



**Strengthening the capacity in Renewable Energy
for Central America
(FOCER)**

**Report of the
First National Forum on Small-Scale Renewable
Energy in Belize**

**Radisson Fort George Hotel
Friday 6th July, 2001
8:00 a.m. – 5:00 p.m.**

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I. PRESENTATION

The Following is a summarized report of the first national forum on small scale renewable energy in Belize held on the sixth of July, 2001 at Belize City, Belize.

This First National Forum on Small Scale Renewable Energy in Belize took place under the patronage of the Global Environment Facility (GEF) through the United Nations Development Program (UNDP), which is implementing the program on Strengthening the Capacity in Renewable Energy for Central America (FOCER).

The experiences and ideas discussed in this report shall enrich the initiatives undertaken as part of the contribution towards the development of a healthy energy mix in Belize.

You are invited to take advantage of this most recent version of the present situation regarding renewable energy in Belize, as discussed by most of its major players.

II. NATIONAL ANTHEM, INTRODUCTION AND THEME OF THE FORUM

Luis Aké
Belize Representative
BUN-CA

This First National Forum on Small Scale Renewable Energy in Belize is taking place under the patronage of the Global Environment Facility (GEF) through the United Nations Development Program (UNDP), which is implementing the program on Strengthening the Capacity in Renewable Energy for Central America (FOCER).

This initiative is taking place in all seven Central American countries and is executed by Biomass Users Network through its regional office for Central America.

BUN-CA is a non governmental organization, whose mission is to create and strengthen the capacity for renewable energy project development, based on regional cooperation and in-country linkages, thereby reducing greenhouse gas emissions by fostering Small –Scale Renewable Energy in Central America.

In all seven Central American countries, the electricity demand surpasses the installed capacity. This additional demand is satisfied primarily with electricity generating plants that consume fuel derived from petroleum. This, along with other contaminating resources, increases greenhouse gas emissions and the global warming of our planet. In addition, with regards to the national economies this means a considerable cost of foreign exchange that is allotted to the importation of fuel.

The countries of the region are interested in the protection of the environment and are concerned regarding the ever increasing costs of fossil fuels, hence the reasons why they are taking steps in utilizing and developing sources of renewable energy as an alternative to satisfy the energy demand.

In order to be able to take adequate advantage of this resource there are certain identified hurdle that need to be surpassed and these are: information, Institution, Technology and Financing.

Belize is no stranger to these hurdles and we come here today to discuss the different renewable energy initiatives that are taking place and the financing schemes that are available in our country.

We hope to create incentive that would reduce the above mentioned hurdles and contribute to the process of including renewable energy in our national development by defining fiscal, economic, social and environmental guide lines.

This forum is the first initiative regarding renewable energy in Belize. We hope to do two more as part of BUN CA and the patronizing agency program, for Belize. We wish to thank UNDP our patronizing agency and lastly but certainly not the least to the persons presenting a topic in today's agenda.

We invite all participants to take advantage of all the topics to be discussed today.

III. WELCOME ADDRESS

Mr. Phillip Balderamos
National Coordinator
Small Grants Program
United Nations Development Program (UNDP)
Belize Office

On behalf of United Nations Development Program it gives me great pleasure to welcome you to the first national forum on small-scale renewable energy in Belize.

The UNDP's country program for Belize focuses on environmental protection within the context of sustainable human development. 95% of our investments are channeled in this direction through projects such as Coastal Zone Management, the Mesoamerica Biological Corridor, the GEF small grants program and others, all these efforts are based on the premise of improving the well being of Belizeans recognizing the importance between the quality and availability of natural resources and the quality and standard of living of humans on this planet.

We recognize the direct relationship between fossil fuel and global warming with the resultant climate change and sea level rise. It is pleasing and very encouraging to note your interest in small-scale renewable energy sources such as those to be discussed today. It is also very encouraging to observe this forum as an opportunity to improve communication and coordination among various interested parties, the government, non-government agencies and the private sector.

BUN CA should be commended on this initiative to promote the strengthening of the Belizean capacity to develop and utilize renewable energy resources and for placing renewable energy on the national development agenda.

UNDP wished that this important issue remains in the forefront of national development and that you make significant progress in implementing small scale renewable energy technology in Belize .

On behalf of UNDP I welcome each and every one of you and hope that you have an informative experience at this forum.

IV. OPENING ADDRESS

Dr. Victor Gonzalez
C.E.O. Ministry of Public Utilities Energy,
Communications and Immigration

Ladies and Gentlemen, a pleasant good morning to you all, it is indeed an honor for me to deliver the opening remarks at this first national forum on small scale renewable energy.

I want to point out this morning that 1.3 billion people have gained access to electricity supply in the past 25 years however the global population has grown by 2 billion over the same period resulting on some 700 million people without electricity. The total number of people without electricity stands at approximately 2 billion and this number is growing, the electricity grid will never reach the vast majority of this people as it would be too expensive this means that in most cases renewable energy technologies are the only alternative solution to this deficiency.

I am pleased to know that the regional office for central America of the Biomass Users Network under the patronage of the global environmental facility through the UNDP is executing the program in strengthening the capacity in small scale renewable energy.

I am shore we all agree that energy is at the heart of our economic development however its production, transportation and use are the cause of major environmental problems at the local and national global levels. The demand for energy using fossil fuels has grown over the past decade by 2% in developing countries and it will continue to grow since it is critical in alleviating poverty. The energy systems developed so far to meet this demand are clearly unsustainable as they lead indirectly to health damaging levels of air pollution, lost of biodiversity and global warming. Nevertheless there are reasons to hope instructive link between energy use and environmental quality can be broken. Improvements in technology and the willingness of governments to experiment with new technologies and energy pricing are fundamentally changing energy markets and presenting new opportunities. Significant growth in energy consumption will be both essential and inevitable in the coming decades, increasing energy use will be essential for the development of these countries. Increased energy consumption will also lead to increased greenhouse gasses, it is clear that the current patterns of energy production is unsustainable, the rising need to reduce greenhouse gases without impeding development is a major climate policy challenge.

Several renewable technologies such as fuel cells and exploitation of solar, wind and geothermal source have the potential to produce energy with considerable reduced impacts notable on air quality than fossil fuels, new applications for biomass energy and water pumping can reduce the time for collecting fuel and water, giving time to devote to more productive tasks.

Ladies and Gentlemen kindly bear with me in doing a few more remarks, when I think about renewable energy I do not think about replacing conventional non renewable energy with renewable energy sources, rather we must push renewable energy to become important and significant components of the total world energy consumption on the long term. Renewable

energy may be argued as the sustainable energy option but its development must be brought to a sufficient energy mix, green energy solutions must be able to compete on a level plain field with the non green energy solutions if they are to be recognized only then will they become the sustainable energy option

Conventional energy is produced and transported in bulk but many of the green energy solutions are more suited for decentralized production we need to think of developing systems that provide for commercial energy needs at the local levels and these commercial energies systems are affordable and competitive green energy options in significant proportions. It can be a lot easier and more cost effective to introduce green energy options where there is anticipated growth in energy demands, the highest anticipated growth is in developing countries, for many communities the green option is the only option however capacity to add green option to their current conventional energy systems is limited. Asking developing countries to subsidize green energy options when conventional energy option is the most affordable and readily available option makes no sense, there has to be a global initiative to support and facilitate adequate capacity building technology transfer funding and financing of green energy option in the developing countries.

I trust ladies and gentlemen I hope that in your deliberations today these matters will be discussed.

PART I:

THE DEVELOPMENT OF RENEWABLE

ENERGY IN BELIZE

V. RENEWABLE ENERGY FOR RURAL

Mr. Herman Charlsworth,
Director General
Office of Electricity Supply

- a. Rural vs Urban Electrification
 - DISTANCES FROM THE GRID
 - DISPERSED SERVICE AREA
 - LOW CONSUMPTION
 - DEVELOPED AREAS / INDUSTRIAL
 - HIGH CONSUMPTION
 - ECONOMICALLY VIABLE
- b. What is renewable energy?
 - REPLENISHABLE
 - NOT CONSUMABLE
 - ENVIRONMENTALLY SUSTAINABLE
- c. Types of renewable energy
 - PHOTO-VOLTAIC
 - BIOMASS
 - WIND
 - HYDRO
 - GEOTHERMAL
- d. Why renewable?
 - REDUCING DEPENDENCE ON FOSSILS FUELS
 - REDUCING FOREIGN EXCHANGE REQUIREMENTS
 - INCREASING SUPPLY SECURITY BY DIVERSIFICATION
- e. Renewable energies rural areas
 - DEVELOPMENT OBJECTIVES:
 - IMPROVING RURAL ENERGY SERVICES
 - ENHANCING QUALITY OF LIFE & MEANS OF PRODUCTION

- f. Uses of renewable energy in rural areas
 - PV electricity for social infrastructure, rural health center, schools.
 - Basic electrification of private households by solar home systems for lighting & information
 - PV pumps for rural drinking water supply and irrigation in agriculture and forestry
 - Electricity supply by mini hydro power plants for rural communities
 - Improved stoves and solar cookers
 - Use of biogas in rural households and agriculture

- g. Barriers to renewable energies
 - AWARENESS
 - FINANCING
 - POLICY
 - INSTITUTIONAL CAPABILITIES

- h. Barrier removal
 - LEGISLATION
 - TAX INCENTIVES
 - CUSTOMS REGULATIONS
 - DESIGN OF FINANCING MECHANISM
 - TRAINING, CAPACITY BUILDING
 - PUBLIC SENSITIZATION

- i. Energy efficiency & energy conservation
 - USE OF COMPACT FLOURESCENT LIGHTING
 - PLANTING TREES FOR SHADE
 - USE OF NATURAL LIGHTING
 - USE OF NATURAL VENTILATION

j. Existing Renewable Energy Projects

<i>Name</i>	<i>Capacity</i>	<i>Technology</i>	<i>Year</i>	<i>Ubication</i>	<i>Cost</i>
Mollejon Plant	25 MW	Hydro Generation	1995	Macal River	\$44.4 M
Belize Sugar Industry	6 MW	Bagasse fired generation	1969	Orange Walk Town	
Cocesna Repeater Station	8.5 KW	Wind Power Generation	1998	Mt. Pine Ridge	\$250,000
Essene Resort	100 KW	Solar generation	1996	San Pedro Ambergris Caye	\$1.8M
Programme for Belize	1.5 KW	Solar Generation	1997	La Milpa Orange Walk	
Engino Electronics Repeater Station	0.530 KW	Solar powered communication	1995	San Ignacio,	\$15,000
	1.5 KW	Solar powered communication		Punta Gorda	\$20,000
Police Dept. Repeater Station	1.5 KW	Solar powered communication		Baldy Beacon Mountain Pine Ridge	\$40,000
Rio Bravo Plant	60 KW	Hydro generation	1987	Blue Creek Orange Walk	\$90,000
Blancaneaux Lodge	50KW	Solar generation	1991		
Rio on Mountain Pine Ridge Tenchronics Repeater Station	1.5 Kw	Solar powered communication	1989	Sibun Hill Mt. Pine Ridge	

VI. RENEWABLE ENERGY TECHNOLOGIES

Mr. Joost Siteur
Project Officer Renewable Energy
BUN-CA / UNDP

Small-Scale Renewable Energy

Electricity, heat and mechanical energy from renewable sources On-grid and off-grid Up to 5 MW

- a. Applications:
 - Biomass
 - Hydro
 - Wind
 - Solar Thermal
 - Solar Photovoltaic (PV)

- b. General Benefits
 - Cost efficient and viable solutions for many (rural) energy needs.
 - Cost-efficient solutions for productive use of residues.
 - Avoid emissions of greenhouse gases.
 - Use indigenous energy resources.
 - Contribute to reduce import bill.

- c. Barriers
 - Despite favorable characteristics, several barriers inhibit its full development in Central America
 - Financial Barriers
 - Institutional Barriers
 - Informational Barriers

VII. SOLAR PANELS AS A SMALL SCALE ENERGY ALTERNATIVE

Mr. Kevin Denny
General Manager
Kelosha Corp. Belize Ltd.

We come to discuss rural electrification using solar panels, my wife and I build a resort in the Stann Creek District and are using only renewable energy sources of energy.

We use solar and small hydro installation to generate energy and to serve as a form of education for people interested. From a recent report I read, it states that there are more than one million homes using solar for lighting, television and fans in the world. P.V. rural electrification has been growing at a rate of 15% a year.

Why should we look into solar for power, its supply is inexhaustible, it allows you to take power anywhere, its quiet, its viable, convenient to use easy to maintain and it is affordable. It can provide power for the basic energy needs of a small family.

The following guide lines eliminates technical shortcomings in the installation of these systems. System Designs; Reliable components and Wiring Service. First you need to do a customer needs analysis, site analysis, design of the system, install the individual component to complete the system check, power up the system and finally a follow up plan. You need to keep the integrity of the systems installed, case studies have shown that people tend to move things around and rewire the system. The home owners become their own electric company and they know when to change a battery or when to replace damaged controls.

At Mama Noots we have 7200 watts available per day from solar, 600watts of wind power, an average of wind speed of 8miles per hour per day. We also have a micro hydro, we use that for triple charging the batteries for the night time uses. We suggest you install at least two types of renewable energies sources
For backup and powering equipment.

That is about it for us.

VIII. WIND ENERGY EXPERIENCE IN BELIZE

Mr. Luigi Saldiver
Regional Manager
COCESNA

I work for COCESNA, so I will speak about COCESNA's experience, I am glad to be here and I hope I can contribute to this forum. COCESNA is acronym for "Corporación Centroamericana de Servicios de Navegación Aérea" it was founded in 1960 by the five Central American Republics, we are in the aeronautic field, the countries of Central America decided to pull their resources to meet the requirements of ICAO and that was what became COCESNA, it is government own by six countries because Belize has now become a member, its main headquarters is in Honduras. We provide the communication for civil aviation purposes we also operate an air traffic control center in Tegucigalpa which provides air traffic control for all flights coming into Central America.

To be able to link our communication services we have a network of repeater stations one of which is located at Baldy Beacon in the pine ridge in Belize. When we started we were at civil hill and then we moved to Baldy Beacon in 1988, COCESNA decided to upgrade its services, we contracted consultants and they selected Baldy Beacon as the better site, because there is no commercial power we had to provide our own power so we used 4 diesel generators rotating them round the clock in order to provide 24 hrs services, that was a very costly thing and we had lots of difficulties with that. So we had to look for other ways of getting energy so we decided to go the new way with environmentally friendly services lower maintenance costs. Consultants were invited to do studies so they looked at solar and wind and because of its location Baldy Beacon has a lot of clouds all year round so its difficult to get sun during the day, they have some solar powered systems at Baldy Beacon. COCESNA decided to go wind because we have to operate 24hrs, seven days a week.

With our wind generator facility I must mention that we have had very few problems, we have had periods of calm and it would be necessary for our diesel generators kick in automatically.

The systems that we use are BW Excel turbines two of them generating a maximum of 10kw and we convert from DC to AC. We seldom have had the need to use our diesel generators except for maintenance purposes.

Our facility has been so successful that today they are conducting studies to install two similar ones in Central America.

I don't know if I will be able to answer any questions, I would like to extend an invitation to anyone interested to visit our facility at Baldy Beacon.

IX. BIOMASS AS A FORM OF ENERGY GENERATION IN BELIZE

Mr. John Gillett
Production Superintendent
Belize Sugar Industries

Bagasse has always been the major source of energy in raw sugar factories during the In Crop period of sugar manufacture subsequent to the oil crisis in 1973, there was a worldwide search for alternative sources of energy to replace fossil fuels. Co-generation which had long been standard practice in the cane sugar industry appeared to have merit. With progress in the development of more efficient boilers and the application of efficient processing systems, energy from bagasse, well above the factory needs became available and could be exported conveniently as electric power.

The world is increasingly aware that many of its primary energy sources are finite and becoming rapidly depleted. It is also recognized that the transformation of primary energy into more readily used forms tends to be accompanied by by-products which contribute to environmental degradation.

Biomass energy conversion is a major topic of interest, since it places the potential of agriculture in its proper context as both an energy consumer and an energy producer.

The sugar industry in Belize is an important sector to be assessed from an energy point of view. In the words of the FAO, sugarcane is the world's most photosynthetically efficient agronomic crop, utilizing about 2-3% of the energy in the incident radiation for biomass energy. Global Environmental Facility is known to have funded several major projects involving the utilization and optimization of sugarcane for energy. For example, a Brazilian project in 1992, for the production of electricity from both sugar cane and wood residues, US \$30 million was provided; a Mauritian project in the same year to optimize the use of bagasse for electricity production US \$3.3 million was provided.

Alternatively, a local COGENERATION scheme could be used whereby useful heat and power is produced sequentially from the same energy source.

2. What is Co-generation?

Today, Co-generation is considered to be the simultaneous production of power and heat - usually in the form of electricity and steam.

Compared with purchased electricity and boilers to produce steam, co-generation requires considerable additional investment.

This additional investment may be rewarded, and co-generation will be economic, when:

- Fuel is available at low cost. This situation arises in situation such as- sugar mill - bagasse disposal With solid fuels, high-pressure steam is usually raised in a boiler and passed through a turbine to generate power. The low-pressure turbine exhaust steam is then available for process heating.
- Co-generation schemes need to be tailored to the particular user demands and considerable professional expertise is needed to understand and meet all requirements in a satisfactory way.

3. What is Bagasse?

Bagasse is the fibrous residue of sugar cane issued from the extraction plant of a sugar mill. It is well suited for use as a fuel, having adequate calorific value is low in ash and virtually free of environmental contaminants such as sulfur. The fiber is composed of the cellulose-lignin-pentosan complex common to the structural matter of plants. The fiber carries with it the absorbed juice and water not removed in the de-watering step together with a mixed product of disintegrated cane trash along with a small quantity of inorganic material termed ash.

Bagasse has the following composition:

- Fibre 47%
- Moisture 50%
- Brix or Solids 3%

The fuel value of dry bagasse shows surprising uniformity throughout the world, ranging between 8,200 - 8,400 Btu per lb. bagasse which translates into an equivalent of about 4,000 Btu per lb. As it is directly used as fuel.

One Mt fresh bagasse “fibre” is equivalent to: 2.2 barrels of fuel oil (92.4 gals or 350L) where fuel oil has a gross calorific value of 4,600 kcal/kg., assuming 50% boiler efficiency when burning 50% moisture in bagasse. From the stand point of steam generation, 1 Mt of fuel oil will replace 3 mt of fresh bagasse or 13,200 Ft³ of natural gas.

4. How is it used as an energy source?

Bagasse is burnt in suitable boilers to produce steam which in turn is transformed via prime movers, for example turbines, to mechanical or electrical energy. Exhaust steam from the turbines is used as a source of thermal energy, for example, in the boiling cycle of the cane juice within a sugar factory.

For bagasse fuel, it is usual practice to burn the fuel in a boiler to produce high pressure steam, then let the HP steam down to a lower pressure in a steam turbine which extracts power, and finally to recover the turbine exhaust steam for heating duties.

This method allows the power turbo machinery to work in a clean steam environment, keeping the fuel and ash problems confined to the boiler stack systems.

Modern boilers are highly developed and well understood. Usually it is possible to capture more than 85% of the lower heating value of the fuel as high pressure steam energy.

Depending on the scale of operations, steam pressure ratios, steam conditions, and turbine details, some 15-25% of the HP steam energy can be extracted as power. The balance is available in the LP turbine exhaust steam.

The use of bagasse as an energy source has been ongoing for a long period of time. However, with sugar production much lower than it is today and with two factories operating earlier in Belize, the quantity of excess bagasse was insufficient to warrant consideration of co-generation of electricity for export to the grid. With only one factory now in operation and Tower Hill grinding in excess of 1.1M tons cane with the potential to increase production, Tower Hill is now producing in the region of 390,000 tons bagasse annually. Our boilers produce approximately two tons of steam per ton of bagasse. We generate in the region of 120 tons of steam per hour and as such use 60 tons bagasse per hour. In addition to the boilers, we incinerate about 12-15 tons of bagasse per hour with the sole purpose of getting rid of a portion of our surplus bagasse. As such, we utilize in the range of 72-75 tons bagasse per hour. With the factory grinding 300 TCH, we produce 95-100 tons bagasse per hour which gives us a net surplus of 25-30 tons per hour or about 650 - 700 tons per day (without incineration the surplus is 35-40 tons per hour or 840-960 tons/day).

At this time of high production, the excess is resulting in a disposal problem. A problem that could readily be converted into energy and save the country a lot of foreign exchange.

Belize presently imports approximately 16m gallons of diesel fuel into the country every year (=US\$20M) and if a portion of the amount used for power generation be substituted with energy from bagasse significant savings in foreign exchange for our country can be achieved.

5. What is the cost of Bagasse?

Bagasse is a by-product of cane sugar manufacture hence the acquisition cost is low. However, there is the cost of conveying, storing and retrieving the material as required.

6. Who is practicing generation of electricity via co-generation?

Over recent years, worldwide there has been a resurgence in interest in co-generation, driven by:

- Privatization and liberalization of electricity generation and distribution activities, leading to tariff structures more closely reflecting costs.
- The relentless search in industry for improved efficiencies as a means to improved competitiveness.

The community desire to maximize fuel efficiency and minimize greenhouse gas emissions as awareness of fossil fuel depletion mounts, and evidence of climate change strengthens.

The success of co-generation facilities in North America, Europe and Japan.

There is an opportunity for co-generation when there is a simultaneous requirement for power and heat.

Modern schemes can have considerable flexibility in the ratio of power to heat provided and may be configured to meet the usual electrical load requirement.

Use of bagasse for co-generation was pioneered in Mauritius and Hawaii. In 1986 sugar factories in Mauritius supplied 26% of the island's electric energy and in 1987 sugar factories in Hawaii provided 10% of the overall electric energy in those islands. Technology in this field has continued to advance resulting in greater efficiency of energy transfer, that is, more kilowatt hours per pound of bagasse.

Co-generation for export of electrical energy is being practiced in our neighboring countries. At the Tower Hill Factory surplus bagasse is readily available, so there exists considerable potential for co-generation. Export in the order of 18 to 20 megawatts should be possible during the period December to June.

In our case, we would need to arrive at a price which is mutually acceptable to the parties of a power purchase agreement.

In our case for any local energy producer, agreement with BEL for purchase price of energy will of course need to be negotiated.

7. What is the impact of bagasse use for energy on the environment?

There will be the impact of ash disposal, however, this will be minimal as all ash being produced at present is used for landfill. In fact, sufficient is not produced to meet the demand.

The carbon-dioxide produced when bagasse is burnt in the boilers is less than that absorbed by the sugar cane plants whilst growing, so the overall effect of growing and processing sugar cane is beneficial to the carbon-cycle of the environment.

An article entitled, "The World Bank's views on Energy from Sugar Cane," by Winston C. Hay states, "Perhaps the greatest economic benefit of co-generation with bagasse is its relatively benign environmental impact. In this respect, it is significant that The World Bank will not provide financing for any energy project unless an environmental impact study has been undertaken and measures proposed to control environmental hazards within acceptable limits. In comparison to fossil fuels, especially coal and oil, the products of combustion from bagasse are much lower in the concentration of the emissions which give most concern for environmental degradation, the oxides of sulphur and nitrogen. There is very little sulphur in bagasse, and only small quantities of oxides and nitrogen are produced at the relatively low temperatures of combustion. Equally important, the combustion of bagasse, a renewable resource, does not increase global concentrations of carbon dioxide, of great concern because of its greenhouse effect. The quantities of carbon dioxide released on combustion are re-absorbed for the

production of bagasse in the next cycle of renewal. The World Bank policies for the power sector were not developed specifically for co-generation in the sugar industry, but this energy efficient, environmentally friendly technology is fully in synchronism with the objectives of these policies.”

BSI is pursuing co-generation as a most worthwhile project which can open the door of opportunity for expansion of the sugar industry. It can provide a means for the efficient disposal of excess bagasse in an environmentally responsible manner. A co-generation plant adjacent to the factory can provide steam and energy to the factory plant and make possible the supply of 18 to 20 megawatts of electricity to the national grid. This project is of strategic importance to the future expansion of the industry and we intend to pursue it actively.

X. RENEWABLE ENERGY IN BELIZE: AN ALTERNATIVE COMPATIBLE WITH SUSTAINABLE

Dr. Gilbert Canton
Chairman
Public Utilities Commission

First of all I would like to say that I am not new to Renewable Energy, I have done some studies at the University of Florida and have some experience in the timber business and have done a gassifier.

I have been asked to address the issue from the stand point of the position that I hold which is the chairman of the public utilities commission, who is the entity charged with the regulation charged with the regulation of the energy sector. The electricity sector is as you all know an integral part of the energy picture in Belize. At this point the public utilities area of involvement in this arena is in regulating the electricity sector as such the scope of my address will be restricted to renewable energy and from the angle of regulation considering that the PUC is a relatively new institution perhaps I should begin providing you with a brief background.

The public utilities act which establishes the public utilities commission was passed in August 1999. The PUC is established as an autonomous multi sectorial agency, the commission is comprised of seven member appointed by the Governor General after the advise of the Prime Minister . The primary duties of the PUC is to ensure that the services rendered by a public utility provider is reasonable. In this regard the PUC has the power to determine and disregard the rates that may be charged in respect to utility services and the standards that they should maintain.

The PUC as a policy is also encourage independent power producers and utilization of the open access of the national grid infrastructure and to promote competition where such competition is feasible.

At present there is one entity namely the Belize Electricity Limited who is providing 100% of the transmission and distribution services in the field of generation however there are several players providing this service and a potential for others to enter BEL is presently purchasing power form CFE in Mexico and from BECOL in Belize. BECOL is providing 40% of the national needs and therefore already a portion of the energy used comes form renewable sources. The PUC is encouraging further divesting of BEL from generation in the form of unbundling the service and providing opportunities for other producers to competitively bid for providing of these services. I know that there are discussions going on with several potential independent power producers such as BSI, energy producers limited and wind power interest.

The million dollar question arises, how competitive these projects be in terms of cost to the transmission and distribution companies. Without going into details and matching profiles, it is

generally concluded that in most scenarios, the cost of renewable energies is not competitive and usually need some form of subsidy to get it in as part of the energy mix. This is not considering due regard to energy security, environmental health and sustainable development.

What Belize really needs at this point is an energy policy that will provide for the desired level of the inclusion of renewable energy in the country's total energy mix for reasons other than just cost. The possibility that the desired energy mix may cause an increase in electricity rates if renewable continue to cost more than the alternatives must be acknowledge and the passing through of this cost to the electricity rates must be recognized under such a policy the PUC in their regulation of electricity rates will be able to broaden the criteria for more than just cost.

Until such time the mandate of the PUC is to provide quality services at the most affordable rates and this does not presently favor the inclusion of renewable

I apologize that my presentation does not address the small scale renewable, I must say though that the regulation for this sector does in no way prohibit the development of small scale renewable energy and at PUC we encourage such development worth being feasible and appropriate.

XI. QUESTIONS AND ANSWERS PERIOD: MORNING SESSION

Coordinator: Luis Aké

1. *In the last election it was a manifesto promises to lower the electricity rates, with the price of electricity increasing especially the cost of diesel, and electricity being imported . How successful do you see that manifesto promises capable of being implemented.*

What we have done is to divide the electricity rates into two parts one basically is being the cost of whole sale power which includes the power purchase and power generated from diesel by BEL, the other component is the value added of delivery which includes the depreciation factors. There has been some efficiencies in the value added component of delivery we have agreed that there would be a 5 cents reduction in 2004 in that component of the rate however because BEL does not have any control over prices on fuel imported from Mexico. We all know that last year or so there has been an increase in cost of power form Mexico in more than double per KWH. What we have done is we have set a base rate for the cost of wholesale power, If the energy prices remain high then there would have to be an energy cost increase to accommodate for that.

Nobody can say for sure if a manifesto promises can be really realized in light of an energy prices escalation situation, but we are doing our best to try to see how we can stick to our rates available, so basically that is what all I have to say.

2. *Has there been an application for a renewable energy project financing?*

Not as yet

3. *If I am interested in building a house with solar panels to be used as roof, would DFC finance my home?*

As long as you comply with the construction standards, we have no objections in granting a loan.

PART II:

FINANCING AND INCENTIVES FOR

RENEWABLE ENERGY PROJECTS

XII. FINANCING FOR RENEWABLE ENERGY PROJECTS AN OVERVIEW AND EXPERIENCES IN OTHER

Mr. Fernando Alvarado
Regional Director
E&Co-Latin America

a. Main Barriers to Financing

- Projects too small
- Early stages – projects “not ready”
- Start ups - no Balance Sheet
- Lack of previous experience, track record
- Rural projects
- New technologies of business models, therefore “riskier” projects

b. Characteristics of existing sources:

- E&Co’s experience Debt
- Local banks: short term, market rates or higher, no flexibility (CABEI the exception)
- International Banks: large projects, traditional sectors, high transaction costs, insurance policies
- Multilateral: long terms BUT high transaction costs, requires co-financing
- Equity
- International banks: idem.
- Multilateral: idem.
- Venture funds: demand high returns
- Private investors: limited resources
- Equipment suppliers: large projects, not necessarily the best terms for the project

c. Financial Schemes

- Stage of the project (pre-investment or investment)
- Degree of sophistication of entrepreneur
- Terms related to sources of income (just one client or several clients?)
- Type of technology (is not the same grid-connected hydro than rural PV)

d. Sources of Financing:

i. REEF

Venture fund for renewable energy and energy efficiency projects

Co-managed by E&Co

Currently US \$65 million (\$100 m in 6 months)

Minimum investment \$500,000

Minority shareholder for limited time

Returns between 20% and 25%

www.energyhouse.com

ii. SDG

Joint initiative of WB/IFC managed by a consortium of firms (Triodos/EEAF/GTC)

Focus on PV private projects in rural communities in developing countries

Solar Dev. Foundation: BDS-Grants between \$10,000 and \$100,000

Solar Dev. Capital: Venture capital between \$100,000 and \$2 millions (March 2001)

Loans and equity investments to high growth potential projects

sdcf@mindspring.com

iii. CFA

Venture Fund for Central America

Managed by Empresas Ambientales in Costa Rica and Environmental Enterprises

Assistance Fund (EEAF) in the States

\$10 million

Investments from \$100,000 to \$2 millions

Preference for established companies and equity investments but also consider start ups and loans

www.eeaf.org

iv. Equipment Suppliers

Invest to facilitate selling equipment

Moderate terms (3 – 5 years)

Not flexible terms but competitive

Facilitate co-financing the project

v. E&Co

Financial Services for RE and EE projects

10 years in project financing

More than 50 projects in 20 developing countries

Biomass, Hydro, PV, Biogas, Wind, Geothermal and Energy Efficiency

Offices in LAC, Africa, Asia and United States

Investments in debt and equity (up to \$250,000)
Enterprise Development Services (EDS)
Other sources of funds: REEF, SDG, etc
Co-manager in REEF
E&Co: Niche Early stage
Catalytic infusion of \$\$\$ and SDE
Fill the gap (funds, managerial and entrepreneurial capacity, organization, etc) to make projects appealing to other investors and financiers
Projects must be viable
Clients: Entrepreneurs
www.energyhouse.com

vi. Enterprise Development Services (EDS): basic component of RE projects
Market studies
Selection or refinement of business model
Preparation of business plans
Financial structuring
Negotiator and Promoter
Financial advisory

1. EDS: FENERCA

Financiamiento de Empresas de Energía Renovable en Centro América:
E&Co manages the program financed by USAID
Generation of new projects (min 20)
Focus on support to “entrepreneurs”
Support in the preparation of business plans that lead to financing
Training seminars to financial sector on renewable energy

2. EDS: FOCER

Fortalecimiento de la Capacidad en Energía Renovable para América Central:
Managed by the NGO BUN-CA
Financial and technical support to project sponsors
Seminars and training workshops
Advices Governments on policy issues
bun-ca@bun-ca.org

3. SDE: FHTE

Fondo Hemisférico de Energía y Transporte Sostenibles
Managed by the IDB
DOE and other donors
Energy efficiency, renewable energy and clean transportation
Eligible: Governments, public institutions, private corporations and NGO's
Access through local IDB reps.
hset@iadb.org www.iadb.org/sds/hset

4. EDS: E&Co

Renewable energy and energy efficiency
Wide array of possibilities and services
Cost recovery mechanisms
Emphasis on pre-investment stages

5. EDS: SDC

Technical and business assistance
Prepare projects for larger investments
Market studies, training on PV, business plans, business models, financial mechanisms for end users

e. Experiences:

i. Hydro

Honduras: Small hydros (250 kW – 15 MW) with PPA
Guatemala: 30 MW hydro to sell on spot market
Nicaragua: 10 MW hydro
Costa Rica: small and medium hydros
Bolivia: 8 MW hydro

ii. Wind

El Salvador: 5 MW wind project
Nicaragua: 30 MW eolic park
Honduras: Hybrid wind-diesel
Argentina: 50 MW eolic park

iii. Biomass

El Salvador: 5 MW co-gen with bagasse
Nicaragua: 3 MW co-gen with rice husks
Nicaragua: 3 MW co-gen with peanut shells

iv. Geothermal

Guatemala: 14 MW project
Nicaragua: 10 MW project
Mexico: 5 MW project

v. PV

El Salvador: Rural electrification 100 SHS
Nicaragua: Change from cash to fee for service
Honduras: Change from cash to sale with credit
Peru: Rural electrification of 200 SHS

vi. *Energy Efficiency*

Trinidad:	Equity investment in ESCO
Jamaica:	Financed an energy efficiency project through a leasing
Mexico:	Debt and equity to a large ESCO
Nicaragua:	Loan to a small ESCO with regional approach

f. What else needs to be done?

- ‘Patient’ Fund
- Terms according to project’s needs
- Realistic requirements
- Returns in the range of 10% to 15%
- Combination of soft money and institutional investors

g. Conclusion

- There are specific sources of financing for RE and EE projects
- Pre-investment and EDS funds available
- E&Co considers that there are good investment opportunities in RE but also necessary projects which are not viable under traditional financial schemes
- Demand for clean energy exists and will continue to grow

For more information about E&Co

E-mail: fernando@energyhouse.com

Webpage: www.energyhouse.com

Phone: (506) 296-3532

XIII. THE PROCEDURES FOR OBTAINING FINANCING AT DFC

Mr. Juvencio Rivero
Manager Belize City
Development Finance Corporation representative

In general terms the Development Finance Corporation is 100% owned by the government of Belize and that is reflected by its mission statement which states that the DFC is a financial institution which is geared to expand and to strengthen the Belizean Economy consistent with the macro policies of the government and by this we mean that we provide financing for projects that the government of Belize has, ensuring self sustainability.

Sources of funds on which DFC operates, DFC operates on sources of funds outside Belize and also equity funds from government. Our main outside sources is the Caribbean Development Bank, the World Bank and recently the selling of some security mortgages from DFC.

The type of Loans that we give; when we look at the types of loans that we give we divide them into different sectors for example housing; agriculture and within the agriculture we finance fishing, citrus and Bananas; industry there is a sector also which would engulf manufacturing; tourism as you hear tourism is making such a major impact on our economy, finance tour guide operations hotels and other services related in the tourism industry; Education, we also give loans to persons wishing to go to study and pursue higher education at a tertiary level.

At the DFC we have two types of clients one would be the individual person that has a project in mind and needs some financing and applies for a loan and we also have a companies which are required to apply under different requirements.

When a person comes to our office looking for a loan the officer will sit down with the client and ask what is his project, the main thing that we look for us to finance that project would be that it should be a developmental project and it should be self sustainable. After the client discussion is finished then we move to the investigation stage this stage will tell us the market conditions of the product, we need to see that the assumptions made are realistic and obtainable. The next step is the appraisal stage, at this stage we do the financial analysis and that would show us the expected income that the project will be able to give during the years of operations

If after analyzing the project we see that it is not a viable one, then we will not continue any further investigations and processing and we would inform the client that his project is not viable.

- There is what we call the six Cs of Credit which are;
- Character of the individual
- Credit history of the Client (other lending institutions)

- Capital (working capital)
- Capacity (capacity to repay the loan)
- Conditions (terms and conditions of the loan)
- Collateral (mortgages)

We have two types of loans, one we classify as crop loan or as a loan that is given out to be paid in one year, the other type of loan is the commercial loan which extend from 10,000 to one million depending on the type of activity, these loans will be given at a much larger period of repayment which would be from 5 to 8 years

Interest rates at the DFC varies depending on the loan that we give for example the lowest that we have is 8.5% for housing, which will depend on the loan amount and the individual income. If a person has a project in mind and his loan is approved then his interest rate would be 13% per annum, student loans would be at 10% all other loans are at 13% per annum.

Sometimes a person come to the office for a loan and does not know how to present a project, a credit officer would sit down with this person and discuss the project and see how best we can work along with that person in order for that project to be successful.

This is my presentation and if you have questions I will attempt to answer them as best as possible.

XIV. BEL'S PERSPECTIVE ON RENEWABLE ENERGY

Mr. Michael Polonio
Vice-president
Belize Electricity Limited

Good Afternoon, I am sorry I am late! I am hoping that we sort of have a discussion forum so I will start with some opening statements and remarks then I am hoping that from there the discussion would be generated.

Belize Electricity is charged with a very serious responsibility which is that of meeting the electricity needs of this country, we are expected to provide not just high quality electricity sufficient to meet the needs for present and future and it must also be cost effective.

There are other issues that must be taken into consideration in the industry we have to look at things such as diversity of supply because we do not want to depend on one type of technology or one type of fuel. We have to look at technology in terms of dependability and maturity. There is the scarcity and high cost of capital which affects decision making, but in the final analysis we must recognize that there are nascent technologies which needs time to develop or they will not develop to be the technologies of the future.

BEL traditionally depended only on diesel fuel generation, I guess because it was of the low investment cost and you sort of a get caught of sort of familiarity and it served its purpose at that time. In the late seventies prices went sky high and it was time to start looking at other alternatives, out of that we developed a number of power projects which were intended to supply both short term and long term generation and transmission needs.

A component of all that was sort of futuristic planning and in 92 the organization under took a study of renewable energies in the country what the sources were and that were available and at what cost and to try and determine what is the best way to go forward. That study looked at hydro we studies all the major rivers in the country, we looked at co generation, we looked at baggasse, we looked at solar and we looked at wind and where as each one of those technologies each one had potential for development on the cost aspect you had a high cost of development than others and because of our mandate which calls to provide competitive costs of electricity, we chose to go with the hydro aspect because it was it was the most economic identified and so BEL diversified into hydro we also later diversified into the purchase of power from Mexico which has its advantages and disadvantages.

So we continued to find other sources and that is where the chalillo proposal came from and we are looking at other options as we go along, we don't eliminate any technology and certainly renewable energy has its advantages and also the cost aspect which as to be taken into consideration

Because of our mandate which is to supply electricity as cost effective as possible we are now letting the private sector do that because they have the time and the skill and so for instance we have gotten proposals from companies that propose to place wind turbine facilities in San Pedro and we always welcome them and we let them know that we are interested but the issue of cost is always a factor, the same thing is true for instance baggasse which is a renewable source we welcomed it we sign a memorandum of understanding with the company but it is not sort of our technology and we do not have control of the fuel and they recognize that so long as they are prepared to do the leading, build the plant and come up with some competitive figures which in the end is acceptable to our rate payers we are prepared to look at all options and the same is true for any renewable source.

In a nut shell Bel's stand point is that we recognize it has its advantages but there is also the reality of all those factors that go with the supply and cost is an issue.

XV. QUESTIONS AND ANSWERS PERIOD: AFTERNOON SESSION

Coordinator: Mr. Joost Siteur, BUN-CA

1. *Please detail for us what the company is considering with regards to small scale renewable energy that would meet the needs of unconnected areas of Belize*

Your are absolutely right there are always going to be some load centers that are best going to be services by local generator or renewable or so forth, however as we stand now what is currently happening with BEL is that the government has taken the sort of lead in assisting to meet the needs of the villages of this country. We are currently implementing power three as we call it which is rural electrification expansion plan which basically asking for us to do a master plan and cost evaluation to supply all these villages. If the project has a negative MPV which means that there has to be a certain kind of capital injection to make it viable they have matched that component, so it comes about that we have a 32 million dollar project. In cases that you mention where small scale renewable energy is the most appropriate way to go.

2. *What is going to be the role of BEL with regards to the proposed energy policy I understand it is being drafted.*

BEL is interested in the drafting of the energy policy and we are talking to the office of electricity supply because such a thing will offer guide lines with regards to the purchasing of energy efficient equipment. The point that I want to get across is that the government is taking the initial steps and the BEL is 100% behind it and will be willing to offer assistance and attend meetings when ever they are called to address these matters.

3. *What are the risks of security of supply of the renewable energy alternatives that have been offered to BEL, these alternatives are BSI in Biomass, Wind energy supply and BECOL in doing another hydro plant.*

As I said the factors that affect the decision are price, cost effectiveness, the maturity of the technology or the fuel that is behind it and so we are looking at all the options and talking to all the options and without getting into specifics each of these technologies have their time frame to come on stream the load is growing now. We are taking to all the investors and as soon as they have firmed up their project and have offered a price that is acceptable that is sufficiently competitive and it fits into the right time to meet the growing needs I imagine there is a place for all of them.

4. *You motioned that you are open to all these options and that you have signed a memorandum of agreement with BSI, when can we see BEL move that memorandum of agreement to and actual power purchase agreement?*

As mentioned earlier whenever they present to us a time frame and a price that makes competitive sense that is where we go forward .

5. *Mr. Polonio you mentioned that all renewable energy initiatives need to be viable if we are to consider them as worth investing, my question is if the hydro project that BEL is promoting called “chalillo” viable and how?*

First of all “ chalillo” has to be economic in the first instance before we invest in it, as far as how that energy will be paid for negotiations are underway we also said continually that the owners of “mollejon” plant need to invest in it because that they will have the majority of the benefits of the dam for holding water for generations down stream.

XVI. CLOSING REMARKS

Mr. Joost Siteur
Project Officer, Renewable Energy
BUN-CA / UNDP

Mr. Siteur started by saying that earlier we had been talking about big and we should be talking about small since its the theme of the forum. He said that we should conclude the session with a small discussion on small scale projects, what are the barriers encountered by people here while executing their respective projects.

Mr. Kevin Denny then mentioned that he does system design and sells solar panel, so far has sold and installed for the government of Belize and for several private individuals. He stated that his resort located in the Stann Creek district is the show place for his products and that he is available at any time for any body interested in buying his products.

Mr. Adamek Klaus form tropicales company then took the floor and explained the type of product he is manufacturing, which is a solar panel system that can charge a 6 volts small florescent light to be used for 8 hours. The cost of his product is 500 BZD. He also mentioned that he has encountered problems such as the high cost of labor, political intervention and a small market

The product is very practical and requires no maintenance. He is also involved with a small biogass project where he hopes to generate energy with the waste form a tortilla factory.

Several other interest were aired, such as equipment to test wind speed in order to be able to install wind turbines. It was mentioned that a solution to the energy demand in the rural areas would be the installation of several small hydro turbines at area where it is difficult to and expensive to transmit power.

Mr. Siteur then said that with the already stated was quite enough for the day, all the issues were certainly not resolved but that was not the aim of the forum.

To conclude he stated that the idea of having the seminar was to people here in Belize with information regarding the topic and to provide the forum for discussion on these issues. He stated that the goal were achieved and that topics such as financial, policy, technical issues and it has shown that there is a need for a policy on energy and there is also financial needs for projects and information on renewable energy.

He said this forum was the first of its kind and it should not be the last and hoped that some contribution was done in regards to the topic. He stated that he hopes that more forums such as these would be organized.

XVII. ANNEXES

Annex 1
First National Forum on Small-Scale Renewable Energy in Belize
6th of July 2001, Belize City

AGENDA

- 8:00 – 8:30 Registration
8:30 – 9:00 National Anthem, Introduction and Theme of the forum, Luis Aké, Belize Representative (BUN-CA)
Welcome address, Mr. Phillip Balderamos, National Coordinator, United Nations Development Program (UNDP) Belize Office.
Opening Address, Dr. Victor Gonzalez C.E.O. Ministry of Public Utilities Energy Communications and Immigration

PART I: THE DEVELOPMENT OF RENEWABLE ENERGY IN BELIZE

- 9:00 – 9:45 Renewable Energy for Rural Electrification, Mr. Herman Charlsworth, Director General Office of Electricity Supply
9:45 – 10:30 Renewable Energy Technologies, Mr. Joost Siteur, Project Officer Renewable Energy BUN-CA / UNDP
10:30 – 10:45 Coffee Break
10:45 – 11:00 Solar panels as a small scale Energy alternative: Mr. Kevin Denny General Manager Kelosha Corp. Belize Ltd.
11:00 – 11:15 Wind energy experience in Belize, Mr. Luigi Saldiver Regional Manager COCESNA
11:15 –11:30 Biomass as a form of energy generation in Belize, Mr. John Gillett, Production Superintendent, Belize Sugar Industries Representative
11:30 – 12:00 Renewable Energy in Belize: An alternative compatible with sustainable development, Dr. Gilbert Canton Chairman of Public Utilities Commission
12:00 – 12:15 Questions and Answers period: Coordinator Luis Aké
12:15 – 13:45 Lunch

PART II: FINANCING AND INCENTIVES FOR RENEWABLE ENERGY PROJECTS

- 13:45 – 14:30 Financing for Renewable Energy projects an overview and experiences in other countries. Mr. Fernando Alvarado, Regional Director E&Co-(Latin America)
14:30 – 15:00 The procedures for obtaining financing at DFC, Mr. Juvencio Rivero Manager Belize City Development Finance Corporation representative
15:00 – 15:30 BEL's Perspective on Renewable Energy, Mr. Michael Polonio, Vice president Belize Electricity Limited
15:30 – 15:45 Coffee Break
15:45 – 16:45 Questions and Answers period: Coordinator: BUN-CA
16:45 – 17:00 Closing Remarks, Mr. Joost Siteur Project Officer, Renewable Energy BUN-CA / UNDP

Annex 2
List of Participants

Nº	Name	Position	Entity
1	Elicia Castillo	Representative	Pine Lumber Company
2	Anselmo Castaneda	Program Coordinator	MesoAmerican Biological Corridor
3	Carlos Fuller	Chief Meorological Officer	Met department
4	John Gillett	Operations Manager	Belize Sugar Industry
5	Douglas Manson	Representative	Department of the Environment
6	Juvencio Rivero	Manager	Development Finance Corporation (DFC)
7	Ruben Perdomo	General Manager	Small Farmers Bank
8	Luis Ake	Belize Consultant	Biomass Users Network, Centroamérica (BUN-CA)
9	Lyndon Flowers	Dean of Engineering	University Of Belize
10	Rachel Montejo	Representaitve	Beltrade
11	Aarón Gongora	Representative	Forestry Department
12	Herman Charlsworth	Director General	Office Of Electricity Supply
13	Gilberth Canton	Chairman	Office of Electricity Supply
14	Deadra Isacks	Executive Director	Belize Alliance of Conservation (BACONGO)
15	Dennis Jones	Managing Director	Belize Enterprize for Sustainable Technology (BEST)
16	David Dyck	Owner	Menonite Rice mill
17	Ambrose Tillett	Engineer	BSN
18	Mike Heusner	Representative	Belize Audoban Society
19	Michael Polonio	Vice President	BEL
20	Victor Gonzales	CEO	Minsitry of Energy communication and customs
21	Victor Lewis	Consultant	Office of Electricity Supply
22	Phillip Balderamos	Project Officer	UNDP
23	Kevin Denny	General Manager	Kelosha Corporation Limited Belize
24	Luigi Saldivar	Manager	COCSNA
25	Robert Tilltte	Electrical Engineer	Belize Sugar Industries
26	Fernado Alvarado	Regional Manager	E&Co
27	Joost Siteur	Project Officer	BUN-CA
28	Alex Laasner		Janus Foundation
29	Celi Cho	Representative	Department of the environment
30	Peter Acosta	Representative	Belize enterprise for sustained technology
31	Robert Blanco	Representative	Sibun water shed association
32	Adamek Klaus	Manager	Tropicales company
33	Rick Magaña	Engineer	Belize City Council
34	Peter Dyck	Representative	Blue Creek Rice mill
35	Chantalle Clarke	Representative	Ministry of Education