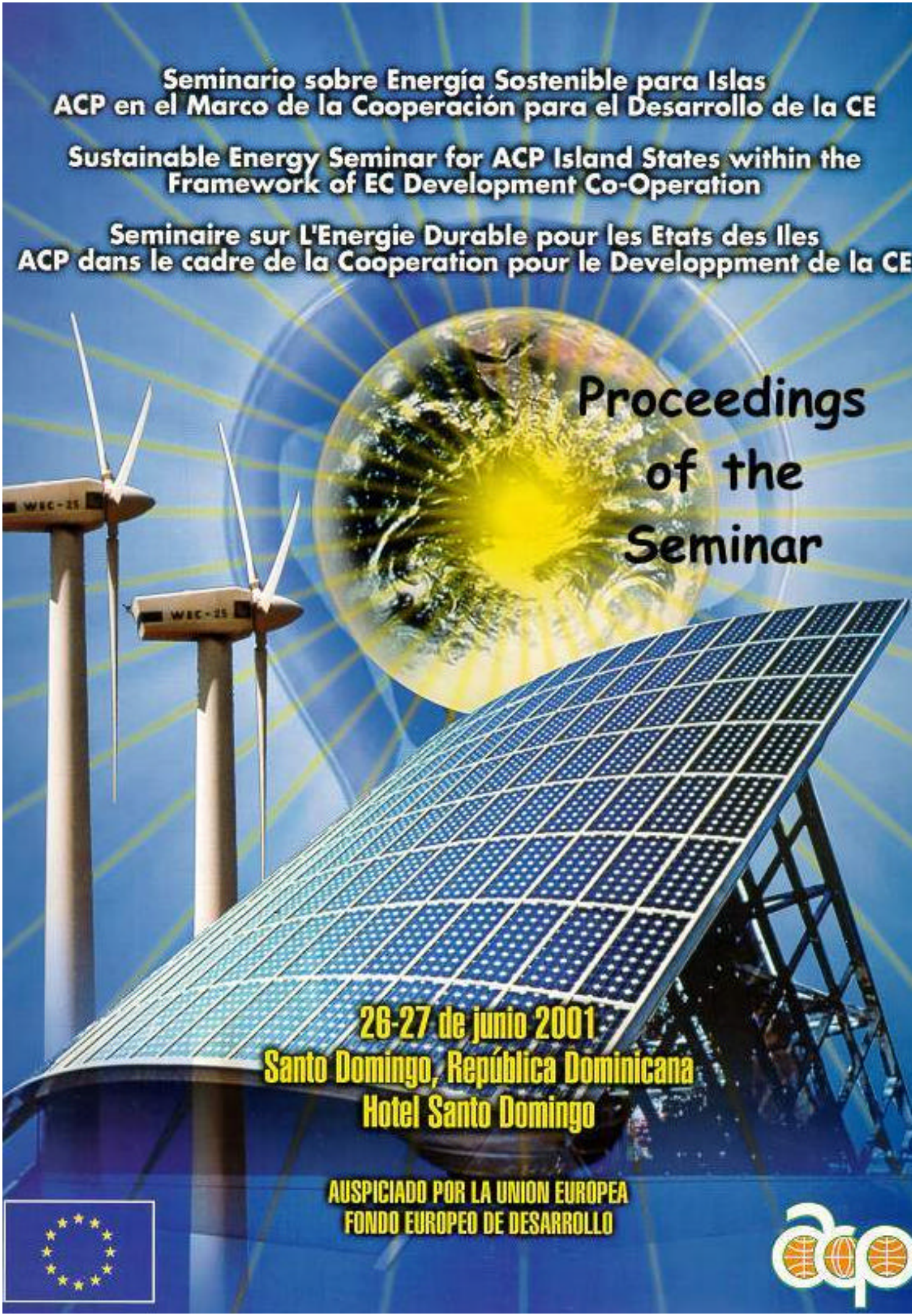
Seminario sobre Energía Sostenible para Islas ACP en el Marco de la Cooperación para el Desarrollo de la CE

Sustainable Energy Seminar for ACP Island States within the Framework of EC Development Co-Operation

Seminaire sur L'Energie Durable pour les Etats des Iles ACP dans le cadre de la Cooperation pour le Developpment de la CE



Proceedings of the Seminar

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Sustainable energy seminar for ACP Island States within the framework of EC development co-operation
June 26 – 27, 2001 – Dominican Republic

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Foreword

Access to sustainable energy services is recognised to be one of the pre-requisites for poverty reduction and sustainable development. This seminar, financed by the European Development Fund, hosted by the Dominican Republic and initiated with the support of the ACP-EU Working Group on Renewable Energy, was timely given the new context of the Cotonou Agreement for development co-operation between the EU and ACP states, and changing development priorities. It occurred at a time when a number of international activities have raised the profile of energy, including the recent G8 Task Force on renewables, the UN climate change process, the UN CSD9 and the upcoming World Summit on Sustainable Development in South Africa.

Energy is of particular significance for the ACP islands, given the very high prices they often pay for fossil fuel imports, and the poor access to adequate energy services that many of the rural poor have to suffer. The seminar aimed to raise awareness of sustainable energy generally, and in particular renewable energy, and to try to answer some of the most pertinent questions: What is the role of energy in poverty alleviation ? Where and when is renewable energy the best choice? What should policy makers in ACPs do ? Where is enhanced capacity needed ? How should the public and private sectors work together ? What is the role of donors such as the European Commission. Although definitive answers require more than a 2-day seminar, many useful findings came through, and the event sparked off a lively debate between the participants.

The discussions went far beyond energy sector issues and looked at energy as a vital tool for sustainable social and economic development. Many of the complex cross-cutting links between energy and, for example, health, education, enterprise development were explored during the seminar. The macro-economic impacts of expensive energy imports was also highlighted as an important issue for the islands. It is clear that energy efficiency and renewable energy often offer the most attractive option in the ACP islands, where all of the alternatives are judged on a level playing-field and when appropriate policy and regulatory conditions exist.

Many good examples of modern energy technology use and appropriate business models already exist, including the successful use of solar photovoltaics world-wide. However there is a clear need for institutional capacity building in many of the ACP island states if the benefits of technologies such as renewable energy are to be fully captured. As part of this public institutions need to become more adept at working with the private sector and attracting outside investment.

It is clear that for sustainable energy to move forward in the ACP island states, there is a need for political commitment to developing appropriate framework conditions and to enhancing local institutional and human resources. Regional co-operation will in may cases offer the most efficient way forward for the islands.

I believe that this event has helped to intensify the dialogue between the European Commission and ACP island states, and hope that European support in the future helps develop the use of sustainable energies in the ACP islands as part of the fight against poverty there.

Antonio García Fragío
Head of Division
DG Development
European Commission

1 Introduction

These proceedings provide the complete documentation for the 'Sustainable Energy Seminar for ACP Island States within the Framework of EC Development Co-operation' which was held in Santo Domingo on June 26 – 27, 2001, hosted by the Government of the Dominican Republic.
Delegates from 26 ACP Island States and energy specialists from all over the world came together in order to discuss the role of energy in ACP Island States and how energy can be mainstreamed into their development programmes.

The proceedings intend to serve different purposes and groups of readers:

Firstly, they summarise the key topics and points raised as well as the findings and recommendations/ conclusions of the seminar. In this respect, they serve for the delegates to present the results of the seminar to their respective governments and offer guidance to decision makers in the EDF programming process to implement the recommendations made.
Secondly, they compile the personal data of all participants enabling them to keep in touch with each other thus helping to build up a network of energy- and non-energy specialists in ACP Island States, in EC, EC Member States and within other donor institutions.
Thirdly, they compile the papers presented at the seminar giving participants and other interested readers the opportunity to read the papers in detail and to follow up on specific aspects and contact the respective authors for further discussion and clarification.

Acknowledgements

The organisers would like to thank all ACP delegates, speakers, representatives of national, regional and international organisations and institutions for their high interest and valuable contribution to make this seminar a successful and memorable event.
The warm hospitality of the Dominican Republic, all social events such as the opening reception, sight seeing tour, dinner reception on the first day, as well as administrative matters such as hotel accommodation, transport, individual support in special cases etc. were well prepared and highly appreciated by all participants.
Special thanks go to the staff members of the National Authorising Office of the European Development Fund (ONFED) of the Dominican Republic for managing the challenge of organising this event including the difficult task of booking flights for participants from all over the world partly on short notice in co-operation with the local travel agency.
The contribution of the Swedish International Development Co-operation Agency (Sida), for funding the participation costs of several ACP delegates, is greatly appreciated.
The support of the ACP Secretariat in Brussels, during the initiation and preparation of this event, is also much appreciated.
The EC Delegation in the Dominican Republic fully supported the organisation and administration which greatly contributed to the success of the event.
The Seminar was funded by the European Commission under the Intra-ACP Budget.

2 Background, Aims and Objectives

The 'Sustainable Energy Seminar for ACP Island States within the Framework of EC Development Co-operation' was the first of two planned events funded under the European Development Fund Intra-ACP budget. The initiation of these events was supported by an ACP-EU Working Group on Renewable Energy, first at its meeting in Abuja in March 2000 and then during the ACP-EU Joint Parliamentary Assembly in October 2000.

The seminar was attended by approximately 80 participants, with 43 official delegates from 26 different ACP Island States, and 35 other participants from European, African, Pacific and Latin-American countries. Participants included NAOs, deputy NAOs, energy specialists and other high ranking governments officials as well as representatives of international donors and regional development institutions.

The main objective of the seminar was to improve sector coherence by enhancing dialogue and raising knowledge and awareness of sustainable energy issues and options within ACP Island states. It is expected that this will help ensure that EC development co-operation mainstreams sustainable energy (and particularly renewable energy and energy efficiency) into the 6 priority development sectors which have been established under the EC Development Policy, as well as enhancing south-south and north-south dialogue generally.

The dialogue and awareness raising aspects were important considering the context of sustainable energy within the Cotonou Agreement and the new EC development policy. In the past sustainable energy has been a relatively low priority in the EDF programming for many of the ACP island states. The aims of the event were thus to:

- *help ensure that EC development co-operation programmes under the 9th EDF fully recognise the role of sustainable energy services for poverty alleviation by integrating sustainable energy into priority sectors;*
- *provide an opportunity to improve dialogue with countries who plan energy as a priority in their programming for the 9th EDF.*

Although energy is not one of the priority areas for EC support, energy is generally recognised as a key cross-cutting issue and a vital tool for sustainable social and economic development and poverty alleviation.
The purpose of this seminar was to ensure that energy's cross-cutting nature is represented in the 9th EDF and that the participants understand the ways that it can be represented.

3 Summary of the seminar results

3.1 Structure of the seminar and main findings

1. In order to achieve this objective, the seminar covered a wide range of political, socio-economic and technological aspects of mainstreaming sustainable energy into sustainable development under 9th EDF programming.
The seminar was structured around 3 main sessions, headed by an opening session and closed by a panel session. The topics of the main sessions were:

- *The framework for EC development co-operation;*
- *The importance of sustainable energy for sustainable development and poverty reduction and the available options;*
- *How to mainstream sustainable energy in future EC development programmes.*

In the main sessions, 20 papers were presented (see programme attached):, most by participants from ACP Islands States. The presentations were generally of very high quality and well prepared.

Two so-called 'mini round table sessions' were incorporated in the main sessions and the closing panel discussion offered an opportunity for debate between ACP participants. From the lively and open nature of these debates, it was clear that there is significant interest in renewable energy and energy efficiency.

2. During the seminar, a memorandum was formulated and jointly accepted in the closing session. This joint memorandum shows the overall agreement of the participants that energy is one important ingredient for poverty reduction through social, economic and environmental sustainable development.

3. An evaluation of the seminar based on questionnaires showed that the majority of the participants regarded the main objectives of the seminar as being achieved. The participants obtained an improved understanding of the issues and options for sustainable energy within EDF programmes and projects. The seminar helped to better recognise the essential role that provision of adequate energy services may play in supporting poverty reduction through economic and social development as well as in recognising the importance of integrating sustainable energy into projects and programmes in other development sectors.

The suggestion was made to consider regional or sub-regional activities in order to follow up on the project ideas initiated and to keep the initiated dialogue and momentum going.

3.2 Summary of opening & main sessions, mini round table and closing panel sessions

3.2.1 Opening session

During the opening session Hon. José Rijo, Member of Parliament and Head of the Dominican Republic Delegation, H.E. Mr. Manuel A. Cáceres Troncoso, National Authorising Officer for the European Development Fund (EDF) of the Dominican Republic and Mr. Antonio Gracía-Fragío, Head of Unit, EC DG Development addressed the delegates.

Mr. José Rijo warmly welcomed all delegates and participants on behalf of the Dominican Republic, the Parliamentary Assembly ACP-EU and the NAO H.E. Mr. Manuel A. Cáceres Troncoso also extending his thanks to the European Commission for supporting the preparation, organisation and funding of this important seminar.
He pointed out in his opening speech the marginalization and vulnerability of the less developed countries and the great constraints to access adequate nutrition, education, health, water supply, work, credit, services, infrastructures, information etc, and the need of energy in all these sectors.
He made very clear the linkage between access to energy services and the cycle of poverty. He demanded a strategy focusing on sustainable energy as a tool for integrated development particularly for the ACP islands, taking into account the growing energy demand due to the rapid population growth and the need for economic development.

In his opening address Mr. Antonio García-Fragío emphasised the long-standing commitment of the European Commission to sustainable Development in ACP countries, and its role as a key global actor in development cooperation together with the EU Member States. He pointed out that energy plays a primary role in sustainable social development, in fighting poverty and on all levels of economic activities. The problem with energy however, is not the shortage of energy per se but the difficulty, for poor people, of gaining access. Many other problems are directly or indirectly caused by limited or inadequate access to energy such as, reduced educational opportunities, increased costs for enterprises or limited opportunities for enterprise development, burden of collecting traditional fuels, environmental problems, health problems and also rural migration to cities. This reveals the cross-cutting nature of energy which should be viewed as a supplier of services for sustainable development rather than as a commodity, thus taking more into account the questions of 'why energy and for whom'. Mr. García-Fragío pointed out, that much traditional thinking in the past had led mainly to increased energy supply for higher class urban users without a major impact on poverty reduction in rural areas.
Therefore, a new strategy which instrumentalizes energy as a tool for sustainable development has been developed by EC and was presented and discussed during the seminar.

H.E. Mr. Troncoso highlighted in his speech the role energy plays for development and referred particularly to the present situation of many developing countries where energy is presently an extremely important and sensitive issue, with prices of fossil fuels and conventional energy sources increasing progressively and affecting considerably both the environment and the trade balance in less developed countries.
He emphasised that in the Dominican Republic, the Government considers rational use of energy, preservation of the environment and poverty reduction as priority development aspects. Availability and access to energy services is regarded as an overarching issue affecting such priority areas like education, conservation and rational use of resources and the environment.
Mr. Troncoso raised an important point, explaining that sustainable energy does not only refer to the use of renewable energies but also to the efficient use of (also: conventionally generated) energy.
That implies not only the optimized utilization of available RE resources like photovoltaic energy, wind-power, biomass conversion, geothermal and hydro energy, but also avoiding waste and considering sustainable commercial availability of energy. Although, he regarded access to energy as a means to reduce poverty, the point of subsidies was raised; it was outlined that energy services, highly subsidized by government, may not be sustainable, which in turn leads to the conclusion that private sector participation, within a defined legal framework is an essential precondition for a sustainable energy service.

3.2.2 Main sessions

The three main sessions concentrated on following questions:

Session 1: What is the framework for EC Development Co-operation?

This session dealt with the framework for future development co-operation between the ACP Islands and the EC under European Development Fund (EDF9). It also highlighted opportunities for sustainable energy interventions through facilities other than the EDF. Funding opportunities with other EC sector programmes were also presented and discussed.
In this session, four papers were presented by the representatives of the EC.

The first presentation introduced the new EC development policy, the Cotonou Agreement and the role that energy plays within this context. It was explained that although, energy is not highlighted as one of the six priority areas which have been established under the EC Development Policy, energy is recognised as a key cross-cutting issue and regarded as a vital tool for sustainable social and economic development and poverty

alleviation. It is important for NAOs to consider this when programming and developing activities under the 9th EDF. It was important in this regard to mention the programming guidelines for EDF have not changed regarding energy. The presentation outlined the various EC instruments in place.

The second presentation introduced specifically the new 'Draft Working Paper Strategy for EC support involving energies for sustainable development in ACP countries'. (document is attached to these proceedings).
The main message from that presentation was, that more attention needs to be paid to mainstreaming sustainable energy in development programmes and projects, since energy per se is unlikely to be a priority action in many ACPs. Therefore, an important part of the dialogue, between the EC and ACP countries, should occur during the development of programming for the 9th EDF, as well as during project/programme development and implementation. In the past, too much focus was laid on energy supply models and not enough on energy demand. The need for energy services of rural population was not sufficiently addressed; subsequently, the potential role of energy for poverty reduction was not fully explored.
Long-term sustainable development should be the guiding principle for future programmes involving energy, with the concept of sustainability encompassing social, economic, environmental, functional, and institutional considerations. Future EC initiatives should be co-ordinated with the activities of the EU Member States and other donors. The widespread need for capacity development (particularly for the public sector) and private sector involvement in energy activities was stressed.

The paper 'Growing markets for renewable energy services' presented an inside view of existing and future markets for renewable energies. While emphasis was laid in the past on R&D activities, the maturing of RE technologies during recent years opened the perspective for mass production and a mass market, as recently happened with wind energy in Europe.
There has been a shift of perspective from commodity aspect of energy to the service character of energy supply.. The new EC policy from DG Transport and Energy (TREN) recognises this shift. The 'EU White Paper' (1997) sets the respective energy policy goals, while the 'Green Paper' (2000) formulates the 'Transition market strategy' integrating renewable energy into liberalised electricity markets. Other EU policy tools like ' campaign for take off' and other EU energy programmes were also presented.
The presently discussed RE issues within the G8 Task Force on RE were outlined:
1. How to reduce costs; how to link energy & poverty reduction; more donor co-ordination.
2. Institutional capacity building and improving financing mechanism for RE.

Some EC instruments of possible interest, outside of development co-operation, were outlined, including 5th Framework, Altener, Save, Synergie.

The first main session was closed by a presentation on 9th EDF programming procedures and EC development instruments in practice. This presentation provided an overview of the 9th EDF programming process in practice, with the associated reviews and an explanation of the concept of rolling programming. The European Investment Bank's activities in the RE sector were outlined, with a particular focus on the potential for lending in developing countries. A description was given of the resources available for lending to countries outside the EU. The Bank's appraisal procedures were explained and details given for lending operations in the renewable energy sector in recent years. The potential for lending for smaller-scale de-centralised renewable energy projects were presented.
The recent trends contributed to making RE projects more "bankable. As a consequence, although EIB lending has so far concentrated on the more commercially and technically developed RE sectors such as hydro-electric and wind-power, this might change in the future as other RE technologies like PV become technically more reliable, socially accepted and commercially viable.

Session 2: Why is sustainable energy important for sustainable development of ACP islands and what are the Issues and Options?

The aim of this session was to increase the understanding of the essential role that provision of adequate energy services has in supporting economic and social development in ACP Islands, as well as the recognition of the importance of integrating sustainable energy as a cross-cutting issue into projects and programmes in other development sectors.

Four presentations complemented each other in focusing on energy as a cross-cutting issue for sustainable development.

The introductory paper stated that not only is energy consumption closely related to economic development but also the other two pillars of sustainable development – environmental conservation and social welfare; all are intricately linked to energy. Increased energy use can lead to more pollution both locally in the form of urban air

pollution and contaminated water, and globally, through increases in greenhouse gas emissions (GHG). Human development too correlates closely with energy consumption. Current energy systems are not sustainable either from the point of view of environmental protection nor from equitable distribution of energy services. The poor suffer comparatively more than the rich from non-sustainable energy systems. The non-availability of modern energy services is detrimental to health, education and transport services, and living standards in general.
The key message is that energy must be regarded as a very important parameter in development. If the energy sector is made more sustainable, a society as a whole advances a great deal towards sustainable development.

The next paper Technology options for RE was an interesting brief presentation of the state the art of selected RE technologies and their range of application for developing countries. It was explained that wind-power is often competitive with conventional grid-based energy sources. Wind turbines range in size up to 2 MW. For off-grid application technologies are available such as photovoltaic (PV) systems, small wind converters, battery charging with different sources (PV, wind, pico hydro). Considering that 2 billion people do not have access to energy services, these small applications have a huge potential and may well be the future for millions of people. In the medium term, biomass conversion for power generation may become an important option in many developing countries, including for small islands. Liquid biofuel will also play a major role in the future, mainly in the transport sector.
Referring to what has been achieved in RE application in Europe so far, the key message from that presentation was that ACP Islands should not miss the opportunity to build their energy future on sustainable energy services for which the technologies exist already or will get more and more mature in near future.

'Energy as a tool sustainable Development' was the title of a book recently published by the EC and UNDP. This book was distributed to the participants. The next paper presented the main findings of the 'small Islands chapter' of this book.

The last paper of this session presented an overview of the critical factors, success criteria and achievement in private investments in the energy sector.
To encourage private investment there is need for regulatory stability and transparency to give some comfort that rules will not change in a capricious manner. This is especially so in exploration activities and large investments in power production. Encouraging free trade and investment, looking to markets more than to governments, and developing economic and national security through a strong energy policy, are the tenets of energy strategies globally.
There is a strong case for government support for renewable energy and other alternatives to fossil fuels as insurance against issues such as climate change and oil depletion. Governments should provide strong incentives for firms to invest in upgrading electricity grids; and also remove barriers to the spread of distributed generation.
The key message is, that the final test of all RE technologies will be in the market place. The private sector will drive both development and marketing of these technologies.

Session 3: How can future sustainable energy activities be accommodated under EC Programmes?

While the first and second main sessions had an introductory character, the third main session was intended to be the main session for the dialogue between the ACP delegates and EC representatives and energy experts.

The session was structured around the following topics:

Sub-Session: Examples from ACP Islands

In this session, project experiences from Kiribati, Tonga[1], Barbados, Jamaica and the Dominican Republic were presented.

The Kiribati presentation was particularly interesting since it reported on the successful EC funded PV project. The experience of Kiribati in PV based rural electrification is unusual and important in that the first examples of PV use in Kiribati were not entirely successful. These early examples were based on the promotion of the purchase of systems by rural households, and it was recognised that this was the main problem; the main draw-backs were institutional, not technical. Kiribati then changed the institutional structure of the solar implementation agency from sales based to a service based institution and turned failure into success. A solar energy company was established to lease systems to individual users; the company purchases and maintains the systems.

[1] The Tonga presentation by Dr. Savae Latu is not included in this proceedings and can be obtained directly from him, for address see List of Partipipants)

In Tonga, the situation is similar to other Islands, 13% of the total imports have to be spent on petrol products for energy and transport purposes. Between 1990 and 1999 these costs have increased about 30%. Efforts in energy policy are therefore directed towards the increased use of renewable energy sources. Presently, a PV project to electrify the Vavau Group of Islands is underway.
The presentation of Barbados showed the advanced use of RE namely thermal solar energy for domestic water heating. The use of RE is regarded as necessary developmental strategy for a number of reasons. It is mainly the uncertainty and limited availability of oil and the pollution associated with the burning of fossil fuels which affect the socio-economic and socio-political development. Under the heading of the presented 'Millennium Solar Energy Project' the use of renewable energy is planned to increase from the present 24% to 40% by 2010.
Jamaica has a formulated a RE policy which is due to be put into practice. The main problems of the Jamaican energy sector are high dependence (92%) on imported fuel, insufficient supply mix (91 % oil products), increasing energy consumption without economic growth (GDP growth 1987 97 was 18.6%, energy consumption increased by 105%). Future efforts will have to concentrate on diversifying energy sources, improving energy efficiency, institutional capacity building, integration of environmental criteria into energy policy decisions and maximising the complementarity between energy and economic sectors.

The comprehensive presentation of the Dominican Republic was divided into three parts:

- Status and experience with the energy legislation, presented by the President of the Energy Commission of the Parliament. The present energy legislation does not explicitly accommodate RE, therefore great efforts are being made to establish the legal basis to stimulate the use of RE in a separate law.
- The presentation of the national energy situation (supply and demand) revealed as main problems: deficiencies in meeting the increased demand, inadequate energy policy, neglecting existing RE resources by concentration on large hydro potential only, deforestation caused by excessive charcoal production and, missed opportunities for energy efficiency measures.
- The third part dealt with macro-economic and legal implications of the optimised use of renewable energy sources. A responsible RE policy will have to concentrate on two main issues: sustainability and alternatives to conventional energy sectors. Based on the existing resources and options, there is, beside medium and small scale hydro-power potentially a large potential for wind in the RE sector to be exploited. In the conventional sector the planned 'trans-Caribbean Gas Pipeline' was mentioned as an energy supply option for the future.

In addition, during this session a local Parliamentarian announced that the Dominican Republic had, that day, ratified the Cotonou Agreement and that a new law had just been approved to open the market for electricity and reduce thefts of electricity.

Sub-Session: Regional Perspectives

The 3 papers presented in this session dealt with the present situation, experience and future perspectives in the Pacific and the Caribbean:

- Position of the Pacific Electrical Utilities, presented by the Pacific Power Association (PPA) : Electricity production in the Pacific is based mainly on diesel fuel. With 30% losses in the existing power system the immediate concern for the PPA is the reduction of these losses which would bring major economic and social benefits, as well as in turn contributing to the reduction of GHG in the region.
- A Pacific way to Renewables (Secretariat of the Pacific Community): Only 30% of Pacific island population have access to electricity. The SPC believes that renewable energy technologies, in particular PV and Wind applications, now have the potential to reduce this figure and to provide electricity to the rural population thus meeting the demand among rural and isolated populations for better and sustainable living standards. The paper presented a detailed review of past and present PV and Wind programmes in the region and analysed success and failures, sustainability and impacts through a standard assessment framework approach.
- The role of RE in the Caribbean (presented by Caribbean Energy Information System - CEIS): The Caribbean is heavily dependent on fossil fuels for its current energy needs, estimated at some 93% of commercial energy consumption. It has however, substantial renewable energy resources, which have never really been exploited to the fullest, in order to enhance regional development. This paper highlighted the unique experiences of small island states in the Caribbean, examined why they have not been able to harness their renewable energy resources adequately so far, and the steps which are being taken to strengthen the infrastructure aimed at ensuring sustainable development.

Sub-Session: Opportunities for Development co-operation

The session was opened by an address of Hon. Darius M. Mbela, Chairman of the ACP-EU Working Group on Renewable Sources of Energy. His statement is attached in the proceedings together with the Interim Report of the ACP-EU Working Party on the use of Renewable Energy Sources in the ACP States.

The papers dealing with opportunities for international development co-operation were presented by a Senior Energy Advisor of the German Agency for Technical Co-operation (GTZ), by the UNDP-GEF Regional Advisor for Asia and the Charmin of the Danish Forum for Energy and Development (FED). All these speakers presented the experiences, objectives and methods of development co-operation in the energy sector of their respective organisations pointing out the willingness for co-operation with ACP Island States in the field of sustainable energy development.

3.2.3 Mini Round Table Sessions

The so-called mini round table sessions I and II were centred around specific topics and were intended as a central instrument of the seminar for discussion and dialogue among the participants.
As the very active participation of the participants in this session showed, energy is considered an important issue for sustainable development.

The following part summarises these discussions.

Mini Round Table Session I

Topic: **Sector wide issues (national/regional policy and planning, investment environment and capacity building needs)**

Chairman: William Gillett, EC DG TREN, Brussels
Rapporteur: Philip Mann, EC DG Dev, Brussels

Question 1: **What is the role of the private sector in very small island states, with very small populations and therefore very limited markets?**

Key points raised:

(a) Most ACP island state utilities have limited experience of grid connected renewable energy, including wind energy.

(b) In many small island states, it is not considered appropriate to privatise the utility, since the market is too small to support competition.

(c) A viable alternative to privatisation in some cases is "corporatisation", i.e.: to convert the utility to a state owned corporation with clearly defined public service obligations and with the government as the only shareholder.

(d) Capacity building is needed in the government departments which are responsible for energy supplies, and there is a need for inter-departmental working.

(e) Private investment is unlikely to be attracted to support energy service provision in remote small islands since there is little (if any) chance of making a profit from such small markets and poor customers.

(f) Some of the larger island states may offer opportunities for private sector investment, especially in grid connected renewable electricity generation. Here, a clearly defined and long-term framework is needed to ensure that investment risks are minimised.

(g) Governments have a social responsibility for providing energy to the poor, and there is little role for profit making in this. "Not-for-profit" organisations may have a role to play.

(h) There is limited experience in the island states with the use of energy regulators. Capacity building is needed on matters related to the regulation of grid connected electricity markets including tariff setting and ensuring security of supply in systems which include renewable energy.

Question 2: 9th EDF PROCESS

Key points raised:

(a) The EC is not proposing any changes to the main priorities identified for the 9th EDF, either at the country or regional level. The purpose of the seminar was to explore ways of mainstreaming sustainable energy into priority development areas (eg rural development, health, education etc).

(b) For those ACP states who have already completed their Country Strategy Papers, the best way to propose actions related to the use of renewable energy and capacity building is to integrate these aspects during the implementation stage of 9th EDF, i.e.: as clearly defined tasks in the work programmes of specific programmes.

(c) The EC has specific facilities for private sector support, which are described on the Internet http://europa.eu.int/comm/development/sector/private_en.htm).

Conclusions

(1) Officials from the 26 ACP Island states welcomed the opportunity to share their ideas and concerns in open discussions with their colleagues, who have similar problems.

(2) There is a real lack of suitable mechanisms and fora, which permit government officials from ACP small island states to share their common experiences and challenges.

(3) There are substantial differences in the market conditions between ACP Island states. There is therefore a "menu" of choices available for both public and private sector involvement - "one size does not fit all". Nevertheless, there are many common problems which can be tackled together, and common experiences to be shared. Island states can help each other.

(4) There is a need for external support to implement and finance sustainable energy, particularly renewable energy, for ACP islands for: institutional capacity building, policy development, and appropriate regulation etc.

Mini Round Table Session II

Topic: Mainstreaming sustainable energy into development programmes

Chairman: Dr. Wolfgang Palz, EC EuropeAid, Brussels
Rapporteur: Thomas Scheutzlich, Projekt-Consult GmbH, Alemania

The two main questions:

1. **Do we need energy for social, economic and sustainable development?**
2. **If yes, should this be done under Cotonou and if yes, in which form?**

Key points raised:

a) Cost of RE technologies: is RE affordable for poor people? Some can afford, but many cannot: A billion people have to live from less than 1 US$ per day; nevertheless they have the right of access to energy services. Cost of RE depend on source, location and country. Wind energy is already competitive in favourable locations with approx. 0,06 $/kWh; large and medium size hydro-power as well.

b) Policy issues: the provision of sustainable energy services require an appropriate policy framework and government commitment. This requires a clear understanding among all parties involved and the strong will to implement this policy. There are success stories for RE in the Caribbean, e.g. Guadeloupe, Martinique as well as in Curacao.

c) Sustainability of energy service: how can sustainability be measured and monitored? The OLADE system of indicators may be helpful.

d) Strategy of mainstreaming energy into national development programmes: Once a government is firmly committed to establishing a favourable framework and to fostering sustainable energy services, activities and project components can always be developed and attached to priority programmes within the Country Strategy. There are many areas in which energy services play a key role and can provide a significant contribution to the acceleration of development, e.g. health (energy for health centres, reducing harmful impacts of traditional biomass use), education (lighting for schools, provision of access to modern

communication technologies), eco-tourism, land and sea transport, small scale industry and handicrafts, fishery and agro-industry.

e) Awareness and information: although the ability- and willingness-to-pay is in many cases higher than commonly expected, there is often a barrier to applying sustainable energy options due to the lack of information and awareness at different levels.

f) Sustainability of energy supply: an energy supply option is only sustainable if this option provides high security and reliability particularly in the case of productive use of energy. Therefore, a least cost analysis based on life cycle cost is required.

g) Subsidies: Under a poverty reduction context, subsidies will remain necessary to a certain extent as long as energy services are not affordable for the poorest part of the population at market conditions. Important however is that subsidies are not hidden, are transparent and designed to fade out as soon as they are no longer necessary. Poverty alleviation projects financed under EDF contain therefore, usually subsidy elements.

It often turns out that RE is not competitive compared to conventional fossil fuel based energy generation due to direct and indirect (hidden) subsidies for conventional energies. It is therefore necessary to analyze and remove barriers for RE and discriminations of RE and apply the same sort of subsidies such as applied to conventional energies. This is partly being done in Europe resulting in increased competitiveness of RE technologies.

Conclusions

(1) There was a common view among the participants that energy is needed in many sectors and in many ways in order to contribute to poverty reduction and sustainable development.

(2) There is an urgent need for capacity building on all levels to explore the ways forward and to create synergy affects among those who need to talk more to each other: the development planners (in all sectors) and the energy specialists.

(3) The Cotonou agreement provides an umbrella in which it is possible to mainstream sustainable energy related activities even when energy is not mentioned as a priority area and the Country Strategy Support Papers are already formulated.

(4) The local EC delegations are prepared and willing to assist ACP countries to develop concepts on how energy can be mainstreamed into their Country Support Strategy and be synchronised with ongoing or planned development programmes. It is up to the NAOs and planners to ask for the respective assistance.

3.2.4 Closing panel session

The panel, chaired by Mr. Antonio García-Fragío, was composed of ACP delegates from Caribbean, Pacific and Indian Ocean, EC representatives and EC Member States.

The panel discussion was centred around four key topics which were found to have been the focus of a number of questions during the seminar. From the statements of the panellists, and the very lively discussion among the participants, the following conclusions can be drawn.

- **Topic 1: Integration of sustainable energy into European Development Fund (EDF) programmes**

The EC's approach of mainstreaming energy into 9th EDF programmes was acknowledged, although discussions highlighted that sustained activities would be necessary to ensure that integration of sustainable energy into health, education, rural development etc programmes happens in practice. It was made clear to participants that no change was being suggested to focal sectors identified in Country Support Strategies (CSSs), rather that sustainable energy should be integrated where appropriate into these focal sectors.

Although energy is not one of the 6 priority areas under the EC Development Policy, it is recognised as a key cross-cutting issue and as a vital tool for sustainable social and economic development and poverty alleviation. The important fact was mentioned that programming guidelines regarding energy have not changed.
For those countries that have completed 9th EDF programmes it is not suggested to change focal sectors but either

1) integrate energy either into the focal sector of the next draft of programmes,
2) more importantly, integrate energy into the projects and programmes that result from the 9th EDF programming
3) rolling programming presents future opportunities.

The cross-cutting links between energy and development priorities will vary from country to country, and have to be analysed at the country/region level; hence the stress on inter-disciplinary working; some examples:

- Health - electricity supply for health centres, interventions to prevent indoor air pollution (preventative health care)
- Education - electricity supply for rural schools, modern energy as a means of accessing modern communication and learning technologies
- rural development - energy for enterprise development
- Water - energy for pumping
- Tourism - hotels etc.

The European Commission is a grant donor and has grant-funded renewables programmes (e.g. Kiribati PV project) with the prospect of being financially self-sustaining in the longer-term. But this also requires a commitment of ACPs to establish appropriate legal and regulatory frameworks.

- **Topic 2: Capacity building**

While capacity building activities should be built into all mainstreamed 9th EDF activities involving energy, there is an identified need for additional over-arching support for institutional capacity building and policy and regulatory support to enable coherent planning and development of enabling conditions for private sector investment.

In this regards capacity building is not only institutional but also human resources capacity building including training, awareness raising at all levels (public and private) and public information.

For the EC, donor co-operation, including the future possibility of co-financing or parallel financing, is an important element of development co-operation instruments.

- **Topic 3: Roles of public sector, private sector and civil society**

The roles of public and private sectors are complementary, and appropriate regulation is key to achieving social objectives and allowing access to energy sources such as renewable energy. There are some remote states/areas where the private sector is unlikely to invest without supporting public funds to catalyse them. In addition in states where there is a danger of utility privatisation creating a private monopoly where once existed a public monopoly, the option of corporatisation should be considered.

There is a need to better understand the role of the public and private sectors, especially where markets are small such as in small islands. For countries that want further analysis/support of the private sector, there are a number of support facilities available as part of the EDF framework but outside of NIPs/RIPs.
These can be for 1) national studies, 2) for capacity building or 3) for direct support to private sector initiatives.

There are important lessons to be learned regarding the structure of renewable energy programmes. The successful EC - funded Kiribati solar electrification programme (presented at the seminar) provides a useful example of the solar utility concept, which could be considered as a model for future programmes.

Civil society involvement in aspects of policy and regulatory reform is important to ensure wide participation.

A larger discussion arose from the question, how best to undertake regulation? It was suggested that:

- Legislation should allow RE applications to grow to a critical mass to make RE profitable;
- Decentralisation in energy generation should be promoted;
- Energy markets should be liberalised in order to allow competition;
- Efforts should be made to achieve complementarities and synergies in the energy sector;
- Efforts in sustainable energy should cover both at the same time renewable energies and energy efficiency;

All agreed that private sector can bring benefits in terms of efficiency but that smaller ACP islands may not be appropriate for privatised utilities (due to small-scale markets). Given the problems of lack of economies of scale, particularly in the smaller islands, there is a need for regional co-operation in the sustainable energy field as well as for enhanced south-south and north-south dialogue.

- **Topic 4: Energy efficiency and the role of renewables**

All participants recognised that renewable energy and energy efficiency have a key role to play in sustainable development and poverty alleviation, particularly for island states where high energy import prices have a major impact on macro-economies;

Energy efficiency is essential. As the Pacific examples shows, losses are up to 30% in some utilities. This offers opportunities for large savings by relative low investment leading to large macro-economic benefits.

Memorandum

At the final wrap-up session a draft memorandum was presented and agreed laying out the main conclusions of the meeting. This memorandum was drafted during the seminar and jointly accepted in the closing session (see overleaf).

Memorandum

This EC-funded event, hosted by the Government of the Dominican Republic and undertaken with the backing of the ACP-EU Working Group on Renewable Energy of the ACP/EU Parliamentary Assembly, included participants from 26 ACP island states which represents the majority of developing island independent states. Participants included parliamentarians, NAOs (or those nominated by NAOs), regional organisations and experts.

WE, the participants at the 'Sustainable Energy Seminar for ACP Island States within the Framework of EC Development Co-operation' June, 26 – 27, 2001 SANTO DOMINGO – DOMINICAN REPUBLIC:

RECOGNISING the key role of the provision of adequate sustainable energy services, in all economic and social sectors, for sustainable development and poverty alleviation in ACP Island States:

RECOGNISING the economic impact of the cost of imported energy sources on ACP Island States, and the need for diversity of energy supply sources for energy security:

RECOGNISING the complementary roles of the public and private sectors, and the need for appropriate regulation to ensure social objectives are met:

RECOGNISING the need for long-term planning, and noting the potential of energy efficiency and the wide availability of renewable sources of energy including wind, solar, hydropower, geothermal, biomass, wastes:

RECOGNISING the positive impact of the development of such sources, likely to be a highly competitive option in ACP Islands in the long-term, at the same time as benefiting the environment and creating employment opportunities and local enterprise development:

STRESS THE NEED FOR:

1. Working in a inter-disciplinary way, at the policy, programme and project levels, to ensure that the importance of the provision of energy services is reflected in all economic and social sectors;
2. Capacity building at the level of national policy development and planning, including improved data and analysis on energy use/needs, and local private sector for the provision of energy services;
3. Development of national energy policies which encourage energy efficiency practices and renewable energy use;
4. Developing appropriate framework conditions for energy sector development, and private sector investment (where appropriate market conditions exist), including a stable policy platform, and transparent, participatory and equitable regulatory platform.
5. Taking advantage of regional complementarities, to enhance joint learning and benefit from economies of scale.

4 Important documents distributed at the seminar

4.1 Draft working paper: Strategy for European Commission Support Involving Energy for Sustainable Development in ACP Countries

DRAFT WORKING PAPER

STRATEGY FOR EUROPEAN COMMISSION SUPPORT INVOLVING ENERGY FOR SUSTAINABLE DEVELOPMENT IN ACP COUNTRIES

European Commission
DG Development

CONTENTS

Strategy for European Commission Support Involving Energy for Sustainable Development in ACP Countries

Executive Summary

Broad access to suitable energy services constitutes a necessary condition for economic and social development. This document provides a framework to guide future activities involving sustainable energy supported by the European Commission in Africa, Caribbean and Pacific countries (ACP). It follows on from the 'Issues Paper for an Energy Co-operation Strategy with the ACP Countries', and is intended to guide future EC activities, and facilitate the pooling of knowledge and experience, on sustainable energy policies and actions, between the EC and the EU Member States. A paper to be produced will set the wider context for EC energy co-operation in all developing countries.

Given the magnitude of the task of providing sustainable energy services to the population of the ACP States, and the fact that energy is not a priority sector in the EC development strategy, EC policies and actions must be highly focussed, make optimum use of the available resources, and recognise the unique role which is played by the Commission.

This paper is set in the context of the new development co-operation Agreement with ACPs (Cotonou), the new EC development policy [1], and a number of other EC documents including White Papers and Communications on, inter alia energy and climate change. The UN CSD 9 in 2001 will focus on energy. There is increased recognition among donors of the important role of renewable sources of energy and end-use energy efficiency techniques. Large, centralised electricity generating plants are now predominantly the domain of the international financing institutions and the private sector. There is an increasing awareness in ACP states that sustainable energy forms an important part of their overall development path, although many lack the internal capacity to implement the necessary plans and policies. Despite the high level of importance accorded to sustainable energy, to date, energy projects have accounted for only around 3-4% of resources committed from the European Development Fund [2].

This work is set in the context of an increased interest in decentralised, user–focussed activities, with energy being seen less as a commodity and more a provider of services. The overall objective of interventions in the energy sector, as with all EC development activities, is to foster long-term sustainable development, in order to support the fight against poverty in developing countries, and help them integrate into the world economy. The International Development Targets provide a framework for development co-operation activities. This document outlines a number of principles to guide future sustainable energy activities. It is suggested that renewable energy and end-use energy efficiency should be considered as first priorities.

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[1] COM(2000) 212 final 'The European Community's Development Policy'

[2] Note that this figure does not account for EDF projects for which energy was only a minor part.

Climate change is a global problem that requires global efforts and global solutions to control greenhouse gas emissions. Given the projected level and structure of future energy demand with unchanged policies, the focus of attention with regard to climate change will inevitably shift towards developing countries in coming years, because many of the most cost-effective mitigation and abatement measures are likely to be found in those countries. Countries in arid and semi-arid zones of the world, and those with a low coast line such as small island states are likely to be strongly affected by climate change. The implementation of the UN Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (particularly the Clean Development Mechanism or CDM), to which the EC is committed provide a background for action. The co-operation with ACP countries requires an enhancement of their capacities to formulate and implement policies and programmes to mitigate climate change and to adapt to its adverse effects. Measures to achieve a reduction of emission intensity without jeopardising the economic growth necessary for development and improvement of living conditions will have to focus primarily on instruments which will contribute to enhance energy conservation and energy efficiency over the whole energy cycle, to substitute high-carbon by lower-carbon fuels, and to increase use of renewable energy technologies.

Improved dialogue between all parties concerned will be an essential element of future work. EC initiatives should be co-ordinated with the activities of the EU Member States and other donors, and there should be coherence between sustainable energy policies and EC supported projects. Since energy per se is unlikely to be a priority action in many ACPs, more attention should be paid to **integrating**, or **mainstreaming**, sustainable energy when conceiving development projects and policies (rural development, health, education, transport etc). An important part of the dialogue, between the EC and ACP countries, should occur during the development of programming for the 9th EDF.

It is proposed that future activities involving sustainable energy in ACPs should be based on two themes:

- Energy sector institutional and policy support and encouraging partnerships between the various actors (public and private sector, utilities, NGOs and civil society);
- Integrating/mainstreaming sustainable energy into other development activities, recognising the role that energy can have in contributing to the achievement of EU development objectives.

Long-term sustainable development should be the guiding principle for future energy programmes, with the concept of *sustainability* encompassing social, economic, environmental, functional, and institutional considerations.

This document recommends a number of lines of action on sustainable energy by the EC and Member States, regularly reviewed through the establishment of an evaluation process. The main lines of action involve a) sustainable energy mainstreaming in the EDF, b) joint actions/co-financing with Member States and, c) partnerships and joint actions with other donors. This document also recommends the development of actions to improve dialogue on sustainable energy, between donors, north-south and south-south.

1 Introduction

Broad access to energy services constitutes a necessary condition for economic and social development. However it has been estimated that almost one third of the world's population (around 2 billion) does not have access to adequate energy services. With population increases, it is estimated that upto 5 billion more people (including the 2 billion) will require access to energy services over the next 50 years. Although a wide range of social and economic conditions exist in the different countries of the ACPs, a common feature is that many of the countries suffer from very poor provision of energy services. The major challenges are first to provide the necessary energy services to enable sustainable development, and second to ensure that these services are achieved in a sustainable way, particularly in social, economic and environmental terms.

Energy is a cross-cutting issue; the provision of adequate energy services is essential for, inter-alia, domestic needs, water, health, agriculture, transport, education, industry and access to modern forms of communication. Sustainable energy actions will generally be made on the basis of efforts to achieve the International Development Targets. It is now widely considered that the focus of activities should be on the provision of *energy services*, rather than *energy* per se, thus regarding energy as a 'means' rather than an 'end' in itself. Thus in practice the aim is the provision of safe, clean, affordable and environmentally benign cooking facilities, water supplies, light, communications, heat, transport etc, by whichever energy technology is the most appropriate.

The purpose of this document is to provide a framework for future EC activities involving sustainable energy in ACPs. It offers a number of general operating principles to guide future activities, and recommends the development of specific activities, based on two overall themes.

The approach builds on previous work within the EC, presented as 'Issues paper for an Energy Co-operation Strategy with ACP Countries', as well as a joint EC/UNDP publication [3], and reports from Member States on the integration of sustainable energy in development projects.

1.1 The Need for a New Strategy

The objective of Community development co-operation policy [(1)] is to foster **sustainable development** designed to reduce **poverty** in developing countries and to integrate them into the **world economy**.

The priorities for development co-operation projects involving energy supply have changed. Following actual or planned de-regulation and privatisation in many parts of the world, the private sector has an increasingly important role for large energy infrastructure projects. The environment and climate change have also become

[3] 'Energy as a Tool for Sustainable Development', 1999, jointly sponsored by the European Commission and UNDP.

established as a major issues [4]. New technologies such as renewable energy have made good progress in some developed countries but have so far made only a limited contribution to energy supplies in developing countries. Despite technological progress in the north, indicators show that for many of the world's poor it is becoming more and more difficult to gain access to appropriate energy services.

The over-arching aim of this strategy is therefore to provide a clear direction and focus for future EC activities involving sustainable energy in ACPs and to develop a framework to enable a coherent set of actions to emerge from a variety of different objectives that are not necessarily complementary.

Developing countries are increasingly aware of the shortage of access to energy services in their countries, as well as the problems caused by the energy that is consumed (balance of payments, environmental damage, lack of energy security etc). Donors in the EU wish to aid the supply and use of energy in developing countries in order to help foster sustainable development and eliminate poverty, while at the same time limiting the local, regional and global environmental effects of these new energy services. They also wish to increase their own future energy security by encouraging developing countries to limit the growth in their future use of fossil fuels.

One feature that emerges strongly is the importance of co-operation and coherence of activities with Member States and other donors. The paper will aid this process of co-operation by suggesting directions for future energy development activities. This will also encourage greater coherence between EC energy projects and policies.

Calls for EC action on sustainable energy in developing countries have come from a number of official documents, as well as meetings of an EC Member State Expert Group and an EC/ACP Joint Assembly Working Group on Renewable Energy in ACP countries. International bodies such as the UNFCCC, the United Nation's Commission on Sustainable Development ninth meeting, focusing on energy, and the G8 Task Force on Renewable Energy also provide an important stimulus for the production of an EC strategy on sustainable energy for ACPs. In addition recent oil price rises have focussed attention on the energy sector.

1.2 Scope of this Paper

Recent changes within the EC give overall responsibility for development co-operation policy with developing countries to DG Development. The scope of this paper, however is primarily addressed to the ACP countries, as these are covered by a comprehensive development agreement (Cotonou). While many of the issues outlined here are relevant to certain other developing countries, differences in levels of development, and the use of different EC instruments necessitates the geographical separation of ACPs from these other countries. A future paper will outline broad sustainable energy strategy for all developing countries.

[4] The importance of the environment in development co-operation is highlighted in: Communication to the Council and European Parliament: "Integrating environment and sustainable development into economic and development co-operation policy" COM(1999)499 and EC Working Document "Responding to the New Challenges of Climate Change - EC Economic and Development Co-operation"

Energy as a subject encompasses a wide range of fuels and activities from exploration, extraction and processing of fossil fuels, to international trade in such fuels, renewable sources of energy, and end-use in the domestic, industrial, transport, and other sectors. The range of energy facilities span from large centralised electricity generation plants, with associated extended grids, to small-scale biomass fuelled stoves used extensively in developing countries. Thus energy as a sector is very broad.

This paper does not specifically address issues of extraction and trade in fossil fuels, or the financing of large centralised electricity generating plants.

Other aspects of energy are assumed to be within the scope of this paper although, with the development focus on the eradication of poverty, a particular emphasis is given to the provision of energy services for the poor, using de-centralised technologies and techniques, including renewables and energy efficiency technologies.

1.3 The Role of Sustainable Energy in Meeting EC Development Co-operation Objectives

The European Community's Development Policy outlined in COM(2000)212 final highlights six priority activities:

- trade and development;
- regional integration and co-operation (including social and environmental problems);
- macro-economic policies with an explicit link to poverty reduction (health and education);
- transport;
- food security and sustainable rural development; and
- institutional capacity-building, good governance and the rule of law.

A number of general and cross-cutting themes are highlighted including: environmental integration; gender inequality; private sector development; and human rights. Sustainable energy forms links (both explicit and implicit) with a number of the 6 areas. Many energy programmes benefit from regional synergies. Energy is essential for health, food security (eg water for agriculture), education and, more generally, rural development. Institutional capacity building is as important in energy sector public bodies as any other sector, given the reform of energy industries in many areas.

The focussing of activities within the 6 areas is necessary in order to concentrate on the EC's comparative advantages, to reduce the number of areas in which the EC works, and increase the quality of interventions in the areas in which it *does* work. For areas not highlighted, but which the EC considers important (energy for example), the Communication states that '…the Community could continue the funding of schemes, but principally through supporting initiatives led by partner donors and

institutions' through co-financing and leaving leadership to Member States and other donors.

Energy is highlighted under the section on strengthening focus on poverty reduction, indicating that it is regarded as an important area, despite the fact that it is not one of the 6 priorities identified. The policy states 'Access to sustainable energy services has a key role to play in supporting social and economic development. The provision of energy services, particularly through decentralised activities and the promotion of renewable energy sources, is an increasingly important issue'.

Development strategy is based on the three pillars of trade, development co-operation and political dialogue. This paper deals principally with development co-operation. Political dialogue on sustainable energy in ACPs is unlikely to be EC led since energy is not one of the 6 priority sectors identified, although co-ordination with other donors active in the energy area (eg Member States, UN, World Bank etc) will be valuable.

A well implemented sustainable energy strategy will help to meet the objectives of development co-operation by:

- Assisting in the provision of energy services to all who need them, in a way that ensures that they will continue to be available to future generations by enhancing the ability of developing countries to meet their own energy needs in the future.;
- Helping to ensure that energy service provision is achieved sustainably (environmentally, socially and institutionally);
- Helping to ensure future energy security for developing countries [5];

Provision of energy services has an important part to play in meeting a number of the agreed International Development Targets (IDTs), which refer, for example, to poverty reduction, primary education and infant mortality.

2 Available Tools and Lessons Learned

2.1 Available Tools

The main source of funding for implementing development projects within ACP countries is the European Development Fund (EDF). National and Regional Support Strategies and Indicative Programmes are presented periodically to indicate priority areas for future action under the EDF. Thus the role of sustainable energy as a tool for development is partly determined at the programming level by the emphasis given to energy in NIPs and RIPs, which result from a co-operative effort between officials in ACP countries and EC staff. The role of sustainable energy needs to be more fully recognised in the design of NIPs and RIPs. The role of energy is also determined by the level of mainstreaming into other sectors at the policy and project levels.

[5] Whereas per-capita emissions in developed countries are likely to stabilise (at well above the world average), developing-country emissions will probably continue to rise steadily. Energy demand in developing countries is projected to approximately double between the present and 2020, by which time carbon emissions from developing countries are projected to exceed those from the developed countries. Ref: European Commission, DG Environment using the POLES world energy model, 1999.

In addition to the EDF the EC is able to draw on other budget lines for developing countries to support actions funded under the EDF. Budget lines relevant to sustainable energy include those for the **environment**, **NGOs** and **tropical forestry**.

DG TREN manages two programmes for which support for developing countries is currently included, namely SYNERGY [6]and the international collaboration activities within the 5th RTD Framework Programme. Closer links with these activities should be considered.

DG Research also supports work for developing countries under DC Research Collaboration.

The EIB is involved with a wide range of investments for large energy infrastructure projects.

Appendix 1 provides a summary of EC programmes supporting energy co-operation activities in developing countries.

2.2 Lessons Learned

It is clear that there is a need for a coherent strategy for activities involving sustainable energy for ACPs, undertaken within the various EC programmes. For sustainable energy to play a role in EC development co-operation, there is a need for a fuller appreciation of the ways in which energy can support other development objectives. Enhanced awareness and understanding of the importance of energy in development is required, both within the EC and in ACPs, in order that it features both at the level of strategic thinking, as well as during the design of individual projects.

For energy services to be sustainable in the long-term, and to ensure that they appropriately meet development needs, national and regional sustainable energy strategies and policies are required. Such policies, and the ability to plan strategically at the national and regional levels, are pre-requisites for long-term sustainable energy development.

The roles of public and private institutions are changing. The private sector is becoming increasingly dominant, especially in large scale energy supplies, and will need to invest heavily in energy infrastructure if the needs of developing countries are to be met. The role of public institutions is to regulate to protect the public good, and set the right framework conditions to attract private investors.

From an operational viewpoint, there is increasing interest in shifting development activities involving energy towards **decentralised**, **user-focussed**, projects. This creates benefits, such as the possibility of improving local participation and hence user ownership of activities. However, decentralised projects are more difficult for donors to manage and different operating practices may be required for some programmes. The shift towards smaller, decentralised projects has created an added need for dialogue between donors, and between donors and recipient countries (ie north-north and north-south), and more generally with the private sector, NGOs and civil society.

[6] The scope and geographical coverage of the SYNERGY Programme is currently under review.

3 Principles Guiding Future Sustainable Energy Actions

The presentation of energy in this paper recognises the essential links between energy and other sectors (rural and urban planning, health, education, water, industry, transport etc). Access to energy services is now understood as being key to social and economic development. Institutional, financial and environmental sustainability define the ways in which these services need to be provided.

The general principles introduced below should be used at the level of programming, as well as forming the basis of logical frameworks during the design of individual projects involving sustainable energy.

3.1 Social Principles

- Full ***consultation*** should involve ***stakeholders*** at all levels to ensure that real needs are met and that the important role of energy in supporting sustainable development is understood;
- Energy projects, or the energy component of development projects, should be targeted at sustainably improving ***livelihoods*** and reducing poverty, either directly or more generally through the development of new economic activity;
- Activities should contribute to reducing ***gender inequality*** where possible;
- Technologies adopted should be those that meet local social and cultural needs; consideration should be given to local ***cultural acceptability*** when designing new activities, and negative socio-economic impacts should be minimised;
- ***Local resources*** (physical and human) should be used in projects involving energy where possible.

3.2 Sustainability Principles

- ***Minimising environmental impacts*** (local, regional and global) of development projects involving energy should be a priority. In practice this involves the choice of technology and institutional arrangements;
- The following technologies and techniques should be considered as first priorities during project design phases.
  - ***renewable energy*** sources such as solar, biomass, wind, hydro (any environmental and social impacts should however be minimised, for example water management and land-use issues associated with large hydro-dams);
  - improvement of ***end-use energy efficiency*** (fuel-wood, fossil fuels and electricity);
  - ***efficient use and conversion of fossil fuels*** (eg combined heat and power);
- Energy projects and programmes, and energy components of other development projects, should be designed to maximise the ***long-term financial viability*** of the activities;
- Activities should be undertaken to create and support ***an attractive climate for future private sector investment*** in sustainable energy;

- Projects should be designed to ensure that sufficient infrastructure and resources are available to achieve ***long-term functional sustainability***;
- The benefits of ***regional integration*** (of infrastructure, policy, technology standards, tariffs etc) should be maximised, particularly where they can provide synergies, economies of scale and contribute to security of energy supplies.

3.3 Institutional Principles

- Recipient developing countries should have in place, or be working towards, the development of an energy policy in support of wider sustainable development aims. Development co-operation should assist in this process where progress is slow [7];
- EC activities in the sustainable energy field should be coherent with and complement those of the EU Member States and other donors, and should maximise the benefits of the EC's comparative advantage. Co-operation with other donors, lenders and equity financiers should be considered for all energy related actions;
- The success of EC activities involving energy supplies and energy use should be measurable and be monitored against an appropriate set of indicators.

4 The Way Forward

This section provides themes on which future EC actions involving sustainable energy could be based. It will be important to focus future activities both geographically and on particular types of activity which offer the greatest potential for success. Specific actions in particular countries must be tailored to meet local political, economic, geographic and cultural conditions.

To provide a framework and focus within which to promote future sustainable energy activities, two main themes are proposed. Specific actions should be developed to support these themes.

The two themes are:

1) Energy sector institutional and policy support and encouraging partnerships between national public administrations, donors, the private sector (including utilities), NGOs and civil society. An important part of this theme should be support for public administrations in developing countries for energy analysis, planning and legislation/policy making in order to encourage private sector involvement.
2) Integration/mainstreaming of sustainable energy into other development activities. Energy should be considered as cross-cutting issue, that is as a means to an end rather than as an end in itself; thus energy should be seen as one important means

[7] One of the International Development Targets involves the implementation by 2005 of national sustainable development strategies in order to reverse by 2015 the current trend towards degradation of environmental resources. Sustainable energy should form part of these strategies.

of achieving development aims, such as those laid down by the International Development Targets (IDTs).

4.1 Theme 1 – Energy Sector Institutional and Policy Support and Encouraging Partnerships between Public Administrations, the Private Sector, NGOs and Civil Society

4.1.1 Background

While it is generally accepted that the private sector and civil society have key roles to play in providing access to energy services, it is essential that the public sector is able to regulate and set policy in order to ensure that wider aims (poverty alleviation and environmental protection, for example) are achieved. In many cases, the roles of the various actors and the relationships between the sectors (public, private and civil society) need to be strengthened.

Appropriate energy policies are not in place in many developing countries and the public institutions often either lack suitable structures or the necessary human resources or other means, access to data for example, to develop them.

To address these issues, this theme is divided into two:

- Energy sector capacity support. It is suggested that the EC could most effectively contribute by supporting the establishment of suitably strong public institutions, to help them to be able to set priorities, plan, and establish appropriate policy and regulatory agendas to ensure long-term sustainable development;
- Activities to strengthen relationships between the public sector, private sector, NGOs and civil society in the provision of sustainable energy services, and to encourage the development of partnerships between them.

4.1.2 Energy Sector Capacity Support

To achieve long term success, activities involving sustainable energy need to be based on coherent national and regional policies and plans in recipient countries. These should underpin, support and guide future sustainable energy activities in developing countries, whether these are financed locally, by international donors or the international private sector. Capacity building for public institutions is essential to enable the public bodies to catalyse investment by the private sector. In addition sufficient public capacity is necessary to ensure that the right regulatory conditions are in place to allow the private sector to invest in and implement projects that meet economic, social and environmental goals.

Many developing countries do not have the appropriate resources in public institutions to allow the development of the necessary policies and plans. This is reflected in shortages of appropriately skilled staff, as well as through inappropriately structured institutions. Given the importance of locally conceived national and regional energy policies, capacity building, and support for energy policy development and planning, should be central elements of development co-operation involving sustainable energy. Europe has considerable experience in energy planning and formulating energy

policy, and is thus in a strong position to help build capacity and support the development of policies and planning in developing countries.

The need for capacity building in developing countries has been recognised in the context of the International Development Targets, which aim to have plans for sustainable development in place by 2005. In addition meetings of the UNFCCC have given priority to capacity building measures. Several EC programmes (SYNERGY for example), and the World Bank under ESMAP, and more recently under the AFRREI [8] programme, include capacity building and policy support in their activities. EC capacity building activities should be internally coherent and complement the activities of the EU Member States, developing countries, as well as the activities of the UNFCCC process and the World Bank programmes.

One of the most decisive factors for the promotion of new and innovative technologies and energy-efficiency measures alike, are competitive markets; these should be associated with effective regulation, to ensure that social needs are met, where necessary. In the majority of developing countries, subsidies artificially reduce the prices of conventional energy sources. Subsidised energy prices do not encourage investments in energy efficiency or renewable energy measures, because the benefits to be reaped from energy savings are lower than warranted under an undistorted price regime.

The risk of **climate change** is the most obvious example of an area where the public sector will continue to play a key role in hammering out international agreements, and co-opting the private sector using experimental incentives. Implementation of the UNFCCC and the Kyoto Protocol requires an improvement in developing countries' capacities to formulate and implement policies and programmes that mitigate climate change. Capacity building can be achieved through training, exchange of personnel from relevant ministries (environment, mines and energy, forestry, finance, economic affairs), policy development, and dissemination of information.

The aims of capacity building for national public administrations are to ensure that appropriately skilled staff are available, motivated and retained to build appropriate institutions and develop policies to achieve sustainable energy objectives. This means helping to create or adapt institutional structures, and ensuring that staff within these institutions have the appropriate skills and understanding of the issues, are appropriately paid, and have access to relevant information both in their country and in other parts of the world.

Institutional capacity building should be seen as a **long-term development activity**. Capacity building efforts in the past were often based on short-term studies by external consultants who were not able to spend sufficient time in the country concerned to appreciate the political, financial and cultural context. In such cases local ownership of recommendations was low and long-term change was not achieved. Thus future capacity building activities by the EC should involve longer-term commitments to strengthen local capacity from within.

One area possibly worthy of further exploration is the development of twinning arrangements between EU Member States and recipient countries as the basis for long-term agreements. The EC could provide an important function in co-ordinating

[8] AFRREI is the recently established 'Africa Rural Renewable Energy Initiative'.

long-term agreements for capacity building between European donors and recipient countries. Co-ordination of activities at the EU level would increase efficiency of activities by reducing possible areas of overlap. The establishment of long-term agreements would increase the understanding of donors of the situation within specific recipient countries, improve the continuity of advice given, enhance trust between donors and recipients, and increase ownership of activities by both sides. Long-term agreements must however be time-bound after which the institutions must survive by themselves.

To determine the most appropriate capacity building activities will require dialogue and analysis of particular national and regional situations. However in general the aims of capacity building are to provide developing countries with the means to:

- Understand more fully the role that the provision of sustainable energy services can have in achieving social, environmental and economic sustainability. Collect and analyse data on the current energy situation and experience in developing countries and assess the needs in all parts of the population (rural, urban and peri-urban). Develop tools to predict the need for energy services in the future, and to perform medium and long-term planning;
- Develop appropriate energy policies that reflect social, economic and environmental objectives. This includes establishing transparent regulatory structures, tariffs to ensure that energy prices represent costs on a national basis as far as possible (for those who can afford them), subsidy levels (some targeted cross-subsidy may, from affluent to poor consumers, may be considered necessary to achieve social goals), technical regulations, import and export practices etc;
- Develop policies, regulations etc to attract sufficient levels of private sector investment for energy infrastructure. Enable proper assessment of proposed energy developments by the international private sector in order that they can be tailored, where possible, to ensure that they are sustainable and meet real local needs;
- Assess, develop and implement appropriate institutional arrangements for energy utilities. Capacity building will help with assessments of the benefits of private versus public utilities, the role of deregulation (European experience will be useful here), independent power producers and energy service companies (ESCOs);
- Assess current technology options (particularly renewable energy, end-use energy efficiency and rational use of fossil fuels, CHP etc) from the standpoint of economic, social and technical sustainability, cultural acceptability and environmental impact;
- Understand current international developments and negotiations, such as those involving climate change, in order to have the ability to influence international debate and benefit from the outcome; knowledge of the potential benefits of the Clean Development Mechanism (CDM) is one example;
- Have the means to build local capacity (public and/or private as appropriate) for the installation, monitoring and maintenance of projects providing energy services; move towards development of a local private sector for technology manufacturing of energy equipment in the longer-term;

- Understand the benefits, and take advantage where possible, of regional (including cross border) integration of energy infrastructure, policy, technology standards etc;
- Develop 'market transformation' activities to shift the market towards, for example, more energy efficient end-use equipment and increased use of renewable energy.
- Develop public education programmes to promote, inter alia, an energy conservation ethic.

4.1.3 Strengthening Relationships between the Public Sector, Private Sector and Civil Society in the Provision of Sustainable Energy Services

Of the three major energy groups (hydrocarbons, electricity and biomass), investments in hydrocarbons (exploration, refining and production) are mostly financed by private international capital.

In the power sector, public funds scarcity and new views on a more limited role for the State have contributed to the recognition that governments cannot and should not finance major power investments. The focus has shifted to privatisation and joint-stock companies with governments often as minority share-holders. However, strengthening the institutions involved as financial intermediaries, and the development of a transparent regulatory and supervisory framework, should be viewed as preconditions to the mobilisation of domestic capital for equity participation.

In the traditional energy sub-sector, the production, transportation and distribution of woodfuels (fuelwood and charcoal) is generally a private sector business. The structure of the industry varies from country to country but it is mostly a part of the informal sector. Investment needs are relatively small which may explain the past neglect of this subsector by governments and international financing institutions. Production of traditional fuels (wood, charcoal, agricultural residues and dung) is cheap because the opportunity cost of labour spent on collection is low and the full cost of reproducing the fuel is not included. It is necessary to create, and find suitable financial mechanisms for participatory institutions capable of managing the natural resource base in a sustainable way. This is not a trivial matter since in many of the poorest countries the turnover of woodfuel commerce in the cities is of the same order of magnitude as electricity sales.

The need for private sector, NGO and civil society involvement in the provision of sustainable energy services is widely recognised. The previous section outlines the need for sector capacity building, particularly for public administrations; actions supporting this will facilitate partnerships between the various actors but further specific actions are necessary.

Important actors involved in the provision of energy services include:

- National public administrations;
- Local private sector (including **utilities** where privatised, ESCOs, and installation, maintenance and manufacturing organisations);

- The international private sector; major players will include financial institutions, equipment manufacturers, multi-national energy companies etc. The role of this sector may increase in importance once the Kyoto emissions trading arrangements are in place;
- Civil society and NGOs, both within recipient countries and from donor countries, will have an important role especially for decentralised energy programmes.

Actions to encourage partnerships will depend on specific country/project conditions. EC priorities could be given to:

- Encouraging partnerships at the project level by working closely with civil society and supporting the development of local private sector as part of project design (ESCOs for example);
- Using donor funds to catalyse international private sector investment where appropriate;
- Consulting with the international private sector when developing policy;
- Supporting the establishment of appropriate financing mechanisms designed for user-focussed, decentralised energy projects;
- Generally supporting means to encourage dialogue between the various actors.

4.2 Theme 2: Integration / Mainstreaming of Sustainable Energy into Other Development Activities

4.2.1 Background

The global objectives of development co-operation, especially economic and social sustainable development and the fight against poverty, are achieved through a variety of policies: development of basic social services, rural development, urban development, environment, health, agriculture, education, conditions for women, transport etc.

These policies all have a link, either direct or indirect, with energy. The rationale behind integrating sustainable energy into development activities is that it is the provision of energy services, not energy per se, that is important. The theme relates mainly to small and medium sized energy service facilities; large electricity generating plants are not included.

The aims of the theme are to highlight the importance of energy service provision in meeting development objectives, show the available possibilities, and ensure that these are integrated into development projects and policies in a sustainable manner. This can be termed sustainable energy *mainstreaming*. As well as established techniques, results from EC energy R&D programmes should be integrated into activities where appropriate. Links with EC R&D programmes will be maintained in order that specific R&D required for development activities can be commissioned.

In practice it will be important to target the integration of sustainable energy into development projects at the level of NIP/RIP development, at the policy level, and during project design and implementation. Specific activities might include education and awareness raising of the role of sustainable energy in achieving development objectives, through the development of information tools, seminars etc.

This theme can be categorised by sector (health, education, transport etc) and type of region (urban, peri-urban and rural). To classify activities in a convenient way, the following groupings are suggested: energy in rural areas; biomass and traditional fuels (rural and urban environments); and efficient use of energy in urban and peri-urban areas. Clearly there will be overlaps between these groups.

4.2.2 Energy in a rural environment

Rural areas are characterised by dispersed, low-density populations, with generally poor access to energy services. Sustainable energy activities in rural environments should serve as support to initiatives involving the development of basic social services (housing, water, health, education etc), and should focus on sustainability (financial, environmental, social, and functional) and the improvement of the conditions for women.

A key aspect related to the poverty issue is the introduction of accessible energy services in rural areas as an indispensable part of social coherence. The often cited two billion poor cannot be fully supplied with modern energy forms within a

foreseeable time frame under the present regime of a centralised energy system. The sustainable alternative is a mix of sustainably managed traditional energy sources and decentralised small supplies of modern energy forms that provide a minimum of essential energy services. It is here that modern technologies can play an important role in the development of cost-effective energy transformation and end use devices, for example in the fields of solar PV, biogas and micro-hydro.

The provision of sustainable energy solutions can contribute to enhancing rural livelihoods in many ways, for example:

- Providing pumping for clean water, or the use of more efficient, cleaner cooking facilities. Both reduce daily drudgery and improve health;
- Improving health using electricity to cool medicines and to provide essential services to health centres;
- Improving access to education with lighting, as well as provision of modern information and communication technologies (radio, telephone, video, TV and e-mail);
- Enhancing prospects for local enterprise and the creation of employment;
- Providing better means of transport for goods and people, enhancing potential for trade and communication.

Extension of electricity networks to rural areas is often unprofitable due to low income levels, and the dispersed nature of populations. At the same time provision of highly appropriate decentralised, modular energy solutions, such as those provided by renewable energy, may not be sufficiently profitable to attract private sector investment. Diesel generators, while also modular, are expensive and require ongoing expenditure for fuel unlike renewable energy. Thus there is a role for support in the provision of appropriate energy solutions such as renewable energy technologies for rural communities. Other options for improving energy services include the switch to liquid fuels, or the provision of improved cook-stoves.

Another role of development projects should be to ensure that there is local capacity for the installation and maintenance of energy equipment.

4.2.3 Traditional biomass and fuels

Traditional biomass (wood, charcoal, agricultural residues, waste etc) accounts for over half of the energy consumed in many developing countries and is used in both rural and urban areas. The use of biomass presents a number of problems, such as poor indoor air quality, the time needed for fuel collection (particularly for women and children) reducing effort available for other productive tasks, and dwindling stocks of fuel in many areas and the resulting environmental problems. In many urban areas fuelwood is now an expensive resource.

However given the extent of biomass use it is unrealistic to expect a total transition to modern fuels in the short term by all people in developing countries. Thus improving the use of biomass, using improved wood-stoves for example, together with improving the arrangements for its provision using sustainable forest management practices, for example, are essential aspects of sustainable energy development.

The sustainable exploitation of biomass resources plays a major role in recreating or preserving a viable physical environment. Energy is part of this picture since fuelwood and charcoal are forestry products essential for cooking. Biomass fuels are an important under-exploited source of renewable energy that is carbon-neutral in the long term, provided the stock of vegetative matter removed is replaced by natural regeneration or replanting. Thus, the approach to biomass supply should involve land use, land ownership, agriculture, forestry, biodiversity and carbon sequestration.

For the same reasons (health, drudgery, environment etc) there is clearly also an important role for development activities to accelerate the transition to more efficient production of energy, use of renewable energy and use of more modern liquid fuels or electricity, where this is viable economically and appropriate to local situations.

Activities aimed at improving biomass production and use, or providing alternatives should:

- be integrated with urban and rural development programmes, targeted especially at improving health and reducing the burden on women;
- attempt to bring the price of wood to its full reproduction cost, rather than its short-run exploitation cost as is the case today;
- be aimed at returning the management of forests and woodlands as far as possible to local communities, and giving them the right to gain income from these resources. Responsibility for sustainable management needs to rest with the communities, monitored by forest authorities;
- target to develop and enforce legal and fiscal instruments at national and local levels to ensure that wood from sustainably managed areas is not undersold by wood from uncontrolled areas.

The development and acceptance of improved biomass combustion technologies including charcoal making equipment, which is more energy efficient and less polluting is a matter for the private market and this is expected to develop as fuelwood prices become realistic. Dissemination of lessons learned as regards rationalising biomass use in this context is of crucial importance. The past has shown that data collection and research on biomass flows are of crucial importance in designing policies and justifying investments. More data and research will be needed to develop all the opportunities.

4.2.4 The control of energy in urban and peri-urban areas

The efficient and effective use of energy in urban and peri-urban areas concerns a number of sectors of activity, including transport, water provision, industry, and urban development. With continued urban and peri-urban population growth, energy service requirements in urban and peri-urban areas will be considerably higher in 20 to 30 years. Since energy infrastructure is generally long-lived, choices made today will have a significant impact on the sustainability of future energy service provision. It is therefore very important to help direct choices now, during the early stages of development, towards the most effective long-term sustainable provision of energy services.

The efficient use of energy has many advantages. In the long term, it reduces hydrocarbon imports, thus improving the balance of payments, reduces environmental impact, reduces household energy expenditure and improves industrial competitiveness. These actions have a direct impact on economic and social sustainable development.

In ***industry***, the potential for energy efficiency improvements is significant, using new technologies, management techniques, changes of processes and/or fuels, regulation, improved tax policies etc. Actions should relate to industries already established as well as those to be developed in the future.

Problems of energy consumption, such as pollution (local, regional and global) and congestion, by the ***transport*** sector are difficult to tackle, both in the developed and developing world. In Africa, transport already accounts for more than 50% of the consumed hydrocarbons while there is on average only one vehicle per 100 people. With development, the demand for transport services will increase significantly. However as with industry, policies established now can help to improve the sustainability of future transport systems. Actions to improve sustainability of energy use in the transport sector should focus on:

- Developing infrastructure to encourage sustainable transport, such as the provision of public transport, use of bicycles etc;
- Urban planning to limit the increased demand for travel;
- Technical improvements to vehicles to reduce emission of local and global pollutants and traffic management systems;

Energy in ***buildings*** is consumed for cooking, the heating of water, space heating, air conditioning, lighting, refrigeration etc. Action should be taken to make use of energy efficient technologies and techniques both for existing and new buildings. The use of appropriate building regulations and codes should be investigated to accelerate the uptake of energy efficiency practices.

It will be necessary in some cases to address the particular problems of peri-urban areas separately from urban to reflect the particular problems experienced in the former.

5 Framework for Possible Future Action

Implementation of this strategy should work towards improved co-ordination with Member States through an appropriate sharing of tasks involving sustainable energy in developing countries, in order to aid coherence of EU effort in this area.

The directions outlined in the energy strategy should be promoted, through consultation with beneficiary countries, in order that they are featured where appropriate in the programming for the next (and subsequent) rounds of the EDF. It is likely that some energy specific activities will emerge, and these will be managed through normal EDF procedures. However since sustainable energy is not one of the main priority sectors for EC development co-operation with ACPs, it is unlikely that large numbers of energy specific activities will be brought forward; thus particular attention will be given to the following:

- Integration / mainstreaming of sustainable energy into EDF programmes and projects;
- Joint activities / co-financing activities with Member States, and other EU activities;
- Joint / parallel activities with international donors outside the EU.

5.1 Mainstreaming Sustainable Energy within the EDF and Budget Lines

The links between provision of sustainable energy supplies and the achievement of development objectives in other sectors have been outlined in sections above. There is a need to raise awareness to ensure that these links are understood among those conceiving EDF programmes and projects.

Given EDF procedures, where proposals are generated at the recipient end, the level of priority given to sustainable energy will largely be determined within recipient countries. Thus there is an important role to inform stakeholders in ACPs of the issues and options for sustainable energy. Within this process it will be important to involve stakeholders from civil society, NGOs, the private sector and utilities, and to help develop partnerships between these groups. Specific activities should involve the provision of appropriate information materials and organisation of regional events and seminars.

In parallel there is a need to raise awareness of sustainable energy, and its links with other sectors, within the EC in Brussels. Important target groups are the geographical Desk Officers and the thematic units (working on education, health, rural development, information and communications technology (ICT) etc). The provision of simple, easy to access case studies and briefing papers, linking sustainable energy with other sectors would enhance understanding of the importance of sustainable energy in development co-operation. Other actions might include the establishment of information networks (eg web site) and short in-house workshops.

5.2 Joint activities / co-financing activities with Member States, and other EU activities

5.2.1 Member States

Joint activities with Member States will help to ensure co-ordination at the European level in the sustainable energy field. The role of the Member States Expert Group for Energy and Development could be expanded help generate and bring forward specific activities.

The possibility of implementing concrete actions in collaboration with Member States should be investigated. Possible mechanisms for joint or parallel EC/Member State activities should be analysed, and where possible implemented. Procedures for ensuring that activities are demand driven by beneficiary countries will need to be developed. Precise overall objectives, and indicators against which success of activities can be measured, should be an integral part of activities.

5.2.2 European Investment Bank (EIB)

The EIB has an important role in the energy sector through its new investment facility. Close co-operation should be sought in order to establish an improved synergy between EIB loan activities and actions under the EDF.

5.2.3 Other Commission Programmes

Closer collaboration should be sought between activities under the EDF and other relevant programmes within the EC, particularly with DG TREN. Modes of co-operation and specific activities should be investigated within the following areas:

- Budget Line for Environment in Developing Countries;
- DG TREN – SYNERGY Programme, and any activities involving the Clean Development Mechanism among others;
- DG RELEX – possible joint studies in areas relevant to sustainable energy in all developing countries;
- DG ENV – COM(2000)212 final (EC Development Policy) states that obligations deriving from Multilateral Environmental Agreements (such as UNFCCC and the Kyoto Protocol) should be considered as a part of the development agenda. The same Communication highlights energy as one of the potential areas to take into account when the implementation of other EC policies are likely to affect developing countries.

5.3 Development of Partnerships with International Organisations

The EC should consider making contributions to programmes/funds of international organisations active in sustainable energy. Such an approach has the advantage that the EC can use its resources and experience to have an influence while not having to establish infrastructures for new programmes. It would also benefit international co-

ordination in the field. If not providing financial contributions, the EC should seek to be represented (as observer if necessary) on programme committees.

Co-operation with international donors could be sought, inter-alia, with the following:

- **Multi-donor funds** such as the Public Private Infrastructure Advisory Facility (PPIAF);
- **Multi-lateral donors -** The World Bank, United Nations Environment and Development Programmes, The Global Environment Facility (GEF), The Food and Agriculture Organisation (FAO) etc
- **Others –** eg The *E7* group of electricity utilities.

5.4 Supporting Actions

5.4.1 Evaluation

In order to gauge the general success of EC energy activities in developing countries, indicators could be developed against which the progress of development co-operation activities in the sustainable energy field can be measured. It is important that the evaluation process is able to account for both energy projects and the energy aspects of other development activities. The evaluation process should also account for the degree of coherence of EC and Member State activities. It is envisaged that periodic evaluations could be carried out to monitor progress against indicators. In order to establish a baseline for future activities, past projects funded under the EDF could also be evaluated.

The use of targets against which to measure the level of energy activity could also be considered.

5.4.2 Improving Dialogue and Co-ordination

Improving dialogue is essential for implementing a successful sustainable energy strategy. Actions resulting from well-informed and co-ordinated institutions will be superior to those taken by an isolated set of bodies. Care needs to be taken to ensure that the views of beneficiary countries are sufficiently represented. The need for improved dialogue is greater today than in the past, because energy actions by today's donors focus more on dispersed, user-focused (hence less visible) activities, rather than on large centralised projects.

- **Improved dialogue between donors (north-north)** will help to ensure coherence and co-ordination, and reduce duplication of effort. There are considerable potential benefits from co-ordinating programmes between donors, in terms of efficiency improvements, coherence of policy messages from donors etc. Donors learn from each other as they exchange information, and increased dialogue will improve the chances of successfully integrating programmes. **The Member State Expert Group**, as well as acting as an advisory group for Commission policies and plans, is likely to have an important programme co-ordination role between the Commission and Member States, possibly involving discussions on division of efforts in the energy field (sectorally or geographically). It will be essential to ensure close co-ordination with the **European Investment Bank** in order to

maintain coherence with EC and Member State activities, as well as to advance co-operation with the private sector, which is amongst the priority areas identified for the 9th EDF. Any DGs with relevant activities should be encouraged to take part in the Expert Group meetings. Options for enhancing EU dialogue will be discussed with a Member State Expert Group that should meet at least once per year.

- **Dialogue north-south** - It is essential that operational north-south links on energy be improved to ensure that the policies developed by donors such as the EC fully reflect the needs of recipient countries. Dialogue will help to ensure that European lessons on policy and technology are transferred; this message emerged strongly from the UNFCCC negotiations on capacity building and actions should be co-ordinated with them. One important opportunity for dialogue is during the development of NIPs and RIPs.
- **Dialogue south-south** – Although largely in the control of developing countries themselves, the EC and other donors can play a key role in enhancing south-south dialogue by supporting regional conferences and workshops and networks.

Discussions on the possible initiation of a forum for exchanging views, on sustainable energy matters, between European donors, independent experts and representatives from developing countries could be taken forward. The objectives and format would need to be further clarified but the aim should be to enhance north-north and north-south dialogue.

The need for other new activities for enhancing dialogue should also be reviewed.

6 Next Steps

General approval of this strategy will be sought amongst Member States (through the Member State Expert Group) and within the Commission. Following this specific actions from the previous section should be brought forward for the ACPs.

Actions deriving from the strategy should be discussed and evaluated periodically and the strategy, regarded as a living document, should be revised every two or three years as necessary.

7 Annex 1: EC Programmes Supporting Energy Co-operation Activities in ACP/ALA Countries

Directorate General	Instrument	ACP	Asia	LA	Energy Sector Activities	CE	RE	EE	
Relex (External Relations) with SCR	Economic Cooperation		x		Modernisation of the energy sector, natural gas, energy efficiency, renewables	x	x	x	
	COGEN		x		Implementation of proven cogeneration technologies in ASEAN countries		x		
	AEEMTRC		x		Institutional support and training		x	x	
	Development Cooperation		x		Technical support to energy sector; rural electrification, and RE dissemination strategy	x	x	x	
	Economic Cooperation			x	Energy efficiency, market liberalisation, institutional support	x	x	x	
	ALURE (II)			x	Co-financing energy sector partnerships; promotion of sectoral reform	x	x	x	
	Development Aid			x	Technical support, e.g. improving efficiency of electricity transmission; demand driven	x	x	x	
Development with SCR	EDF Grants to Energy Sector	x			Energy activities through NIPs; principally electricity infrastructure, and RE	x	x	x	
	South Africa B7-3200	x			One initiative on PV in rural schools		x		
Science Research and Development	DC Research Collaboration	x	x	x	DC research collaboration; policies, dissemination strategies, and feasibility studies		x	x	
TREN (Transport and Energy)	ALTENER (II)*				Promotion of RE; breakdown of economic, technical, and institutional barriers		x		
	SAVE (II)*				Promotion of investments in EE; labelling standardisation; energy management			x	
	SYNERGY	x	x	x	Policy evolution and cooperation through training seminars and capacity building	x	x	x	
	THERMIE**	x	x	x	Demonstration and dissemination of non-nuclear energy technology	x	x	x	
General Budget Lines	Environ DC B7-6200	x	x	x	Policy/strategy; assessments and reports on, for example charcoal; pico-hydro; agroforestry		x	x	
	Tropical Forests B7-6201	x	x	x	Assessing and managing biodiversity resources; projects and regional programmes		x		
	NGOs B7-6000	x	x	x	Co-financed projects; energy in integrated development projects; rural electrification		x		
Other institutions	CDI	x			Promotion of private sector partnerships, technical assistance, feasibility studies		x	x	

CE=Conventional Energy; RE=Renewable Energy; EE=Energy Efficiency/Rational Use of Energy; NIP=National Indicative Programme

4.2 ACP-EU Joint Parliamentary Assembly: Interim Report

Working Party on the Use of Renewable Energy Sources in the ACP States

ACP-EU JOINT PARLIAMENTARY ASSEMBLY

WORKING PARTY
ON THE USE OF RENEWABLE ENERGY SOURCES
IN THE ACP STATES

19 March 2001

INTERIM REPORT

on behalf of the Working Group on the use of renewable energy sources in the ACP States

on the use of renewable energy sources in the ACP States

Rapporteur: Anders Wijkman

Part A: Draft Motion for a resolution

DRAFT- MOTION FOR A RESOLUTION

on the use of renewable energy), sources in the ACP States

The ACP-EU Joint Assemble ,

- meeting in Libreville (Gabon) from 19 to 22 March 2001,
- having regard to Title VII - energy development - of the Lom8 IV Convention, where the European Community and the ACP States recognise the mutual benefits of cooperation in energy and identify increased use of alternative, new and renewable energy sources as one of the main objectives of energy development,
- having regard to the new partnership agreement between the ACP States and the European Community and its Member States, and in particular Article 32 (2) thereof, where both sides agree on cooperation aimed at supporting specific measures and schemes addressing sustainable management issues, such as renewable energy sources especially different forms of solar energy and energy efficiency,
- having regard to Article 57 of the new partnership agreement, where the responsibilities are established for defining and adopting the objectives and priorities on which the Indicative Programmes are based,
- having regard to its resolution on climate change and small island developing states in the framework of ACP -EU cooperation,
- having regard to its interim resolution of 2' March 2000 on the use of renewable energy sources in ACP States (ACP-EU 2885/fin),
- having regard to the report of its working group on the use of renewable energy sources in ACP States (ACP-EU 3057/B/rev),

A. whereas primary energy demand in ACP and other developing countries is projected to increase from 2.513 Mtoe in 1990 to ca. 7.319 Mtoe in 2020, in particular due to rapid population growth (2.6% annually in Africa from 19902010),

B. whereas two-thirds of the population in Africa live in rural areas without access to modern energy services, fuels and the electricity grid,

C. whereas in 1990 only g% of rural people and 38% of urban dwellers in Sub-Saharan Africa had electricity connections,

D. whereas small Island ACP States are heavily dependent on imported fossil fuels for the majority of their rapidly growing energy needs and on 'inefficient combustible biomass for their non-commercial energy production,

E. whereas petroleum is imported in the small island ACP States at some of the highest prices in the world, for example 200-300% of international levels in the Pacific region,

F. whereas energy and energy services have not been sufficiently integrated so far as a horizontal key element in programmes aimed at reducing poverty,

G. whereas Sub-Saharan Africa has enormous diverse renewable energy resources which remain largely unexploited so far, whereas many small island ACP States have abundant resources of alternative renewable energies, such as wind and solar,

H. whereas in particular Africa's hydropower resources offer large opportunities for increasing sustainable energy supply through regional cooperation (power trade and building up of transnational electricity interconnections),

I. whereas there has been significant development of alternative energy technologies over the last decade, both in terms of performance and cost reduction, but public funding and support remain imperative,

J. whereas modem renewable energy technologies can be price-efficient and competitive with conventional energy sources in a favourable legal and regulatory environment,

K. whereas the largest potential for meeting the energy needs of the poor in rural areas with the least possible environmental impact are in new renewable energy technologies,

L. whereas the traditional use of biomass (fuelwood) for cooking in rural areas of ACP States is often inefficient, and leads to health problems and environmental damage,

M. whereas experience from projects in various ACP States (Sahel zone involving nine countries, Papua-New Guinea and South Africa) has shown that the existing products and equipment are now of a high technical standard, but that maintenance programmes with a view to sustainable use of new technologies for the use of renewable energies (RE technologies) should be a particular priority and that the infrastructure (distribution networks) needs financial and technical improvements,

N. whereas energy has in general not been identified as a priority in the Indicative Programmes of ACP) States and, whereas energy projects have played so far only a marginal role in the implementation of the 7th and 8th European Development Funds (EDF), in spite of the emphasis put on energy cooperation in the Lomé IV Convention,

0. whereas encouragement of targeted transfers ok know-how to the ACP countries will, in the long-term, create durable and self-sustaining demand, showing the directions to be taken in economic and ecological terms,

P. whereas the European Union should in this respect act as an intermediary between the European renewable energy sector and its potential partners in the ACP countries, which are already capable of assimilating technical know-how,

Q. whereas new national indicative programmes will be elaborated under the new partnership agreement,

1. Stresses that ACP States face an extraordinary economic and political challenge to meet the growing demand for energy, and stresses that enormous investments in energy infrastructure and services and in corresponding training and information programmes will be needed;

2. Stresses that energy must be considered as a cross-cutting issue with a high development potential, especially in view of poverty reduction, as the availability of energy and services is imperative for satisfying basic needs, such as access to food, potable water, household lighting and cooking, health services and education;

3. Calls on the ACP States and the Commission to regard energy as an important instrument for development and calls therefore for the elaboration of a coherent and sound energy strategy in ACP States, based on the concept of sustainable provision of energy services, aimed at integrating the social and economic needs of users while minimising the environmental impact of energy use; calls in this context on the ACP States to define energy, including the promotion of the use of renewable energy

sources, where appropriate, as a priority in the new Indicative Programmes, taking into account the possibilities of regional cooperation;

4. Calls on the Commission to include sustainable energy supplies, in particular through energy efficiency and the use of renewable forms of energy, as a priority action field in its new development policy strategy;

5. Calls on the Commission and the Member States of the EU to integrate the aspect of sustainable energy provision in all development and cooperation programmes and projects-,

6. Urges the Commission and Member States of the European Union to promote the idea of sustainable energy supply, particularly with a view to setting up development partnerships with economic circles (partnerships between the public and private sectors);

7. Stresses that satisfying energy needs is especially urgent in rural areas remote from the grid, and points out that the lack of economic and social perspectives in rural areas is related to the lack of adequate energy supply, resulting in rapidly growing urbanisation;

8. Stresses that the small-scale and modular nature of new and emerging renewable energy technologies, such as solar PV systems, small-scale off-grid wind turbines, mini- or micro-hydro systems or modem biomass-based generators, is often more appropriate to the level and structure of demand than conventional alternatives, in particular in rural areas;

9. Points out that access to electrical energy is a basic precondition for access to information and communications technology and that renewable energy sources for generating electricity in rural areas can be of key importance in this respect;

10. Stressesthedifferences,intennsofeconomy,climateandinfrastructure,which necessitate a tailor-made approach for each country;

11. Notes that increased use of renewable energy sources would reduce dependence on expensive imports of fossil fuels and contribute to improve balances of payments; stresses that the implementation of systems of new and renewable energy technologies can have a significant positive impact on job creation and employment;

12. Stresses that the increasing use of renewable energies in the developing countries will play a major part in combating the global, man-made greenhouse effect since in 20 1 0 emissions Of CO2 in those countries will probably be greater than in the industrialised countries, including Eastern Europe;

13. Emphasises the decisive role of science and technology and the need to develop strategies for the transfer of know-how so as to build indigenous capacity for development and maintenance of modern energy technologies in ACP States;

14. Stresses the need to step up technology transfers by directly encouraging the acquisition of professional qualifications (university and technical training, industrial traineeships) as part of mobility programmes;

15. Calls on the ACP States to examine the possibilities to overcome existing obstacles, for the use of renewable energy sources, such as lack of adequate legal, fiscal or- regulatory framework, and the reasons for lack of private foreign investment

16. Advocates a reduction in subsidies for conventional energy Generation and in import duties **on** RE technology;

17. Advocates Fiscal inducements to increase the market penetration of RE technology and energy-efficiency measures, in particular for locally produced technology;

18. Regards the inclusion of the private sector and attractive terms for foreign direct investments as essential, with a focus on the fight against corruption;

19. Calls on the African ACP States to work together, in particular for better exploitation of **the** vast hydropower resources, and to put in place stable and transparent government and utilities coordination for policy making and for implementation of regional energy cooperation; points out that, without regional cooperation, it will hardly be possible to attract investors for financing transnational infrastructure;

20. Calls on the Commission and the ACP States to encourage cooperation between businesses in the EU and the ACP States with a view to fostering more rapid dissemination of systems and technology in the field of renewable energy;

21. Welcomes the increasing attention paid to renewable energy sources in the civil services of the ACP States with the creation of special departments in ministries or the creation of separate agencies;

22. Calls for greater support for the ACP States in creating administrative capacity in the energy sector to give the authorities more reliable statistics, thereby improving the scope for planning and decision-making in developing their energy strategies;

23. Welcomes the Commission's intention to hold regional seminars on the use of renewable energies for the competent decision-making bodies in the ACP States to prepare the way for a substantial increase in projects concerned with sustainable energy supplies;

24. Calls on the Commission and the ACP States to prepare a campaign for adequate information on the use of renewable energy sources in ACP States;

25. Calls on the Commission to examine the possibilities of creating,- new, appropriate finance mechanisms for renewable energy projects, in order to overcome the lack of financial resources for credit Financing of the high up-front costs of renewable energy technologies; in this connection the creation of micro-credit systems or the provision of funding for training and development in the banking sector should be looked into,

26. Calls on the Commission and the Council to 'introduce binding environmental rules guiding grants-based assistance and activities within investment banks - like the EIB - and national export credit agencies, so as to promote investments in sustainable energy and energy efficiency;

27. Welcomes the fact that the private financial sector is beginning to become involved in renewable energies in the developing countries;

28. Calls on the European Investment Bank to draw up innovative appropriate financial instruments for the support of small and medium-sized projects for renewable energy sources in ACP States in the frame of the EIB managed part of the EDF;

29. Stresses the importance of the 'Global Environment Facility' and the 'Clean Development Mechanism' for the financing of RE projects in the ACP States;

30. Regrets in this connection the failure of the UNFCCC conference in November 2000 in the Hague and calls for negotiations to be resumed without delay and brought to a speedy conclusion in order to make available additional funding for the fight against the greenhouse effect in developing countries-,

31. Welcomes the G-8 initiative to create a task force which is to prepare concrete recommendations for consideration on sound ways to better encourage the use of renewable energy sources in developing countries;

32. Invites its Co-Presidents to for-ward this resolution to the ACP-EU Council, thQ Commission, and the European Investment Bank.

4.3 Background paper ('Recommended airplane reading')

Energy and Sustainable Development in ACP Island States

SUSTAINABLE ENERGY SEMINAR FOR ACP ISLAND STATES
WITHIN THE FRAMEWORK OF EC DEVELOPMENT CO-OPERATION
JUNE 26 – 27, 2001 – DOMINICAN REPUBLIC

ENERGY AND SUSTAINABLE DEVELOPMENT IN ACP ISLAND STATES

Background Paper
for the Sustainable energy seminar for ACP Island States
within the framework of EC development co-operation

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This document has been prepared by Projekt-Consult GmbH on behalf of the European Commission. The views presented do not necessarily represent those of the European Commission.

Content

1. Introduction

The following document introduces the participants to some technical and non-.technical aspects of the relationship between energy, poverty alleviation and sustainable development and will help to raise awareness about the role energy plays in the society and economy of ACP Island States.

It will sensitise the participants for the questions why energy plays a crucial role in development, how can it be ensured that energy is adequately considered in the planning process for the 9thEDF (European Development Fund) and how National Authorising Officers, with the help of energy specialists, can take of advantage of sustainable energy supply in order to achieve economic, social and political development objectives in ACP Island States.

It is one of the main objectives of the seminar to discuss these questions and to show ways to answer them in the context of the EDF 9.

2. Why this seminar on sustainable energy for ACP Island States?

Lack of access to adequate energy services in most ACP island states is a barrier to social and economic development and the alleviation of poverty.

The seminar on sustainable energy is timely given the upcoming 9th EDF, as well as the wider international context in which there is increasing interest in energy and the links with poverty reduction, sustainable development and the environment.

This seminar aims to:

- *help ensure that EC development co-operation programmes under the 9th EDF fully recognise the role of sustainable energy services for poverty alleviation by integrating sustainable energy into priority sectors, as highlighted in the sustainable energy strategy;*
- *increase understanding of the approach taken in the EC sustainable energy strategy, and gain feedback from ACPs;*
- *enhance South-South and North-South dialogue on sustainable energy issues;*
- *highlight opportunities for sustainable energy interventions through facilities other than the EDF;*
- *provide an opportunity to improve dialogue with countries who plan energy as a priority in their programming for the 9th EDF.*

Energy and sustainable development currently has a high international profile, with the recent UN CSD9 activities which called for energy being treated as a priority in the RIO+10 process, a G8 Task Force on Renewable Energy due to report in Italy in July, and the on-going UN climate change negotiations, highlighting the importance of energy in developing countries.
Recent activities of the UN FCCC (especially on the Clean Development Mechanism – CDM); the current G8 Task Force on Renewable Energy; UN CSD9 on sustainable energy, all show the importance attached to sustainable energy in developing countries.

The EC strategy on development activities involving sustainable energy in ACPs stresses the promotion of decentralised, user-focussed energy services, especially renewable energy and energy efficiency, as a means of alleviating poverty.
Current thinking is that these energy services should be integrated into development actions in other sectors (rural development, tourism, health, education etc) and areas such as environmental sustainability, gender, regional co-operation etc.

The need for institutional and policy support, and the essential role of the private sector in providing sustainable energy services, are highlighted in the EC Development Policy as well as in the new Cotonou Agreement.

In "The European Community's Development Policy"[1] Energy is mentioned to play a key role in poverty alleviation. Under the section on strengthening focus on poverty reduction; it states:
'*Access to sustainable energy services has a key role to play in supporting social and economic development. The provision of energy services, particularly through decentralised activities and the promotion of renewable energy sources, is an increasingly important issue'*.

The Cotonou Agreement highlights the importance of sustainable energy in 4 Articles:

- Article 23 *Economic Development*: "Co-operation shall support sustainable policy and institutional reforms and the investments necessary for equitable access to economic activities and productive resources, particularly: …(sub-section) …
f) development of competitive industrial, mining and energy sectors, while encouraging private sector involvement and development…"
- Article 30 *Regional Co-operation:* "1. Co-operation shall, in the area of regional co-operation, support a wide variety of functional and thematic fields which specifically address common problems and take advantage of scale of economies, including: … (sub-section)
a) the environment; water resource management and energy;…"
- Article 32 *Environment and natural resources* "1. Co-operation on environmental protection and sustainable utilisation and management of natural resources shall aim at: … (sub-section)
c) supporting specific measures and schemes aimed at addressing critical sustainable management issues and also relating to current and future regional and international commitments concerning mineral and natural resources such as: … (sub-section)
iii. renewable energy sources notably solar energy and energy efficiency…"
- Article 43 *Information and Communication Technologies, and Information Society*… (sub-section)
4. The Parties will therefore take measures… the development and encouragement of the use of affordable renewable energy resources…"

3. Energy as a mean for poverty alleviation

3.1. Improved access to energy services and poverty alleviation

On global level, about 1.6 billion people do not consume any electricity, very little use LPG or kerosene.
In the ACP Island States high proportions of the population have access to only poor energy services, inhibiting social and economic development and continuing the cycle of

[1] The European Community's Development Policy, Brussels, 26.4.2000, (COM(2000) 212 final

poverty. The scattered and often low density of populations hinders the development of energy markets and reduces the options for developing economies of scale.

Improved access to affordable and environmentally compatible energy services supports economic development as well as social development such as the initiation of small economic cycles, improvement of public health and education thus contributing to the reduction of poverty. Thus provision of sustainable energy services has a necessary (but not sufficient) role to play in the achievement of the widely agreed International Development Targets (ITDs).

The use of renewable energy and the implementation of energy efficiency measures play an increasingly important role in providing and improving access to energy services. These activities can provide real economic benefits, both on the macro level by reducing fossil fuel imports, and the local level by providing cost savings for the owners of small businesses. At the same time the high up-front costs, as well as lack of access to capital, is a barrier to the uptake of renewable energy.

Government interventions should therefore help

- to accelerate the development of modern and sustainable energy services for the poor by providing access to better energy services and linking gender-energy-health concerns
- to compensate for market failure in energy markets by controlling pollution/safety standard costs on society and promoting private initiatives in environmental protection.
- to mitigate risks beyond the control of private investors and private risk insurers in energy supply.
- To represent national and global interests in energy – related international affairs

The close linkage between the poverty and access to sustainable energy services can be demonstrated in the following example:

The traditional use of fuel wood for domestic energy purposes is problematic in many ways. The main concern related to poverty is the health problems for the users:

According to the Word Bank, indoor air pollution kills yearly two million women and children through acute respiratory infection, eye diseases, and complications during pregnancies.

3.2. Mainstreaming energy in sustainable development

Any economic and social development for poverty reduction depends essentially on the availability of energy services. Lack of access to energy services or shortages of this service hampers economic and social development. It is important to make national planners and political decision makers aware that it is the energy service whose availability drives any economical and social development and represents an essential bottleneck if not sufficiently available.
This is particularly true for small ACP Island countries with limited natural resources and high dependency on imported fuels. Additionally, small Islands will mostly be affected by the negative impact on climate change/sea level rise and have therefore, a particular interest on combating these effects.

Typical sectors of ACP Islands affected by availability or lack of adequate energy services are:

- *Health and education: Electricity supply for health stations, clinics (lighting and refrigeration) and schools (lighting)*
- *Small scale (rural) industry, like metal working, building materials, grain milling, wood processing;*
- *Food processing crop drying, fish smoking, bakery, small scale slaughterhouses;*
- *Water supply for irrigation and domestic use*
- *Tourism industry (hotels, tourist facilities)*
- *Household energy for cooking, lighting and entertainment*
- *Information and communications technologies (ICTs)*
- *Transport (sea, air and land transport)*

The up-scaling and diversification of these economic activities including the provision of sustainable energy services are necessary and crucial for any sustainable development.

Mainstreaming of sustainable energy into these development activities means the consequent consideration of the role of energy as an necessary (but not sufficient) means to achieve these development objectives.

3.3. Improving the framework for mainstreaming energy

Generic energy issues such as the creation of a RE-favourable policy framework, improvement of access to financing, institutional and human resource capacity building, regulatory and legal issues and awareness raising at public and government level are essential for sustainable energy development.

These over-arching activities help to remove existing barriers in the energy sector although. The extent to which these issues are tackled under future EC development co-operation will be largely determined during the programming of the 9th EDF. Although energy per se is unlikely to be a focal sector for many ACP islands under the EDF, such generic issues should be integrated where appropriate into the 9th EDF.

However, in recognition of the overall importance of these generic issue for sustainable energy development, a close co-operation between EC and other donors which are active in this sector (e.g. EU member states, UN) will be helpful.
An example is the strategy of the GEF to finance incremental costs of Renewable Energy and Energy Efficiency projects as outlined in the Climate Change Operational Programmes # 5 and 6 through its implementing agencies World Bank, UNDP and UNEP

Other EC Member State donors of the EU like the German-based GTZ supporting the improvement of policy framework for RE in the Caribbean as well as EC Member States contributing to regional Development Banks (CDB, ADB) as well as to the European Development Bank (EIB) providing financing for energy projects are other examples for possible international co-operation on these generic energy issues.

3.4. Privatisation and Market Liberalisation

The energy policy pursued most widely by Caribbean governments in recent years has been the privatisation of a number of formerly state-owned electric utilities, the most recent being Belize and Guyana. Privatisation is motivated, amongst others, by budgetary pressures, a need to improve efficiency, and a desire to attract private capital. Usually, through privatisation, restructuring and cost reductions have taken place, government subsidies to the energy sector have been reduced, and competition has increased.
Liberalisation has raised some questions.
With regard to the poor, does it satisfactorily address security of supply, extend accessibility to energy services, and promote sustainable development?
Does the government have sufficient, or any, control over the activities of the utility, once privatised?

Many privately owned utilities believe that they should service their clients by focusing on efficiency, including cost-effective technologies; and that making energy available to the poor and rural areas is mainly an issue for social policy.

The answer, generally, is that there is a need for policymakers to introduce effective, strong and transparent regulatory frameworks, and to desist from detailed interference in the sector. This regulatory framework should set clear guidelines as to what utilities are supposed to do, and what incentives they will be allowed for the pursuit of social objectives. The relationship of governments to utilities is the first of the areas in which a regional energy programme could seek to offer assistance.

4. The energy situation in ACP Islands States

4.1. Macro-economic aspects in the Caribbean and Pacific Region

Many ACP Island States are heavily dependant on fossil fuel imports, with prices for these energy supplies being some of the most expensive in the world due to high transportation and distribution costs. Despite the ACP Islands substantial renewable energy resources, exploitation lags far behind their potential, due to barriers, mainly in the policy framework, financing and due to lack of institutional capacity as well as awareness and information of decision makers and the users.

Reducing the dependency and expenditure on imported fuel would greatly support national efforts in sustainable economic development.
There are two main options for reducing this dependency: Increase efforts to develop and apply energy efficiency measures in all energy consumer sectors and to increase the exploitation and utilisation of renewable energies.

The Caribbean Region is highly dependent on fossil fuels, with petroleum products accounting for an estimated 93 % of commercial energy consumption. Renewable energy technologies, including hydroelectricity, likely provide less than 2 % of the region's commercial energy.

Annual Caribbean Regional Commercial Energy Consumption by Source

Energy Source	Consumption [Peta Joules]
Petroleum	539
Bagasse	37
Hydroelectricity	1
Natural gas	1
Total	**579**

Source: Caribbean Energy Information System, 1995

Beside the use of bagasse for co-generation there is a high – difficult to quantify - consumption of biomass for domestic use, like fuel wood for charcoal production for cooking. The use of this biomass constitutes a thread for both the health of the users, especially women, children as well as to the environment.

As the following table shows the region's electricity consumption is also heavily weighted towards fossil fuels, with petroleum and natural gas accounting for 98 % of the total supply.

Annual Caribbean Regional Electricity Consumption by Source

Energy Source	Consumption [GWh]	Share
Fuel oil	12.856	63%
Natural gas	5.340	26%
Diesel	1.752	9%
Hydro	395	2%
Wind	0,5	0
Total	20.344	100%

Source: Caribbean Energy Information System, 1996

The Caribbean has substantial renewable energy resources, especially solar, wind, hydro and biomass energy, and has demonstrated the technical and economic feasibility of a variety of renewable energy technologies and applications. However, as shown in the following table, the current stock of renewable energy installations still lags far behind its technical potential. With Caribbean energy consumption growing at an estimated 5 % per year, there is ample opportunity to integrate renewable energy into the region's energy mix.

Renewable energy technologies in operation in the Caribbean and their technical Potential

Energy Source	Techno-logy	Number of Units in Operation	Applications	Technical Potential*
Solar energy	Domestic water heaters	33,000**	Water heating	Hundreds of Thousands
Solar energy	Photovoltaic systems	350****	Communication, navigation, residential electricity, water pumping and health care	Hundreds of Thousands
Solar energy	Solar dryers	38	Agricultural or wood product drying	Hundreds
Biomass	Cogeneration	30	Steam and electricity generation	Hundreds of MW
Biomass	Biodigestors	312	Cooking, water heating, electricity generation, lighting, refrigeration, etc.	Thousands
Wind energy	Turbines	4 (3.4 MW)	Electricity generation	Hundreds of MW
Hydropower	Turbines	235 (124 MW)	Electricity generation	7,200 MW***
Geothermal	Turbines	None	Electricity generation	Tens of MW

Source: *NEWEN: New and Renewable Energy Statistics in the Caribbean*, Caribbean Energy Information System, 1996.
Note:
* These are order of magnitude estimates developed with input from CEIS and UWI/CERMES, except for the hydro estimate which is from NEWEN.
** An estimated 24,000, or 73%, of which are in Barbados.
*** Of which 7,000 MW is in Guyana, 114 MW in Jamaica and 71 MW in Belize. This is significant since hydro presently constitutes only 0%, 4% and 36%, respectively, of total electricity generation in these countries.
****This figure seems to be very low, it should now be in the range of thousands of units.

The situation in the Pacific Island Countries (PICs) is similar: petroleum products account for an estimated 80 % of its primary energy consumption. Renewable energy, mostly hydro electricity, is estimated to contribute less than 10% of the PIC's energy use. To counter this heavy reliance on fossil fuels and at the same time promote the sustainable development of their economies, promoting the widespread use of renewable energy and the efficient use of conventional energy are key priority features in national energy sector plans and energy strategies of these PICs.

The use of fossil fuels in the PICs is mostly in power generation and transportation. While transportation is totally dependent on it, power generation is heavily weighted towards it too. The next table provides the share of fossil fuel and renewable energy in the PICs' power generation.

Like in the Caribbean biomass is traditionally used in PICs for domestic purposes causing the already mentioned health and environmental problems.

PICs' Power Generation by energy source [%]

Country	Fossil Fuel	Renewable Energy
1. Cook Is	100	0
2. Fiji	49	51
3. FSM	96	4
4. Kiribati	100	0*
5. Marshall Is	100	0
6. Nauru	100	0
7. Niue	100	0
8. Palau	100	0
9. Papua New Guinea	40	60
10. Samoa	49	51
11. Solomon Island	100	0
12. Tonga	100	0
13. Tuvalu	100	0
14. Vanuatu	86	14

Note: Adopted from the Forum Island Country Power Sector Tariff/Cost Study, Pacific Islands Forum Secretariat [1998].
* Not considered are the Solar Home Systems installed in Kiribati.
Renewable energy is mostly hydropower except in Fiji, where bagasse and wood wastes are used in power generation. Due to non-availability of data, renewable energy's share in the installed capacity is assumed to be equivalent to its power generation output.

The Pacific region has substantial renewable energy resources even though they are unevenly distributed due to the varying sizes of the islands and their locations. The next Table gives an idea on the renewable energy potentials of the PICs:

RE Resource Potentials of the PICs

Country	Solar	Wind	Biomass	Hydro	Geothermal	OTEC	Wave
1. Cook Islands	✔ ✔ ✔	✔ ✔	✔ ✔			✔ ✔	✔
2. FSM	✔ ✔	✔	✔ ✔	✔ ✔	✔ ✔	??	??
3. Fiji	✔ ✔	✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔	✔ ✔
4. Kiribati	✔ ✔ ✔	~	✔			✔ ✔	??
5. Marshall Is.	✔ ✔ ✔	✔	✔			✔ ✔	??
6. Nauru	✔ ✔ ✔	~	✔			✔ ✔	??
7. Niue	✔ ✔ ✔	✔ ✔	✔			??	??
8. Palau	✔ ✔ ✔	✔	✔ ✔			??	??
9. PNG	✔ ✔	✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔	??	??
10. Samoa	✔ ✔	✔ ✔	✔ ✔	✔ ✔	✔ ✔	??	??
11. Solomon Is.	✔ ✔	✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔	??	??
12. Tonga	✔ ✔ ✔	✔ ✔	✔			??	✔ ✔
13. Tuvalu	✔ ✔	~	✔			??	??
14. Vanuatu	✔ ✔	✔ ✔	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔	??	??

Source: Adapted from Johnston (1995)
Note:
✔ ✔ ✔- excellent resource, ✔ ✔ - good resource, ✔ - some resource, ?? - Definite potential but extent unknown, ~ - unlikely to be an exploitable resource. Wind and wave energy are very site specific. Biomass includes resources for electricity generation and fuel wood.

4.2. Economic and social development and environmental sustainability

Conventional methods of electricity production through fossil fuel plants are beside the transport sector among the most significant contributors to air, land and water pollution. They are the primary source of greenhouse gas emissions that may induce climate change.

Climate change, with sharp rises in temperature, changes in rainfall patterns, rises in global sea level due to thermal expansion of the oceans and the melting of glaciers, and unpredictable impacts on fauna and flora affects particularly ACP Islands.
Small Islands are vulnerable to economic as well as environmental shocks. In addition to the problems faced by most developing countries such as lack of financial resources, small islands face a unique combination of challenges in making the transition to sustainable development. Among the many constraints are fragile natural environments, little resilience to natural disasters, growing populations, isolation from markets, a narrow resource base, difficulties arising from economies of scale, and high cost for energy, infrastructure, transportation, communication and access to other services.

However, while ACP Island States are thus recognized as the most vulnerable to climate change, they have made the smallest contribution to its causes.

As is states in the AOSIS report to CSD 9[2]:

'In addition to the climate change stress, further stress on the island system is occurring as countries develop. Their reliance on fossil fuels has increased, in particular for producing electricity, and transportation seems to be the fastest growing consumer of petroleum, including sea and aviation transport. It is therefore important to acknowledge that in providing access to energy sources, in particular electricity, there is significant opportunity to utilize renewable energy sources. Although renewable energy technologies such as solar, hydropower, biomass and to a lesser extent wind have already been utilized in a number of SIDS [Small island Developing States] to improve, communication, health, education and some small cottage industry, there remain significant opportunities and potential to further develop these and other renewable energy resources. At the same time it is quite apparent that there are also major opportunities for improving energy efficiency in SIDS, and that this should be considered in parallel to renewable energy development.'

Summarising, ACP Island States have a high interest in sustainable energy supply for
1) macro-economic reasons,
2) to increase access energy and hence reduce poverty and
3) to lead by example.

In order to combine the objectives of economic growth, social development and environmental compatibility, the provision of sustainable energy services as a necessary incident for further development of ACP Islands States.

[2] **REPORT OF THE 3RD ALLIANCE OF SMALL ISLAND STATES (AOSIS) WORKSHOP ON CLIMATE CHANGE, ENERGY AND PREPARATIONS FOR THE 9TH SESSION OF THE COMMISSION ON SUSTAINABLE DEVELOPMENT, January 2001**

4.3. Barriers to sustainable energy services in ACP Islands

Achieving the ACP Islands renewable energy and energy efficiency potential thus reducing its reliance on petroleum, depends in part on the removal of certain key barriers. While the ACP regions are different in many aspects, numerous studies show, that the barriers hampering the implementation of energy efficiency measures as well the wider utilisation of renewable energy technologies are mainly of the same or very similar nature. The following barriers are focused on renewable energy, but they are valid in very similar way for energy efficiency measures.

These barriers are mainly related to

Inadequate Policy: While selected countries have policies that facilitate the use of renewable energy sources, there is a need to develop and apply enhanced policy measures to capture the ACP islands renewable energy potential, including policies or incentives for the purchase of renewable energy-generated electricity by electric utilities, appropriate import tariffs on renewable energy equipment, building codes that provide for the incorporation of renewable energy measures, tax/financial incentives in line with similar incentives for conventional energy, certification of renewable energy equipment and services and others.

Lack of Awareness: While in the Caribbean, Pacific and African regions there are a number of operating or demonstration renewable energy installations, lack of awareness is still considered a major barrier to its development.
Beside the decision makers and politicians themselves the general public lacks awareness of renewable energy products and opportunities. Architects and engineers lack awareness of opportunities to incorporate renewable energy systems into new buildings. Electric utilities lack awareness of recent advances in renewable energy technology that has improved its operating performance and reliability. Cross-sector links need to be built at the policy and operational levels to improve understanding of the essential role of energy in health, education, rural development, enterprise development, tourism etc.

Inadequate institutional and human resource capacities: The ACP Island regions similarly lacks capacity to develop, finance and operate renewable energy projects or businesses. There is a need to build the capacity of engineers in the design of appropriate technologies, of entrepreneurs in the design and manufacture of renewable energy systems and the financing of their businesses, of technicians in the installation and servicing of renewable energy systems, of financial institutions in the evaluation and financing of renewable energy projects and systems, of policy-makers in the development and implementation of policies, legislation and regulations and of utilities in the negotiation of power purchase agreements with international renewable energy project developers.

Financing: Renewable energy systems are caracterised by high up-font costs, with low running costs. These high up-front capital cost of renewable energy products and projects and the lack of tailored financing mechanisms makes financing a barrier to renewable energy development. There is a need to demonstrate tailored financing mechanisms in order to remove this barrier and to make renewable energy financing a familiar and normal business activity for financial institutions and renewable energy firms.

5. Available EE and RE technologies

5.1. Energy Efficiency

The pursuit of efficiency in the use of energy (EE), usually in the form of Demand Side Management (DSM) is a high priority, when it comes to meeting increasing electricity demands, than RE, since EE measures can usually be taken immediately and often without major investment, especially at the end-user level. It is a widely known truth that the cheapest kWh is the one saved.

A country with a high growth rate in the demand for electricity has a great interest in reducing it, without loss of economic output, so as to minimise the cost of investment in new generating plant. Experience (e.g. in Jamaica) suggests that it would be cost-effective to undertake the effort involved in gathering data on the end use of energy, and planning and implementing DSM programmes. Any regional energy programmes should also aim, among other things, at providing governments with assistance in doing so.

On the level of domestic energy consumption of the rural population, energy efficient domestic appliances and improved biomass cook stoves gain increasing importance.

Agricultural, industrial and commercial sectors offer large energy saving potentials, e.g. electrical motors used in agricultural machinery, pumps etc are often inefficient or oversized.

5.2. Renewable Energy Technology

RET is particularly pertinent to developing countries, where climatic conditions, such as sunlight, and infrastructural arrangements favour its expanded use. Thus, some would argue that ACP Islands could leap-frog energy sources to a RET development path.

Wind, hydropower, biomass, solar, geothermal and ocean thermal energy conversion (OTEC), are the major renewable energy technologies relevant to the ACP Island Staes today. These are at various stages of development with wind, solar and others commercially available, while OTEC is largely at the R&D stage.
Fuel cell technology could also be important in the future but is not commercially available as yet.

Four energy technologies have been identified in this study as being of greatest interest to policy makers in the Caribbean. They are according to their potential impact on electricity generation in near future: wind energy, small hydropower systems (SHS), biomass (including bagasse, rice husks, and wood waste) and solar energy (photovoltaic (PV) systems for remote rural sites).
There are also important opportunities for the use of solar energy, in two forms, namely (i) Solar water heating systems (SWHS), (but these would generally be expected to be implemented as a part of DSM programmes; and (ii) solar crop drying; which, while belonging more to the agricultural than to the energy sector, nonetheless requires the same expertise, training and promotion as discussed with other technologies; and also seems to offer significant economic benefits.

The irony of the situation, however, is that while the more significant opportunities for utilising RET now lies heavily in the developing countries, it is the developed countries that have access to the technology and financial resources to utilise renewable energy sources. Few of the governments in the Caribbean region have developed policies to promote the use of RET, or have even assessed their renewable resources;

An important characteristic of RET is that there are high up-front investment costs because the fuel equivalent for the life cycle of the system is essentially purchased at one time. This characteristic, together with the usually large existing foreign debts and high prevailing rates of interest in developing countries, makes access to investment capital an essential requirement for the widespread use of RET systems. The multilateral lending agencies normally provide capital for large energy projects, and by extension, exercise the ability to influence electricity sector planning in developing countries. Hence, institutions such as the World Bank and the Inter-American Development Bank (IDB) are often identified as important implementing agencies for RET dispersion. The World Bank, in particular, provides approximately 70% of the capital for energy projects from multilateral lending sources, and so it plays a major role in determining the types of energy projects that will be developed.

6. Anexes

In annex 6.1, the *'Draft Working Document - Strategy for European Commission Support Involving Energy for Sustainable Development in ACP Countries'* has been attached as reference.

In annex 6.2, for those participants who wish to read more about the present status of available and future RE technologies, a special chapter with technical details are attached.

In annex 6.3, two case studies for the application of RET (Wind and Geothermal) are presented including their political, economical and environmental implications.

6.1. RE Technologies: the state of the art

6.1.1. Wind Energy

Windpower has come of age during this decade. If it fulfils its promise it could provide as much as 5 % of the world's electricity by the year 2040.
The largest installation of windpower on a Caribbean island is on Curacao, where a 3MW wind farm was installed by KODELA, the utility company in 1993. A new 9MW windfarm will be commissioned in mid 2000 and operated by private enterprise. Other wind turbines providing energy to the grid operate in Jamaica, Guadeloupe and Costa Rica. A number of Caribbean islands such as Barbados, Antigua and Montserrat have turbines that are not now functional.
In mid-1999 the installed wind power capacity worldwide (30 countries) was about 11,000 MW. By the beginning of 2000 the installed capacity should be approximately 12,500 MW. Between 1994 and 1999 the growth of installed wind power varied between 24 and 30% per annum. By year 2005 the total installed capacity could be around 33,000 MW.

The energy produced by a wind turbine is proportional to the swept area of the turbine and is also proportional to the cube of the wind speed. Wind energy is most cost effective when average wind speeds exceed 7.8 metres/second at a site.

There are a number of trends in the wind energy sector:

- Wind turbines have become larger with 750 kw machines being the norm today. Units with a capacity of 1.65 MW and a rotor diameter of 66 meters were installed in 1998. By November 1999, about 480 units of 1MW or more were installed worldwide. Machines as large as 3 MW are now being designed.

- Wind turbines now have fewer components and greater reliability. Examples to simplification of designs include passive yaw, passive blade pitch control, and slower running, direct drive generators.
- Wind turbine output has become more controllable and grid compatible. Variable speed systems with synchronous generators now integrate better in existing grid systems leading to potentially higher penetration even on weak grids.
- Wind energy has become more predictable leading to a higher value for the capacity credit given to windpower and thus a higher value due the electricity produced.

Energy generation costs of wind power is dictated by four major factors.
a) local average wind speed
b) energy output of the system
c) project turn-key cost
d) life span of the windfarm

Wind energy costs may be reduced to a level of around US$ 0.03/kWh. The next table shows the prices for which wind energy is now sold in Europe.

Summary of prices for Wind Energy in Europe, December 1999

Country	Price [USc/kWh]	Comments
Denmark	9.4	Fixed price of approximately 9.4 cents. Additional tax benefits are available. Lowish windspeeds 6 to 7.5 m/s.
England and Wales	4.5	Competitive tendering under NFFO scheme. Prices have reduced from 17 cents in the early 90's to circa 4.5 cents for 15 year contracts indexed to RPI. Moderate windspeeds circa 8 m/sec.
France	4.5 to 5.5	Competitive tendering under Eole 2005 scheme. Prices are circa 5.5 cents for 25 year contracts indexed to RPI (last 10 years is at lower price). Moderate windspeeds 8 to 8.5 m/s.
Germany	10.5	Fixed price of approx. 90% of consumer price which is circa 17 Pfennings for life of the plant. In some States, additional tax benefits are available. Low windspeeds 5 to 7 m/s.
Netherlands	7.5 to 8	Fixed premium buy back rate of 6 cents plus green electricity payment of 1.5 to 2 cents. Lowish windspeeds 6.5 to 7.5 m/s.
Northern Ireland	5.5	Competitive tendering under Northern Ireland NFFO Scheme. Prices have reduced from 8 cents in the early 90's to circa 5.5 cents for 15 year contracts indexed to RPI. Moderately high windspeeds 9 m/s.
Portugal	6	Fixed premium buy back of 11.8 Escudos for 12 year contract indexed to Portugese fuel prices. Moderate windspeeds.
Scotland	3.5	Competitive tendering under SRO scheme. Prices have reduced from 8 cents in the early 90's to circa 3.5 for 15 year contracts indexed to RPI. High windspeeds 9+ m/s.
Southern Ireland	4.5	Competitive tendering under AER scheme. Prices have reduced from circa 7 cents in the early 90's to circa 4.5 cents for 15 year contracts indexed to RPI. European Union grants were offered to help reduce costs in the latest round. Moderately high windspeeds 9 m/s.
Spain	6.8	By Royal Decree, a price linked to the consumer energy price which is currently 11 pesetas.
Switzerland	12.5	A small market for Green Energy exists with prices negotiated on a project basis – circa 12.5 cents. Lowish windspeeds 6 to 7.5 m/s.

Negative environmental impacts are limited to visual aesthetics, noise and some interference with electromagnetic signals. There is little or no impact on ground-based flora or fauna.

6.1.2. Hydropower

Worldwide, hydropower is the largest renewable source of electricity, contributing about 18% of the total world electricity production.
In the Caribbean, attractive hydropower potential exists mainly in Guyana, Suriname, Belize and, Jamaica with 24 MW hydropower capacity installed. In Jamaica, a large hydro potential site with about 50 MW is known and some run-of-the –river schemes sum up to 6 MW.

The type of hydropower installations can be classified in different ways:
- By the effective head of water whether low, medium or high heads.
- By the capacity, the rated output.
- By the type of turbine used.
- By the location and type (run-of river-scheme, dam or reservoir).

The specific cost for hydropower plants largely depend on size and location/site conditions and vary over a wide range from 1,000 to 5,000 US$/kW installed capacity.
Because hydropower schemes have high capital costs, they are sensitive to the high interest rate regime of recent years in Caribbean countries since much of the construction costs are met from local funds. Imported components are usually financed by regional or multilateral lending institutions. For this reason, it is paradoxical that on close analysis hydropower schemes look favourable in retrospect but uncertain in prospect. However, hydropower compares unfavourable with fuel consuming alternatives whose costs are more evenly spread over the life of the plant.
The technology for small and mini hydropower can be regarded as being mature and reliable. Potentials for cost reduction refer to new materials and the application of the latest electronic technology for the control and regulation of the plant. Other than in PV technology, hydropower turbines are locally be manufactured since many years with proven turbine designs available in the range of up to about 0.5 MW.

Hydropower does have some environmental impacts that can be grouped in three main headings:
- Hydrological effects such as water flows, ground water, water supply and irrigation needs.
- The ecological effects – on plants and animals as well as the land itself.
- The social costs on landowners and displaced persons.

There is still little agreement on how to translate environmental gains into the economic data that are used in comparing options. One issue of current pertinence is the costing of long term compensation for people displaced or their productivity adversely affected by new hydroelectric installations.

6.1.3. Biomass

Biomass may be defined as any organic substance other than oil, natural gas, and coal. Primarily plant matter, it accounts for about 15 per cent of world energy use and 38 per cent of energy use in developing countries.
Biomass, mainly in the form of agricultural and industrial waste, burned to fuel conventional steam turbines to produce electricity, has been in use for many years. Biomass is often regarded as “non-polluting” despite the large emission of carbon dioxide and other pollutants, because the amount of carbon dioxide emitted in the combustion process equals the amount absorbed from the atmosphere during the growth of plants and photosynthesis of atmospheric carbon dioxide.

Growing biomass for energy in an environmentally sensitive manner can provide a livelihood for farmers and pay for restoration of land. A common example of biomass conversion into electricity in some Caribbean countries, is the burning of bagasse, the left over residue of sugar cane, in a conventional steam boiler plant. Likewise, the residues of growing corn, rice and other field products provide a large mass of material suitable for electricity production. Ethanol from sugar cane can be used as an octane enhancer in gasolene.

Biomass electricity generating plants have tended to be small because of the dispersed nature of the feedstock. Also, many operating low-pressure boilers have low efficiencies in the range of 10-18 per cent taking into account losses from bagasse input to electricity output, although 50% is achievable using moist bagasse. As a result, biomass plants have relied on low or zero cost of the biomass fuel to be operated economically. With the advent of biomass-integrated gasifiers/gas turbines the unit cost of electricity production will decline in the future.

Biomass also has a problem of seasonality. A large quantity of biomass matter may be available in agricultural communities during the season following harvest, such as after the processing of sugar cane, but become scarce during the growing season. Adequate planning is required in order to effect a continuous supply of the biomass, to assure a steady output from the power plant.

Biomass for energy will not play a significant role in oil substitution in the short-term. Most developed countries have no immediate need, and consequently only long-term interest in developing certain biomass technologies. Even so, some developed countries, although with abundant fossil fuel reserves, have already embarked on vigorous biomass production for energy use. Caribbean countries lack the financial resources to expend on biomass development and thus most prioritize biomass projects by using rigid criteria such as the energy contribution potential, risk and pay-off time of each project. Assessment, development, and utilization of biomass resources should coexist with optimization of oil usage, and energy conservation. Integrated waste disposal/energy generating projects are of special interest. Positive benefits which obtain from solving environmental problems can offset some of the costs of energy generation from wastes.

In the Caribbean biomass sources include:
- agricultural by-products e.g., bagasse and sugar cane tops;
- agro-industrial waste, e.g., vinasse (dunder) from the sugar industry;
- municipal, domestic and animal waste, e.g., garbage, sewage, dung;
- aquatic biomass e.g., spirulina, water hyacinth;
- wood and woody materials, including wood chips from the lumber industry.

Fuel wood
Especially in the domestic energy sector an important energy source is fuelwood either in the form of charcoal or as fire wood for direct combustion.
Excessive and uncontrolled use of fuel wood however, causes de-forestation, erosion, lowering ground water level etc.
In many ACP Islands like in Dominica, Jamaica, Antigua, Solomon Islands and others countries fuel wood for charcoal production for domestic purposes like cooking - and to lesser extent the direct combustion of fire wood - was in the past and is still overexploited presenting substantial thread to the environment and sustainable development of these countries.

Fast Growing Trees
Wood remains a major source of fuel. In Jamaica about 3.6% of energy needs comes from fuelwood and charcoal. It can also be used for industrial energy. In Brazil for

example, the steel industry uses over two million tonnes of charcoal per year. The end result of the unmanaged use of wood as fuel is deforestation. A solution being strongly encouraged in Jamaica and other Caribbean countries is the planting of fast-growing trees suitable for coppicing. This technique which involves cutting the growth every few years and allowing the tree to sprout again is the subject of trials in some Caribbean counties such as Jamaica, Cuba and Costa Rica. An alternative is planting trees in high density and thinning later, a practice followed in Sweden. Sweden expects biomass to satisfy an important part of its energy and transportation fuel demands in the next two decades. Most of biomass energy use at present occurs in developing countries – burning wood and charcoal for cooking, and in some cases for heating. In the Caribbean biomass conversion systems have a role to play in reducing conventional energy demand and increasing energy supply.

Biogas

Animal dung (from cattle, chickens and pigs) and sewage are the resources for biogas. Mixed in a slurry of about 95% water they are fed into a specially built digester where digestion is allowed to take place for two to eight weeks. The bacterial action generates heat and the ideal process temperature is at least 35%C. A well-run digester can produce 200-400m^3 of biogas with a methane content of more than 50% for each dry tonne of input. This is about 65% of the fuel energy of the original dung. Even at lower conversion efficiencies the process may be worthwhile in order to obtain a clean fuel and dispose of wastes. The remaining effluent is also useful as a fertilizer.

Landfill Gas

Landfill gas will have potential as an energy source in Caribbean states when the quantity of municipal solid waste in landfill is adequate for commercial production. The conditions are neither as wet or warm in a landfill compared to a biogas digester, hence the anaerobic digestion is slower, taking many years rather than weeks. The landfill gas produced is a mixture primarily of CH_2 and CO_2. Theoretically, the yield of a good site over time is of the order of 150-300m^3 of gas per tonne of waste with between 50% and 60% by volume of methane. The landfill is usually lined with a layer of impermeable clay and covered with similar material after it is filled, producing an environment conducive to anaerobic digestion. The landfill gas is collected by a network of interconnected perforated pipes buried at depths of up to 20 metres in the solid waste. In planning new sites the pipe system is constructed before the solid waste is brought to the site. Landfill gas is increasingly used for power generation with most plants using the gas to drive internal combustion engines. However, gas turbines that have better efficiencies are now coming into use. Wood fuels may also be integrated into landfill systems allowing shared capital costs, increased security of supply and an increase in overall power output.

Agro-Industrial Waste

One important positive environmental impact could come from the anaerobic treatment of distillery wastewater (vinasse) from sugar and citrus-based facilities. With treatment the average BOD removals could be of the order of 90 per cent. This approach, where waste water can be subjected to anaerobic digestion, and converted to energy, not only solves an environmental waste disposal problem, but provides for the ancillary production of energy.

Bagasse

Bagasse (sugar cane residue) is an important biomass fuel in the Caribbean. Sugar factories in all Caribbean countries use bagasse as a heat source for raising steam; albeit they burn it inefficiently in order not to accumulate surplus wastes. Most Caribbean sugar factories also produce electricity from bagasse for their own needs, but only a few (Cuba and Puerto Rico) are able to export electricity because of contractual and operational difficulties in selling power only during the one-crop per year growing season. Studies

suggest that the “barbojo” (cane tops and leaves) could yield important amounts of electricity. About 5.7% of the electricity produced in Jamaica come from bagasse. This could be increased if the sugar cane industry had two crops per year. Among the problems in increasing the use of bagasse are:

- *Inadequate or irregular cane supply.*
- *Unreliable sugar mill operation caused by breakdowns, process bottlenecks and unstable steam pressure.*
- *Inadequate plant design such as –*
- *insufficient vapour bleeding;*
- *low system steam pressure;*
- *no heat recovery from boiler flue gases.*

Rice Husks

Rice husks, although they have a high silica (ash) content compared with other biomass fuels, have a uniform texture which lend them to gasification technologies. Rice husk gasifiers have been profitably operated in China and Indonesia:

6.1.4. Solar Energy

There are four major solar energy processes.

1. Photovoltaics involves the direct conversion of sunlight into electricity, through a modular arrangement of solar cells in flat plate or concentrators.
2. Low temperature solar thermal systems are used to heat water, air or other medium and is an important part of the Caribbean energy infrastructure.
3. High temperature solar thermal systems produce high-temperature heat that is then converted to electricity in a conventional cycle, through a concentrator system. There are no systems producing electricity by this method in the Caribbean.
4. Passive solar systems seek, by design, to reduce space cooling (heating) and lighting.

Photovoltaics (PV)

Photovoltaics are solar cell devices that absorb light and convert it into electricity through the use of semi-conducting materials. Sunlight has a maximum power of 1000 W/m^2, so solar cells must cover a large area in order to collect important amounts of power.

At the international level, the main field of PV application in the last decade was the basic electrification of mostly rural households with Solar Home Systems ranging from as small as 11 Wp up to several 100 Wp with prices from 200 to 1200 US$ and more. A SHS consists of the *Solar Generator* (SG) which is an array of one or two PV-panel(s) with the Battery Control Unit (BCU), and the *Balance of System* (BOS) which consists of the storage battery, the domestic installations like cables, clips, fixtures, switches, sockets etc. and DC applications like fluorescent lamp, radio, TV and any other small DC appliances.
Typical costs for grid connected systems are now ranging from 2 to 6 US$/Wp. Probably by 2015 system costs of about 1 US$/Wp will be possible. At those prices PV could become a viable alternative to fossil fuel based electricity generation. Only if, and when, PV comes into economic reach of the utility power market, will there be rapid growth.

In the meantime the value of PV in the Caribbean is primarily for security lighting, and for stand alone systems in areas far from the grid. PV has developed a market niche in telecommunications, signalling, leisure, water pumping and stand- alone rural electrification. In the Caribbean, stand-alone PV systems are a means towards social and economic development in remote parts of some countries like in the hinterlands of Guyana and Suriname.

Between 200,000 (WB 1995)[3] and 700,000 Solar Home Systems (SHS)[4] have been installed world-wide during the past two decades. Success stories have been reported particularly from Indonesia, Morocco, Kenya, and Mexico. The above numbers need some qualification, however. Firstly, the majority of the systems was installed under donor funded, often highly subsidised programmes; and secondly, reliable statistics on the number of systems in operation do not exist.
Nonetheless, the number of SHS installed world-wide is impressive, and will significantly increase if the large-scale donor assisted programmes currently under preparation, with several 10 thousand units gain momentum, and when they manage to create the market transformation they are intended to do.[5]
In the past decades PV technology has progressed significantly in terms of system efficiency and reliability, and also due to the increasing economics-of-scale in terms of the economic parameters. The availability of sophisticated PV components in the industrialised countries, on the one hand, and the apparently high number of SHS installed in rural areas, on the other, have led to the widespread public opinion of being a reliable and a readily available 'off-the-shelf-technology'.
This, however, does not always apply for the local production of PV- components in developing countries without imposing a strict quality control. Quite often local production does not meet internationally recognised technical standards, resulting in poor quality of the produced components, and thus potentially jeopardising Solar Home System (SHS) dissemination programmes. At the international level, standardised quality control, certification of quality PV products, etc. are just at the beginning.

Solar Water Heaters
The most direct application of solar energy is conversion of sunlight to heat. Solar water heaters for domestic and industrial use, such as hotels and hospitals, are the most frequent use of this technology in the Caribbean. SWH are cost effective in the high solar insulation of the Caribbean and have had significant penetration in countries such as Barbados and St. Lucia for example. In Barbados growth was driven by fiscal incentives.

Solar Cooling
The supply of solar heat and demand for cooling are in tandem, thus cooling with solar heat is an obvious application. Absorption cooling, adsorption cooling and desiccant cooling are the technologies applicable. However, the economics of these systems have been poor and they are not recommended applications for the Caribbean at this time.
Solar Cooking
There are two types of cookers; a simple box type and a parabolic concentrating type cooker. A household using a solar cooker can have a payback time on the equipment of 2-3 years. However, the large-scale use of solar cookers requires some adjustment and lifestyle adaptation on the part of the users. It will be difficult to bring solar cooking into the Caribbean household culture although there are important environmental benefits.

6.1.5. Geothermal Energy

Geothermal resources can be found in areas of high volcanic activity in many parts of the world. Geothermal resources may be categorized as hydrothermal, geopressured, hot dry rock and magma. Presently all commercial operations are based on hydrothermal

[3] World Bank (1995).

[4] Posorski, Fahlenbock (1998).

[5] Several larger SHS programmes are e.g. Indonesia 200,000, Philippines 10,000, Morocco 25,000, Argentina 65,000

systems where wells are about 2,000 metres deep with reservoir temperatures of 180^{o} – 270^{o}C. Geothermal resources are utilized for power production in Guadeloupe and many Caribbean islands such as St. Lucia, Dominica, and Montserrat have potential. However, a major drawback to the development of geothermal resources is capital. Enterprizes in developing countries are usually not large or diversified enough to assume the investment risks associated with geothermal exploration. Thus financial and technical assistance is crucial to enabling countries to exploit their geothermal potential.

For geothermal resources to be productive there are three physical requirements – an aquifer containing geothermal water that can be reached by drilling; a cap rock to retain the geothermal heaters; and a heat source.

The geothermal resources may be developed by dry steam power plants, single flash steam power plants, binary cycle power plants and double flash power plants.

Dry steam plants are the simplest, the most commercially attractive and the best known. The Larderello geothermal field in Italy and the Geysers in the USA are long standing dry steam developments. Falling fluid pressures have led to a reinjection policy at the Geysers to make the resource more sustainable.

In a single flash steam power plant the geothermal water used at surface may be wet steam, hot water at high pressure, or water that has flashed within the wall while moving to the surface. Flashing is often best avoided as dissolved minerals may cause a build-up of scale deposits. A conventional turbine is the heart of the plant. Reinjection wells must be available for fluid disposal of the unflashed brine.

In a binary cycle power plant a secondary working fluid such as butane is used. Such fluids have a lower boiling point than water and are vapourised and used to drive a turbine. This allows low-temperature resources to be used and thus is most applicable to Caribbean geothermal resources. Also, chemically impure fluids can be utilized if they are kept under pressure so that no flashing takes place. Higher efficiencies have been produced than in low-temperature steam flash plants but capital costs are high. Keeping the geothermal fluid under pressure and repressuring the secondary fluid consumes nearly 30% of the total power output of the system. Further, large volumes of geothermal fluids and large pumps are involved.

The double flash power plant is an attempt to improve flashing methods and is an alternative to high cost binary plants. Double flash can only be used where geothermal fluids have little impurities so that scaling and non-condensate gas problems are minimized. The procedure is that unflashed liquid remaining after the initial high pressure flashing flows to a low-pressure tank where another drop in pressure provides more steam. This steam is mixed with the exhaust from the high pressure turbine to drive another turbine or stage of the same turbine. Again large volumes of fluid are needed, perhaps ten times more than for similar-sized dry steam plants. Variants on the binary and double flash systems are the main subject of present geothermal research.

6.1.6. OTEC

Ocean Thermal Energy Conversion (OTEC) is a relatively new solar thermal technology which is currently being tested for commercial use as a renewable energy source. The OTEC energy generation system is dependent on the temperature difference that exists between warm surface waters and cold deep ocean waters. A temperature difference of at least 20^{o}C is a prerequisite for a viable OTEC operation. This condition is likely to be more available in tropical and sub-tropical seas.

In the tropics there is a significant temperature difference between surface and deep water, the latter also being rich in nutrients such as nitrates and phosphates. If the warm and cold water (20^{o}C difference) are brought together, a turbine can be operated to generate electricity by OTEC. There are two methods of generating such energy. The "closed cycle" system uses a working fluid, such as ammonia or freon, which is evaporated in a heat exchanger through which warm water passes. Vapour is produced at pressure and this is used to drive a turbine which generates electricity. The exhaust vapour from the turbine is condensed back into liquid in a heat exchanger through which cold water passes.

"Open Cycle" OTEC uses sea water as the working fluid, the sea water being flash evaporated under a partial vacuum. The low-pressure steam is passed through an extremely large turbine which produces energy. Spent vapour is cooled in a condenser and because the condensate is not returned directly to an evaporator it is called open-cycle. Powerful vacuum pumps not only maintain the vacuum required to make the warm sea water flash evaporate but remove much of the large quantities of gases dissolved in the sea water. Desalinized water is a by-product of closed-cycle OTEC whereas aquaculture and air-conditioning are ancillary products of both closed-cycle and open-cycle OTEC, both of which utilize cold deep water.

One of the key components of an OTEC system is a continuous supply of cold sea water pumped up from ocean depths. These deep ocean waters not only have low temperatures, but are also rich in nutrients and are more or less sterile. However, the installation of a cold water pipeline to pump up the cold water represents a significant technical challenge, and, depending upon the coastal underwater topography, length and diameter of piping required, flow rates and pumping power needed, it can become the most expensive component of any OTEC system.

There are some technical problems in laying the pipeline and there are also high costs in servicing and maintaining the pipeline over time. The pipe should be made from polyethylene and be relatively light.

A number of Caribbean islands have the bathymetric conditions suitable for OTEC technology – Andros Island, Antigua, Aruba, Bahamas, Cayman, Cuba, Curacao, Dominica, Grenada, Guadeloupe, Jamaica, Martinique, Montserrat, St. Lucia, Turks and Caicos Islands, U.S. Virgin Islands, amongst others. A 5MW OTEC plant will require approximately 4-5 hectares of land area and 150 metres of ocean frontage.

<u>Present problems and constraints on OTEC may be summarized as:</u>

- Investors and governments are conservative in approach and often unwilling to invest in technology that has no proven track record. Everyone seems to be waiting for the first plant to be successfully demonstrated but are not willing to do so themselves.
- OTEC has a high capital cost, particularly in the large turbines, heat exchangers and pipes. However, these costs are rapidly being engineered downwards, and will further improve as OTEC technology expands.
- OTEC does have competition from other conventional energy forms which are lower in cost at present. This cost differential will be reduced as fossil fuel prices increase and OTEC costs decrease. At the same time it is competing with other renewable energy sources (such as wind) which are more cost effective. OTEC has a specific market niche (tropical islands lacking fresh water) in which it will become economically feasible.
- OTEC has geographic limitations because near shore sites require an appropriate slope of the ocean floor and a temperature difference of 20^{o}C to be operationally effective. Floating systems offshore will enhance OTEC's versatility.

6.2. Case studies from the Caribbean[6]

6.2.1. Case study I: The Potential for Wind Energy Systems

Introduction

The north-east trade winds provide a relatively stable wind regime in the Caribbean, which has been utilised in the recent past as a source of power for grinding sugar cane and for pumping water for irrigation. The advent of steam-driven mills caused the use of wind-mills for grinding cane to come to an end in the first part of this century, and the submersible electric pump has had a similar effect on wind pumps.

The oil price crisis of the early 1970s, resulting from Middle East tensions, caused the USA and other industrial countries to undertake research into renewable forms of energy, and wind power began to be looked at seriously in the United States starting in 1973. Much of the pioneering work was undertaken by the National Aeronautics and Space Administration, which focused its attention on intermediate to large-size horizontal-axis machines, and Sandia Laboratories, the latter concentrating on vertical-axis machines of the Darrieus type. In Canada, the National Research Council put a considerable theoretical and practical effort into the Darrieus design.

Major Climatic Features of the Caribbean

The islands of the Caribbean lie in the tropical west Atlantic Ocean and the Caribbean Sea between 10-20 degrees north latitude and 58-70 degrees west longitude. The climate of these islands, insofar as the wind energy potential is concerned, is dominated by the northeast Trade Winds. They are controlled largely by the pressure gradient across the region, created by the location and intensity of the sub-tropical anticyclone (or region of high pressure) located between Bermuda and the Azores Islands in the North Atlantic. The Trade Winds are a persistent feature of the region. Wind speeds are greatest in the eastern Caribbean from about 12-18 degrees north latitude and along the north coast of South America from 11-13 degrees north latitude. Wind speeds, on the average, tend to be lower in the western Caribbean and in the areas northwest of Hispaniola.

The Trade Winds blow throughout the year, disturbed only at intervals during the summer by the passage of westward moving tropical disturbances and in winter by eastward moving Atlantic depressions and cold fronts. As a direct result of this, exposed areas of the smaller islands and coastal regions of the larger land masses have a very low incidence of meteorologically calm conditions.

Owing to the Trade Wind regime, there is not a great deal of variation in wind direction. During the months of December through June, the wind blows almost exclusively from directions in the sector between northeast and southeast. This period corresponds with the period of highest mean wind speeds and with the onset of the "dry" season. During the months of July through November, there is a more pronounced shift to southeasterly winds with the occasional wind from the south and southwest. These latter directions are mainly associated with tropical disturbances passing close to a given station or with local sea breeze effects, due to heating of

the land mass, particularly when the Trades are relatively weak.

Sites in these islands tend to have a distinct diurnal variation in wind speed which is subject to little, if any, seasonal variation. The pattern of diurnal variation in wind speed is

[6]Source:
Projekt-Consult GmbH: Caribbean Renewable Energy Development Project (CREDP), Final Report elaborated on behalf of CEIS/ UNDP, March 2000

strongly dependent on the distance of the particular site from the windward coast; in other words, on the overland distance which the wind must travel to reach the site. In general, sites on the extreme windward coasts of the smaller islands tend to exhibit a diurnal variation which is more typical of an oceanic regime, although the overall degree of variation is fairly small. Inland sites, however, are strongly affected by momentum redistribution due to heating and frictional effects, and show a wind speed maximum near to the time of maximum daytime heating, with lower wind speeds at night. In some of the larger islands, particularly in the western Caribbean where the Trades are weaker, sea breeze effects dominate the site wind regime.

Extreme wind speeds in this region are associated almost exclusively with hurricanes, although some strong winds have been reported in thunderstorms. In general, some 20-50 thunderstorm days can be expected to occur in a given year, mostly in the hurricane season months of June through November. On average, some 8-12 named storms (i.e. with sustained wind speeds in excess of 20 m/s) can be expected each year. In general, maximum sustained winds in the range 40-60 m/s are associated with hurricanes passing over islands in the region. Extreme gusts of 70-90 m/s have been reported in some severe storms, but fortunately, such occurrences are very rare and the typical 25-year extreme gust is 50-60 m/s.

The islands are located in a tropical ocean, the temperature of which varies very little from a mean of 26-27 degrees Celsius. Combined with the fact that the variation in solar heating is also relatively small, this means that the air temperature is also relatively constant, without the extremes of heat or cold which are features of continental climates. Maximum temperatures rarely rise above 34 degrees Celsius in summer, while night-time minima rarely go below 15 degrees Celsius in winter. Broadly speaking, the year may be divided into a dry season from January through May, and a wet season during the remainder of the year. The exact timing of the seasons is a function of latitude and inter-annual rainfall amounts vary widely throughout the region. Relative humidity is lowest in the dry season with a mean of 65-70%, and highest in the wet season, with a mean of 75-80%. Pressure variation typically shows a single cycle seasonal variation with higher mean pressures in the first half of the year. Mean sea level air density varies from 1.178 to 1.183 kg/m^3.

A feature of the Caribbean climate is that the wind blows hardest in the dry season, which is also the tourist season, falling off somewhat in the wet season. In those countries with hydroelectric resources, which are all run-of-river, wind and hydro generation would complement each other, with the potential to result in a relatively stable output of power from renewable sources during the course of a year.

Resource Assessments

Formal attempts to harness wind power to the production of electricity in the Caribbean began with a wind energy resource assessment in Barbados and six other islands of the Eastern

Caribbean. The project was financed by the Caribbean Development Bank (CDB), using funds provided by the United States Agency for International Development (USAID) for the Caribbean Alternative Energy Project. This study showed that while the sea-level trade winds were generally not strong enough to justify utility scale generation at the prices then prevailing for plant and fuel oil, there were many sites on ridges and in mountain passes where such investments would be fully justified. This work was recently augmented by the Organisation of Eastern Caribbean States, which extended the study to the remaining countries of the Eastern Caribbean, using funds provided by the British Development Division in the Caribbean. All the English-speaking countries of the Eastern Caribbean have now been surveyed, and it is clear that wind power is both economic and feasible in every island.

To prove the point, two demonstration projects were initiated under the USAID/CDB funding. One was the installation of a 120 kW vertical axis wind turbine in Antigua, and the other, originally intended for Barbados, resulted in the installation of an 85 kW horizontal-axis machine in Montserrat. Subsequent to these, demonstration projects were implemented in Barbados, Curaçao and Grand Turk. These resulted in a 3.0 MW wind farm in Curaçao and a small wind farm of 215 kW maximum rating in Montserrat. There were also plans for construction of a wind farm in Grand Turk, but these were shelved due to a decline in demand for electricity occasioned by economic hardship. However, these projects have confirmed that wind power is an important energy source for use in the Caribbean.

Curacao is pleased with the operation of the wind farm at Terra Kòrá and is understood to be planning an increase in its capacity to about 15 MW. The designers of the original project had the foresight to install infrastructure capable of supporting 25 MW. The Antigua demonstration wind turbine served only to demonstrate the maintenance inadequacies of the local utility, but the Montserrat wind farm survived until it was destroyed by the eruption on the volcano in the south of the island. In Barbados, meanwhile, a 9 MW wind farm is being promoted, while in Jamaica a 20 MW farm is under consideration for the Manchester plateau.

The Potential Market

The assessments reported above have made it clear that wind power has a very considerable potential to provide electric power in the Caribbean. The Caribbean is currently estimated to be producing 3,187 GWh annually (this excludes Jamaica, Curaçoa, Haiti, Republica Dominicana and Trinidad and Tobago), or an average of 363 MWh every hour. This represents a peak in the neighbourhood of 550 MW. If we assume that the penetration of wind power can be 20 percent of this figure, the market is 110 MW in the Eastern Caribbean alone.

The fact that the present penetration is minuscule means that potential users are not aware of the benefits of the technology. There are also problems to be overcome in promoting the use of the technology, and these are reviewed below.

Environmental Impact of Wind Turbines

Up to the time of writing no significant environmental problems have emerged in the application of wind power in the Caribbean. Due to the small sizes of most of the island states and to their
dependence on tourism, it had been expected that environmental issues such as noise or visual intrusion might emerge as areas of concern. However, there have been no significant negative comments on either count, though this may be due to the small number of machines deployed, as well as to care having been taken in the choice of sites to minimise the possibility of complaints arising from either source.

Environmental effects are not always negative. For example, in a report entitled "Environmental Impacts of Renewable Energy", the 24-country Organisation for Economic Cooperation and Development (OECD) concluded that although the use of wind turbines and other renewable energy technologies could be constrained by environmental considerations, their large scale use, especially in the medium and longer term, is both "necessary and environmentally desirable". This is a powerful statement.

The OECD report follows considerable investigation into the effects of renewable energies on the environment. It concluded that renewables produce far fewer environmental hazards than their fossil fuel and nuclear counterparts. Specifically, the report points out that "contrarily to fossil fuels or nuclear energy which may imply long-term and planet-wide

impacts (acid precipitations, carbon dioxide and other greenhouse gases, radio-active elements, etc) renewables generally imply more localised and shorter-term effects". The reduction of undesirable environmental effects is clearly a social benefit of considerable significance, as much to Caribbean states as to the wider world.

One of the important environmental effects of the use of wind power in the Caribbean is the benign effect of wind turbines on the physical environment, and their potential contribution to reduction of global greenhouse gas emissions.

Social Impact of Wind Turbines

Social well-being is generally recognised as being strongly linked to energy consumption, the per capita usage of energy being highest in the more developed nations and lowest in the least developed. An examination of per capita energy consumption in the islands of the Eastern Caribbean shows that this is also the case in the Caribbean.

The islands in which there is a significant industrial base as well as an active tourism sector have the highest per capita incomes and the highest per capita energy consumptions. The highest per capita energy consumptions are found in the French/Dutch island of St.Martin/Sint Maarten and the British Virgin Islands, which are very heavily dependent on tourism. In fact, throughout the Caribbean, the existence of tourism as a major component of the economic life of any island is reflected in a higher per capita consumption of energy than in comparable islands with lower tourist traffic, other things being equal.

It may thus be concluded that not only is energy consumption an indicator of economic development, but that tourism, on which so much of the economic well-being of the region depends, requires for its full development a heavy commitment to provision of electricity. Wind power, with its low environmental impact and independence of fossil fuels, is particularly well adapted to meeting the region's needs for cheap power over the long term.

The most profound effect of wind power on Caribbean communities would be the economic benefit of a moderately-priced source of power that was independent of oil and its fluctuations in price.

Economic Problems affecting the Use of Wind Power

The use of wind to generate electricity would be a significant economic benefit to the region. Except for Trinidad and Tobago and Barbados, none of the islands in the Caribbean archipelago have indigenous sources of petroleum, and replacement of fossil fuel generation by generation from a renewable source like wind or water power would protect their economies from surges in electric power prices occasioned by upward changes in the world price for oil.

Of the Caribbean Islands with hydroelectric potential, namely Jamaica, Dominica, St.Vincent and Grenada, the first three are already actively exploiting the resource.[7] Grenada, which has numerous small streams, may soon begin a program of hydropower development. Hydropower is regarded as a mature and proven technology, even though the capital costs for its exploitation are relatively high in this part of the world, so there is no difficulty attracting funds for resource assessments or project implementation. By contrast, wind power is better known for its problems and deficiencies than for its successes, and in the conservative, risk-averse Caribbean investment climate, utilities are generally reluctant to invest in wind power.

[7] Beside these islands, the CEIS countries Guyana, Suriname and Belize also have vast hydropower potential partly untapped.

Numerous economic analyses comparing power produced from the wind with power produced from conventional diesel plant have shown that the economic viability of wind power is critically dependent on three factors, the site wind speed, the installed cost of the turbine and the price paid by the respective utility for fuel oil. High site wind speeds, low machine costs and high fuel oil prices favour investments in wind power, while low site wind speeds, high machine costs and low fuel oil prices tend in the opposite direction. As a consequence, given satisfactory wind resource and machine prices, the climate for investment in wind power, or any other renewable energy source, is strongly influenced by the world crude oil price, on which fuel oil prices ultimately depend.

Crude oil prices rose to a high of about $35 per barrel in 1985-86, and then plummeted to a low of $10-11 in the latter part of 1986. The trend since then has been for prices to rise slowly, though there have been considerable excursions from the trend due to international events. Crude oil prices are likely to remain in the range $18-22 per barrel in the very near future, even if they exhibit some volatility. Even at this level, however, wind power is competitive with conventional plant in most Caribbean islands, and a rise in oil prices would only make it more so.

Economic Policy Issues

There has been consistent failure on the part of Caribbean decision-makers to consider the alternative value of money spent on fuel if it were to be spent on other materials of higher social value than fuel oil, i.e to attribute shadow prices to fuel oil purchases that are higher than the nominal prices. It is quite clear that better uses could be found for relatively scarce foreign exchange than using it to provide fuel for electric power production if there are available other means of generating power, the expenses of which can be met largely from local currency sources. This is true, not only of evaluations of wind power projects, but also of hydropower projects, which, as noted above, are rather more expensive in the Caribbean than in other parts of the world. As a consequence, the economic benefits of using the renewable energies are not brought out as forcefully as they should be.

Occasionally the opportunity presents itself to point out that oil is implicitly under-priced to utilities. The electricity tariff structure in a certain Caribbean island remained unchanged even though the price of oil has dropped in recent years. In this case, the utility's fuel cost per kilowatt-hour fell from US$0.10 to US$0.05 without any adjustment in the tariffs, implying, of course, that the value to the island community of the fuel used to produce a kilowatt-hour is at least twice what it was at the time. If this argument was to be used in the evaluation of wind and other alternative energy projects, they would appear a lot more attractive to the various island governments.

Other Policy Issues

A major difficulty preventing the more wide-spread use of wind power in the region is the position taken by Caribbean utilities on the question of the price they are willing to pay for a kilowatt-hour of power produced by a source outside the utility system - the so-called "buy-back" price. There is general agreement among the utilities that the avoided cost of the fuel that would otherwise be used to generate this extra kilowatt-hour is the price that they are willing to pay or credit to wind power. However, it is not at all clear that the avoided cost of fuel represents an equitable price for electricity produced from outside sources, since there are other credits that should be considered in arriving at the buy-back price.

This is in sharp contrast to the situation in the United States. In response to the 1973 oil crisis, federal and state tax credits were established to promote alternative energy sources, including wind power, and in 1978 the Public Utilities Regulatory Policies Act

(PURPA) was enacted. PURPA established that small power producers would be exempt from state and federal regulation and would be assured of the following.

1. *Mandatory interconnection. PURPA requires that utilities physically connect small power producers to the utility system but obligates the producers to pay interconnection costs;*
2. *Mandatory purchase. PURPA guarantees small power producers a market for their energy;*
3. *Mandatory rates. In general, PURPA is designed to strengthen the bargaining power of small power producers vis-a-vis the utility. PURPA mandates that utilities generally must purchase electric energy and capacity at rates related to their "avoided cost" or basically their marginal cost of producing power. At the same time, PURPA prohibits ratepayers from subsidising inferior or inefficient sources of energy.*

The franchises under which utilities operate in the Caribbean specify that the utility is the only entity allowed to produce electricity for sale to the public. This precludes the establishment of wind farms, which are so popular elsewhere, except by special arrangement with the respective island utilities, which in every case, save that of Barbados, where the utility is privately owned, also means with the express permission of the island government. Effectively, this means a utility can block a private sector investment in wind power, if not by mere opposition, then by specifying an unrealistic buy-back price.

At present, Caribbean utilities are not paying the full costs of generation. No account is taken of the damage to the environment caused by using cheap, sulphur-containing residual oil, or to the global environment by emitting carbon dioxide. If Caribbean utilities were taxed on the basis of carbon or other emissions, so as to reflect the injury they cause to the environment, they would have no option but to use wind power, or hydroelectric power where available, as a means of reducing the taxes they would otherwise have to pay.

Altogether, the policy area is one in which much work has to be done to provide a climate that encourages use of wind power and other renewables in the Caribbean.

Financial Aspects

It should be apparent from the foregoing that the economic analyses of wind power investments in the Caribbean have, to date, been little more than national financial analyses, since shadow pricing of fuel has not been considered, nor has the full range of economic benefits to the utilities and countries concerned been taken into account.

Machine prices are dropping, and more efficient blade aerofoils are in use. In a good wind regime, where the average annual wind speed is 8.0 metres per second, today's machines can produce power for 6 to 6.5 cents of the US dollar per kilowatt-hour, assuming that financing is available at about 10 percent. Current fuel oil prices are such that the fuel cost per kilowatt-hour is typically 5 to 9 US cents in most Caribbean islands, so unless the utilities are willing to recognise their real generation costs the immediate prospects for wind power as a utility investment are not as attractive as they might be. However, this has not prevented some investments from taking place, because there are places in the Caribbean where the local cost of fuel oil is somewhat higher than the norm, due to transport difficulties. Also, not all utilities are insensitive to the fact that oil prices will almost certainly rise in the medium to long term, and these utilities are exploring the economics of wind power as an alternative for the future.

Utility rates in the Caribbean tend to be high, due to relatively high costs for transmission, distribution and overheads. Most utilities have a tariff based on a fixed charge for

operating and maintaining their respective systems, with the addition of a fuel surcharge which varies with the price paid for fuel oil. The fuel surcharge is meant to show the excess cost of fuel over the pre-1973 price as a separate item on the consumer's bill, the idea being that when the price of oil
crises, consumers would be able to see the amount of the charge due to such increases. In this way the oil-producing countries would be seen as the villains of the piece, and the utilities would not be accused of making windfall profits.

The existence of high prices for electricity presents private industry with something of an opportunity. A business that is a large user of electricity, as well as being reasonably well situated with respect to the wind, can install a wind turbine on its premises and generate much useful power. In such a case, the savings are not just fuel, but the entire cost of electricity at utility tariff prices. As these are high, the economics of small-scale generation, for example, to supply a factory or for water pumping, are very favourable. Unfortunately, much of Caribbean industry is on the leeward coasts of the islands, where the wind regimes are not always sufficiently strong to justify such an investment.

Conclusion

The Caribbean is a large potential market for wind energy systems. However, in order to gain access to this market, the vendors of equipment and/or services will have to embark on innovative and educational marketing efforts designed to sell the region's utility engineers on the benefits of wind power.

In this, they must be aided by the regional governments. Policies must be put in place to encourage and expedite the use of wind and other renewables in the electric power sector. Much needs to be done by regional governments to establish a suitable framework in which the renewables can contribute to the satisfaction of overall energy demand. Ministers responsible for energy must make the required policy decisions, and then make sure that they are carried out. Leaving matters in the hands of utility engineers is not the way to go, as current experience clearly demonstrates.

Example for current Wind Project: 20 MW Wind Farm at Wigton, Manchester, Jamaica

The Petroleum Corporation of Jamaica (PCJ), in joint venture with Renewable Energy Systems Limited (RES) of the UK, proposes to develop a wind farm at Wigton in Manchester, central Jamaica, to provide clean energy to the Jamaica Public Service Company Limited (JPS).

Work started on the project in 1995 and the first wind mast for anenometry was erected at Wigton in January, 1996. The lands at Wigton are owned by the alumina companies and the site chosen for mounting wind turbines are compatible with future mining activities.

The wind farm is expected to have a capacity of approximately 20 MW, comprising approximately 27 turbines, each machine having a capacity of 750 kW. Turbines have been identified on the basis of commercial terms offered by a short list of manufacturers combined with an assessment of the technical suitability of the machines for the prevailing conditions in Jamaica and at the site. Present expectations are that the supplier will be NEG Micon, using a
NM 750/48 machine built in Holland. This will enable some funding support from the Netherlands Miliev program. The turbines will generate power at 690V, which will be transformed to 20 or 24 kV at the base of each turbine. Cabling between the turbines will be underground leading to a substation on the site, housing the necessary metering, switch gear and protection equipment, and where the output will be transformed to 69kV for connection to the grid.

Wind speeds at the site are approximately 8.2 metres/second. The plant will have a design life of more than 20 years. A capacity credit needs to be given for a firm capacity of 7 MW.
A price of about 5.9 cents US/kWh is needed to make the project viable. However, JPS is not willing to give more than 5 cents/kWh. Thus a subsidy is being considered. If this happens then Jamaica would be the first Caribbean country where consumers would pay slightly more for "green" energy.

6.2.2. Case study II: The Potential for Geothermal Energy

The following case study is based on a paper by: [Huttrer, (02/2000)]

Introduction
The northern islands of the Lesser Antilles are all potential sites of geothermal resources because virtually all of the islands are underlain by active or dormant (but not extinct) volcanoes. The 11 islands falling into this category are, from north to south, Saba, St. Eustatius (Statia), St. Christopher (St. Kitts), Nevis, Montserrat, Guadeloupe, Dominica, Martinique, St. Lucia, St. Vincent and Grenada (Figure 1).

The islands comprise two eastward convex arcs. South of Montserrat, these arcs merge to form a single curvilinear island chain that intersects the South American continent at the Peninsula de Paria of Venezuela. The western island arc and its southern extension are of relatively recent volcanic origin. The northern and eastern islands, though once loci of volcanism, are now mantled by thick sedimentary deposits.

The reason for the active volcanism is that the Caribbean islands occupy a crustal plate that forms a "tongue" or buttress along the sides of which the North and South American Plates move westward and beneath which the Atlantic Plate is subducting westward (Figure 2). The Atlantic Plate subduction has created volcanic arcs typical of plate boundaries and, in the Caribbean, each volcano or group of volcanoes has formed the foundation of a discrete island.

Geothermal Power Generation Opportunities
The potential for construction of small to medium sized (5-25 MW) geothermal power generation facilities and/or significant direct-use projects is excellent in many Caribbean islands. The countries are still developing, their transmission and distribution grids are extensive and their power and thermal energy requirements are growing. Excluding the French islands, the largest electrical loads are on St. Vincent, St. Lucia and Dominica where 10-20 MW is or will soon be needed. Next in size is Grenada where 8-12 MW could be used and finally come all the rest of the islands whose current needs range from 2 to 5 MW.
In virtually all of the islands, generation (predominantly diesel-fueled, with some hydro), transmission and distribution costs (including all soft costs) range between $0.12 and $0.15 per Kwh. It is important to note that while few of the utility companies have an accurate accounting of their real costs, it seems very likely that geothermally generated power could be provided for a lower cost than the utilities now pay in-house. In many countries, O&M-caused brownouts or power outages are all too common and are reportedly on the increase.

Careful, realistic calculations of planned geothermal project economics and of current true power costs must be made. Assuming that they confirm the economic viability of a planned project, they will be critically important in convincing governments and utility

officials that geothermal power will be less expensive and more reliable than their traditional generating systems.

Caribbean Geothermal Power Project Pros and Cons

The conditions favoring small geothermal power developments in the Lesser Antilles include:

- *Good to excellent chances for discovery of economically viable geothermal resources.A generally positive attitude by all of the national governments toward the exploitation of their indigenous resources.*
- *A growing realization that power generation by entities other than the government can be simultaneously beneficial to the host nation and to independent power producers.*
- *Increasing impatience on the part of citizens and government officials, on all the islands, towards long standing, excessive O&M problems with diesel generator sets.*
- *Power demand growth of 7-10% per year in most countries. This may actually accelerate because all of the nations are seeking to increase their revenues by attracting tourists. More tourists will require more hotels and more air conditioned hotels will require more power.*
- *The high cost of power generation on most islands that almost certainly could be decreased with the addition of geothermally generated electricity.*
- *The pressing need for fresh water on all the islands except Dominica and St. Lucia. If more economical electricity were to become available on the dry islands, large reverse osmosis installations could be built and operated to alleviate periodic water shortages, rationing and the need to depend on rainfall collection in cisterns.*

Some negative aspects or obstacles regarding initiation of Caribbean small geothermal power project are:

- *The difficulty in financing small (<$50 million) projects.*
- *The relatively low rate of return likely on small Caribbean geothermal power projects and the associated need to minimize exploration expenditures which unavoidably will increase the risk level perceived by potential investors.*
- *The speckled history of fiscal management on the part of the governments of several of these islands and their consequent low international credit ratings.*
- *The marginal solvency of many of the national utility companies and the inability or unwillingness of the national governments to guarantee payments by their utilities for power purchased.*
- *The common occurrence of destructive hurricanes in the region and the recent experiences with damage due to the volcanic eruptions on Montserrat.*

Exploration/Development Status Summaries

Some prefeasibility and reconnaissance exploration has been conducted since 1995, but the only exploratory drilling and power plant construction in the region was done in prior years (1979-1986). The scope of these activities is summarized below.

Prefeasibility studies - The author, with assistance from Dr. D. E. Michels and J. Renner, conducted prefeasibility studies on St. Vincent, Saba, St. Eustatius (Statia), St. Christopher (Kitts) and Nevis since 1995. In all cases, the work included reviews of geothermally-relevant literature, acquisition and stereoscopic analysis of airphotos, reconnaissance (confirmatory) geologic mapping, petrographic studies of fresh and altered rock samples, geochemistry of thermal and non-thermal waters and collection of large amounts of non-resource related information. The latter included data regarding electric power, environmental topics, permitting, government philosophies about use of indigenous resources, locally available labor, facilities, supplies and costs and logistical/construction matters.

Reconnaissance - Second stage work is herein defined to include some or all of: detailed geologic mapping, comprehensive water and/or gas geochemistry, electrical surveys (resistivity, S-P, CSAMT, MT etc.), gravity or magnetic surveys, soil mercury, radioactivity or CO_2 and shallow (thermal gradient or slim-hole) drilling. It has been done, *prior to 1995*, on Dominica, Guadeloupe and Martinique by the French, on St. Lucia by the English, Los Alamos National Laboratories and Aquater of Italy and on Montserrat by British, Italian and US entities. On St. Vincent, in 1996 and 1997, a US company undertook some second stage studies including geochemistry, geology and electrical geophysical surveys. These studies have resulted in advanced characterization of the chemistry, temperature and depth of resources on St. Vincent and the signing of documents needed to allow geothermal drilling and development in the future

Deep Exploratory Drilling - Following reconnaissance studies performed in the 1970's and 1980's, this expensive work has been undertaken to date only on Guadeloupe by CFG and BRGM and on St. Lucia where 2 wells were drilled by a multilaterally-funded team led by Italian geothermists. The first St. Lucia well found heat but low permeability however second well, spudded in 1987, discovered what appeared to be an economically exploitable resource. Unfortunately, this well suffered mechanical failures and the produced steam was never harnessed to generate power. There has been no deep drilling in the Caribbean since the completion of this well in 1988.

Development - The drilling of successful deep wells on Guadeloupe in 1969-1970 led to the building of a 4.2 MW double flash power plant in 1984. This plant has had intermittent problems caused by relatively high amounts of non-condensable gasses and associated H_2SO_4, but these seem to have been mitigated by CFG and the plant is now in operation. There is excellent potential for expansion of this development, and plans to have 20 MW on line by 2003 have been reported.

Work Needed to Site Deep Wells

On more of the islands where strong geothermal indicia have been mapped via pre-feasibility studies, second stage reconnaissance work as defined above should be conducted. The extent and precise type of the geophysical work will be dictated by logistical considerations and the nature of the preliminary geothermal system model. Thermal gradient drilling should comprise no less than five 300 meter holes sited in accordance with the results of preceding surveys.

Once thermal gradient drilling results are available, decisions will have to be made whether to drill one or more slim holes or to drill a full scale exploratory well(s). A discussion of the factors to be considered when making these decisions is beyond the scope of this paper but it is estimated that pre-production well drilling costs will approximate $1.5 million.

Geothermal Resource Indicia and Status Summaries

Presented below, in descending order of development potential, are brief descriptions of geothermal indicia development status' on each of the 11 volcanic islands:

Guadeloupe - The volcano La Soufrière on Basseterre has large fumerolic areas and there are thermal springs on the mountain flanks. Plans are to expand the 4.2 MW currently generated at La Bouillante to 20 MW by 2003.

St. Lucia - Geothermal indicia on St. Lucia comprise a very large solfatara near the village of Soufrière, thermal springs nearby and very recent volcanic activity including both phreatic and pyroclastic eruptions. There is sporadic talk of resumption of the project undertaken in the 1980's, but nothing concrete has developed to date.

Dominica - The likely presence of geothermal resources beneath Dominica is suggested by a boiling lake, numerous boiling hot springs, several large solfataras and very recent (<500 YBP) volcanic activity. There are at least three geothermal centers. In 1995, an American company entered into agreements with the utility and the government to develop the resource at Soufriére but to date no action has resulted.

St. Vincent - La Soufrière volcano has erupted three times since 1902, there is a steaming resurgent dome in the crater and there are numerous hot springs in river valleys on the western side of the volcano. Following 1995 prefeasibility studies, an American firm conducted second stage work preliminary to drilling and signed geothermal project-related agreements with Vincentian entities. To date no further work has been done.

Nevis - On Nevis' western and southern sides, there are two solfataras, numerous thermal wells and a large area of hydrothermal alteration. Also, strong earthquakes with hypocenters very near Nevis occurred in 1951 and 1961. There are encouraging geothermal indicia at 5 places on
the island. The need for second stage work can be easily justified.

Saba - Saba is a small island comprising a central volcano with at least 15 andesitic domes on its flanks. There is a record of volcanic eruption(s) less than 1000 years ago and there are numerous hot springs along the shoreline and just off shore. The island is highly fractured, some hot springs temperatures have risen in the last 40 years. Though the potential power marked on-island is small, there may be potential for power export via sub-sea cable to Statia, St. Maartin and/or Antigua, Accordingly, second-stage work should be conducted.

St. Kitts - Though there are moderately large areas of steaming ground in the crater of Mt. Liamuiga and some small thermal springs along the western shoreline, the geothermal indicia are less well defined than on the previously described islands. Second stage studies will have to refine the currently rather nebulous geothermal targets. The work will be costly and may have lower priority than that on the above-listed islands.

Grenada - Prefeasibility studies have revealed one small solfatara on Mt. St. Katherine, several small thermal springs in ravines radial to the central volcano and numerous relatively young phreatic explosion craters. Additionally, the sub-sea volcano Kick-em-Jenny lies only 5 miles off Grenada's north coast suggesting that the zone between it and central northeastern Grenada may be geothermally prospective. Second stage work will have to cover large, rugged areas, but if successful, the market for geothermal power would be significant.

Martinique - The very active Mt. Pelé comprises an obvious locus for geothermal resources. There are solfataras, hot springs, earthquake epicenters nearby and well developed fracture systems. This island is controlled by France. If and when they decide to develop the undoubtedly great geothermal resource, they will do so. To date, they have not been inclined to invite participation by non-French entities.

Montserrat - Even before the 1995 eruptions, the southwestern flank of the Soufrière Hills volcano was the site of solfataric activity and of numerous thermal springs. There was also significant seismic activity and several well developed fracture systems transecting the volcano. Though the energy potential of the Soufriére Hills has been made abundantly obvious, there may be few financial or insurance firms willing to participate in a geothermal project on the flanks of a very active volcano.

Statia - While some heat probably remains beneath The Quill as evidenced by reported occurrences of thermal waters in two wells drilled for drinking water, there are no known

hot springs or paleo-thermal areas on the island. This island has the lowest priority for follow-on exploratory work. Further studies will have to wait until more cost effective technology makes Statia an economical development prospect.

Summary

There are 11 volcanic islands in the Lesser Antilles of the Caribbean Sea having modest to very significant geothermal resource potential. Prefeasibility and reconnaissance phase exploration and power generation have been accomplished to varying degrees on these islands with generally encouraging results.

Power demands range from 2 to 45 MW and the average annual power demand growth rate of 7-10% is anticipated to increase. Access to grids is not a problem on any island. Geothermal power could almost surely be sold to the utilities for less than the $0.12 to $0.15 per Kwh cost of generation now estimated by the various utility companies and the prospect of initiating significant savings is appealing to government officials as well as the citizens-on-the-streets.

Though financing of small projects may be difficult to obtain and greater returns on investment may be possible via other types of projects, these obstacles should be surmountable. The environmental and social benefits of geothermal resource use are very impressive and they virtually mandate that the developed nations make strong efforts towards its development in the Caribbean island nations.

5 Annexes

5.1 Programme of the Seminar

SUSTAINABLE ENERGY SEMINAR FOR ACP ISLAND STATES WITHIN THE FRAMEWORK OF EC DEVELOPMENT CO-OPERATION
JUNE 26 – 27, 2001 – DOMINICAN REPUBLIC

PROGRAMME OF THE SEMINAR

PLACE OF THE EVENT: HOTEL SANTO DOMINGO, 'SALON CAONABO' (ACCESS FROM MAIN LOBBY)

Time	Topic	Speaker	Chairman of session/rapporteur
		Monday, June 25, 2001	
15: 00 – 19: 00	Registration of participants at the Hotel 'Santo Domingo'		
18: 45 – 19: 15	Meeting of session chairmen and rapporteurs for the sessions (meet in front of Seminar Secretariat)		Thomas Scheutzlich
20: 00	Cocktail Reception at the Hotel 'Santo Domingo' Welcome speeches	Manuel A. Cáceres Troncoso, Ordenador Nacional FED of the Domican Republic Antonio García-Fragio,EC, Head of Division, Infrastructure, Transport and Urban Development, DG Development	
		Tuesday, June 26, 2001	
08: 00 – 09: 00	Registration (for participants arrived late)		
09: 00 – 09: 30 Opening session	Welcome address Opening speech from EC Opening speech from the host NAO of the Dominican Republic	Lic. José Rijo, Member of Parliament Antonio García-Fragio, EC, Head of Division Infrastructure, Transport & Urban Development, DG Development W. Manuel A. Cáceres Troncoso, Ordenador Nacional FED of the Dominican Republic	ONFED

Session 1: What is the framework for EC Development Co-operation			
09: 30 – 11: 00 The EC framework for Development Co-operation	1.1 Energy in the context of new EC Development Policy	Antonio Gracía Fragió, EC, Head of Division, Infrastructure, Transport and Urban Development, DG Development	Antonio Garcia-Fragio
	1.2 EC Strategy on Sustainable Energy for ACP States – draft working paper	Philip Mann, DG Development EC Brussels	
	1.3 Growing markets for renewable energy services	William Gillett, DG Transport and Energy EC Brussels	
	1.4 EC Development Instruments in Practice	Gabin Hamann, EC Delegation Dominican Republic	
11: 00 – 11: 15	Coffee		
Session 2: Why is sustainable energy important for sustainable development of ACP islands and what are the options?			
11: 15 – 12: 45 Energy as a cross-cutting issue for sustainable development	2.1 Introduction: Energy as a crucial driving force for development and poverty alleviation	Alex Arter Projekt-Consult GmbH/ Entec AG	Dr. Bernhard Bösl
	2.2 Technology options for Renewable Energy	Dr. Wolfgang Palz, Adviser for Technology Innovation at EuropeAid Cooperation Office, EC Brussels	
	2.3 Energy as tool for sustainable development on ACP Islands	Anthony Derrick, IT Power UK	
	2.4 Private Investment and the Energy Sector	Dr. Raymond Wright, Group Managing Director Petrol Corporation of Jamaica	
12: 45 – 14: 00	Lunch		
Session 3: How can future sustainable energy activities be accommodated under EC Programmes ?			
14: 00 – 15: 30 Examples from ACP Islands	3.1 Lessons learned "PV systems for rural electrificaton in Kiribati and Tuvalu"	Mr Terubentau Akura, General Manager, Solar Energy Company, Kiribati	Dr. Raymond Wright
	3.2 Solar electrification for the Vavau group of islands, Tonga	Dr Savae Latu, Secretary for Lands Survey and Natural Resources, Ministry of Lands, Survey and Natural Resources, Tonga	
	3.3 Sustainable energy practises in Barbados: the Millennium Solar Energy Project	Mr. Troy Antonio Watermann, Senior Technical Officer, National Council for Science and Technology, Barbados	
	3.4 Policy Review with sustainable development as the criteria – the Jamaican experience	Mr. Conroy Watson, Director of Energy, Min. of Energy, Jamaica	
15: 30 – 16: 00	Coffee		
16: 00 – 17: 30	3.5 Round table session I: National/ regional options, policy and planning, investment, environmental and capacity building needs	ACP audience	William Gillett (Chair) Philip Mann (Rapporteur) & 2 co-moderators
17: 30 – 17: 45	Summary of first day		Thomas Scheutzlich

20: 00	Dinner Reception		
Wednesday, ***June 27, 2001***			
08: 30 – 10: 00	3.6 Round table session II: Mainstreaming sustainable energy in development programmes	Speakers from ACP	Dr. Wolfgang Palz (Chair) Thomas Scheutzlich (Rapporteur) & 2 co- moderators
10: 00 – 10: 30	Coffee		
10: 30 – 11: 00 Continuation: examp-les from ACP Islands	3.7 Legislación y Políticas Económicas y Tecnológicas Necesarias para el Logro de una Energía Sostenible en al Republica Dominicana"	Hon. Ing. Rafael Abréu, President of the Energy Commission of the Parliament Antonio Almonte, Director Indotec Dominican Republic	Dr. Nandita Mongia
11: 00 – 12:30 Regional perspectives	3.8 The position of the Pacific electrical utilities on sustainable energy with regard to renewable energy and energy efficiency (title to be confirmed)	Anthony E. Neil Director, Pacific Power Association, Fiji	
	3.9 A Pacific way to Renewables	Jean-Michel Durand South Pacific Secretariat; New Caledonia	
	3.10 The role of RE in sustainable development in the Caribbean	Mona Whyte Project Manager Caribbean Energy Information System, Scientific Research Council, Jamaica	
12: 30 – 14: 00	Lunch		
14: 00 – 15: 30 Opportunities for Development co-operation	3.11 Overview of the ACP / EU Joint Parliamentary Assembly resolution on renewable energy	Hon Darius M. Mbela, Chairman of the ACP working Group on Renewable Energy.	Darius M. MbELA
	3.12 Energy as a Tool for Sustainable Development – the GTZ Experience	Dr. Bernard Bösl GTZ Germany	
	3.13 The Pacific Islands Renewable Energy Project: a regional approach applied for GEF support, (Title tbc)	Dr. Nandita Mongia GEF Regional Co-ordinator for Climate Change	
	3.14 Sustainable energy as vehicle for local-regional island development (Generic energy issues)	Mr. Hans Bjerregaard Forum for Energy and Development, Denmark	
15: 30 – 16: 00	Coffee		
16 : 00 – 17: 30	Rapport from Rapporteurs of round table sessions I and II followed by Panel discussion and conclusions	Panelists from EC, ACP islands and Institutions	Antonio Garcia-Fragio (Chair) William Gillet (Rapporteur)
17: 30 – 17: 45	Closing session	Mr Manuel A. Cáceres Troncoso, NAO of the Dominican Republic	

5.2 List of participants

SUSTAINABLE ENERGY SEMINAR FOR ACP ISLAND STATES WITHIN THE FRAMEWORK OF EC DEVELOPMENT CO-OPERATION
JUNE 26 – 27, 2001 – DOMINICAN REPUBLIC

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