

**Formulation of a
National Energy Plan for Belize
(Sector Diagnostic & Policy Recommendations)
Project**

Energy Policy Recommendations

December 2003



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Executive Summary

The Formulation of a National Energy Plan for Belize (Sector Diagnostic & Policy Recommendations) Project is pleased to present the following Energy Policy Recommendations to Government.

The recommendations summarised here are explained in more detail in the body of the document, accompanied by a background to the project and a brief overview of the country's energy sector.

This selection of recommendations, identified as priority issues by the Project Steering Committee, is designed to improve the energy sustainability of Belize. Whilst the recommendations are not comprehensive, it is hoped that they will serve as the first step towards the formulation of a National Energy Policy for Belize.

As a priority, the project recommends that the Government formulates and adopts a National Energy Policy that includes the Government's objectives for all aspects of energy. At the same time, an Office of Energy should be created to coordinate and oversee the implementation of this Policy.

Energy Policy, Coordination and Oversight	Develop a comprehensive National Energy Policy, using a multi-stakeholder dialogue process. Mandate within the policy that a 10-12 year National Energy Implementation Plan be created (and regularly updated) detailing potential energy sources and technologies, timescales and investments required to service Belize's growing energy demands in a sustainable manner.
	An Office of Energy should be created under the Office of the Prime Minister, within the Government of Belize, with responsibility for the oversight and planning of the Government's approach on energy issues. The Office would be responsible for the National Energy Policy and Implementation Plan and for overseeing and coordinating their implementation within the various Government Departments. The Office of Energy should be staffed with technically qualified personnel and advised by a multi-sectoral committee of energy stakeholders from industry and civil society.
	Energy data should be collected and analysed on a regular basis, and a national energy balance produced annually for supply to regional and world energy organisations. The responsibility for energy data should be placed with the Office of Energy.
	Identify regional energy networks and initiatives that have potential benefit to Belize (such as the Caribbean Energy Efficiency Development Project (DEEPC), the Caribbean Renewable Energy Development Project (CREDP), the Finnish Government's Energy and Environment Partnership with Central America, the Caribbean Energy Information System (CEIS), the Latin American Energy Organization (OLADE), and the Biomass Users Network in Central America (BUN-CA)). Proactively participate, by ensuring qualified personnel attend meetings and liaise with the secretariats and project managers.

Fossil Fuels	Petroleum exploration and development in Belize should continue to be supported and encouraged, in an environmentally sound manner; as a potential source of revenue and a national supply of fuel which translates to increased fuel security, fuel price stability and a reduction in foreign currency requirements.
	A single grade of unleaded gasoline should be used in order to achieve volume purchase benefits and to realize cost savings from the consolidation of storage and supply. These savings should be used to reduce the consumer price of fuel (with the legislated price formula adjusted accordingly).
	Considering the negative impact of illegal fuel sales, these sales should be stopped (through diligent policing) in order to reduce the fuel tax burden on the customers of legal supplies.
	The transportation and storage of all petroleum products (including LPGs) by both commercial and private entities should be regulated according to internationally accepted safety standards, and these standards should be actively policed, and self regulated.
	The scheme to collect waste oil should be expanded nationwide, with an accompanying public awareness initiative to encourage public participation.
Transport	KEY OBSERVATION: Motor vehicle transport in Belize will continue to be fossil fuel based, since current non-fossil fuel technologies are not considered economically viable in Belize.
	The use of fuel-efficient vehicles should be encouraged, for example through incentives to promote the importation of newer, small-engined, more fuel efficient vehicles. At the same time a public awareness campaign should be conducted on the benefits of fuel economy.
	Belize should initiate a programme of baseline pollution monitoring, so that emissions and their impacts can be measured over time.
	On the basis of the pollution monitoring, Belize should set emissions standards for motor vehicles, and should work towards emissions testing vehicles. The testing should be introduced in a structured manner over an extended period of time, allowing the public and relevant authorities to prepare. A public awareness campaign should be a key element of the process.
	The improvement of public (mass) transport should be encouraged (fuel economy, emissions, quality of service), and the public should then be encouraged to use this form of transport.
	Conduct a study on the environmental impact of high speed power boats in Belize.
Electricity Services	Generation should continue to be unbundled and sourced through appropriate competitive bidding procedures with oversight responsibility provided by the PUC. Bids should continue to be evaluated using country specific evaluation criteria such as the seeking of the lowest real electricity prices attainable tempered as required by environmental and social considerations.
	Industry awareness of the open access to the grid should be increased to facilitate contracts and direct supply from generators to large consumers, thereby increasing competition in both generation and distribution.
	Based on the comprehensive renewable energy resource assessment and the long term projected generation requirements, establish a Renewable Energy Portfolio Standard (RPS) as a target for the percentage of electricity that must be generated using renewable sources and a minimum local generation standard for the percentage of electricity that must be generated using local sources.
	Develop generation plant standards, in addition to the Pollution Regulations and the required Environmental Impact Assessment (EIA), which ensure that operations comply with international environmental standards.
	Ensure generation plans are regularly updated, and include worst-case scenarios to evaluate the response to unplanned events.

Electricity Services cont'd	<p>Electrical interconnection with Guatemala should be encouraged to enable future access to the regional electricity market. To this end, active involvement in regional initiatives such as SIEPAC and Plan Puebla Panama are recommended.</p>
	<p>Establish Quality of Service Standards and penalties, and ensure the institutional capacity to create and enforce these standards.</p>
	<p>Technical specifications and type approved standards should be established for imported appliances:</p> <ul style="list-style-type: none"> a) appliances must be suitable for use in the Belizean system b) international standard labelling should be introduced to indicate the energy consumption of appliances
	<p>A demand-side management (DSM) study should be conducted as part of the generation planning exercise, to assess whether generation can be avoided by reducing customer demand through the promotion of energy efficient appliances.</p>
	<p>The regulatory agency for the electricity sector should be sufficiently strengthened through technical assistance, training, and other capacity building efforts to effectively and efficiently carry out its mandate.</p>
Renewable Energy Initiatives	<p>Conduct renewable-energy resource assessments for hydro, wind, biomass, geothermal, and solar energy and compile these into a single Renewable Energy Resource Database for use in promoting Belize as a destination for renewable-energy investments. The database should not only identify resources, but should contain potential project proposals. An accompanying investor's information pack should be developed, targeted to local investors as a priority.</p>
	<p>Design and initiate a national renewable energy education and awareness programme aimed at all sectors of civil society, to communicate the overall goals of the government with respect to the country's economic development, protection of the environment, and the links to, and advantages of renewables. This programme should include an extra-curricular component, including activity development to introduce energy issues to young people.</p>
	<p>Establish a comprehensive renewable energy training initiative to compliment the resources identified, with the purpose of increasing the capacity to develop and utilize these resources among the utility staff and potential project developers. This effort should be conducted in cooperation with other countries in the region, in particular as part of the Caribbean Renewable Energy Development Project (CREDP).</p>
	<p>Where companies install and utilise renewable energy technologies in Belize, they should be required to train local personnel at all levels in the management, installation, operation and maintenance of the equipment.</p>
	<p>Conduct a gender and culture sensitive analysis on traditional biomass use. The analysis should determine the impact of traditional biomass use on human health, the environment and the economy. In particular, the issues of deforestation and health threats resulting from the use of fuel wood for cooking and small industry should be examined. Recommendations should be made for energy patterns based, in part, on the analysis (e.g. replacement of fuel wood with liquid petroleum gas, biogas, etc.), or alternative options (such as the promotion of more efficient, appropriate and culturally sensitive biomass technologies for cooking and the replanting of fast growing, appropriate trees). The analysis should also contain long term implementation plans, learning from previous initiatives conducted in rural areas.</p>
	<p>The logistics and feasibility of the creation of a dedicated renewable energy fund for renewable energy project feasibility studies and for project investment should be investigated.</p>
	<p>A detailed knowledge of the Clean Development Mechanism (CDM) should be developed centrally, as an advisory service to renewable energy project developers, to ensure that Belize gains maximum benefit from the CDM and associated initiatives.</p>

Renewable Energy Initiatives <i>cont'd</i>	<p>Create a National Solar Water Heating Initiative. This would involve an awareness programme to educate both the commercial and the residential sectors (especially targeting the tourism industry), creating financial incentives for the purchase of solar water heaters (e.g. tax rebates) and providing assistance to manufacturers and vendors of solar water heaters to enter Belize's marketplace.</p>
	<p>Conduct an assessment of the potential for solar and wind pumps in rural water systems. The assessment should cover total lifecycle cost, and maintenance and operational requirements.</p>
	<p>Review available wind assessment reports to date and conduct an up-to-date analysis of wind generation on Baldy Beacon. Based on the analysis conduct a pre-feasibility study for a grid connected wind farm.</p>
	<p>Any benefits of using ethanol to reduce emissions, increase fuel security, and increase price stability, whilst utilizing and investing in the local agricultural industry should be evaluated against the total cost of producing the ethanol and adapting the existing gasoline infrastructure to accommodate an ethanol blend.</p>
Energy Efficiency Initiatives	<p>Implement a comprehensive energy-efficiency training program for utility personnel, hotel developers and engineers, potential entrepreneurs and other relevant stakeholders.</p>
	<p>The Belize Building Codes should be reviewed to include potential energy saving design features.</p>
	<p>Appliance importers should be educated about energy efficiency and encouraged to import energy efficient appliances.</p>
	<p>Design and initiate a national energy-efficiency education and awareness programme aimed at all sectors of civil society, to communicate the overall goals of the government with respect to the country's economic development, protection of the environment, and the links to, and advantages of energy-efficiency. This programme can be conducted in conjunction with the awareness programme on renewable energy.</p>
	<p>A study of energy end use practices in all sectors (public, commercial, residential, etc.) of the economy should be conducted in collaboration with BEL and an organisation experienced in conducting surveys. This study will highlight key opportunities for energy savings.</p>
	<p>A survey/analysis of the market potential for energy efficiency measures should be undertaken. This will review generation and consumption patterns throughout Belize in each of the key sectors. These analyses will be used in the design of appropriate energy-efficiency measures and in efforts to attract entrepreneurial initiatives focused on energy savings.</p>
	<p>Incentives should be provided such as reduction in import duties for energy efficient equipment (e.g. compact fluorescent bulbs) to encourage their importation and use.</p>
	<p>Support the creation of ESCOs in Belize through workshops, information provision and linkages to countries with ESCO experience.</p>
<p>Assess the potential for energy efficiency practices in all Government buildings. Based on this assessment, develop a standards manual for use by all government agencies describing recommended and/or required practices for existing and new buildings and equipment. Conduct energy audits in all Government buildings.</p>	

Introduction

Belize's First National Communications to the Conference of the Parties of the United Nations Framework Convention on Climate Change (2000) recommended that a national energy policy be created to guarantee a supply of affordable, clean, reliable energy. This confirmed the views of many energy stakeholders that although Belize has made significant achievements in the energy sector, the absence of a comprehensive strategy will impede the country's sustainable energy development.

Belize has goals of increased economic development, poverty reduction and improved environmental protection. Achievement of each of these goals depends on energy as a key input. Therefore an energy policy is required that:

- Provides for low energy costs without compromising energy security or environmental health and does not depend on volatile international oil prices;
- Maximises local renewable energy potential in all forms;
- Balances low cost fossil fuel driven generation with renewable sources in a mix that compensates for the non-cost and intangible benefits of renewable energy;
- Recognises the importance of energy conservation and poverty alleviation in determining energy needs;
- Encourages private sector participation and competition;
- Ensures that present and future energy needs are met.

Following the launch of the United Nations Development Programme (UNDP) Thematic Trust Fund for Energy for Sustainable Development in 2001, Belize was one of a limited number of countries worldwide to gain funding. The successful project, entitled "Formulation of a National Energy Plan for Belize (Sector Diagnostic and Policy Recommendations)" was co-funded by the Government of Belize (GOB) and the Public Utilities Commission of Belize (PUC), and lasted 1 year from January to December 2003. In recognition of the need for an energy policy, but limited by time and funds, the project objectives were set to analyse the energy sector in order to make policy recommendations to Government. These recommendations would promote affordable, efficient and accessible forms of sustainable energy. The project was implemented by the PUC and advised by a multi-disciplinary stakeholder committee from a wide variety of Government departments, academia, industry and civil society¹.

The recommendations were developed using a structured process of presentations and discussions on a variety of specific energy topics. Each discussion was followed by the preparation of a topic-based position paper, containing multiple recommendations. The Steering Committee met every 3-6 weeks to review the position paper and to discuss the next energy topic. Discussions were augmented by the findings from two studies commissioned by the project: (a) a Commercial/Industrial Energy Usage Survey and (b) an Energy Sector Diagnostic. Finally, the position papers and recommendations were compiled into a single report. The recommendations were then discussed at a public consultation² to gain broad public input prior to the final Steering Committee revision of the report.

¹ Members of the project steering committee are listed in Annex 2

² The Public Consultation was held on 2nd December 2003 at the Biltmore Plaza Hotel, Belize City. Participants of both sexes came from every district in Belize, and represented a wide variety of socio-economic backgrounds and private and civil society interests.

This report is the primary output of the project. It presents a selection of energy policy recommendations that are designed to improve the energy sustainability of Belize. It is hoped that this project and report will serve as the first step towards the formulation of a National Energy Policy.

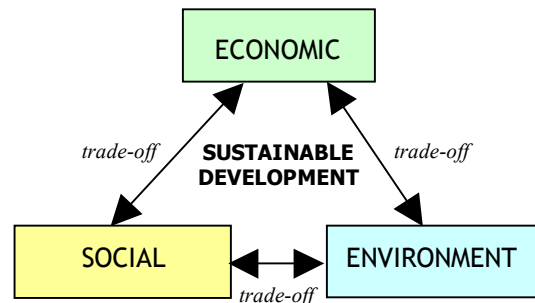
It is critical that the momentum created by the project is maintained. The Project Steering Committee will continue to meet, with the aim of serving as an advisory body to the future process. It is recommended that this body becomes the advisory committee of the Office of Energy.

Background

Belize is located in northern Central America bordered on east by the Caribbean Sea, on the north by Mexico and on the west and south by Guatemala. The national territory, including the twelve (12) miles of territorial waters, covers about 46,620 sq.km (18,000 sq.miles), of which 22,960 sq.km (8,867 sq.miles) is land.

The population of Belize is 240,204 (Census 2000), with slightly less than half (47.7%) under the age of 18³. Over a third of the population is classified as poor⁴, and 10.8% very poor⁵. The economy has developed from one based primarily on agriculture to one more service oriented. Tourism is rapidly increasing in significance; representing 18% of Belize's Gross Domestic Product (GDP), it is the largest foreign currency earner and provides 1 in every 4 jobs. In 2000, Belize's GDP was Bz\$1,321 million, with an average 7% growth p.a. over the previous 4 years. Exports in 2000 were Bz\$421 million and imports Bz\$1,034 million. Approximately one-third of all earnings from domestic exports is used for the purchase of fossil fuels. In addition, energy imports constitute approximately 15% of total imports. In 2002, 50% of Belize's electricity was imported from Mexico.

The policy recommendations adhere to Belize's priorities of increased economic development, poverty reduction and improved environmental protection. However, it is almost impossible for any recommendation to satisfy all three goals, as the needs of one area can conflict with the needs of another. Therefore the concept of sustainable development involves balancing the achievements in each area.



Specifically, the recommendations were required to balance the following objectives:

- Socially Equitable
 - Affordable
 - Accessible
 - Acceptable
- Environmentally Sustainable
 - Minimise negative environmental impacts
 - Minimise negative health impacts
 - Safe
- Economically Stimulating
 - Competitive
 - Reliable and efficient
 - Security of supply and minimisation of foreign currency requirements

The effectiveness of the policy recommendations, if implemented, will be contingent upon the proper enforcement of regulations, monitoring, and evaluation of related actions.

³ Belize 2002 Living Standards Measurement Survey Report

⁴ The percentage of the population classified as poor was 33.5% according to the Belize 2002 Living Standards Measurement Survey Report, where poor is classified as unable to meet basic food and non food costs

⁵ Very poor (indigent) is classified as unable to meet basic food costs – Belize 2002 Living Standards Measurement Survey Report

Energy Sector

In 2002, Belize used 12,707 TJ (303 ktoe) of primary energy, the majority of which came from oil and its derivatives (see chart 1⁶). The total use equates to 48 GJ per capita - a figure which is average for Latin America, but high for a developing country.

71% of Belize's energy is imported, including 100% of fossil fuels and 50% of electricity. This makes energy security a significant issue - in terms of price control, supply control and foreign currency requirements. The latter is especially significant since one third of domestic export earnings are spent on imported fossil fuels.

Belize has three main sources of indigenous energy: hydroelectricity supplying the national grid, bagasse (sugar cane residue) cogeneration used in the sugar industry and fuelwood used by poorer communities and some small industries.

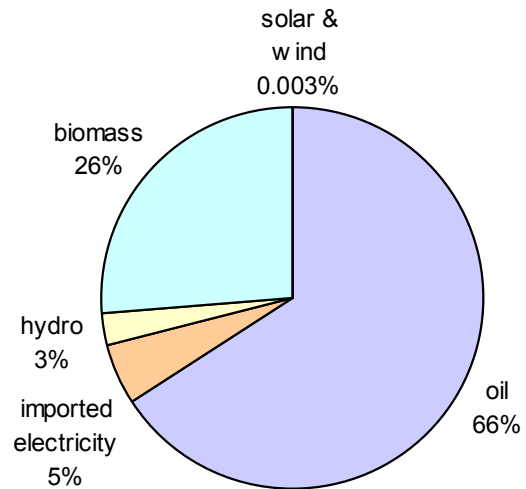


Chart 1: Primary Energy, Belize 2002⁶

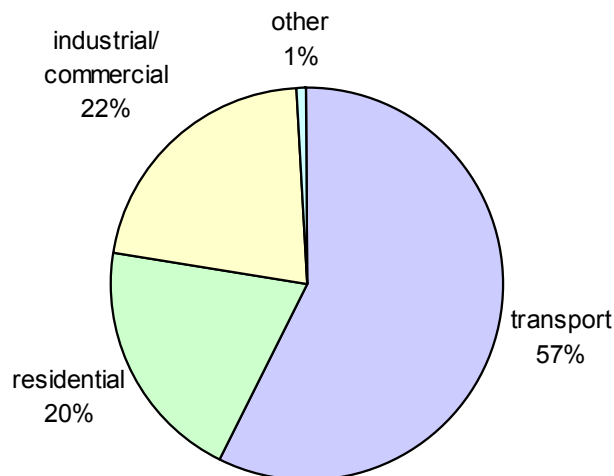


Chart 2: Final Energy Uses, Belize 2002⁷

Although there are multiple oil seeps and some shows in Belize, no commercially viable quantities of oil have been found to date.

Transport

The primary use of energy is for transport, comprising 57% of the final usage (see chart 2⁷). All the energy used in transportation is derived from imported fossil fuels. The transport sector is growing steadily, with private trucks (30% of vehicles) growing at 9% p.a., and private cars (27% of vehicles) growing at 5% p.a. The popularity of trucks is caused in part by the driving conditions in Belize and is also due to more favourable import duties. The huge growth in cruise

ship tourism has caused a significant rise in the number of buses and power boats.

Petroleum Products

There are three main players in the oil industry in Belize; Esso Standard Oil (Esso), Shell Belize and Texaco Belize, selling petroleum products in a very small, regulated market. The

⁶ Oil includes all oil derivative fuels: diesel, gasoline, butane & propane. Biomass comprises fuelwood and sugar cane bagasse.

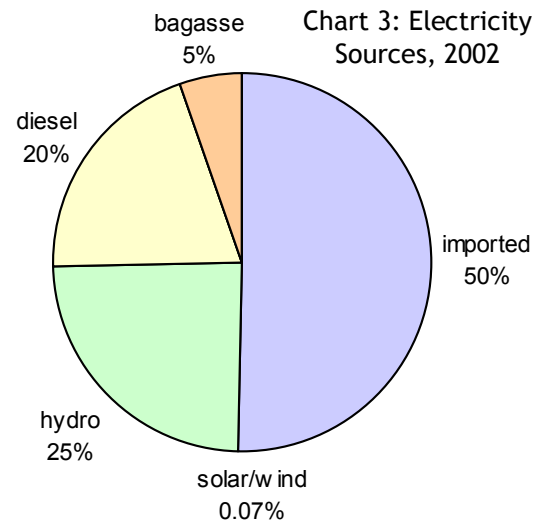
⁷ Approximated from the 2002 fuel imports, fossil fuel uses from the Belize's First National Communication to the UNFCCC (base year 1994) and BEL 2002 electricity use. Further detail is included in Annex 1.

Government of Belize regulates retail service station prices (the highest in the Caribbean), which include a high proportion of taxes used to buffer against the international fluctuations in the oil market. Although the markets are open, currently only Esso imports oil for commercial consumption. The main source of supply is the United States.

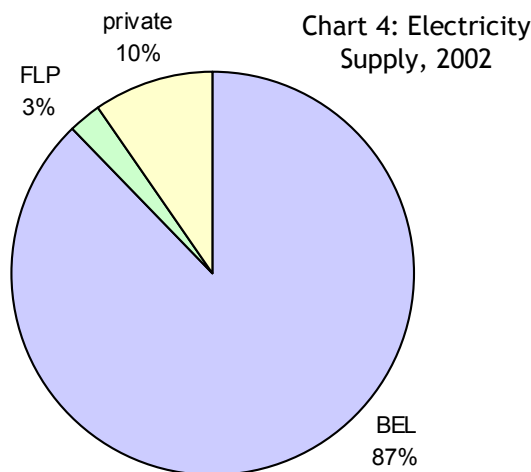
There are four importers in the Liquid Petroleum Gas (butane and propane) industry, who sell through agents and direct to the consumer. The LPG retail price is also mandated by Government, and supplies are sourced from Mexico and El Salvador.

Electricity

In country electricity generation consumes over 5% of Belize’s primary energy. In addition, 50% of the total electricity supply is imported from Mexico. 30% of the total electricity supply is generated from renewable sources, and this equates to 60% of the local generation (chart 3). Local generation is currently sourced from a single independent power producer (IPP) using a 25MW run-of-river hydroelectric scheme. The distribution company, Belize Electricity Limited (BEL) also provides emergency backup, voltage control and peaking needs internally. Three independent generation projects are scheduled for 2006; a storage facility to double the output of the existing hydroelectricity scheme, a 2MW run-of-river hydro facility and an expansion of the sugar factory’s existing bagasse cogeneration to supply 13MW to the grid.



The majority of electricity generated in Belize is distributed by BEL (56MW peak) through the national grid, although 3% is generated and distributed by a community owned company (Farmers Light Plant, FLP) to the community grid, and 10% is generated privately for sole consumption (chart 4).



The total electricity demand is over 359,000 MWh p.a., which equates to 1,356 kWh per capita. Demand is growing rapidly, with a forecast growth of 8%-10% p.a.

It is estimated that over 90% of Belize’s population has access to electricity, with the high cost of grid expansion to remote areas being the primary reason for non access. The Government is committed to electrifying all the communities within Belize.

Household Energy and Poverty

The high number of households using electricity is reflected in the Census 2000 survey, which found 82% of households using electricity for their lighting (see chart 5). However, kerosene lamps are still popular, and in Toledo, the poorest district of Belize (79% poverty, with 56% extremely poor⁸), 50% of households use kerosene for lighting.

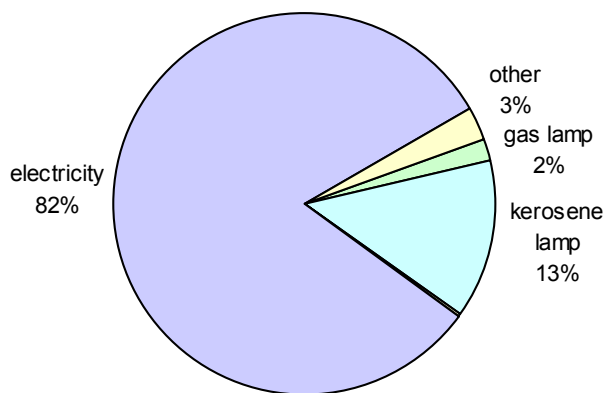
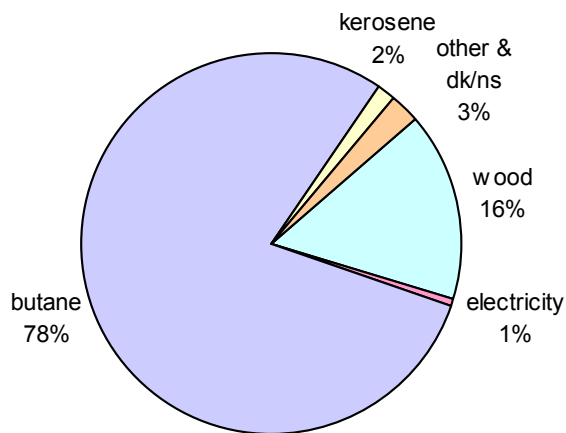


Chart 5: Household Lighting, 2000

The majority of Belizeans use butane gas for cooking, since butane is significantly cheaper than electricity. However, 16% of households are using wood as their primary cooking fuel (see chart 6), and this figure rises to 55% in Toledo. There is also a clear difference between urban and rural fuel use, with 2% of urban households using wood compared to 29% of rural households.

Chart 6: Household Cooking, 2000



The poor are using sources of energy which have potential negative impacts. According to international studies, wood smoke can cause serious health problems, open fires are unsafe with small children, wood collection places a time and physical burden on women and children, and the large-scale cutting of wood degrades the environment⁹.

Renewable Energy Technologies (RET)

There are renewable energy technologies in use in Belize - the Mollejon run-of-river hydro facility, bagasse cogeneration in the sugar industry, 4 small wind turbines (11.5kW total) and solar pv used in isolated areas; which will be complimented by the planned grid

connected renewable generation described in the electricity section. In addition, over 80MW¹⁰ of potential renewable resources have been identified as suitable for economic generation, including additional small hydro, wind, additional bagasse as well as solar water heaters and solar pv for emergency purposes.

However, there are barriers preventing widespread RET adoption in Belize. These include the cost of the technologies, the lack of available financing, the lack of awareness and the lack of comprehensive technical capacity in terms of people who can select, implement and maintain the new technologies.

⁸ Belize 2002 Living Standards Measurement Survey Report

⁹ World Energy Assessment: Energy and the Challenge of Sustainability: United Nations Development Programme, United Nations Department of Economic & Social Affairs, World Energy Council.

¹⁰ Quantified by Dr Ivan Azurdia-Bravo, Fundacion Solar – as part of the Energy Sector Diagnostic commissioned by the project.

Policy Recommendations

The recommendations are not intended to be comprehensive but reflect the priority energy issues as raised by the Steering Committee. The resulting recommendations are categorised into 6 main areas:

1. Energy Policy, Coordination and Oversight
2. Fossil Fuels
3. Transport
4. Electricity Services
5. Renewable Energy Initiatives
6. Energy Efficiency Initiatives

These recommendations form the first stage of a multistage process. A significant project is required to analyse, develop and augment these recommendations in order to develop a comprehensive National Energy Policy. This Policy will then guide all energy activities within the country.

1. Energy Policy, Coordination and Oversight

1.1 National Energy Policy

As stated earlier, the absence of a comprehensive energy strategy will impede Belize's ability to develop sustainable energy sources, and will therefore slow the country's overall sustainable development. It is therefore critical that a National Energy Policy is developed, using a similar multi-stakeholder process to that used to create these recommendations.

However, a policy is in itself not sufficient, since it will only signal the intent of Government, and will not provide any detailed guidance on implementation. The policy should therefore mandate that a 10-12 year National Energy Implementation Plan be created, based on the National Energy Policy. This plan would project future energy requirements, identify potential energy sources, technologies, timescales and investments required, and would serve as the basis for all energy project proposals. It should be regularly updated.

The Implementation Plan should take into account previous energy studies such as the "Renewable Energy Study", 1990, prepared by the Canadian International Power Services Inc. for the now privatised Belize Electricity Board (BEB), and the "Least Cost Generation and Transmission Planning Study", 1999, developed by General Electric for Belize Electricity Limited (BEL). The latter is not an energy study per se, but it has a series of considerations that take renewable energy technologies into account. Both studies are focussed on the engineering and financial aspects of commercial electricity generation.

However, in creating the National Energy Policy and Implementation Plan, engineering and financial approaches must be integrated into sociological and anthropological as well as environmental sciences to create a National Energy Policy that balances efficiency and equity issues across all energy sectors to ensure the sustainable development of Belize.

Policy Recommendation: Develop a comprehensive National Energy Policy, using a multi-stakeholder dialogue process. Mandate within the policy that a 10-12 year National Energy

Implementation Plan be created (and regularly updated) detailing potential energy sources and technologies, timescales and investments required to service Belize's growing energy demands in a sustainable manner.

1.2 Coordination

The responsibility for energy issues is currently divided between more than 6 Government departments and the Public Utilities Commission (PUC). Although operating adequately, the dispersed responsibilities can result in inefficiencies, with poor information sharing, capacity deficits and no cohesive overall approach.

Several key energy issues, such as using energy to address the needs of the rural poor and the role of energy in economic development, require the creation of long term development plans involving input from personnel from multiple Government departments and therefore require central coordination.

There is also a significant amount of international funding available for energy projects - especially where energy is used as a tool for sustainable development. However, accessing the funds requires a highly pro-active and targeted approach with a detailed knowledge of the multitude of project funds available and the project opportunities within Belize. This approach is most easily developed and implemented by a single specialist entity.

Policy Recommendation: An Office of Energy should be created under the Office of the Prime Minister, within the Government of Belize, with responsibility for the oversight and planning of the Government's approach on energy issues. The Office would be responsible for the National Energy Policy and Implementation Plan and for overseeing and coordinating their implementation within the various Government Departments.

The Office of Energy should be staffed with technically qualified personnel and advised by a multi-sectoral committee of energy stakeholders from industry and civil society.

As part of its role, the entity would ensure energy issues are included in all relevant development strategies (such as economic development, poverty alleviation and health), would receive and coordinate all projects and expressions of interest concerning energy and would seek funding to implement projects identified according to the National Energy Implementation Plan. The entity would also work closely with the Caribbean Climate Change Centre due to be opened shortly in Belize, and would ensure close liaison between all climate change and energy initiatives.

1.3 Data

There is currently a lack of comprehensive and accurate energy data. This is partly due to the fact that no single entity has been responsible for collecting and analysing energy data, meaning the data has not been requested or verified over time. It is critical that Belize establishes a comprehensive and accurate energy baseline so that future progress can be measured and monitored. Accurate energy data is being requested by numerous international agencies, and is often a condition of funding.

Policy Recommendation: Energy data should be collected and analysed on a regular basis, and a national energy balance produced annually for supply to regional and world energy organisations. The responsibility for energy data should be placed with the Office of Energy.

1.4 Regional Cooperation

There are several regional energy initiatives either ongoing or in the process of being developed. By actively participating in these initiatives, Belize can gain funding, training and expertise in various energy sectors. In addition, by establishing communications with the energy departments of Governments in other countries, Belize can explore information and technology sharing, reducing the acquisition and implementation costs of new technologies.

Policy Recommendation: Identify regional energy networks and initiatives that have potential benefit to Belize (such as the Caribbean Energy Efficiency Development Project (DEEPC), the Caribbean Renewable Energy Development Project (CREDP), the Finnish Government's Energy and Environment Partnership with Central America, the Caribbean Energy Information System (CEIS), the Latin American Energy Organization (OLADE), and the Biomass Users Network in Central America (BUN-CA)). Proactively participate, by ensuring qualified personnel attend meetings and liaise with the secretariats and project managers.

2. Fossil Fuels

Belize imports 100% of its fossil fuels, the cost of which equates to one third of Belize's domestic export earnings. This comprises a substantial element of the national requirement for foreign currency.

However, Belize's requirement for oil products is unlikely to reduce significantly in the foreseeable future.

2.1 Exploration & Development

Multiple oil seeps and some shows have been found in Belize, and it is considered only a matter of time before a commercial oil field is found. The agreements being signed by the petroleum companies undertaking the exploration work provides Government with a share of any petroleum found, as royalties. If a commercially viable source of petroleum is discovered, the levied royalties and sales from Government's share of petroleum production would generate a new and significant source of revenues, as petrodollars. There would be a decrease in Belize's import fuel bill - thereby reducing the country's dependence on supplies from other countries, reducing the local impact of the fluctuations of the world oil markets and reducing the need for foreign currency. Excess petrodollars could be utilized to diversify the Belizean economy.

Policy Recommendation: Petroleum exploration and development in Belize should continue to be supported and encouraged, in an environmentally sound manner; as a potential source of revenue and a national supply of fuel which translates to increased fuel security, fuel price stability and a reduction in foreign currency requirements.

2.2 Gasoline Grades

Belizeans currently pay the highest prices for petroleum and diesel in the Caribbean. Whilst Belize has no control over international oil prices, there is potential to reduce the local price of fuel by consolidating the country's two grades of petroleum (Regular and Premium) to a single grade. The driving conditions in Belize do not require a high octane fuel, and there is no vehicular requirement for the separate grades. Following the example of other countries, such as Barbados and Jamaica, a single grade fuel would enable the gasoline volumes to be combined, allowing the oil companies to negotiate improved purchasing deals. It would also increase the number of potential suppliers to Belize, again providing additional negotiation potential and improved security of supply. Within the country, savings would be achieved through transporting and storing one grade of fuel instead of two.

Policy Recommendation: A single grade of unleaded gasoline should be used in order to achieve volume purchase benefits and to realize cost savings from the consolidation of storage and supply. These savings should be used to reduce the consumer price of fuel (with the legislated price formula adjusted accordingly).

2.3 Market Distortion

Belize has an illegal fuel market supplied by export-only duty free fuel (purchased and illegally re-sold within the country) and contraband fuel smuggled from neighbouring countries. This fuel can be sold at a considerable discount to legal supplies, since it has been purchased at a cost net of Government taxes. The practice is not only illegal, but also considerably reduces the customer base on which Government can levy fuel taxes, thereby forcing the Government to raise the fuel taxation levels in order to maintain revenues. Government is highly dependant on this revenue source for social obligations. If the illegal market is stopped (or significantly reduced) the retail fuel price may be lowered.

Policy Recommendation: Considering the negative impact of illegal fuel sales, these sales should be stopped (through diligent policing) in order to reduce the fuel tax burden on the customers of legal supplies.

2.4 Transportation & Storage

The transportation and storage of petroleum products is currently unregulated, with a wide variety of storage vessels and methods of transport being used. Some oil companies use international safety standards and insist that these standards are used by their contractors. However, most companies do not conform to any safety standards and in addition, private individuals have no restrictions or guidance. It is vital that all petroleum products are safely transported and stored in Belize.

Policy Recommendation: The transportation and storage of all petroleum products (including LPGs) by both commercial and private entities should be regulated according to internationally accepted safety standards, and these standards should be actively policed, and self regulated.

2.5 Waste Oil Disposal

Historically, Belize has had no formal disposal of waste fuels, although large users, such as the oil companies and Belize Electricity Limited have had their own systems of safe collection and disposal. Recently, the Department of Environment has created a scheme to collect waste oil in the Belize City area. Waste oil can be delivered to specified collection points, where it is stored (safely) and then collected by the Department for supply to Guatemala to be recycled into lower grade oil.

Policy Recommendation: The scheme to collect waste oil should be expanded nationwide, with an accompanying public awareness initiative to encourage public participation.

3. Transport

Motor vehicle transport is the largest consumer of energy in Belize, and is the second largest emitter of greenhouse gases¹¹. It uses predominantly gasoline and diesel fuels, although a small amount of butane is also used. Whilst developed countries have ongoing research programmes into alternative vehicle technologies such as electric cars and hydrogen fuel cells, none of the technologies are commercially available. Due to Belize's small size and developing economy it cannot afford to import technologies until they are commercially produced and affordable to Belizeans. Since commercial vehicle technologies will not change in the medium term Belize's dependence on fossil fuels for transportation will continue.

Key Observation: Motor vehicle transport in Belize will continue to be fossil fuel based, since current non-fossil fuel technologies are not considered economically viable in Belize.

3.1 Fuel Efficiency

As stated previously, the transport sector is growing, with the number of private trucks increasing at 9% p.a. (30% of vehicles), and private cars at 5% p.a. (27% of vehicles). This growth in the number of vehicles means that the volume of fossil fuels used will continue to increase. The only way to mitigate these increases is to reduce vehicle fuel consumption. However, there is currently little evidence of vehicle purchase decisions being based on fuel economy, and existing driver behaviour does not favour fuel efficiency.

Policy Recommendation: The use of fuel-efficient vehicles should be encouraged, for example through incentives to promote the importation of newer, small-engined, more fuel efficient vehicles. At the same time a public awareness campaign should be conducted on the benefits of fuel economy.

3.2 Emissions

The First National Communications by Belize to the UNFCCC identified motor vehicle transport is the second largest emitter of greenhouse gasses in Belize. However, this study was conducted for the base year 1994, and no analysis has been conducted since. There is

¹¹ Belize: First National Communications to the Conference of the Parties of the United Nations Framework Convention on Climate Change

therefore no information about the effect of the increasing vehicle ownership on greenhouse gas emissions in Belize. In addition, vehicle owners appear to have little concern regarding the quantity of exhaust from their vehicles, and vehicle emissions are not limited by law.

Policy Recommendation: Belize should initiate a programme of baseline pollution monitoring, so that emissions and their impacts can be measured over time.

Policy Recommendation: On the basis of the pollution monitoring, Belize should set emissions standards for motor vehicles, and should work towards emissions testing vehicles. The testing should be introduced in a structured manner over an extended period of time, allowing the public and relevant authorities to prepare. A public awareness campaign should be a key element of the process.

3.3 Public (Mass) Transport

A high percentage of the approximately 650 buses in Belize are old stock, with poor fuel economy and no emissions control. Some small operators have converted their vehicles to run on butane (on the basis of cost) which has the advantage of producing fewer harmful emissions. However, the majority of buses still use diesel. The rise in cruise ship tourism has caused the number of buses in Belize to increase rapidly in recent years.

Policy Recommendation: The improvement of public (mass) transport should be encouraged (fuel economy, emissions, quality of service), and the public should then be encouraged to use this form of transport.

3.4 Marine Transport

With the rapid growth in cruise ship tourism in Belize, the number of water taxis (high speed power boats) serving as tenders for the cruise ships has increased significantly over the last 3 years. There is no information on the impact of these boats, and although they are new, it is not known whether they are configured to minimize environmental damage.

Policy Recommendation: Conduct a study on the environmental impact of high speed power boats in Belize.

4. Electricity Services

The Public Utilities Act and the Electricity Act reformed the electricity sector by providing for competitive environments in electricity generation and distribution and open access in transmission. The electricity sector is currently regulated through the newly formed, independent Public Utilities Commission (PUC). Reform to date has transformed the state owned monopoly in generation, transmission, and distribution into a privately owned transmission and distribution agency purchasing generation from Independent Power Producers (IPPs) in a competition-for-generation market environment.

However, care has to be taken that competition is not allowed solely on the basis of cost, since electricity services also have environmental and social impacts. The objective of a

National Energy Policy should be to establish the correct balance of each of these factors for the sustainable development of the country.

4.1 Generation

Generation can be divided into two main categories: (1) generation installed for self use on private premises and, (2) generation installed for supply to the national grid (interconnected and isolated) for eventual downstream supply to electricity consumers. Self-generation is practiced by large industrial operations and operations in remote locations as a main supply and by commercial and residential grid customers as backup for grid downtime. Generation discussed in this report refers to generation in category (2) unless otherwise specifically stated.

There are presently two sources of independent supply, Belize Electric Company Limited (BECOL) and Commission Federal de Electricidad (CFE), with the purchasing agency Belize Electricity Limited (BEL) providing emergency backup, voltage control, and peaking needs internally.

The present regulatory structure provides for the continued unbundling of generation from transmission and distribution through a competitive bidding process. The imminent conclusion of the tender process for 18 MW of electricity is expected to result in at least two additional IPPs entering the market. Generation from these new IPPs will be based on local, renewable fuels.

Policy Recommendation: Generation should continue to be unbundled and sourced through appropriate competitive bidding procedures with oversight responsibility provided by the PUC. Bids should continue to be evaluated using country specific evaluation criteria such as the seeking of the lowest real electricity prices attainable tempered as required by environmental and social considerations.

Further competition in the generation market could be facilitated by increased awareness (locally and internationally) of the open access policy for transmission¹². Open access could lead to direct supply contracts between generators and large (primarily industrial) consumers. However care should be provided in approving such arrangements so as not to disrupt the distribution market and precipitate an increase in cost to other captured consumers.

Policy Recommendation: Industry awareness of the open access to the grid should be increased to facilitate contracts and direct supply from generators to large consumers, thereby increasing competition in both generation and distribution.

The National Energy Policy must include provisions for an acceptable energy mix between renewable energy sources and fossil fuel based generation, and between local and foreign sources. The mix should take into account tradeoffs in the various national objectives such as low prices, energy security, reliability, environmental externalities, and enhancements in social and economic development. If price is allowed to be the only determinant when considering generation options, some of the other objectives may not be met. As such

¹² Under law, there is open access to the transmission of electricity. This means that any generator can enter into a direct contract with an electricity consumer, and Belize Electricity Limited (BEL) (as the owner of the transmission lines) has to facilitate the transmission of the electricity. BEL is allowed to charge a cost for transmission – to cover legitimate operating costs.

tradeoffs may result in increased prices, the development and implementation of the energy mix will have to involve full consultation and transparency.

Policy Recommendation: Based on the comprehensive renewable energy resource assessment and the long term projected generation requirements, establish a Renewable Energy Portfolio Standard (RPS) as a target for the percentage of electricity that must be generated using renewable sources and a minimum local generation standard for the percentage of electricity that must be generated using local sources.

Whether renewable energy or fossil fuel technology is used for generation, standards must be developed and enforced to ensure that any new generation plant is built to standards of emission discharge and efficiency criteria that meet and perhaps exceed international standards.

Policy Recommendation: Develop generation plant standards, in addition to the Pollution Regulations and the required Environmental Impact Assessment (EIA), which ensure that operations comply with international environmental standards.

Generation planning must be continuously updated to provide the best available basis for determining and implementing generation projects and must include worst-case scenarios. For example, provisions should be tabled in the event that the favourable contractual arrangements with CFE do not continue; if CFE either terminates the supply contract or offers a new contract involving significant price increases.

Policy Recommendation: Ensure generation plans are regularly updated, and include worst-case scenarios to evaluate the response to unplanned events.

4.2 Transmission

Belize has a relatively small electricity demand in relation to the size of the interconnected grid (transmission facilities) mainly as a result of the wide dispersion of the major urban areas and the recent drive by the Government of Belize through its rural electrification program to energize all communities.

It is not anticipated that there will be investment in a separate and distinct grid system as this would be uneconomic and burden consumers with unnecessary payback obligations. Provision is made however for open access to the grid to foster competitive developments in generation and distribution.

Policy Recommendation: Electrical interconnection with Guatemala should be encouraged to enable future access to the regional electricity market. To this end, active involvement in regional initiatives such as SIEPAC and Plan Puebla Panama are recommended.

4.3 Distribution

In an energy survey¹³ commissioned by the Formulation of a National Energy Plan for Belize (Sector Diagnostic & Policy Recommendations) Project, 40% of commercial and industrial

¹³ Commercial and Industrial Energy Survey 2002, conducted April – June 2003.

companies cited either electrical outages or voltage fluctuations when asked for their major energy issues. The survey also found that over 29% of the companies had standby generators for emergency generation, comprising over 14.5MW capacity.

The supply of electricity needs further development in standards (for example voltage control, loss of load probability) that are enforced and backed up by a penalty regime. Over the past three years, quality of service indicators have been developed by BEL and monitored by the PUC in anticipation of the Full Tariff Review Proceedings (FTRP) to be conducted in 2004. The FTRP will establish Quality of Service Standards and the accompanying penalty regime. The PUC will need expert assistance in carrying out the review and promulgating the necessary regulations.

Policy Recommendation: Establish Quality of Service Standards and penalties, and ensure the institutional capacity to create and enforce these standards.

4.4 Use

Although equipment rated at 120V is most suitable for the Belize electrical system, equipment on sale in Belize is imported from a number of different countries which use a variety of different electrical ratings. There are currently no standards governing imported appliances. Retailers stock a very limited selection of appliances that can be considered energy efficient, and there is limited information regarding the energy consumption of appliances, meaning the energy conscious consumer is unable to make an informed purchase.

Policy Recommendation: Technical specifications and type approved standards should be established for imported appliances:

- a) appliances must be suitable for use in the Belizean system
- b) international standard labelling should be introduced to indicate the energy consumption of appliances

Policy Recommendation: A demand-side management (DSM) study should be conducted as part of the generation planning exercise, to assess whether generation can be avoided by reducing customer demand through promotion of energy efficient appliances.

4.5 Regulation

The task of electricity regulation is increasing rapidly, with the Full Tariff Review Proceedings (FTRP) commencing in 2004, and competition regulation requiring effective monitoring and promotion. In addition, the above policies will involve considerable work to implement.

Policy Recommendation: The regulatory agency for the electricity sector should be sufficiently strengthened through technical assistance, training, and other capacity building efforts to effectively and efficiently carry out its mandate.

5. Renewable Energy Initiatives

5.1 Project Identification

To expand the use of renewable energy technologies in Belize it will be critical to identify key project opportunities. One of the main prerequisites to attracting potential investors is a basic set of data identifying key resource locations and describing the likely quantity and quality of such resources. A broad assessment of renewable energy resources, including hydro, wind, biomass, solar and geothermal, should be assembled, building on past studies such as the BEB “Renewable Energy Study” (1990) and the BEL “Least-cost Generation and Transmission Planning Study” (1999). Site-specific assessments should be conducted in anticipation of locating quality resources with the potential for commercial exploitation. All projects identified must integrate the issue of natural disaster preparedness into their design and execution.

Policy Recommendation: Conduct renewable-energy resource assessments for hydro, wind, biomass, geothermal, and solar energy and compile these into a single Renewable Energy Resource Database for use in promoting Belize as a destination for renewable-energy investments. The database should not only identify resources, but should contain potential project proposals. An accompanying investor’s information pack should be developed, targeted to local investors as a priority.

5.2 Capacity Building & Awareness

The long-term success of renewable energy initiatives depends on a high level of support from the general public. A well-designed awareness and promotion campaign would result in a population not only more receptive to assuming the initial risks of these alternatives, but also demanding the incorporation of cleaner energy systems.

Policy Recommendation: Design and initiate a national renewable energy education and awareness programme aimed at all sectors of civil society, to communicate the overall goals of the government with respect to the country’s economic development, protection of the environment, and the links to, and advantages of renewables. This programme should include an extra-curricular component, including activity development to introduce energy issues to young people.

If key decision makers and technicians do not have a complete understanding of renewable energy technologies they are unlikely to promote their widespread use. In addition, utility officials and engineers often do not have access to all the information necessary to select, develop and use renewables within their system. For any installed system to be successful and achieve its full potential, comprehensive technical capacity in the operation and maintenance of renewable technologies is required.

Policy Recommendation: Establish a comprehensive renewable energy training initiative to compliment the resources identified, with the purpose of increasing the capacity to develop and utilize these resources among the utility staff and potential project developers. This effort should be conducted in cooperation with other countries in the region, in particular as part of the Caribbean Renewable Energy Development Project (CREDP).

Policy Recommendation: Where companies install and utilise renewable energy technologies in Belize, they should be required to train local personnel at all levels in the management, installation, operation and maintenance of the equipment.

5.3 Traditional Biomass Use/Opportunities Assessment

Fuelwood is currently used for cooking by 16% of households in Belize, and is most significant in Toledo, where it is the most popular cooking fuel (55%). Although studies in other countries have shown that fuelwood use can have significant negative impacts on human health and the environment, with greatest impact on women and children, there is no up-to-date analysis of the pattern and impacts of usage in Belize. In addition, given the limited success of many projects purporting to improve the lives of the rural poor, careful attention has to be given to the implementation of any suggested solutions with focus on developing proposals in close cooperation with the communities to maximise ownership.

Policy Recommendation: Conduct a gender and culture sensitive analysis on traditional biomass use. The analysis should determine the impact of traditional biomass use on human health, the environment and the economy. In particular, the issues of deforestation and health threats resulting from the use of fuel wood for cooking and small industry should be examined. Recommendations should be made for energy patterns based, in part, on the analysis (e.g. replacement of fuel wood with liquid petroleum gas, biogas, etc.), or alternative options (such as the promotion of more efficient, appropriate and culturally sensitive biomass technologies for cooking and the replanting of fast growing, appropriate trees). The analysis should also contain long term implementation plans, learning from previous initiatives conducted in rural areas.

5.4 Renewable Energy Funding

It is recognized that the initial cost of investment in renewable-energy facilities, coupled with the perceived risks of their use, may make it difficult for project developers to attract financing. This situation often presents itself in the preparatory phases of the potential project (i.e., pre-feasibility and feasibility studies), but may also include project financing for well-designed, commercially viable projects. Thus, funds are required for investment in sound renewable-energy project opportunities. While such funds would not account for the entire investment of any project, they would be targeted at catalysing additional resources and serving as seed capital for worthy ventures.

Policy Recommendation: The logistics and feasibility of the creation of a dedicated renewable energy fund for renewable energy project feasibility studies and for project investment should be investigated.

The Clean Development Mechanism established by the Kyoto Protocol finances emission-reduction projects in the countries of non-Annex I Parties (such as Belize) through the trading of certified emission reductions (CERs). The emissions reductions produced by renewable energy projects in developing countries are purchased by developed countries - providing finance for the projects. However, strict verification and certification procedures are necessary to ensure the ecological integrity of the mechanism, and therefore there is a wealth of procedural and institutional detail required to submit a project. There is currently

little knowledge within Belize of project requirements to satisfy the requirements of the CDM.

Policy Recommendation: A detailed knowledge of the Clean Development Mechanism (CDM) should be developed centrally, as an advisory service to renewable energy project developers, to ensure that Belize gains maximum benefit from the CDM and associated initiatives.

5.5 Specific Renewable Energy Initiatives

Whilst the renewable energy resource assessment exercise is expected to generate renewable energy projects, some specific initiatives have been identified by the Committee, and are described in detail below.

Belize's hot sunny climate offers tremendous potential for solar-based water-heating applications. Solar water heaters have already proved technically viable and economically efficient in other Caribbean island nations such as Barbados. Given the high cost of electricity and the significant load required for water heating, solar water heaters would be cost-effective and would provide a relatively quick return on investment. These heaters should be designed to combine solar water heating with a conventional energy backup, in order that commercial operations can guarantee a specific water temperature even in cloudy conditions.

Policy Recommendation: Create a National Solar Water Heating Initiative. This would involve an awareness programme to educate both the commercial and the residential sectors (especially targeting the tourism industry), creating financial incentives for the purchase of solar water heaters (e.g. tax rebates) and providing assistance to manufacturers and vendors of solar water heaters to enter Belize's marketplace.

The Government, through the World Bank funded Social Investment Fund (SIF), has installed safe water distribution systems in many rural villages. These systems mainly use electric pumps to fill a raised tank, from which water can be fed by gravity to supply the village. The villages are responsible for the operational cost of the pump (including energy costs), and some of the pumps are coming to the end of their useful life.

Policy Recommendation: Conduct an assessment of the potential for solar and wind pumps in rural water systems. The assessment should cover total lifecycle cost, and maintenance and operational requirements.

Belize's abundant wind resources are sufficient to provide substantial generating capacity into the grid. Data from the existing small wind turbines on Baldy Beacon shows that there is a strong, constant wind flow averaging 7m/s, and the local environment (clear land, proximity to the transmission line from the proposed Chalillo dam) is well suited to a wind farm.

Policy Recommendation: Review available wind assessment reports to date and conduct an up-to-date analysis of wind generation on Baldy Beacon. Based on this analysis conduct a pre-feasibility study for a grid connected wind farm.

The established sugar industry in Belize has the capability of producing ethanol, an alcohol that can be used as a fuel additive. Up to 10% ethanol can be blended with gasoline without requiring any engine modification, reducing vehicle emissions and reducing the amount of gasoline required. However, ethanol can be more expensive to produce than the cost of imported gasoline, and its use would involve modifications to the current gasoline blending, storage and transportation system.

Policy Recommendation: Any benefits of using ethanol to reduce emissions, increase fuel security, and increase price stability, whilst utilizing and investing in the local agricultural industry should be evaluated against the total cost of producing the ethanol and adapting the existing gasoline infrastructure to accommodate an ethanol blend.

6. Energy Efficiency Initiatives

From society's perspective, achieving greater energy efficiency generally requires less investment than does new generation, and also means fewer energy-related environmental impacts. From an individual perspective, it can mean significant savings over the long term. However, despite the obvious benefits, there has historically been a lack of energy-efficiency initiatives in Belize.

6.1 Capacity Building & Awareness

A critical first step toward the success of any energy-efficiency initiative involves the development of appropriate awareness and technical capacity among the personnel of utilities, commercial energy plants and volume energy users. This would encourage infrastructure developments and large energy facilities to be designed according to energy efficiency principles, and would lead the process of public energy efficiency awareness.

Policy Recommendation: Implement a comprehensive energy-efficiency training program for utility personnel, hotel developers and engineers, potential entrepreneurs and other relevant stakeholders.

Policy Recommendation: The Belize Building Codes should be reviewed to include potential energy saving design features.

Policy Recommendation: Appliance importers should be educated about energy efficiency and encouraged to import energy efficient appliances.

The long-term success of energy-efficiency initiatives depends on a high level of support from the general public. A well-designed awareness and promotion campaign should target changing the public's usage patterns and encouraging them to buy more energy efficient equipment.

Policy Recommendation: Design and initiate a national energy-efficiency education and awareness programme aimed at all sectors of civil society, to communicate the overall goals of the government with respect to the country's economic development, protection of the environment, and the links to, and advantages of energy-efficiency. This programme can be conducted in conjunction with the awareness programme on renewable energy.

6.2 Energy End Use Analysis

As a means of determining the energy use patterns of the various sectors of the economy a comprehensive study should be undertaken. The results of this study would provide necessary information regarding potential areas for energy efficiency applications.

Policy Recommendation: A study of energy end use practices in all sectors (public, commercial, residential, etc.) of the economy should be conducted in collaboration with BEL and an organisation experienced in conducting surveys. This study will highlight key opportunities for energy savings.

6.3 Energy Efficiency Opportunity Identification

To promote energy efficiency, it will be critical to analyse the technical potential of the energy-efficiency market. It is assumed that opportunities for electricity savings using conservation, high efficiency technologies and better management of demand, are plentiful.

Policy Recommendation: A survey/analysis of the market potential for energy efficiency measures should be undertaken. This will review generation and consumption patterns throughout Belize in each of the key sectors. These analyses will be used in the design of appropriate energy-efficiency measures and in efforts to attract entrepreneurial initiatives focused on energy savings.

Policy Recommendation: Incentives should be provided such as reduction in import duties for energy efficient equipment (e.g. compact fluorescent bulbs) to encourage their importation and use.

6.4 Energy Service Companies (ESCOs)

ESCOs are businesses that derive their income from generating energy savings for their clients. They may be affiliated with the utility company or operate as independent, third party enterprises. The client pays on proof of energy savings, and the ESCO charges a percentage of those savings. Hence the client saves money, the ESCO makes money, and less energy is consumed.

Policy Recommendation: Support the creation of ESCOs in Belize through workshops, information provision and linkages to countries with ESCO experience.

6.5 Government Building Energy Efficiency

The Government of Belize is responsible for approximately 7% of the electricity consumption in the country (excluding street lighting), making it one of the largest single energy users. As such, the Government should lead the energy conservation initiative by encouraging energy saving within Government buildings and departments, and in particular by implementing the procurement and use of energy efficient appliances. This would have two important benefits. First, given the considerable number of government installations, reducing energy consumption in this sector will significantly reduce costs. Second, the Government will serve

as an example to other sectors in the economy by adopting energy efficiency practices. By employing an ESCO(s) to assist in the exercise the Government would also encourage ESCO establishment.

Policy Recommendation: Assess the potential for energy efficiency practices in all Government buildings. Based on this assessment, develop a standards manual for use by all government agencies describing recommended and/or required practices for existing and new buildings and equipment. Conduct energy audits in all Government buildings.

Conclusion

Given that energy is an essential input into the country's development and that Belize currently relies heavily on the importation of fossil fuels to satisfy its energy needs, these policy recommendations will provide a positive benefit to the national economy, the protection of the environment and poverty reduction.

It is critical that the current momentum is maintained. The next stage in the process is the formulation and implementation of a National Energy Policy to guide all energy activities within the country.

This initiative reinforces Belize's commitment to sustainable development and begins a process of developing a vibrant and sustainable energy sector.

Annex 1 - Detailed Energy Tables

PRIMARY ENERGY - BELIZE 2002 (a,b,c)

	<i>fuel source</i>	<i>year</i>	<i>volume</i>	<i>unit</i>	<i>data source</i>	<i>tonnes</i>	<i>Mtoe</i>	<i>ktoe</i>	<i>TJ</i>	
Propane	imported	2002	2,765,697	Lbs	CSO	1,256	0.00	1.42	59	
Butane	imported	2002	26,389,639	Lbs	CSO	11,981	0.01	13.54	567	
Diesel	imported	2002	29,740,331	US Gallons	Esso & BEL	94,444	0.10	97.75	4,093	<i>d</i>
Bunker C	imported	2002	89,193	US Gallons	CSO	317	0.00	0.30	13	
Gasoline	imported	2002	25,833,133	US Gallons	Esso	72,356	0.08	77.42	3,241	<i>e</i>
Kerosene	imported	2002	2,558,766	US Gallons	Esso & CSO	7,806	0.01	8.16	342	<i>f</i>
Aviation Gasoline	imported	2002	499,800	US Gallons	Esso	1,337	0.00	1.42	60	<i>g</i>
Electricity (CFE)	imported	2002	180,510	MWh	BEL		0.02	15.52	650	<i>h</i>
Fuelwood	local	2002	118,244	m3	NEP calc'd		0.03	27.58	1,155	<i>i</i>
Bagasse	local	2001/02	286,127	metric tons	BSI	286,127	0.05	52.76	2,210	<i>j</i>
Hydro	local	2002	88	GWh	BEL & survey		0.01	7.60	318	<i>k</i>
Solar	local	2002	0.0	GWh	survey		0.00	0.003	0	<i>l</i>
Wind	local	2002	0.1	GWh	survey		0.00	0.006	0	<i>m</i>
						TOTAL	0.30	303	12,707	

- a) figures from the Central Statistics Office (CSO) often do not match figures from other sources. The calculations above use what is considered to be the most reliable data in each case.
- b) volumes are imported amounts less exports. Storage capacity is so small in Belize that stock changes are assumed insignificant.
- c) international bunkers (marine and aviation) are included in the CSO export figures.
- d) diesel is imported by Esso, the sole wholesale distributor, and BEL for generation purposes. Volumes sold through the Corozal Free Zone have been deducted.
- e) Esso is the sole importer of gasoline. Volumes sold through the Corozal Free Zone have been deducted.
- f) Esso is the sole importer, and imports dual purpose kerosene for illumination and aviation fuel. CSO recorded exports (of all types of kerosene) have been deducted.
- g) calculations used the conversion factors for Jet Fuel.
- h) despite electricity not being a primary energy source, it has been included because it is imported, and therefore not transformed locally. If not included, the total energy figure for Belize would be misleading.
- i) Fuelwood consumption for cooking is based on the FAO estimates for Central America (1.127m³/capita), and assuming 40% of the population uses firewood or charcoal for cooking. It should be noted that 2 limited studies have indicated firewood use could be 5 - 10 times higher however, these studies were not felt to be reliable enough to use as base data. Wood is also used in the lime industry, some food production and some hotels and restaurants. However total amounts could not be quantified. Similarly, the wood converted to charcoal and subsequently used for commercial & personal barbecues could not be quantified.
- j) Bagasse is used by the sugar industry in cogeneration for the sugar factory. Data is for the crop year Dec 2001 to Jun 2002.
- k) Thermal final equivalent (international convention). The majority is from a single run-of-river facility, but there are also some small non-commercial schemes. The output of these small schemes was assessed during the Commercial & Industrial Energy Survey in 2003, but since outputs are not measured the electricity produced is an estimate.
- l) Thermal final equivalent (international convention). Private systems. The output was assessed during the Commercial & Industrial Energy Survey in 2003, but not all locations were surveyed, and since outputs are not measured, the electricity produced is an estimate.
- m) Thermal final equivalent (international convention). Private systems. The output was assessed during the Commercial & Industrial Energy Survey in 2003, but not all locations were surveyed, and since outputs are not measured, the electricity produced is an estimate.

ENERGY USE - Belize 2002

Due to unavailability of detailed fossil fuel use data, the fossil fuel use was approximated, using the percentage of fuel by use, as calculated by the Belize First National Communications to the UNFCCC, combined with the 2002 fuel imports.

TJ	fossil fuels	electricity	total
transport	5,764		5,764
residential	1,436	586	2,022
industrial/ commercial	1,702	492	2,194
other		76	76
	8,901	1,155	10,056

calculated as follows:

transport, fossil fuels	all 2002 gasoline imports + UNFCCC percentages for road & navigation, diesel x 2002 diesel imports, less diesel used for electricity generation + UNFCCC percentage for road LPG x 2002 butane & propane imports + 2002 kerosene imports x 99% (percentage of kerosene used for aviation) + 2002 aviation gasoline imports
residential, fossil fuels	UNFCCC percentage for residential, diesel x 2002 diesel imports, less diesel used for electricity generation + UNFCCC percentage for residential, LPG x 2002 butane & propane imports + 2002 kerosene imports x 1% (percentage of kerosene used for lighting) + 2002 fuelwood use (calculated as all residential)
residential, electricity	BEL 2002 residential electricity use + 50% of FLP electricity generation (less 21% losses)
i/c, fossil fuels	UNFCCC percentages for manuf & const & commercial, diesel x 2002 diesel imports, less diesel used for electricity generation + UNFCCC percentages for manuf & const & commercial, LPG x 2002 propane & butane imports + 2002 Bunker C imports
i/c, electricity	BEL 2002 industrial and commercial use + BSI electricity generation + all private electricity generation (all industrial/commercial) + 50% of FLP electricity generation (less 21% losses)
other, electricity	Street lights

Annex 2 - Members of the Project Steering Committee

Ministry of Commerce & Industry
Nigeli Sosa

Belize Electricity Limited
Jose Moreno / Mike Polonio

Ministry of Economic Development
Carlos Montero / Elvis Requena

Association of National Development
Agencies (ANDA)
Diane Wade-Moore
(Belize Audubon Society)

Ministry of Human Development
Roland Rivers

United Nations Development Programme
(UNDP)
Shaun Finnetty

Ministry of Transport, Works &
Communications
Luis Blas Mendez

University of Belize
Dr Omitade Adediran / Dr Aaron Lewis

Department of Environment
Ismael Fabro / Jeavon Hulse

Association of Professional Engineers of
Belize
Jose "Pepe" Garcia

Geology & Petroleum Department
Evadne Wade
Craig Moore

ESSO Standard Oils SA
Guillermo Alamina

National Meteorology Service
Carlos Fuller / Roy Thompson

Belize Sugar Industries
Robert Tillett

Public Utilities Commission
Dr Gilbert Canton / Victor Lewis
Anna Rossington

Biomass Users Network-C.A (BUN-CA)
Luis Ake

The Belize Alliance of Conservation Non Government Organisations (BACONGO) was originally a member of the Committee but did not attend any meetings.

It should be noted that the views expressed by the Steering Committee members were their own, and are not necessarily endorsed or shared by their affiliated organizations or employers.

Glossary

bagasse	- the fibrous material remaining after the extraction of juice from sugarcane; often burned by sugar mills as a source of energy.
BEB	- Belize Electricity Board - Government owned electricity company, prior to privatisation in 1999.
BECOL	- Belize Electric Company Limited - independent power producer, owner of the Mollejon hydroelectric facility.
BEL	- Belize Electricity Limited - dominant company in electricity transmission and supply.
biomass	- organic, non-fossil material of biological origin, a part of which constitutes an exploitable energy resource.
BUN-CA	- Biomass Users Network for Central America.
butane	- a normally gaseous hydrocarbon which is extracted from natural gas or refinery gas streams. It is used as household fuel, propellant and refrigerant.
Bz\$	- Belize dollar (2Bz\$=1US\$).
CEIS	- Caribbean Energy Information System
CFE	- Commission Federal de Electricidad (Mexican electricity company).
cogeneration	- simultaneous production of heat energy and electrical or mechanical power from the same fuel in the same facility.
CREDP	- Caribbean Renewable Energy Development Project
DEEPC	- Caribbean Energy Efficiency Development Project
diesel	- a petroleum-based fuel which is burned in engines ignited by compression rather than spark.
dk/ns	- don't know/not stated (survey response).
DSM	- Demand Side Management - an attempt by utilities to reduce customers' demand for electricity or energy by encouraging efficiency.
EIA	- Environmental Impact Assessment
ESCO	- Energy Service Company. A business that installs energy efficient and other demand side management measures in facilities.
ethanol	- ethyl alcohol. Alcohol produced by the fermentation of glucose. Produced from agricultural products such as corn, grain and sugar cane.
FLP	- Farmers' Light Plant - community owned electricity generation, distribution and supply company which serves the local community.
fossil fuels	- naturally occurring carbon or hydrocarbon fuel e.g. coal, natural gas and oil, formed by the decomposition of pre-historic organisms.
FTRP	- Full Tariff Review Proceedings
gasoline	- light hydrocarbon oil for use in internal combustion engines. Requires a spark to ignite.
GDP	- Gross Domestic Product
GJ	- Giga joule (10 ⁹) - measure of energy.
GWh	- Giga Watt hour (10 ⁹) - measure of electricity use.

GOB	- Government of Belize
IPP	- Independent Power Producer
kerosene	- a petroleum distillate that boils at a temperature between 300 degrees and 550 degrees Fahrenheit. Kerosene is used in space heaters, cook stoves, and water heaters, and is suitable for use as an illuminant when burned in wick lamps.
ktoe	- kilotonne of oil equivalent - a measure of energy.
kWh	- kilo Watt hour (10^3) - measure of electricity use.
LPG	- Liquid Petroleum Gas - light hydrocarbons, principally propane and butane, which are gaseous under normal conditions, but are maintained in a liquid state by an increase in pressure or a lowering of temperature.
MW	- Mega Watt (10^6)- measure of electrical capacity.
MWh	- Mega Watt hour (10^6)- measure of electricity use.
oil seep	- the surface expression of a migration pathway, along which petroleum is currently flowing, driven by buoyancy from a sub-surface origin.
oil show	- the unexpected discovery of oil (for example whilst digging a well for water) or when oil is found inside rock.
OLADE	- Latin American Energy Organization
petrodollar	- dollar amounts paid to oil-producing countries.
Plan Puebla Panama	- major regional infrastructure project, initiated by Mexico's President Fox, to accelerate integration and development across Central America.
premium propane	- grade of gasoline sold in Belize, with octane rating of 91. - a heavy gaseous hydrocarbon found in crude oil and natural gas; used as fuel and in the making of petrochemicals.
PUC	- Public Utilities Commission - the independent regulator of the utility companies in Belize.
RE	- renewable energy.
regular	- grade of gasoline sold in Belize, with octane rating of 87.
RET	- renewable energy technology.
RPS	- Renewable Energy Portfolio Standard
SIEPAC	- Sistema de Interconexion Electrica de Paises de America Central (Electrical Interconnection System of the Countries of Central America) - project to create an electrical interconnection from Panama to Guatemala, and also to create a regional electrical market. Included within the Plan Puebla Panama, and governed by CEAC, the Council for the Electrification of Central America.
SIF	- Social Investment Fund
Solar pv	- solar photovoltaic - technology in which a semiconductor (usually made of silicon) converts the radiant energy of sunlight into electrical energy.
Sustainable development	- development that meets the needs of the people today without compromising the ability of future generations to meet their own needs.
Sustainable energy	- environmentally sound, safe, reliable, affordable energy - that supports sustainable development in all its economic, environmental, social and security dimensions.

TJ	- Terajoule (10^{12}) - measure of energy.
Traditional biomass	- forms of biomass traditionally used for small scale, non industrialised energy - such as the burning of wood and crop residues for cooking and heating.
UNFCCC	- United Nations Framework Convention on Climate Change