to mankind.

Central Maine Power Company's first foray into renewable resources was stimulated by Federal law that required utilities to buy power from non-utility generators. This was accomplished through a bidding process, whereby Maine regulators required the utility to allow all non-utility generators to participate in a bidding process. The company was then mandated to enter into long term contracts with those bidders whose prices were equal to or less than the utilities full avoided cost, that is the cost of new utility generation. Bidding processes can be a very effective means of achieving a least or low cost resource. However I must warn you, that the process in Maine had two major flaws. First, the utilities' avoided cost, following the Arab oil embargoes, was based on

estimates of oil at $100. a barrel. As you know this figure that was never reached. Furthermore it was many times more than actual costs by the time the successful bidders were delivering on their renewable resource contracts. Secondly, in the early rounds of bidding the utility was required to publish its avoided cost and to accept all bids up to that cost. Given this rule, it is easy to understand why all the bids received came in just under avoided cost. This lack of a truly open bid process prevented the utility from learning how inexpensively it could have purchased these renewable resources. I believe in bidding, but it is certainly not least cost when the deck is stacked against the utility. In structuring the bid process, I would suggest the following considerations:

- Do not announce the utility's ceiling price
- Include a sample contract with the Request for Proposal which provides the following options to the utility:
  - The right to vary the quantity of power purchased
  - The ability to renegotiate the price of the power
  - Conditions for early buy out of the contract
  - Penalties to be accessed if supplier fails to deliver
  - The right to delay the purchase

Though I favor all source bidding in which supply side and demand side resources are included, I must note the following from a report produced at Lawrence Berkeley Laboratory at the University of California entitled *Review Of Demand-Side Bidding Programs: Impacts, Costs and Cost-Effectiveness*:

> We found that average payments to DSM developers were higher for those utilities that issued integrated supply and DSM solicitations compared to those utilities that used either separate RFPs for DSM resources or parallel RFPs for supply and DSM.

This report was prepared for the U.S. Department of Energy by C.A. Goldman and M.S. Kito in 1994 based on the experience of utility bidding programs at 18 utilities.

DESIGNING FINANCIAL INCENTIVES FOR DSM PROGRAMS

In designing programs, you do not need to reinvent the wheel. There have been many successful

programs run by a plethora of utilities. Several organizations have compiled manuals detailing these programs. There are also a multitude of conference proceedings describing programs that have worked. You may want your design staff to draw from several like programs in developing theirs. In the early days we all tended to develop a program for each end use, and each program offered different financial incentives. Keep your program offerings few, broad and comprehensive; umbrella programs that deliver integrated technical solutions to specific target audiences are generally more saleable and cost-effective. Program designs should:

- Be clear and simple
- Easy for the customer to understand and participate
- Clearly define the goals and objectives of the program
- Detail technologies included and their applicability to specific end uses
- Explain the financial incentives offered
- Have a starting date and a completion date
- Effectively advertised and promoted
- Be closely monitored following implementation
- Quickly modified to meet changing market and customer needs

There are many types of financing opportunities that can be offered to induce various classes of utility customers to engage in demand side management. I am going to discuss seven of the most common programs. I have been personally involved in the design of programs using all but one of these:

- Rebates
- Direct utility installation
- Loans
- Shared Savings
- Leasing
- Partnerships with Energy Service Companies (ESCOs)
- Bidding
- Government Bonds

WHAT IS THE APPROPRIATE LEVEL OF FINANCIAL INCENTIVES

Before discussing each of these, I should deal with the question I suspect is on most of your

minds, the size of the incentive. Asking what is the appropriate level for financial incentives is like asking "how high is up?" Basically it depends on the customer's perception. For commercial and industrial customers, financing energy efficiency upgrades often becomes a trade off between such an investment and alternate uses of those funds such as increasing inventory, expanding manufacturing capacity or even such mundane needs as increased insurance premiums for workers compensation and employees health insurance. Many businesses analyze incentive reduced energy efficiency investments against their internal hurdle rates. We found that business customers quoted pay back requirements ranging from the most aggressive at six months to no longer than a year and a half.

In the residential sector, customers tend to have less measure payback criteria. We often found customers asking for non-cost effective measures such as window replacements, because they perceived these to be of greater value than the more cost effective measures such as weatherstripping and insulation.

In order to test the most effective level for attracting participation in a residential weatherization rebate program at Central Maine, we conducted markets test of three rebate levels. The results of this project indicated that residential customers were attracted more to the idea of the rebate, than the size of the rebate. Reaction to the initial mailing in our direct marketing campaign showed insignificant differences in the percentage of customers who response at each rebate level. Again we are facing customer perception--it was the idea of a "deal" from the utility that was more important to these customers than the monetary value of the deal.

REBATES

Rebates have been the cornerstone of energy efficiency programs for numerous utilities. Rebates can be offered as a straight dollar amount for any given energy efficiency measure installed, or they can be calculated based on the kilowatt-hours or kilowatts saved by the measure. Rebates can be offered directly to the consumer or to a third party intermediary such as a lighting supplier, industrial vendor or even to the manufacturer. I am particularly familiar with two very different approaches that were taken in residential lighting financing programs. At Central Maine Power we developed a coupon program in which we mailed discount coupons with the residential customers' monthly bill. These coupons could be turned in at two local supermarket chains for an instant rebate at the cash register. They worked just like a 15 cents-off coupon for a box of Cornflakes--except they offered $9.00-off the purchase of a compact fluorescent lamp. In California several utilities worked cooperatively with a group of lamp manufacturers and gave the rebate to the manufacturers to enable them to reduce the wholesale cost. The logic behind this, was that reducing the dollar wholesale cost, reduced the dollar mark-up by the retailer as well, since mark-ups in the distribution chain are based on a per cent of wholesale cost. And with reductions at both the wholesale and retail level, the ultimate cost to the consumer would be lower. In new construction programs, rebates are often used to pay the incremental cost of installing energy efficiency measures that increase efficiency a specified percentage above the specified standard.

DIRECT UTILITY INSTALLATION

Direct utility installation programs providing weatherization, insulation, water saving and lighting measures were an outgrowth of a Federal mandate that required utilities in the States to provide

free or very low-cost residential energy audits to their customers. Utilities quickly learned that while many customers requested these on-site audits, relatively few followed through and installed the recommended measures. In order to gain capacity and /or energy savings from these audits, utilities began installing an array of low-cost measures such a window insulation, door sweeps, compact fluorescent lamps, low flow shower heads and sink aerators. Direct installation can be cost effective for utilities and certainly provide a value to customers. Several utilities included an educational component with their direct install programs whereby they spent time explaining the value of the measures to the resident and instructing them on how to do routine maintenance such as vacuuming refrigerator coils. Evaluation reports have shown that future customer behavior in managing energy wisely is increased when an educational component is added to direct installation programs.

At Central Maine Power we found that rebate programs for residential weatherization and insulation programs had high overheads. It took a great many marketing dollars and many hours of in-house telemarketing hours to identify customers whose homes would benefit from these measures and who were willing to participate. Eventually, we moved towards providing these services at a nominal cost of $49.95. This eliminated frivolous participation, but provided a cost effective means of financing these measure for numerous residential customers.

LOANS

Loan programs have been offered by numerous utilities and have been directed to all customer classes. Loan programs were developed in the early stages of utility sponsored DSM as a means to overcome a perceived market barrier: the lack of capital on the part of the customer for

investments in energy efficient equipment. In the residential sector we found that older customers were resistant to loans. They were used to pay-as-you-go living and preferred rebates. Business customers were often maxed-out on their normal credit lines and feared their bankers would reduce any future extensions by the size of the subsidized energy loan. Industrial customers were always looking at the trade offs of alternative investments with faster pay backs than energy efficient investments. Loans were of course attractive to those customers who were about to make certain investments anyway and by buying more efficient items could participate in the utility loan program.

Loan Programs can be handled with a single bank or a group of banks or the utility can cat as a financial intermediary. Note that many industrial customers have lower borrowing costs than utilities, so find utility financing unattractive. Most commonly utilities arrange to buy down interest rates, often to zero percent for these loans. Loans are also an attractive mechanism by which governmental agencies, economic development projects and neighborhood rehabilitation programs can participate in the efficiency market.

One of my clients, a utility based in the southeastern United States runs an extremely effective loan program for efficient heat pumps. They have worked hard to cultivate and build a network of qualified heat pump dealers who refer their customers to the utility's loan program. The utility aggressively markets their loan program through direct mail and both inbound and outbound telemarketing. Customers who do not have a dealer are given three referrals. The utility has developed the ability to qualify customers over the phone. They then create a computer generated loan document to be signed at the time a utility inspector checks the installation. Checks are cut

prior to the inspection and mailed to the vendor following it. Once the signed document is returned to the utility, the account is set up to be billed with the monthly utility statement.

SHARED SAVINGS

Shared savings programs developed as a way for utilities to induce commercial and industrial customers to invest in energy efficient equipment. The utility finances the purchase and installation of the equipment and then recoups part, or in some cases all, of their investment in contracted monthly payments, usually over three to five years. Theoretically the customer's monthly payment is equal to or less than the reduction in charges from the utility brought about by the new efficiency measures. Promotional materials for shared savings programs stress that after the utility has been repaid, savings continue to accrue monthly to the customer. We found some resistance to shared savings from customers with little available credit. They claimed that their bankers considered the outstanding stream of shared savings payments to the utility as outstanding debt, not as off-the-ledger loans.

Early in my career at Central Maine we market tested a shared savings program for residential insulation, weatherization, and water heating measures. It was a no go. Residential customers found the concept difficult to understand, and credit and collection regulations severely limited the utility's ability to collect from those customers who defaulted.

LEASING

Leasing is a common financing mechanism in the United States where about 32% of all private non-residential purchases of durable equipment is leased. Leasing permits tax deductions of the

payments, does not impair the customers' debt capacity or credit lines, and are available on both capital and operating bases; however, capital leases are more common by about two-to-one. Leases for energy efficient equipment are financed by manufacturers, third parties and increasing by utilities or their unregulated subsidiaries.

ENERGY SERVICE COMPANIES

Several utilities have developed performance-based financing programs with independent, entrepreneurial Energy Service Companies. These programs put the burden of up-front financing on the ESCO which is then reimbursed for its investment on a pay-for- performance basis. The utility monitors the savings either through bill analysis or through dedicated metering and pays the ESCO for the actual savings. The financial success, the measured energy savings and the development of excellent relationships with customers by ESCOs is attested to by the fact that as utilities in the States are moving into an unregulated environment, many of the most market oriented ones have either created unregulated energy service subsidiaries or purchased existing ones. They are using these entities to build relationships and aggressively cultivate potentially lucrative customers whom they cannot now serve under current regulation.

Though most utilities have used bidding programs to achieve savings in the industrial and commercial program,

BIDDING

I have already indicated that I favor bidding as an effective means of achieving both supply and demand side resources at least cost prices. With DSM bidding, the utility only needs to pay, over

the installed life of the measure, for kilowatts and kilowatt hours that are actually saved. In several of the other financing methods discussed the utility pays up front and has no recourse should the measure fail to perform as expected. Bidding shifts this risk from the utility to the bidder, be that the customer or a third party. To protect the utility from the bidder's failure to deliver the contracted savings, we, at Central Maine Power, required the successful bidder to obtain a bank letter-of-credit to secured the utility in the event the bidder failed to uphold his obligation. The financial security provisions can be structured so that the bidder may reduce the value of the letter-of-credit proportionately to the savings delivered. In the event the bidder fails to deliver savings, the utility can collect on the letter-of-credit and use the funds to purchase replacement power or to contract with an alternate DSM provider.

DSM bids from both utility customers and third party providers can be used to compete against a utility's own DSM programs as well as against supply side options, to assure that the utility achieves a truly least cost resource mix.

When we, at Central Maine Power, announced the innovative, first-in-the-world, combined demand and supply source bid proposal in the late 1980's we expected supply side bidders to offer savings in the industrial and commercial sectors and were surprised to receive a major bid from an ESCO that proposed to offer savings in the residential sector. We eventually accepted bids from this vendor in two separate rounds of bidding. The subsequent relationship proved to be most successful, not only in providing the contracted savings, but also in providing a customer service which enhanced the participating customer's satisfaction with the utility due to the service provided to them by this vendor.

RATE INCENTIVES

Rate incentives can also be used as a means to encourage a change in customer usage. These incentives work by effecting the customer's use of electricity as specific times. Interruptible rates offer an innovative way for a utility to meets its system peak load and pass on financial benefits to its commercial and industrial customers at a price close to current market price for peak-generation capacity. Interruptible rates are most effective when offered to customers with large and relatively constant loads. At Central Maine we offered both voluntary interruptible and mandatory interruptible rates. Under the voluntary rate, customers had the option of whether or not to shed capacity upon request from the company. Under the mandatory program the customer faced financial penalties and removable from the rate for failure to meet the contracted reduction in load. Interruptible rates not only give the customers' choices with respect to the cost of electricity, but also focus their attention on the importance of energy management.

One of the most interesting ideas for interruptible capacity in the commercial sector was discussed widely in New England during the late 1980's, but, to the best of my knowledge, was never widely marketed. That was the development of interruptible cooperatives who as a group would agree to shed load on a rotating basis among its members. The idea was that if several large office building joined together, the individual building could take turns reducing lighting levels and equipment use. There might be some application in the Caribbean, if major resort hotel could form such cooperatives.

The most common rate incentives for residential customers are targeted towards specific end uses, most commonly air conditioning and water heating. Generally the utility sends a signal (via radio, ripple wave or power line carrier) to the applicable appliance at the customer's home which shuts

down the appliance for a specific time period. Air conditioning cycle is usually for a period of 15, 20 or 30 minutes; for water heating the off period in several hours. The financial pricing for residential peak reduction or load shifting varies. Several utilities offer separate metering for water heaters and offer special rates. At Central Maine we offered a monthly credit on the customers' bill for specific high peaking months only.

GOVERNMENT BONDS

All of the financing mechanisms I have discussed so far, are essentially utility driven. Other speakers will be discussing other sources of funding. However I would like to tell you about one governmental program in the state of Oregon that I think might be applicable in the Caribbean. In 1980 voters approved a amendment to the state constitution that authorized sale of general obligation bonds to finance small scale, local energy projects. The following year the state legislature created the Small Scale Energy Loan Program (SELP).

SELP issues three types of bonds:

- Governmental Purpose, for projects that save energy in publicly-owned and operated facilities
- Private Activity, for projects that use renewable resources
- Federally Taxable, for project that save energy for businesses and homeowners

SELP bonds outstanding may not exceed on-half of one percent of the true cash value of the state. Loan size ranges from $5,000 for residential projects to million of dollars for industrial and energy generation projects. The largest loan is $17 million. As of May, 1994 SELP had financed 431 projects totally $281 million. These projects save or produce energy worth over $38 million each year.

FIND A WAY TO CUT YOUR LOSSES

I hope that I have given you a broad based view of a variety of methods of financing renewable energy and demand side resources. I want to conclude by reiterating a point I made earlier. Be extremely careful to structure your purchases of these resources, so that you can negotiate a release from your obligation. If we have learned anything from two decades of plowing the field of alternate resources it is that all utilities operate in an ever changing environment. Demand, supply, technology, our world economy and the value of our currencies will all fluctuate in the future. The forecasts on which we base today's decisions may look very funny from a position of hindsight. The greater flexibility we build into our planning, the greater our chances for success.

APPENDIX 2

AN OVERVIEW OF ENERGY CONSUMPTION IN BARBADOS AND GOVERNMENT'S POLICY ON ENERGY DEVELOPMENT

During the last five years, energy consumption patterns in Barbados have remained relatively stable. In 1968, crude oil accounted for some 61.8 per cent of the total energy used, natural gas 7.8 per cent, L.P.G. 5.8 per cent, bagasse 24.5 per cent and solar heaters 0.1 per cent. These figures represent total energy used converted to tons of oil equivalent. By 1992, natural gas consumption had doubled to 13.6 per cent, mainly at the expense of bagasse and L.P.G.

These figures tell us that petroleum based energy dominates the local market, accounting for some 74 per cent of total energy used. This situation becomes even more revealing when we consider that bagasse is a waste product from sugar cane, which is used as a fuel to generate energy only within the sugar industry. Local petroleum product accounts for some 20 per cent of the L.P.G. used and 33 per cent of the crude oil. No natural gas is imported. A significant amount of our energy consumer therefore is imported petroleum products. Except for the use of bagasse in the sugar industry, renewable energy contributes a very small part to our energy mix.

Having seen that general picture of the extent to which renewables are currently being used in Barbados, we should now look at more details of the actual use, the potential for their further use and finally, Government's policy for the encouragement of renewable energy development.

Indeed, there is potential for a wide range of renewable energy applications in Barbados, particularly in solar, wind and biomass energy.

Solar has potential applications in the agricultural, industrial, commercial and domestic sectors. There is now a well-developed industry in the domestic sector, where there are at least four (4) firms supplying water heaters to the local market, and to some small extent, the international market. We have also moved to produce a smaller low-income water heater, which could even further expand the local and Caribbean market.

There is some moderate development in the agriculture sector with food drying, and photovoltaic are being used mainly in small appliances. However, there is room for considerable development in the e areas of solar cooling, solar distillation, and indeed all of the areas outside of the domestic sector.

Solar is now being seen as offering the best opportunities for medium and small-scale applications.

Barbados has limited tree cover, with no wide forest areas. Therefore, apart from its use in the sugar industry, biomass appears generally not to be attractive in Barbados. There are currently a number of small biogas units on farms. In 1992, there were about 13 biogas digesters operational on the island. It is not expected that there will be any significant development in this area. Bagasse production has dropped off significatnly in recent years, mainly due to the drop in sugar production. In 1992, out of a total of 570.8 gwh produced by Barbados Light and Power Co. Ltd., 15,000kwh were sold to them by the sugar industry. With the anticipated increase in sugar production from a low of 39,000 tons in 1994 to a consistent 75,000 tons/year expected in the next five years, there may be increased energy surplus for sale to the electric company.

Wind energy is seen as the renewable having the best potential for large-scale power generation in Barbados. In 1982, the Government signed a non-reimbursable technical cooperation agreement with the Inter-American Development Bank (IDB) to conduct a study of the wind power potential of the island. A 250kw machine was commissioned in 1986. After 3 years of varied, but mainly disappointing performance, the results of the project were presented to Government. It was thought that wind power could provide as much as 10-20 per cent of electricity demand in the medium to long-term, but a realistic price for power generated would have to be negotiated with the utility company.

Policy

Government realized in its development plan of 1983 that it was necessary to establish a sound energy policy which included the development of energy conservation and renewables. It was considered then, that our heavy dependence on imported crude and reformate supplies was a major problem, and a heavy drain on foreign exchange earnings, as in most other non-oil producing developing countries. Since then, the Government's broad policy objectives have been:

1. To reduce the foreign exchange impact of imported energy by development of local resources

2. To contribute to the global environmental program to reduce hydrocarbon emissions

3. To increase the security of energy supply

Now to look at what was actually done :

OIL

In 1983 the purchase of the Barbados National Oil Company was completed, and Government set about a programme of increased exploration and production.

CONSERVATION

A World Bank-funded energy conservation study was launched in 1983 and it estimated that the overall energy conservation potential of the country was 14-17 percent of the total energy used at a capital cost of approximately Bds.$13.1 million, and that this could result in a saving of Bds.$8.4 million annually. A detailed final report on this project was submitted in June 1985. The major goal of the project was to develop a national energy conservation initiative and plan, which included the training of personnel in energy conservation areas, the conducting of technical assessments of energy conservation projects. The overriding purpose of the project was to reduce the foreign exchange expenditures on petroleum products.

In order to arrive at the energy conservation potential of the country, a number of tasks were undertaken, and some 45 facilities audited. The tasks were as follows :

1. Studying the energy conservation potential of the Barbados Water Authority, the single largest electricity consumer of the country

2. Training in the energy conservation unit

3. Energy efficiency building design

4. Training of transport board drivers

5. Energy conservation in the electricity sector through Barbados Light and Power Company Ltd.

WIND

As seen above, the wind power study was initiated during that period.

SOLAR

Government has also given a number of fiscal incentives towards the encouragement of renewables. Solar water heaters were allowed as a deductible item on personal income tax returns, and a limited range of energy saving devices were allowed duty free status, particularly for the hotel and business sectors. These measures were however discontinued during the International Monetary Fund's structural adjustment period, and were only recently reintroduced in 1994 in a much reduced package.

There is a problem of a lack of staff in Government to sustain these programmes. Other problems include a lack of resources and a lack of recognition of the importance of energy by the political directorate and by the public service administration. Government's policy is generally to leave investment to the private sector. Its own role would be to provide incentives and to seek funding for research, and other studies that would provide basic technical data for its own technocrats, and for use by interested investors, e.g. the wind power study.

There have been a number of investors interested in setting up wind farms in Barbados. However, the major hurdle is the price for the generated power which they could expect to be paid by Barbados Light and Power Co. Ltd. i.e. the fuel avoided cost. The utility has argued that it cannot justify a higher cost of its shareholders, and the investors maintain that the project cannot be economically feasible at that price.

It is clear that if we are to have increased contribution from renewables, then this problem must be addressed. It appears that Barbados Light and Power may not have factored into the equation the external costs of renewables, which when done, will even out the equation.

This, then is a brief overview of the energy situation within the country and Government's broad policy towards energy development, and in particular, renewable energy and energy conservation.

GUYANA'S PLANS FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY AND FUNDING NEEDS

1. DOMESTIC RENEWABLE ENERGY RESOURCES:

1.1. Hydropower:

Economic potential for hydropower is estimated to be in the region of 7,000 MW. This resource is not being exploited currently but clearly, the solution to the country's long term power needs lies in hydro-energy.

The Guyana Natural Resources Agency (GNRA) has prepared a position paper on the development of medium-large scale hydro-electric facilities in Guyana. Based on existing data and previous studies, six sites have been identified with a view of selecting one for development in the first instance. These six sites are:

* *Tiboku*	-	*Mazaruni River Basin*
* *Amaila*	-	*Potaro River Basin*
* *Tumatumari*	-	*Potaro River Basin*
* *Kamaria*	-	*Cuyuni River Basin*
* *Tiger Hill*	-	*Demerara River Basin*
* *Arisaru*	-	*Essequibo River Basin*

All these sites have been studied up to at least the pre-feasibility level, but environmental impact assessments have to be done. One the basis of existing information, the Hydropower Unit of the GNRA recommends that Guyana's large scale hydroelectric development programme should commence with the Amaila Falls site, with a potential capacity of 195 MW.

The next two most attractive sites are Tumatumari (57 MW) and Tiboku (67 MW).

In the area of small hydropower, a project to construct a 500 KW plant at Moco Moco in the Rupununi District is currently in progress with joint funding by the Government of China and Guyana.

1.2. Bagasse:

Bagasse is currently utilized for the congeneration of steam and electricity in the sugar industry. Analysis of the true potential of this energy source, however, reveals that with substantial inputs of finance capital and new technology, far more electricity can be generated than is currently the case.

At the moment, Guysuco's total steam generation capacity, for which bagasse is the fuel source, stands at 22.84 MW. Attachment 1 shows the breakdown by sugar

estate. Guysuco has indicated that based on the present conditions and improvements currently envisaged for the industry, another 6 MW can be made available to the grid from Albion Estate in the medium term. A Study conducted with IDB financing, however, suggested that it would be feasible to upgrade plant and equipment at the LBI and Albion Estates to produce up to 10 MW and 20 MW respectively.

The National Energy Policy has identied improvement in bagasse utilization for generating electricity as a key element in the medium term, as far as the strategies for satisfying electricity needs are concerned.

1.3. *Fuelwood:*

Forests cover approximately seventy-five percent (75%) or sixteen (16) million hectares of the country's land area. However, active encouragement of increased fuelwood consumption would have to be tempered by environmental concerns. In-situ woodwaste from the Timber Industry remains a viable potential source of energy. At the current time, two lumber enterprises generate a total of 3 MW of power from woodwaste for their industrial uses.

The Government of Guyana has given priority of the construction of a 5 - 10 MW woodwaste-fired electricity plant in the Crabwood Creek area on the Corentyne in the East of Guyana. At Crabwood Creek, there are at least twelve (12) sawmills along a 2.5 KM stretch of road which produce a substantial amount of unused woodwaste. The project proposes to utilize these by-products to generate electricity from a centralized facility. The Guyana Electricity Corporation (GEC) will in turn guarantee the delivery of all quantities of energy brought from the facility to the sawmillers and adjacent community in Crabwood Creek. The Government hopes to have the facility constructed by private investors on an FBOO basis and thinks it represents a sound energy investment opportunity.

1.4. *Other Sources*

Rice Husk is a viable potential source of energy and is currently used by two rice millers for steam and electricity generation (approx. 2 MW). This source needs to be developed further.

Currently,solar and wind play a very minimal role in Guyana's energy spectrum, but their potential contribution cannot be disregarded in the long term.

With regard to the solar,a number of photo voltaic systems have been installed in Guyana. However,many of these have been in state of disrepair for some while.

A project, financed by the European Union has seen the rehabilitation of four (4) major systems attached to medical centers in the hinterland regions. 15-20 KW of power are associated with these four systems. An additional 15 smaller systems are now being rehabilitated. This is ~0 % completed. This rehabilitation programme is being carried out by the Institute of Applied Science and Technology.

With regard wind, there is a paucity of information on the wind regime and there fore the true potential of this resource cannot be evaluated. Assistance is currently being sought to have the country's wind regime assessed.

Biogas digesters provide methane gas for cooking and refrigeration. In the residential sector, the impact is more social and environmental rather than economic. The cost of construction of these disgesters must be reduced considerably for any major economic impact in the residential sector. For large commercial and agricultural enterprises, this technology can be cost-effective.

2. *PLANS FOR RENEWABLE ENERGY*

Immediate and Short Term (next two years)

1. *Encouragement of further utilization of small scale renewable energy applications by business enterprises and in remote communities e.g. photo voltaic systems, solar water heaters, use of wind energy for pumping and small electricity loads, mini-hydropower etc.*

2. *Continue to update data base on renewable energy, in particular data on the wind regime with a view to assessing the potential of this resource for generation of electricity for the grid.*

3. *Construction of woodwaste electric plant at Crabwood Creek.*

4. *Construction of 500 KW mini - hydropower plant at Moco-Moco.*

Medium Term (next five years)

1. *Improved utilization of bagasse for electricity generation with a view to making*

power in excess of Guysuco's needs available to the national grid.

2. *Active encouragement of development of additional woodwaste and mini-hydropower facilities.*

Long Term (five years and beyond)

1. *Large hydropower (Amalia in the first instance) and possibly other renewable sources like wind, depending on cost competitiveness.*

3. *ENERGY EFFICIENCY*

The National Energy Policy has as one of its major policy options the "promotion of energy conservation through the efficiency and rational utilization of energy".

In this regard, a number of initiatives have been taken. The Guyana National Energy Authority has established an Energy Services Unit (ESU) which provides services in energy auditing, energy management and equipment performance testing. However, this unit needs strengthening, and funds are being sought both for training and equipment procurement.

An Energy Conservation Public Awareness Programme has recently been reintroduced after being discontinued for a while due to lack of funds. See attached two examples of conservation messages placed in the print media featuring Mr. Switch. This programme could do with some additional financing if it is to be sustained.

During 1996, the Guyana National Energy Authority has as part of its work programme, the commencement of a programme to encourage wide spread use of energy efficient light bulbs. The objective is to implement a practical energy conservation measure with a potentially significant positive effect and to effect savings in electricity consumption, leading to avoided capacity expansion.

4. FUNDING NEEDS

PROJECT/ACTIVITY	PROJECTED COST US$
- 10 MW Woodwaste Plant at Crabwood Creek	12,000,000.00
- 6 MW Bagasse Plant	8,000,000.00
- 195 MW Hydropower Facility at Amaila Falls	475,000,000.00
- Training in Energy Auditing Techniques and Procuring Additional Equipment.	20,000.00
- Support for Energy Conservation Public Awareness Programme	50,000.00
- Financial Support for Businesses and Communities willing to install and use Small Scale Renewable Energy Systems.	1,000,000.00

BAGASSE STEAM GENERATING FACILITIES AT GUYANA SUGAR CORPORATION (GUYSUCO

INSTALLED CAPACITY (M W)

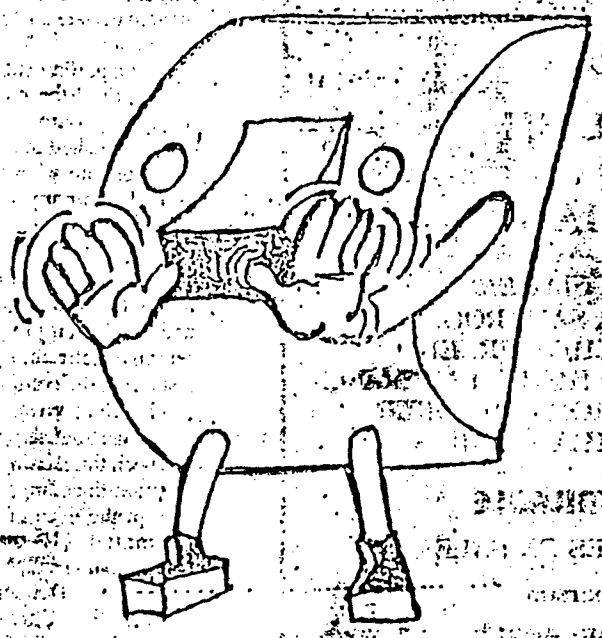
	M W
Uitvlugt Sugar Estate	3.50
Wales Sugar Estate	1.80
La Bonne Intention Sugar Estate	2.50
Enmore Sugar Estate	2.00
Blairmont Sugar Estate	2.00
Rose Hall Sugar Estate	3.00
Albion Sugar Estate	6.40
Skeldon Sugar Estate	1.64
	22.84

SOURCE: GUYSUCO

DECEMBER 1995.

Mr. Switch says

Energy conservation makes sense



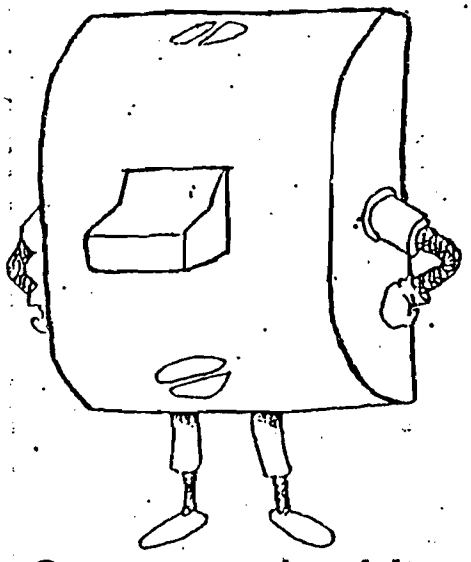
Improve your driving habits:

- Careless driving is not only dangerous, it wastes energy and your money.
- Use your accelerator smoothly. Jerky action wastes gasolene

Compliments of **GUYANA NATIONAL ENERGY AUTHORITY**

Save Energy in the Home

"SWITCH" ON
ENERGY CONSERVATION



Conserve on electricity:

- Use your washing machine only when you have a full load
- Make maximum use of natural light wherever possible. It's free.
- Use low-wattage bulbs in areas such as bathrooms and corridors

Compliments of **Guyana National Energy Authority**

3/1/96. Daily Chronicle

OVERVIEW OF RENEWABLE ENERGY SOURCES - JAMAICA

INTRODUCTION

Energy is fundamental to life. It is needed to provide essential services such as fuel for cooking, transportation, manufacturing and powering industrial plants. The importance of energy in providing these essential services means that it is closely linked to economic growth and plays a critical role in National development. The oil price shock and the insecurity of supplies which started in the early 1970's and again rear its ugly head in 1990 - 91, have left a lasting impact on the economies of Oil Importing Developing Countries (OIDC).

Jamaica being an OICD is no exception. Some 99% of all commercial energy demand is being met by imported petroleum and coal. Gross energy supply in 1994 was 20.64 boe. Petroleum imports accounts for 87.5% of this figure, coal 1.6%, hydro 3%, fuelwood, charcoal and bagasse together 10.3%. With the high energy potential of renewable energy resources we wish to greatly reverse this situation, or atleast stabilize the demand for imported energy.

The aim of this paper is to present an overview of new and renewable sources of energy (NRSE), and the possibility for funding. These areas include hydro, solar, wind generated, fuel wood and charcoal, bagasse, biogas and biomass.

HYDRO ENERGY

Presently there are eight (8) hydro-electric power plants ranging in size from 0.2mw to 6mw, all of which provide a total installed capacity of about 24mw. Topographical conditions limit the potential for large and medium size hydro-power plants. Utilization of hydropower potential for power generation is likely to remain as small schemes unless there is a massive injection of capital. Indications however, are that the total hydro-power potential in Jamaica is about 114 mv of which only 24 mv has already been accessed.

Hydro-power potential which may develop during the next fifteen to twenty (15-20) years is estimated at 90mw. Most important among the potential hydro-power schemes in terms of size are the Back Rio Grande with a capacity of about 50mw; energy potential of about 97 hwh/yr and Laughlands Great River with a capacity of about 6mv; energy potential of about 21 gwh/yr. In 1992, these schemes are estimated to cost about US$104M and US$7M respectively.

While not economically feasible in the short run, some of these schemes if developed could possibly reduce some of the adverse environmental effects of using fossil fuels; and reduce dependents on imported energy. Grants or soft financing is being sought under the Global Environmental facility and from relevant funding agencies for these projects to get off the ground. In addition private investors are being encouraged to invest in the energy sector.

SOLAR ENERGY

Solar energy in its various forms is capable of supplying five to ten times the energy demands of Jamaica. Currently major economic solar application is available in the form of solar water heating, drying and lighting. (photovoltaic pv).

Solar water heating units stands at about 3000 with Kingston accounting for 1500. The heating capacity is not available presently. With the rate of electricity tied to the volatile foreign exchange a further positive impact on demand for solar water heaters is expected.

Solar Crop Drying is another economically viable aspect of solar energy. This method can improve the product quality of vegetables, timber and fruits. Presently three small businesses are using this method intensely to produce their products.

Solar lighting or photovoltaic (pv) is also very cost-effective depending on where and how it is used. It is the most benign forms of electricity generation where there is an established national grid. PV cells can be used as stand-alone systems with a no-cooling requirement, no operating emission or waste. These operating characteristics highlight the environmental benefits of utilizing pv cells.

Petroleum Corporation of Jamaica has initiated lighting some 12 parish capitals and remote towns in Jamaica as well as Jamaica House.

The cost of PV systems vary by projects. These estimates are not readily available but from experience in the USA, the capital cost for a typical off-grid PV system range from US$10,000 to US$20,000/kw installed.

WIND GENERATED ENERGY

Considerable date has been collected in Jamaica on wind regimes. Its review indicates that at current oil prices small windmills for water pumping are uneconomic. Until the oil prices change in a way to make these technologies attractive, the initiatives for the use of wind should be left to the private sector and isolated users. However, persons willing to experiment with such technologies may be considered for tax incentives. Such tax incentives would demonstrate Government's commitment to solving the energy problems without unduly burdening the revenue base, and allow the willing participants an opportunity to test the available technologies.

This energy technology is being actively pursued as a source of energy generation in Jamaica. It is important to note that initiatives for the use of wind energy are been taken by private investors. One such is presently in operations at Munro College in St. Elizabeth, a joint project between PCJ and the Old Boys' Association of Munro College. Since its inception the Wind Plant has been operating at 75% of its capacity of mw/hr.

FUELWOOD AND CHARCOAL

There is no reliable inventory of biomass potential in Jamaica which could serve as a base for assessing the fuel wood/charcoal use. Estimates show that in 1993, domestic supply of fuel wood was approximately 1.4M boe, 52% of which was converted to charcoal. Net fuel wood charcoal use for 1993 is estimated at 0.7M boe.

Some serious concerns associated with charcoal production are:

1) *determination of major source of charcoal;*

2) *designing a comprehensive management plan to allow for sustainable charcoal production without adverse environmental effects;*

3) *monitor the consumption of charcoal.*

4) *deforestation and land degradation.*

In an attempt to deal with some of the above-mentioned issues, PCJ is undertaking a fuelwood project which ocupies 10 acres of land in the parish of St. Elizabeth.

This project is at the pilot stage but hopes to provide technical information as well as seedlings for private individuals, or groups which wish to produce these trees. The projects consists of five types of trees, four (4) exotic trees (imported) and one native. The energy value of each has been tested and the results seems to be economically feasible.

BAGASSE

In 1994 bagasse accounted for 49% of total alternative energy consumption. In 1992 sugar industry consumed 1.2 million boe of bagasse and about 164,000 boe of petroleum. In 1993 bagasse consumption was 46%, and 43% in 1992. This trend shows a marginal, but steady increase in the use of bagasse in the sugar industry.

Through an improved energy efficiency programme, sugar factories could satisfy all their energy needs while supplying surplus power to the National Grid through co-generation projects. Without sale to the national grid there is, currently little incentive t improve the steam process. Boilers are often purposely designed to be low-efficient in order to get rid of surplus bagasse.

With improved efficiency, the Sugar Industry could supply up to 15% of surplus bagasse to generate energy to JPSCO. This aspect of bagasse utilization needs further technical and economic evaluations. The Sugar Industry Research Institute (SIRI) in their research concluded that the majority of the bagasse has to be burned in the sugar factories and that it could feasible to increase the efficiency of the steam process to produce electricity for the main grid at the largest factories.

According to Sugar Research Institute about 20mw of electricity could be produced at Frome through the installation of an efficient steam system and co-generation. Since this source of energy would normally be disposed of by burning, it is heartening to know that it can be transformed into economic use such as powering the sugar factory.

BIOGAS

The use of Biogas is well known in Jamaica under various programmes more than 70 digesters were developed and installed. Work was initiated in Biogas Technology over 10 years ago. Latin America Energy Organization (OLADE) was one of the prime agencies facilitating the organization of comprehensive programme for widespread dissemination and adoption of the technology by the farming community.

Of the 104 developed and installed there, there are 40 presently operating; and mainly used for residential purposes. The main feedstock used is animal dung. The designs include semi-continuous and batch models including some national designs such as; Mexican, Guatemalan, Costa Rican, Indian and Chinese. The Chinese fixed dome design proved most suitable in terms of cost and maintenance requirements. In addition, its mode of operation was more adaptable to local farm conditions.

Plans in Biogas Technology include the diversification of the feedstock to include peels from fruits such as banana and mango, and agro industrial wastes such as coffee pulp and dunder. This area is merely addressed under industrial waste management initiatives.

In 1994 the Biogas project was extended to incorporate Waste Water Management in its programme with the objective to:-

a) Reduce contamination of rivers and ultimately the sea;

b) Generate biogas;

c) produce organic fertilizers.

At the end of 1994 20 different types of waste water were selected to be analyzed. The samples covered included coffee distilling, dairy, sugar factories and meat processing.

In the agricultural sector for biogas to be effectively used there needs to be environmental awareness among farmers. The use of biogas on farm is highly dependent on improvement in markets especially export, as each farm has to be of

a particular size. In rural areas where there are mainly small farms the potential for energy production with Biogas Technology does not have a high priority. There is a high demand for the use of gas for water heating and electricity generation. If biogas is used efficiently it could possibly supplement the energy demands of the country over time. Presently measures are being put in place to update some defunct Biogas plants, this will help in the widespread use of the technology.

BIOMASS

In 1992 Biomass contributed 10.3% of the total energy required in Jamaica. Biomass in the form of municipal solid waste, in the Kingston area amounts to:

a) *270 tons/day on week days.*

b) *135 tons/day on Sundays.*

c) *10 - 15% from private haulers.*

The composition of this waste is:- 70% organic, 20% plastics, and 10% rubble. Under ideal conditions, these quantities would allow for continuous generation of about 5MW of electricity. A plant based on power is likely to have:

a) *high investments costs;*

b) *complex design of boiler and flue gas scrubbing equipment;*

c) *risks of adverse environmental effect.*

Investment would also be needed in waste handling and management facilities.

.... What level of investment was proposed ? ....

- *Plant was set up by Wheelaborator costing US$ ------*

ENERGY INFORMATION SYSTEM

It is hoped that the Caribbean Energy System (CEIS) will continue to be vigilant in its data collection and encourage member countries to provide timely data/information for the benefit of economic growth.

Timely data can save or assist energy sectors and organizations in capturing and forecasting happenings on the global market;. therefore giving us economic tools with which to compete. Timely information is also relevant to guide policy makers in making rational policy decisions.

CEIS in its new phase intends to persue the following ....

1. *Renewable energy in schools - a survey was done throughout all schools in the region and the major concerns of most teachers are funding for science projects with a bias towards alternative energy.*

2. *Register of renewable energy projects and technologies in all countries should be kept at the national level listing the status of all energy activities.*

3. *Regular energy audits - since 1975 not much was done by way of audits. Data/information needs regular updating in order to be useful in policy decision.*

4. *Energy Models - Reference Energy Systems (RES). It is a Caribbean Reference Energy System Spreadsheet (CRESS). The basic model reflects the fuels used in the countries and energy resources of all CARICOM countries. It :*

   a) *evaluates the total energy demand for any given year KBOE*

   b) *evaluates the total energy demand for different scenarios*

      - *energy conservation*
      - *fuel substitution*
      - *economic growth*

   c) *utilities graphic features as well as visual, basic and macro commands.*

d) assumes that the uses have a basic knowledge of spreadsheet software.

This model is not yet release but is ready. It is available for CEIS Governments for testing and evaluation of its applicability and appropriateness. Feedback will be directed to CEIS for continuous updating and refining by UWI Technicians.

5. Traning programme is schedule to take place (subject to appropriate funding), in March on Energy Management and Decision Models. Training is divided into two parts.

Part 1. Information and data specialist and other knowledge personnel who collect and supply information in the Caribbean territories.

Part 2. A more advance programme geared for - the presentation of information decision support systems, and engineering economic modelling - for planners, engineers, economist and managers in the private and public sectors.

APPENDIX 5

ENERGY INFORMATION			
PROJECT TITLE	OBJECTIVES	ACTIVITIES	COST ($US)
	To provide information and education to all interest groups in the energy sectors of the region. Caribbean-wide	Targeted at : **Consumers** : Use of multi-media channels to provide consumers with information on energy end use, efficiency and conservation with a view to influencing investment decisions and effective behavioral changes **Technicians/engineers** : Provide continuing education programmes to practicing engineers/technicians via encouragement of the inclusion of specialized courses in energy management, energy planning and renewable energy technologies at regional institutions **Politicians** : Provide politicians with information on the importance of the energy issue to sustainable development **Policy makers** :Provide policy makers with information on DSM and renewable energy options and their role in sustainable development **Students** : Provide students with incentives to engage in research and development in the use of alternative energy and energy efficiency/conservation **Business community** : Inform the business community of the business opportunities evolving in the energy sector and the costs and benefits of energy efficiency measures **Utilities** : Provide information to utilities on the experiences of others with DSM and renewable energy projects	

SOLAR AND HYDRO POWER

PROJECT TITLE	OBJECTIVES	ACTIVITIES	COST (US$)
Development of hydropower in the Caribbean	To support the development of hydropower potential in the Caribbean islands	☐ For Guyana : Identification of the six hydropower sites with greatest potential and formulation of a design study ☐ For Jamaica : Facilitation of access to cheap financing and investment opportunities where design studies have already been completed.	$200,000 $100,000
Development of OTEC power potential in the Caribbean	To initiate the development of OTEC for electrical power generation and for desalination of sea water	☐ Survey of the Caribbean subregion with the aim of determining the sites with greatest OTEC power potential ☐ Promotional work to obtain support and source financing	$50,000/ country $50,000/ country
Promotion of solar crop drying	To promote the use of solar dryers in agro-processing	☐ Identification of potential markets for solar crop drying and promotional activities	$50,000/ country

WIND ENERGY			
PROJECT TITLE	OBJECTIVES	ACTIVITIES	COST (US$)
Pilot wind farm development	To promote the development of wind energy	☐ Identification of most promising locations for pilot wind farms (suggested - Barbados, Jamaica, St. Lucia and Antigua) ☐ Examination of political and utility attitudes ☐ Selection of four promising sites, installation of monitoring masts, micro siting studies, EIA, other necessary studies	TOTAL COST : $160,000
Study on avoided costs of wind energy use in the Caribbean	To determine the costs avoided by wind energy use	☐ Study to be undertaken on an island by island basis with the participation of the utilities	GEF
Study on funding of wind energy development in the Caribbean	To determine appropriate funding mechanisms to bridge the gap between capital costs and revenue from wind energy generation	☐ Study to be carried out on an island by island basis	

GEOTHERMAL ENERGY			
PROJECT TITLE	OBJECTIVES	MAJOR ACTIVITIES	COST (US$)
Development of Geothermal energy in the Caribbean	To facilitate the development of Geothermal energy in Caribbean countries with greatest potential	☐ Exploration of identified geothermal energy resources on selected Caribbean islands (In order of priority - St. Lucia and Nevis, Montserrat, St. Kitts, Grenada)	$500,000 to $800,000 per island (Approx. $1.5 million for activity in Nevis and St. Lucia)
ENERGY EFFICIENCY			
Developing a Caribbean energy efficiency culture	To increase awareness of energy efficiency and develop technical expertise through the support to ESCO organization and training	☐ Through the Association of Energy engineers: - Chapter development throughout the Caribbean - Setting up of a database of projects and members - Implementation of a certification programme - Provision of information services ☐ Organization of 28 Seminars throughout the Caribbean on : - effective lighting retrofit solutions - performance contracting - optimizing HVAC - renewable energy technologies - fundamentals of cogeneration - fundamentals of cogeneration - fundamentals of DSM ☐ Regional Conference and Trade Show	$450,000

PROJECT TITLE	OBJECTIVES	ACTIVITIES	COST (US$)
DSM for Caribbean Utilities	To assist utilities in implementing DSM programmes	☐ For each participating utility, development of DSM in stages, to include human resource development of utility staff in DSM. Phases of regional project : Resource and impact assessment Pilot programme design Pilot programme implementation and evaluation Full scale programme design and implementation ☐ Pilot project for Barbados - feasibility study and project implementation	$1 million over 3 years Feasibility - $50,000 Implementation - $150,000
Jamaica Hotel Association's Green Negril project	To involve the tourism industry in environmental management activities which would include energy efficiency activities	☐ Implementation of demonstration projects in Negril which would serve to educate hoteliers of the importance and potential of energy and environmental issues ☐ Conduct of selective energy audits	$100,000 over 2 years
Curacao Energy Efficiency programme for Government buildings		☐ Performance of energy audits ☐ Demonstration retrofit project ☐ Measurement and verification	TOTAL COST : $50,000
Curacao Household Energy Survey for End users	To assist energy planning in Curacao through the determination of the characteristics of energy use.	☐ Identification of categories of end users in energy in households ☐ Determination of household statistics ☐ Provide accounting for total household energy use	
District cooling feasibility study - POS	To utilize natural gas cooling in downtown Port of Spain	☐ Feasibility study on providing cooling of downtown Port of Spain using natural gas absorption chillers	Project cost - $100,000

PROJECT TITLE	OBJECTIVES	ACTIVITIES	COST (US$)
Establishment of an M.Sc. energy Engineering programme	To assist the University of the West Indies in the establishment of an M.Sc. degree in Energy Engineering for Caribbean professionals		Course estimated to cost $10,000 per year for 15 students
Development of evaluation criteria and protocol for DSM	To assist and encourage governments and utilities in implementing and evaluating DSM programmes	☐ Development of a standard criteria/procedure for evaluation of performance of DSM programmes amongst Caribbean islands. (would allow for analysis and comparison of programmes,determination of avoided costs, and requires collaboration with utilities)	$20,000
INSTITUTIONS			
Establishment of a Renewable Energy Centre in Jamaica	To promote the use of renewable energy technologies by stimulation of private sector involvement and promotion of the establishment of joint-venture manufacturing installations for the production of renewable energy systems locally		
Establishment of a Caribbean Institute for Alernative Energy, Research Development and Policy	Promotion of renewable energy use by appropriate research and development activity, and by efficient allocation of resources		

CAPACITY ENHANCEMENT			
PROJECT TITLE	OBJECTIVES	ACTIVITIES	COST (US$)
Renewable Energy Capacity Enhancement	Commercialization of viable renewable energy systems by effecting policy, providing pivotal information, training and demonstrating financially viable projects	Sub projects - ☐ Training in the commercialization of renewable energy technologies Geared towards small-scale applications for community groups, and large scale applications for commercial investors - training in the application of viable renewable energy technologies - determination of financial viability of renewable energy technologies -training in the assessment of renewable energy resources ☐ Work with the community groups/large investors to develop commercial renewable energy ventures ☐ Work with recipient countries to develop renewable energy policies that enable the establishment of commercial renewable energy projects ☐ Establishment of a grant/loan fund to support commercial renewable energy operation in the region	Total:$7,000,000 $2,000,000 $1,500,000 $500,000 $2,000,000 (Project management cost - $1,000,000)