The Bahamas
National Energy Policy

September 2010

SECOND REPORT

OF THE

NATIONAL ENERGY POLICY COMMITTEE

FINAL

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EXECUTIVE SUMMARY

This second report of the National Energy Policy Committee (NEPC) updates the first report submitted in November 2008. Its findings focus on the electricity and transport sectors, the two main usage sectors of fossil fuels in The Bahamas.

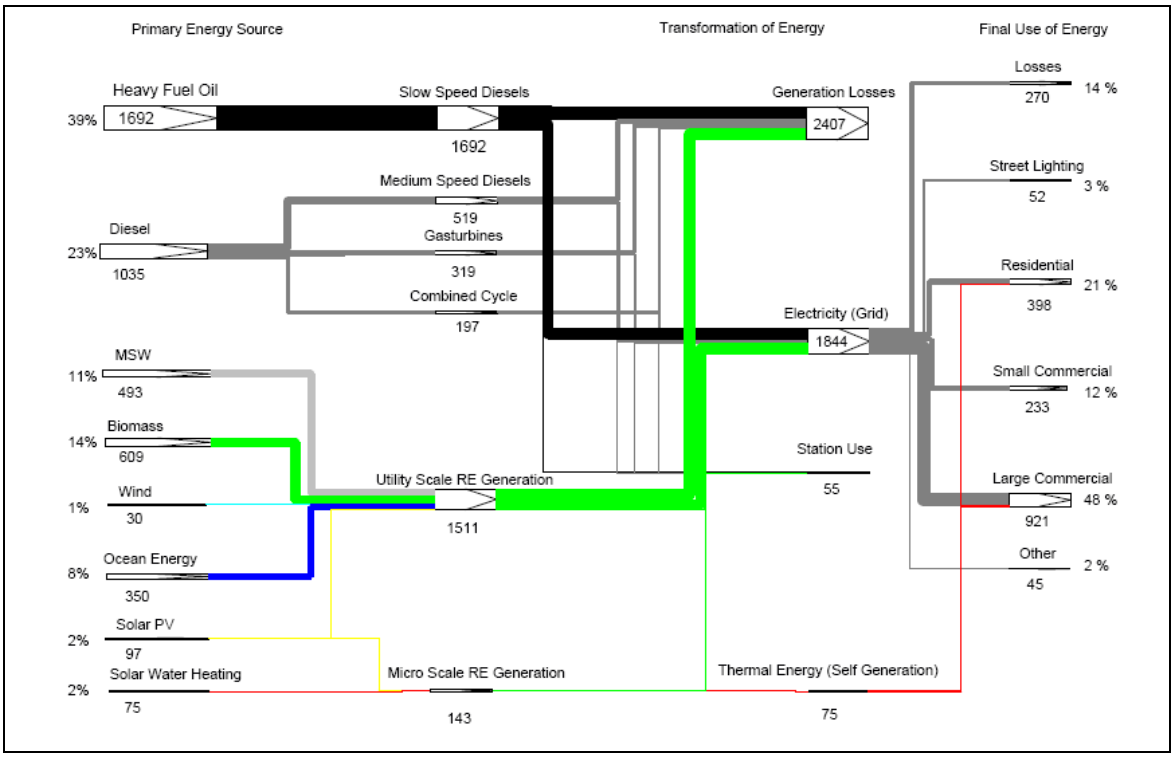
For the electricity sector, this report benefits from the work undertaken in the implementation plan detailed in Annex 4 of the first NEPC report. Two technical cooperation projects in the electricity sector were executed in the interim period. These projects concluded that The Bahamas can achieve the objectives of the national energy policy in the electricity sector by:

- tapping available sources of alternate, renewable energy resources with existing mature renewable technologies;
- applying waste-to-energy technologies;
- promoting energy efficiency and conservation measures;
- reducing oil imports; and,
- lowering greenhouse gases emissions.

For the electricity sector, a significant constraint to the use of renewable sources of energy in The Bahamas is the Electricity Act (1956), which does not promote the use of renewable sources. It gives exclusive rights for the generation and sale of electricity, prohibits self-generation and interconnection to the grid, and it does not impose a requirement that a certain percentage of electricity be generated from renewable sources. The present regulatory framework serves as a disincentive to private-public partnerships in the expansion or development of the Commonwealth's electricity infrastructure and sustainable energy goals.

The report presents, using the BEC service area as an example, an achievable sustainable energy matrix for The Bahamas by 2030, based upon its review of the available renewable resources, the mature technologies that can be deployed and a cost-benefit analysis of those technologies. The proposed sustainable electricity matrix (Figure A) includes:

- Limiting the growth of electricity demand with energy efficiency so that the demand will remain at present levels, which equates to a 30% reduction against a business-as-usual scenario by 2030;
- Enhancing the efficiency of fossil-fired generation; and
- Introducing renewable energy technologies so that their increase in overall supply grows to be at least 30% of total power generation by 2030.



Note: "Large Commercial" includes packinghouses, large warehouses with large motors, large plants with large motors, hospitals, auditoriums, large buildings, hotels, etc.

Figure A: Proposed Sustainable Energy Matrix Achievable by 2030 (only BEC area)

In addition, the report proposes the adoption of a new electricity sector framework, consisting of an electricity sector regulator (URCA); the promotion of renewable energy technologies; the promotion of energy efficiency measures with defined policy targets and objectives over short, medium and long terms; and the creation of a sustainable energy unit (SEU) in the Ministry responsible for the energy policy. The SEU would build upon the energy auditing exercises undertaken, it should be charged with the responsibility of monitoring the achievement of the policy targets as well as, prioritizing efforts on improving the energy efficiency in the public sector.

With respect to the transport sector, the second major energy use sector in The Bahamas, this report also proposes a policy agenda to address the significant data gaps that currently exist and prevent development of recommendations for the sector.

POLICY STATEMENT AND VISION

Recognizing the important role energy plays in the development of nations;

Recognizing further, that The Bahamas depends on imported petroleum products to satisfy over 99% of its consumer energy demand;

Acknowledging that the demand for electricity is projected to grow over the next five years mainly due to large new private tourism investment projects, and electricity expansion costs will be high and financing a challenge[1];

Recognizing the reliance of the tourism, the hospitality sector and service industries on a constant and reliable electricity supply to enable them to be major contributors to employment and GDP growth;

Acknowledging the transportation sector consumes a large portion of total imported petroleum products and the important role transportation plays in The Bahamas as an archipelagic nation;

Understanding the need to ensure the best use of scarce energy resources in order to attain sustainable socio-economic development and improve the quality of life of the Bahamian people;

Understanding further, that our efforts to ensure the health and prosperity of our nation are unlikely to succeed if the country does not move immediately to achieve energy security and promote energy efficiency and conservation;

Recognizing that renewable energy technologies are a means to mitigate the adverse effects of climate change and provide for the sustainability of vulnerable ecosystems in The Bahamas, as a Small Island Developing State, as well as to meet national energy needs;

Understanding the need to ensure our economy can weather the volatility in the prices of fossil energy sources;

Recalling the commitment of The Bahamas to achieving the Millennium Development Goals, particularly Goal 7, Target 9 to integrate the principles of sustainable development into country policies and programs[2];

Recognizing that reduction in the use of fossil fuels will enable The Bahamas to reduce its emissions of greenhouse gases as called for by the United Nations Framework Convention on Climate Change;

Acknowledging the significant financial and technical support that will be required to implement the National Energy Policy and its Implementation Strategy;

[1] "Final Report: Development of a National Energy Policy for The Bahamas", Inter-American Development Bank.
[2] Statement of the Right Honourable Prime Minister at the 63rd Session of the United Nations General Assembly.

Acknowledging also, that sustained effort is required, in light of volatility and reduction in oil prices, not to be detracted from the long-term effort required to conserve energy and integrate alternate energy sources into national supplies;

Acknowledging further, the significant and very positive economic impact that can be achieved through the pursuit of emerging energy opportunities;

Recognizing that as a small island developing state with many islands, settlements and cays, that a wide variety of possible energy opportunities and solutions could be exploited, and the knowledge derived potentially exported;

The Government of the Commonwealth of The Bahamas is committed to the following National Energy Vision:

The Bahamas will become a world leader in the development and implementation of sustainable energy opportunities, by aggressively re-engineering our legislative, regulatory, and institutional frameworks; retooling our human resources; and implementing a diverse range of well researched and regulated, environmentally sensitive and sustainable energy programmes and initiatives, built upon our geographical (both proximity and diversity), climatic (sun, wind, and sea), and traditional economic strengths (tourism and banking).

BACKGROUND

Cabinet appointed the National Energy Policy Committee (NEPC) by conclusion ICO (08) 12th Meeting, Conclusion 20. The NEPC membership reflects the multi-stakeholder approach requested by Cabinet (see Annex 1a).

The NEPC members drew upon the final Inter-American Development Bank (IDB) report, the Washington International Renewable Energy Conference (WIREC) 2008 report, the national energy pledge[3] made by The Bahamas at that conference, a report on renewable energy sources by Haley & Aldrich, as well as the Caribbean Renewable Energy Development Programme (CREDP) and national energy policies of Barbados, Belize and Jamaica.

In addition to its appointed members, resource persons are providing the NEPC with expert input related to renewable energy and oil and gas resource potential in the Commonwealth (see Annex 1b). These resource persons informed the Committee on these matters, providing a local perspective on the IDB study.

The Committee also took advantage of the offer made by the IDB to make available to the Committee the author of their report and to provide an update based on recent trends and discussions related to an energy policy.

Ocean Engineering and Energy Systems (OCEES), an American engineering firm specialising in ocean thermal energy conversion (OTEC), also provided insight into the possibilities of this alternative form of energy use for electricity generation and district cooling systems.

The IDB in the continuation of its support to The Bahamas developed, with input from the Bahamas Environment, Science and Technology Commission, two grant projects to support efforts of the NEPC to implement activities that (1) support the reform of the energy sector; (2) fill data gaps identified by the initial report; and (3) undertake an assessment of the RE potential in The Bahamas.

As a result of these two projects[4], the National Energy Policy, with regard to the electricity sector, has been updated. The transport sector, however, will require analysis in order to produce similarly concrete recommendations for the sector.

[3] Full text of the pledge is found in Annex 2.
[4] "Promoting Sustainable Energy in The Bahamas: Final Report" and "Strengthening the Energy Sector in The Bahamas: Final Report", Fichtner.

OVERVIEW OF THE BAHAMIAN ECONOMY

	2001	2002	2003	2004	2005	2006	2007	2008
Real GDP (2006 prices) (B$M):	6,393.8	6,524.8	6,368.9	6,358.8	6,571.1	6,875.6	7,066.2	---
Population ('000)	309	311.9	316.3	320.7	325.2	330.0	334.0	338.3
Total Labor force	164,675	167,980	173,795	176,330	178,705	180,255	186,105	191,595
Total Tourism Arrivals ('000s):	4,183	4,406	4,594	5,004	4,779	4,731	4,601	4,394
Air Arrivals ('000s):	1,428.1	1,402.9	1,429.0	1,450.3	1,514.5	1,491.6	1,487.3	1,392.6
Sea Arrivals ('000s):	2,754.5	3,003.1	3,165.1	3,553.7	3,264.9	3,239.0	3,114.1	3,001.0
Tourism expenditures (B$M) estimated	1,647.7	1,759.8	1,757.3	1,884.5	2,068.9	2,057.3	2,191.7	---
Volume of Oil Imports (Mbbl)	4,893	5,234	4,872	5,128	5,077	5,453	6,026	6,594
Value of Oil Imports for local consumption (B$'000)	273,233	290,191	284,268	365,452	523,952	669,008	802,066	1,147,724

Table 1: The Bahamas - Selected Macroeconomic Indicators[5]

The Overall Bahamian Economy

The Commonwealth of The Bahamas ("The Bahamas") comprises 700 islands and cays with a total land area of 5,383 square miles spread over 100,000 square miles. The total population of the country is 338,000 persons 69% of whom reside in New Providence, the capital city of Nassau; 16% reside in Grand Bahama, the second major center; and 15% is scattered among the other 28 inhabited islands.

Like other small island developing states, The Bahamas has a small economy that is disproportionately service-based. Expenditure on imported goods is extremely high, approximately five times the total value of exported goods. The largest sectors of the economy are tourism and financial services. Tourism, together with tourism-driven construction and manufacturing, accounts for approximately 60% of Gross Domestic Product (GDP) and directly or indirectly employs half of the archipelago's labor force.

Financial services compose the second-most important sector of the Bahamian economy, accounting for 15-20% of GDP and employing approximately 4,900 persons. The majority of banks and trust companies are non-resident or offshore companies that generate no Bahamian dollar earnings and cover all their expenses for administrative cost, utilities, maintenance and other local overhead by bringing in foreign exchange (Dupuch, 2005).

[5] Quarterly Statistical Digest, August 2010, Volume 19, No. 3, Central Bank of The Bahamas.
Bahamas Handbook, Volumes 2009 and 2010, Etienne Dupuch Jr. Publications Ltd.

Agriculture, fisheries and manufacturing together account for less than 10% of GDP. The Government has tried various economic incentives to increase the growth rate of the agricultural sector; however, this sector is not increasing in value. In 2003, the sector was valued at approximately US$51.78 million, a decrease of 5% from the 2002 estimate (Dupuch, 2005).

In 2004, the total fisheries landings were valued at US$95.3 million (BEST, 2005). The commercially important marine fauna live on the shallow banks of Bahamian waters and include spiny lobster, queen conch and Nassau grouper.

Locally manufactured goods include arts and crafts, fabrics, paint and paper items, bottled water, beverages and pharmaceutical products. In 1997, manufacturing output totaled over US$230 million (Dupuch, 2005). The leading manufactured item groups in The Bahamas are beverages and pharmaceutical products.

A comparison of the Central Bank oil imports for local consumption and the estimated tourism expenditures between 2001 and 2008 reveals that the percentage of funds repatriated to purchase oil for local consumption grew from 16.6 to 26.7 % over the period[6]. The value of oil imports grew from 273.3 million to 1.147 billion Bahamian Dollars over the eight-year period.

Electricity and the Bahamian Economy

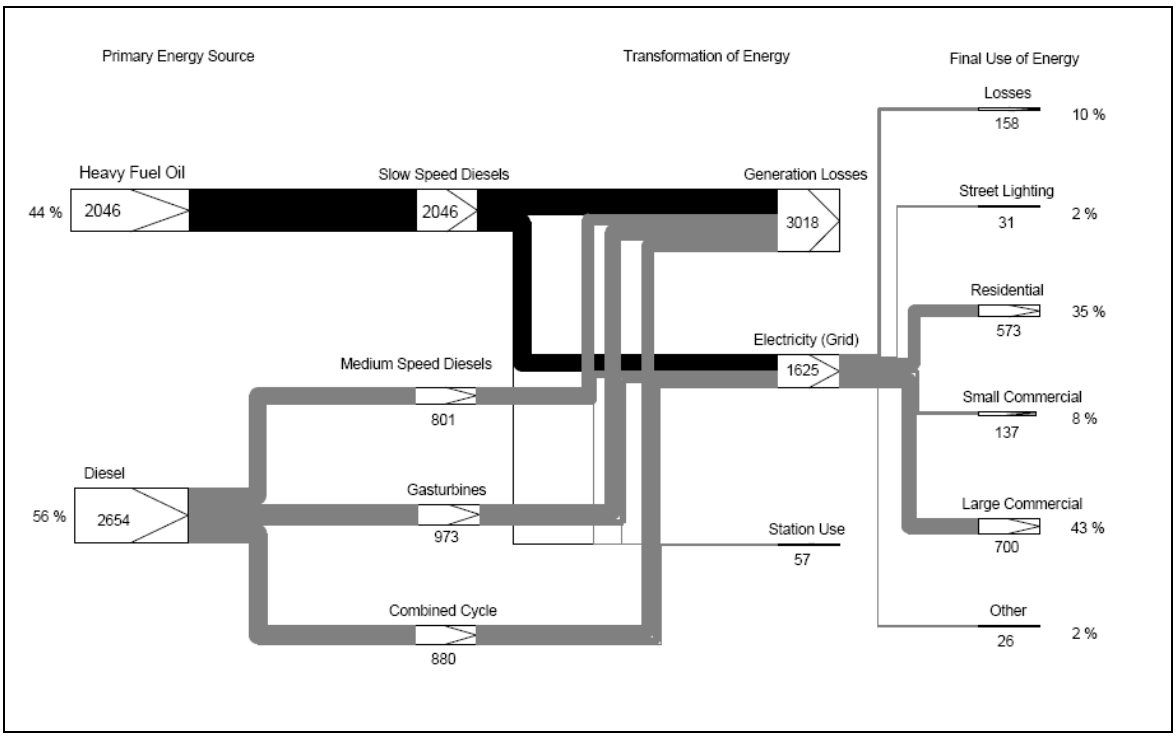
Renewable energy (RE) sources or technologies represent a negligible contribution to the national energy mix. Two main players, the Bahamas Electricity Corporation ("BEC") and the Grand Bahama Power Company, supply virtually all the Commonwealth's electricity needs. International and local oil companies supply the fuels and lubricants derived from fossil fuels used in the electricity and transport sector.

BEC, a wholly-owned government public corporation, operates 29 generating plants (28 diesel engine stations and 1 gas turbine power station) with an installed capacity of 438 MW, providing service to approximately 93,000 customers. BEC's area of supply extends to all of the major islands of The Bahamas with the exception of Grand Bahama and small private franchise holders exist throughout the smaller islands and cays.

For 2009, the generation statistics showed that heavy fuel oil was used to generate 44% of electricity and automotive diesel oil was used to generate 56% of electricity produced by BEC. BEC is a solely dependent on fossil fuels as well as all other sectors of the Bahamian society (Figure 1).

The supply of electricity supply is inherently inefficient since as much as two-thirds of the energy can be lost before it reaches the final customer. The bulk of the losses occur in the fossil-fired power plants as heat losses. (Note that while the efficiency of the fossil-fired power plants can be further increased, renewable energy facilities using direct conversion technologies, such as photovoltaic systems, feature little or no losses, usually.)

[6] The estimated total tourism expenditure and value of oil imported for local consumption for the period 2001 to 2008 as reported in the selected macroeconomic indicators in Table 1 refers.



Note: "Large Commercial" includes packinghouses, large warehouses with large motors, large plants with large motors, hospitals, auditoriums, large buildings, hotels, etc.

Figure 1: Present Structure of BEC Power Supply (2009)

Government intervention in 2008 was necessary to offset the increased cost to consumers in the lower economic brackets. Intervention also introduced a fuel surcharge cap to residential consumers as a direct result of the increased short-term cost of oil in the international market.

The Grand Bahama Power Company Limited provides services on the island of Grand Bahama, serving some 18,000 customers. Grand Bahama is the industrial center of The Bahamas as well as the main international container port facility. Its facilities consist of a 27 MW diesel plant, two gas turbines totaling 35 MW and a 75 MW steam plant. The total installed generating capacity in 2004 was 141.5 MW.

The electricity sector is presently facing three major challenges:

- The sector is highly dependent on imported oil, practically serving as the only source of energy in the country;
- The major electricity supplier is facing financial constraints; and
- The electricity demand in The Bahamas will be increasing in the medium term.

The Government of The Bahamas (GoBH) considers reducing the dependency on imported oil to be an objective for the energy sector by:

- tapping renewable energy resources through renewable technologies such as bio-energy, solar energy, wind power, ocean thermal energy conversion (OTEC), or wave energy;
- applying waste-to-energy technologies; and
- promoting energy efficiency and conservation measures.

With respect to BEC, the GoBH concurrently pursues objectives:

- to improve economic efficiency;
- to ensure long-term sustainability of the electricity services; and
- to improve and ensure the quality of the electricity supply.

Transport and the Bahamian Economy

Petroleum products dominate all major modes of transportation across the Bahamian archipelago. As a tourism and service-based economy, the movement of people, goods and materials is vital to economic activity and almost directly matched to the expansion of tourism and service-based activities across the Commonwealth.

The total value of oil imports for local consumption has, over the eight-year period from 2002 to 2008, increased significantly. Motor gasoline used for local consumption for example, increased in value from 63.291 million Bahamian dollars in 2002 to 201.147 million Bahamian dollars in 2008, a three-fold increase over the period. Similar changes are noted in jet fuel and aviation gasoline[7].

Examination of other statistical information reveals significant gaps in data and information on energy usage in the transport sector. Various source documents contain extrapolations that need verification and further detail to encompass the socio-economic and energy practices in The Bahamas.

The identified gaps need to be addressed as the national energy policy is further elaborated; and these gaps include, but are not limited to:

- passenger vehicle numbers, types, model years;
- commercial land vehicle numbers, types, model years;
- passenger, recreational, cargo and commercial marine vessel numbers and types;
- passenger and private aircraft numbers and types;
- mileage and consumption data of all fuel types and vehicle categories and classes;
- existing traffic control systems;
- public transit statistics;
- petroleum product pricing and marketing trend factors;
- petroleum product shipping, delivery and distribution frequencies and practices

[7] Table 7.10 Value of Oil Imports for Local Consumption, Central Bank of The Bahamas Quarterly Statistical Digest, August 2010

In addition, trends in transportation are influenced directly by consumer habits and lifestyles. It has been suggested that the state of the Bahamian economy reflects, to a degree, trends in global automotive transportation. For example, larger, less fuel-efficient vehicles have been introduced into the local marketplace and these vehicles have made their way into the local fleet, thus increasing energy use and reducing mileage of the entire transport sector.

Further focused analysis of the local market and consumer trends in the transport sector is critical for future planning to achieve sustainable energy use and consumption in the sector.

GLOBAL AND NATIONAL OVERVIEWS ON ENERGY FOR ELECTRICITY

The Global Energy Situation

Experts believe non-renewable energy sources will remain dominant in global energy production. It is generally held that oil reserves are dwindling, while oil prices have become volatile and expected to remain volatile as supplies become constrained by factors such as hurricanes that impact offshore facilities in the Gulf coast of the United States of America and rising global demand especially in energy-intensive manufacturing economies such as China and India.

Several other factors point to continued demand and volatile prices for oil:

- oil producers will continue to divert exports for home consumption
- Future uncertainties in the marketplace arising from short-term reaction to the global political situations (wars, constrained output, damage to infrastructure, speculation)
- Growing demand as a result of economic activities in emerging economies
- Geologic conditions which limit easy access to oil and gas reserves

Many primary sources of energy, like other global commodities, exhibit market price fluctuations. While there are many theories about future factors that may influence the direction of primary energy sources e.g., peak oil theory etc., these may lack historical support; however history has revealed that the potential exists for wide energy price fluctuations driven by factors that are difficult to clearly define.

Between the period 2006 to 2007 global energy demand was estimated to be at 87.5 million barrels per day (oil equivalent), up just 2%[8]. During the same period global crude oil prices increased from approximately $60 per bbl to approximately $110 per bbl, an increase of nearly 83%. Current year global energy consumption estimates are not yet available; however, during 2008 global crude oil prices have moved upward from $110 per bbl to $150 per bbl and then downward to $65 per bbl. Generic economic principles suggest that prices should be driven by changes in supply and demand; yet there is no evidence to suggest that the volatility shown in global crude oil prices are the result of actual supply or demand changes.

Energy prices, like other commodity prices, are subject to significant fluctuations that can challenge national planning, given that energy is a key enabler of many planned activities. This situation of volatile fossil fuel prices increases agricultural production costs, which will lead to higher food prices. Developing countries will face both high food and fuel prices in this environment of volatile prices.

It is also believed that volatile fossil fuel prices will stimulate the push to alternative energy sources and consistent energy policy; and, while most non-renewable sources follow the trend of petroleum prices, diversifying the primary sources of energy to include renewable, particularly locally produced renewable, may reduce the impact of global crude oil price volatility on The Bahamas, thereby insulating The Bahamas to the degree possible, given our national circumstances.

[8] United States Energy Information Administration

The National Situation

Energy security and access to energy

As The Bahamas possesses no quantifiable, easily exploited energy reserves of fossil fuels and depends on imported sources to meet its energy needs, its energy security level is extremely low. Threats to global energy security include the political instability of several energy-producing countries, the manipulation of energy supplies, competition over energy sources, attacks on supply infrastructure, as well as accidents and natural disasters. Long-term measures to increase energy security center on reducing dependence on any one source of imported energy. It can also involve entering into international agreements to underpin international energy trading relationships and the development of contingency plans to respond to supply challenges.

The Bahamas and its service-based economy, is particularly vulnerable to global economic forces that control the cost and availability of fossil fuels. Its share of expenditures expatriated to purchase fossil fuels have grown and the increased use of reverse osmosis to produce potable water has served to increase energy insecurity and dependence.

Access to energy from imported fossil fuels in The Bahamas is directly linked to the ability of the country to access the international oil market and the availability of foreign reserves to pay for the supplies needed. A localised shortage of supply recently occurred because of one private sector oil retailer in a family island having gone out of business.

The introduction of renewable energy options improves The Bahamas' energy security position by allowing the country to diversify its power generation mix once barriers to accessing renewable sources are overcome.

Energy resources - fossil fuels

The Bahamas has some oil and gas potential in non-renewable reserves within its exclusive economic zone (EEZ). There are no proven reserves of easily exploitable fossil fuel sources of significant quantities in the Bahamas based on survey activities undertaken to date. Surveys did indicate some marginal exploitable resources, in deep reserves however, the potential for tapping them at current market rates may not be financially viable. As a result, The Bahamas is wholly dependant on imported petroleum products to meet its needs. This situation is unlikely to change in either the short or medium term based on current knowledge.

Natural gas could provide a good alternative for electricity generation with the following advantages: lower purchase cost, less environmental risk, longer contract terms, cleaner combustion, lower operating costs. However, access to natural gas is restrained for the following reasons:

- Liquefied Natural Gas (LNG): The demand in The Bahamas alone is too small to justify the capital investments needed for regasification facilities;
- Compressed Natural Gas (CNG): the source of gas is within the region, however, additional research is required to assess CNG feasibility.

Energy resources - potential of renewable energies

Renewable energy (RE) resources have yet to be exploited in The Bahamas in any significant way. Possible renewable resources include bio-energy, solar (hot water and power generation by photovoltaic systems), wind, ocean energy, and waste-to-energy at residential, commercial, industrial and utility (> 1 MW), scales.

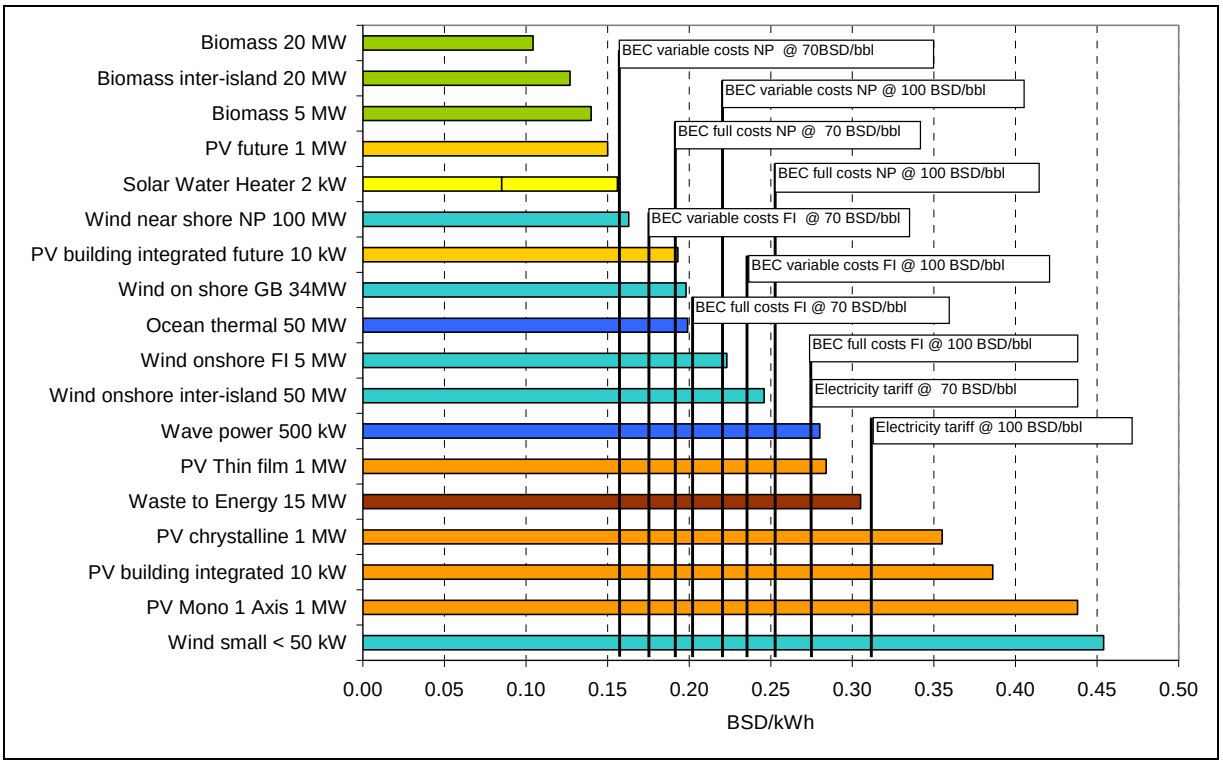
The technical potential of domestic RE sources is defined as the maximum generation yield on suitable lands, sites, and roofs considering natural and technical restrictions like exclusion of nature protection areas, suitability of lands for certain plants, or possible density of wind power plants. The technical potential is 50 times the present power demand of The Bahamas, which is more than sufficient to cover the future power demand increase (Table 2).

The most competitive RE source is presently biomass (Figure 2). Other RE technologies are not economically viable under current Bahamian conditions. When considering the presently competitive technologies only, the economic potential amounts to 70% of present power demand. With fossil fuel prices potentially increasing in the future, and costs of some RE technologies like solar and PV expected to decrease further, the economic potential of domestic RE will grow to a level more than five times the projected demand by 2030.

Technology	***Technical potential***	***Present economical potential***	***Future economical potential***
Solar Water Heaters (entire Bahamas)	*7.5 TWh/a*	*0.2 TWh/a*	*0.2 TWh/a*
Building-integrated Photovoltaic (New Providence; Grand Bahama)	*3.7 TWh/a*	-	*0.22TWH/a*
Open-field PV Power plants (entire Bahamas)	*12 TWh/a*	-	*12 TWh/a*
Wind Power (entire Bahamas)	*82 TWh/a*	*0.15 TWh/a*	*0.2 TWh/a*
Bio-energy; for electricity generation (Abaco, Andros, Grand Bahama, Eleuthera)	*3.7 TWh/a*	*1.3 TWh/a*	*2.5TWh/a*
Ocean Energy (OTEC, wave)	*12 TWh/a*	-	*5.5 TWh/a*
Waste-to-Energy	*0.15 TWh/a*	*0.11 TWh/a*	*0.11 TWh/a*
Total	*122 TWh/a*	*1.58 TWh/a*	*20.73 TWh/a*

Notes: 1 TWh = 10^6 MWh; Economic potential @ 70 BSD/bbl; future economic potential in 2030 @ 100 BSD/bbl; future economic potential considers also cost decreases of PV; solar water heater replace electrical water heater; economic potential of solar water heater limited to total hot water demand on The Bahamas; for the economic potential of waste to energy a sufficient level of waste fees is assumed to run a 15 MW plant on New Providence

Table 2: Potential of renewable energy in The Bahamas



Notes: NP = New Providence; FI = Family Islands; GB = Grand Bahama; BEC variable costs include fuel costs + variable O&M; all renewable energy costs calculated at 12% weighted average cost of capital; range of costs with solar water due to two different technologies; future costs for year 2020 with PV costs decreased by 50% against 2010; wind near shore and onshore costs include interconnection to grid

Figure 2: Range of generation costs of different RE technologies compared to different scales of avoided costs

The immediate deployment of renewable energy sources should focus on solar water heaters, bio-energy, and near shore wind power. Waste-to-energy currently represents the more immediate actionable initiative to address waste management requirements in the short term while at the same time increasing power supplies from non-fossil fuels, improving air quality, reducing pollution and illegal burning of wastes and fires on the public landfills. Additional environmental benefits include the reduction of top soil to entomb waste, recovery of recyclable materials and the reduction of the seepage of contaminants into the subsurface.

Ocean Thermal Energy Conversion (OTEC) processes also represent an exploitable renewable resource. As the Bahama Banks are characterized by steep drop-offs, most of the major islands have a location where OTEC technology would be feasible; however, this technology is at the experimental stage. Seawater district cooling could also be used in these locations, but there are few sites with appreciable demands for it. Deep-well reverse thermal conversion may also be an exploitable source of energy.

Given the favourable conditions in The Bahamas, photovoltaic power (PV) generation has good prospects to become the bulk energy carrier in the medium and long terms; therefore, a favourable regulatory framework should be created immediately for PV so that this technology can be deployed as quickly as possible as PV continues to become more cost competitive.

Going beyond a share of 20% renewable energies on power supply would require that renewable energies are to be transferred from one island to another through either interconnectors or as a fuel. Interconnectors might well be advisable even earlier, since they would allow tapping low cost potential of renewable energy for the use on New Providence. Interconnectors have the additional benefit of enhancing the reliability of previously isolated island grids at lower costs.

Also of note, fixed costs are relatively high for grid extensions to remote communities, where population density and demand is low and concentrated at peak times. Particularly in developing countries, applications of small wind, small hydro, biomass and solar photovoltaic in village mini-grids or for stand-alone household systems are proving commercially competitive with conventional alternatives.[9]

Barriers to the deployment of renewable energy (RE)

Deployment of RE at both the residential and utility scales encounters a number of challenges:

- Lack of awareness, knowledge and skills among users, planners, designers, and service providers regarding how RE technologies and opportunities can be applied;
- Lack of access to capital to cover the high up-front investments e.g. domestic banks are not ready to finance RE projects since they are not familiar with the concept;
- Independent power producers (IPP) are not granted grid access by law;
- Lack of incentives for BEC to buy electricity from IPP rather than transferring all costs to the final customer;
- Lack of clear technical and commercial grid connection rules, i.e., grid connection must be negotiated case by case, which is time-consuming; and
- Uncompetitive technologies under present conditions, however, this picture may change with costs of some RE technologies further decreasing and prices of competing fossil fuels increasing.

Energy regulation

The Bahamas regulatory framework is governed by the Electricity Act[10], the Out Island Electricity Act[11] and the Out Island Utilities Act. The Electricity Act established BEC to secure the supply of electricity, at "reasonable" prices, as well as to purchase, generate, transmit, transform, distribute and sell energy either in bulk or to individual consumers. The Out Island Act provide an opportunity for supplying electricity and creating and operating utilities in the Family Islands, if it is demonstrated to be in the nation's best interest. Meeting this condition (of national best interest) in the Family Islands has proven difficult for the private sector and BEC continues to provide power to all the Family Islands, except Grand Bahama and small franchise holders.

[9] "Renewable Energy", International Energy Agency.
[10] Chapter 194, Electricity Act of the statute laws of the Commonwealth of The Bahamas.
[11] Chapter 195, Out Island Electricity Act of the statute laws of the Commonwealth of The Bahamas.

The Hawksbill Creek Act[12] also provides for the creation of a franchise holder to provide electricity within the area defined by the Hawksbill Creek Act or areas controlled by the Grand Bahama Port Authority.

This framework has created a regional monopoly on electricity production and distribution in The Bahamas. It presents challenges in fostering an environment of competition, efficiency and conservation that will maintain "reasonable" prices for reliable electricity supplies, particularly in a global environment of volatile oil prices.

The current Electricity Act constrains RE use in that it: (i) gives exclusive rights for the generation and sale of electricity to a single entity, thus inhibiting self-generation and interconnection; and (ii) does not impose a requirement that a certain percentage of its electricity be generated from alternate or "green" sources. As such, the legal and regulatory framework of the electricity sector and fiscal incentives would need to be reviewed and amended in order to facilitate investments for commercial applications. The present regulatory framework serves as a disincentive to private-public partnerships in the expansion or development of the Commonwealth's energy infrastructure.

The existing Electricity Act, as the core piece of sector legislation does not address the relevant issues that are required to implement the objectives of a national energy policy:

- A monopoly supplier and has no obligation to accept electricity generated by a independent power producer (IPP) be it from fossil or from regenerative energy resources;
- There are no national schemes for the promotion of renewable energy sources or energy efficiency measures;
- No rules for the interconnection of power generation capacity are in place that would allow a independent power producer to connect generation capacity to the grid;
- The GoBH acts as policy-maker, regulator and owner of BEC which is not an appropriate governance model;
- The Electricity Act does not clearly define the regulatory tasks to be performed nor does it clearly delineate the duties, obligations, limitations of powers for the sector stakeholders; and
- There are no drivers to improve efficiency as well as financial and technical performance of electricity suppliers.

Therefore, it can be concluded that a basic change in the institutional set up as well as the sector structure and framework will be required to create an environment that enables the achievement of the policy objectives and to allow for sustainability and efficiency of service provision.

Energy efficiency and conservation

Efficient energy use, sometimes simply called energy efficiency, is using less energy to provide the same level of energy service. An example would be insulating a home to use less heating and cooling energy to achieve the same temperature. Another example would be installing

[12] Chapters 261, 262, 263, 264, 265 Hawksbill Creek Act of the statute laws of the Commonwealth of The Bahamas.

fluorescent lights and/or daylights instead of incandescent lights to attain the same level of illumination. Efficient energy use is achieved primarily by means of a more efficient technology or process rather than by changes in individual behavior.

Energy conservation is the practice of decreasing the quantity of energy used. It may be achieved through efficient energy use, in which case energy use is decreased while achieving a similar outcome, or by reduced consumption of energy services. Energy conservation may result in increase of financial capital, environmental value, national security, personal security, and human comfort. Individuals and organizations that are direct consumers of energy may want to conserve energy in order to reduce energy costs and promote economic security. Industrial and commercial users may want to increase efficiency and maximize profit.

Conservation can also relate to efforts to reduce or eliminate the wastage of imported fossil fuel products through the control, monitoring, metering and accounting for the products used including efforts to reduce loss, wastage, leakage or spillage from deliberate or accidental acts. Significant volumes of fossil fuels have been reported wasted through leaks, spillage and or wastage throughout the Bahamas. Inventory control practices in commercial and public institutions are reported to be lax and the overall control by the appropriate government regulatory environment deficient.

No national assessment has been conducted to assess the Commonwealth's energy use, energy efficiency or the extent of energy conservation efforts. No energy efficiency standards exist and no public policy encourage energy conservation or the efficient use of energy has been promulgated nationally. Regulations to provide for better inventory control practices, monitor loss due to spillage leakage or wastage of fossil fuel products are in need of updating in light of modern practices of the petroleum sector.

It can thus be assumed that any improvement in either measure has come as a result of the acquisition of technologies through the availably in the marketplace of more efficient vehicles, appliances, or equipment for heating or cooling of residences, as no energy-use products are manufactured in the Commonwealth.

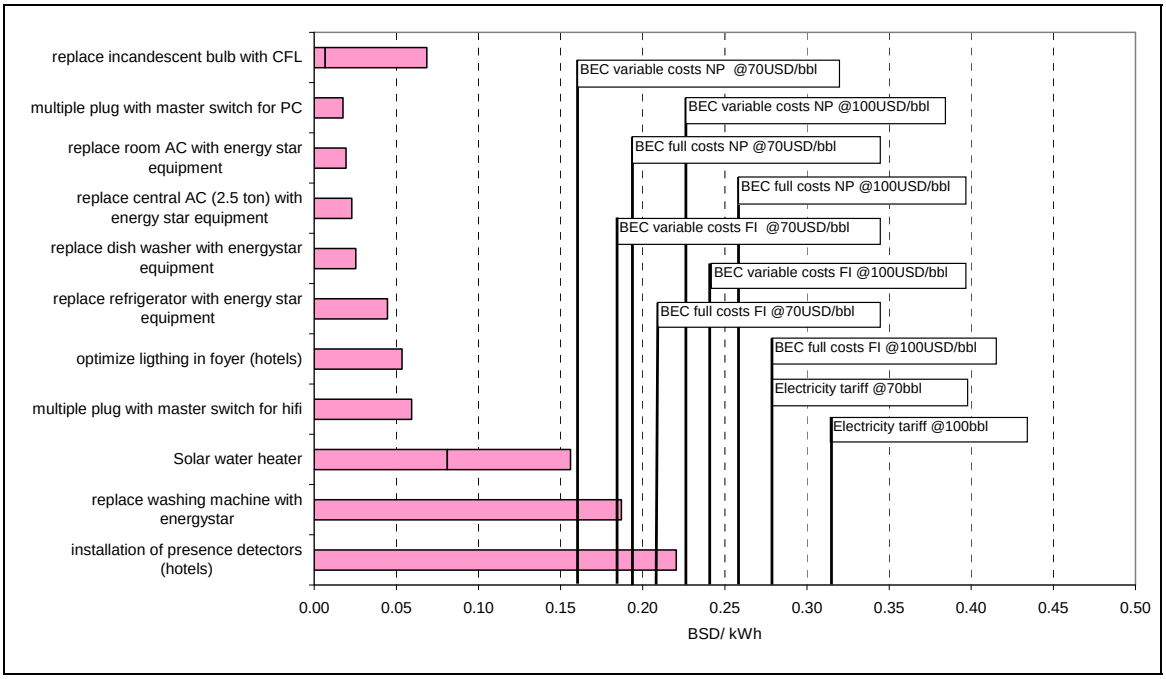
The deployment of more energy efficient equipment, for example, using the energy star quality improvements in the US, has benefited The Bahamas. The development of modern hotels have similarly made use of energy conservation equipment and employed energy management practices to reduce the cost of operations.

Efforts recently have been made to reduce the cost to consumers of access to energy-saving devices by reducing or eliminating the duties paid on a range of energy efficient or conserving appliances and technologies. No assessment has been made on the effectiveness of these newly introduced measures; however, Figure 3 shows most residential energy-saving devices are worthwhile investments.

Total potential from electricity savings in existing buildings with the residential sector and the hotel sector is estimated at around 605 GWh, equivalent to 27% of present power demand.

Similar levels of savings may be expected with other power consuming sectors like public buildings and industry.

Much of this potential comes at no or very low investment cost, reducing stand-by losses of electrical appliances. Further, energy can be saved at present cost through altering consumption patterns, like increasing the room temperature in air-conditioned rooms or switching off lights and appliances when not in use. In any case, the entire potential mentioned above is highly economically viable as a recently conducted sample of energy audits indicates.



Notes: 1 BSD = 1 USD; NP = New Providence; FI = Family Islands; BEC variable costs include fuel costs + variable O&M; all energy efficiency costs calculated at 9% weighted average cost of capital; range of costs of replacement of incandescent lights due to different power of bulbs; range of costs with solar water due to two different technologies

Figure 3: Cost range of energy efficiency measures

Energy efficiency is the deliberate effort to manage the economic impact of the dollar value of energy produced and consumed in The Bahamas. While The Bahamas is a net consumer of energy, the national energy policy (NEP) does consider the economic impact of investing in Bahamian energy production for local consumption and export. The dollar value of locally produced energy should positively offset the economic impact of energy consumed.

Widespread interest in energy management is driven primarily by increasing unit cost of energy ($/gallon, $/bbl, $/kWh) similar to that experienced between 2006 and 2008. Energy concerns begin at the individual level, household or other entity's energy bill, but permeate the economy as the cumulative cost of supply cascades through all economic activities that have an energy component. The NEP includes actions intended to better manage the national bill as well as reduce the rate of growth relative to global average.

Many of the priorities suggested in the NEP are intended to influence the units of energy consumed. Conservation encourages Bahamians to reduce their discretionary energy consumption by changing their usage pattern, fostering increased awareness and modifying behavior that contributes to the wastage of energy. Efficiency will encourage Bahamians to reduce their non-discretionary energy consumption by way of choosing more efficient technologies. However, there remains a minimum level of non-discretionary energy consumption necessary to support the minimum quality of life in The Bahamas. Non-discretionary energy consumption is best managed by choosing the most cost-effective and economically beneficial means of acquiring, producing, storing and distributing energy.

Barriers to energy efficiency

Deployment of energy efficiency encounters a number of non-economic barriers, which may include but not be limited to:

- Lack of awareness, knowledge, and skills among users, planners, designers, and service providers about energy efficient alternatives to the incumbent technologies and the opportunities of energy efficiency;
- Higher up-front investments - albeit most energy efficiency measures are highly cost competitive, in particular private consumers tend to prefer no/low investment but high running costs to high up-front investments but low running costs;
- Limited availability of high efficient technologies - the size of the Bahamian market limits the choice between different appliances, etc., so that often only inefficient default technologies are promoted; and
- Landlord-tenant problem, i.e., the house owner who installs and invests in a renewable energy plant does not benefit from lowered running energy costs but the tenant as the energy consumer does.

THE NATIONAL ENERGY POLICY

The national energy policy should encompass short, medium and long-term goals designed to foster energy conservation and diversification of energy sources and energy use sectors. The ultimate goal is to protect gross domestic product, foreign exchange and reserves while simultaneously minimising energy consumption and increasing energy efficiency and security.

Electricity Sector Policy Agenda

Based on the above analysis and the Government's primary objectives to lessen the reliance on oil and pursue alternative and renewable energy sources, a sustainable electricity matrix can be achieved by 2030.

A policy agenda to pave the way to the sustainable energy matrix would feature the following cornerstones: a new electricity sector framework, promotion of renewable energy, promotion of energy efficiency, and a Sustainable Energy Unit.

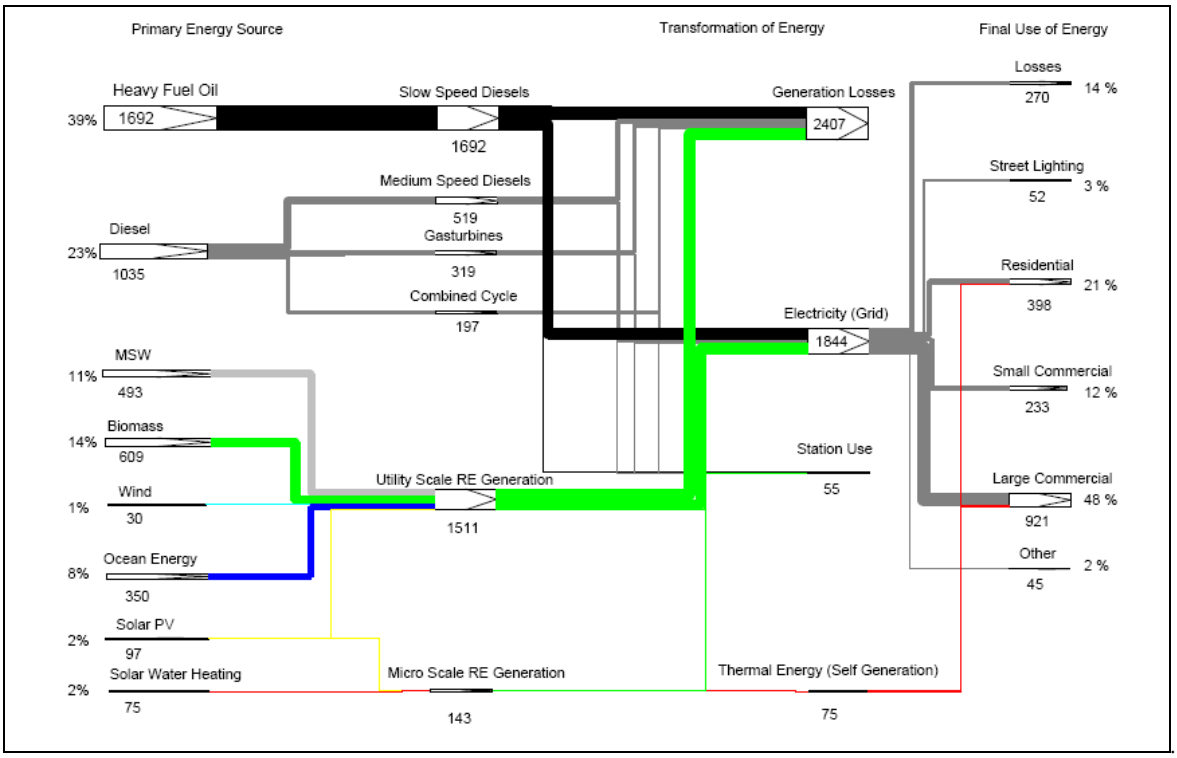
Sustainable electricity matrix for The Bahamas

The sustainable electricity matrix would include:

- Limiting the growth of electricity demand with energy efficiency so that the demand will remain at present levels, which equates to a 30% reduction against a business-as-usual scenario by 2030;
- Enhancing the efficiency of fossil-fired generation; and
- Introducing renewable energy technologies so that their increase in overall supply grows to be at least 30% of total power generation by 2030.

Figure 4 depicts the sustainable energy matrix for the area presently supplied by BEC, which represents 75% of the present electricity demand.

Following the path towards the sustainable electricity matrix would allow The Bahamas to achieve substantial benefits both in saved fossil fuels and a lowered environmental impact. Table 3 shows the resulting costs and benefits for the BEC supply area. In addition, all energy efficiency measures and those renewable energy plants, which are customer graded, would directly lead to reductions of the individual electricity bill, amounting to more than BSD 5 billion for all BEC customers (based on an electricity tariff of 31.4 ct/kWh).



Note: "Large Commercial" includes packinghouses, large warehouses with large motors, large plants with large motors, hospitals, auditoriums, large buildings, hotels, etc.

Figure 4: A sustainable energy matrix for The Bahamas (only BEC area)

	Unit	Energy Efficiency	Renewable Energy	Total
Saved fossil generated power	GWh	14,594	27,206	41,800
Saved fossil fuels	Mbbl	34.96	65.18	100
Avoided CO2 emissions	Mt	29	53	82
Benefits saved fossil fuels costs	MBSD	3,496	6,518	10,014
External benefits	MBSD	428	798	1,226
Total social benefits	**MBSD**	**3,924**	**7,316**	**11,240**
Total lifetime costs	**MBSD**	**392**	**4,588**	**4,980**

Notes: costs and benefits over the average lifetime of the equipment i.e. 15 yrs for energy efficiency including solar water heaters, 20 yrs for renewable energy plants; renewable energy incorporates waste to energy scheme; fossil fuel costs rated at a oil price of 100 BSD/bbl; external benefits calculated exclusively from avoided CO2 costs @15 BSD/tCO2; for the calculation of investment average power saving costs of 5 ct/kWh @ 9% WACC assumed; electricity tariff 31.4 ct/kWh

Table 3: Cost and benefits of a sustainable electricity matrix (only BEC area).

New electricity sector framework

The existing Electricity Act (1956) is no longer suitable to deal with the challenges of the electricity sector in The Bahamas. In particular, it does not allow for a financially viable operation of BEC and consumer-based generation.

Recent experiences in sector reforms have shown that a number of basic conditions should be met to provide for a sound basis of a sustainable energy supply:

- Separation of the sector roles and allocation to the appropriate sector entities;
- Establishment of an adequate sector structure;
- Adoption of a sound regulatory regime;
- Establishment of an independent vehicle for regulation; and
- Adoption of an appropriate governance mode for the utility.

These principles translate to an overarching Energy (Electricity) Act, which

- sets general sector objectives;
- defines the roles and functions of the various stakeholders in the sector;
- establishes the Utilities Regulation and Competition Authority (URCA) as the sector regulator and determines its specific powers and duties in the sector in addition to those already set out in the URCA Act;
- provides for licenses requirements for any activity in the electricity sector and establishes licensing procedures;
- defines the envisaged market structure for the electricity sector including the steps of the reform process;
- defines electricity supply activities (generation, transmission, system operation/ dispatch, distribution and retail);
- establishes access for IPP to the transmission / distribution system as well as competitive tendering for new generation capacity;
- determines the role of the Government of The Bahamas (GoBH) and URCA in respect to the promotion and development of renewable energy (including waste-to-energy) and energy efficiency.

There is a need to demarcate clearly the activities of the GoBH and the regulatory authority URCA in order to create a sector environment that is governed by sound regulatory practice and attracts private sector investment. The envisioned demarcation of activities is shown in Table 4.

Government of The Bahamas		
Policy function	• *National energy policy (1)*	• *Tasks / activities* • *Overall sector objectives* • *Responsibilities of institutions* • *Implementation programs*
Sector Structure	• *Market structure and organisation*	• *Competition for generation capacity /TPA* • *Private sector participation*
Long term planning	• *Long-term energy balance*	• *Final approval of Least Cost Expansion Plan*
Renewable Energy	• *Programs for development and use of RE* • *Supporting legislation for renewable energy*	• *RE targets and objectives* • *Definition of an RE intervention scheme*
Energy Efficiency	• *EE Programs*	• *EE targets* • *EE intervention schemes* • *Monitoring*
Regulatory Body (URCA)		
Sector Competition	• *Define rules for sector competition* • *Procurement processes*	• *Supervise competitive processes*
Licensing for supply activities	• *Prepare and issue licenses for the various supply activities* • *Suspend / Revoke Licenses*	• *Supervise electricity supply activities*
Long term planning	• *Assessment of capacity requirements (in cooperation with utility)* • *Energy Balance*	• *Set procedures* • *Provide comments and recommendations* • *Approve LCEP*
Economic regulation	• *Price regulation for monopolistic market segments* • *Tariff regulation for customers* • *Merit order dispatch* • *Performance Orientation* • *Customer Protection*	• *Set rules and procedures for price and tariff regulations* • *Define methodologies* • *Approve prices and tariffs* • *Charging of Incentives / Penalties*
Technical regulation	• *Service Quality and Supply Standards* • *Technical Codes (e.g. Grid Code, Connection Code, metering Code)* • *Customer Protection*	• *Supervision, monitoring and enforcement* • *Charging of Incentives / Penalties for deviations*
Dispute Resolution	• *Dispute resolution and arbitration*	• *Procedures for dispute resolution and arbitration*
Renewable Energy and Energy Efficiency	• *Assist in preparation of intervention schemes*	• *Supervise*

(1) Discharged to National Energy Policy Committee by conclusion ICO (8) 12th Meeting, Conclusion No. 20.

Table 4: Proposed sector roles between GoBH and URCA

The envisioned sector structure is shown in Table 5. It is obvious that this structure cannot be introduced under the existing Electricity Act (1956) and will require the establishment of new relevant legislation, which will allow for the development of a new market structure and foster the reform process.

Electricity Supply Activity	Market Status	Ownership
New Generation Capacity (fossil)	• Competition for the market • Long-term performance oriented PPAs	• Private ownership
Existing BEC Generation Capacity	• Economic dispatch • Performance oriented PPAs	• BEC • Possible unbundling from BEC
Renewable Energy: generation capacity < [*] MW	• Feed-in tariffs • Standard PPAs	• Private ownership
Renewable Energy: generation capacity > [*] MW	• Competitive procurement	• Private ownership
Waste-to-Energy	• Competitive Procurement • Specific Security Package required	• Private ownership
System Operation (Single Buyer)	• Monopoly activity	• Presently BEC • Possible unbundling from BEC
Transmission & Distribution	• Monopoly activity	• BEC
Retail (bulk or domestic customers)	• Monopoly activity	• BEC

Table 5: Envisioned structure for the electricity sector of The Bahamas

Further to the implementation of a new Energy (Electricity) Act, the following actions should be undertaken:

- Immediate establishment of the URCA as the regulator: To become active in the process of creating a new legislative and regulatory framework, the participation of URCA as future sector regulator will be indispensible. At present URCA is not involved in the electricity sector and needs to build up the relevant organization and staffing to be able to take over. URCA would need to start immediately with the participation in the preparation of the sector act and regulations; therefore, Gob should issue a directive or decision that mandates URCA as the regulator for the electricity sector in the short term.
- Renewable energy (RE) and energy efficiency (EE): the implementation of RE and EE will not only depend upon the abolishment of certain barriers, but also will require specific promotion programs. The task of preparing such programs should be in the hand of GoBH and should be started immediately even without having the regulatory authority in place. Drafting of relevant legislation should be started immediately.
- Competitive Process: Processes for acquiring RE and waste-to-energy projects to achieve optimum results should be conducted under internationally accepted tendering procedures. As such, procedures have yet to be established, a competitive tendering committee should be established with the participation of the GoBH, URCA and BEC.

- Adoption of appropriate corporate governance for BEC: GoBH should establish BEC as a private electricity company under the Companies Act. This will allow redefining the roles, functions, duties, responsibilities, authorities and powers of the various bodies in the company to reflect autonomy of the management in its day-to-day activities and enable decision-making under commercial criteria. Until such time as a revised company structure can be implemented, GoBH should provide written instructions to the Board of Directors and set performance goals for BEC management, which are aligned with government objectives.

It is recommended that these activities should start immediately, even without having a new Electricity Act in place.

Promotion of renewable energy (RE)

A share of at least 15% and 30% of RE power supply is targeted by 2020 and 2030, respectively.

The core of promoting power generation from RE sources consists of the following:

- Net metering/ net billing schemes established for small wind power plants and photovoltaic plants up to a size of 50 kW, with net billing only granted to plants operated on or near buildings occupied by the operator of the plant and generation equipment installed primarily to cover, partially or fully, the customer's electricity needs;
- Feed-in tariffs for biomass-fired power plants, photovoltaic plants, waste-to-energy facilities and wind power plants in a non-customer based generation mode; and
- Tendering scheme for utility-scale power plants with a minimum capacity of 5 MW.

A possible means of meeting the additional costs, which may arise from promoting renewable power generation, could come from the establishment of a common Renewable Energy Fund (in some US states called a "Public Benefit Fund") where the monies dedicated to renewable energy are collected. Potential sources for financing are:

- the generic public budget from the Government of The Bahamas;
- a particular tax;
- a surcharge on electricity tariffs;
- bilateral grants to support the adoption of RE/EE measures; and
- income from climate trade.

The economic conditions for interconnecting renewable energy power plants will be regulated under the Electricity Act. Technical conditions of interconnection shall be developed separately potentially following well-established standards in other countries, like IEEE 1547 in the USA.

In addition the following measures could be done:

- conduct an information campaign to raise the awareness on renewable energy and their opportunities;
- incorporate renewable energy into educational curricula. This applies both to senior high schools, colleges and universities;

- introduce further exemptions for imported renewable energy equipment; and
- apply renewable energy in public buildings for demonstration purposes.

Promotion of energy efficiency (EE)

EE measures and energy-saving means should be established so that any future growth of demand for energy services would be entirely balanced. This means by 2030 the current level of energy services from electricity, i.e. lighting, air-conditioning, communication, etc. would be provided with 30% less power than presently required.

The following policy initiatives should be established:

- Only energy-rated electrical appliances, e.g. those bearing the Energy Star label, are admitted to the Bahamian market;
- Minimum energy standards for new buildings;
- Legal obligation to use solar water heaters (Solar Ordinance);
- Custom exemptions for energy efficiency equipment;
- Information campaign;
- Self-explanatory tools to identify individual efficiency potentials of households;
- Free energy audits for low-income households;
- Obligation of hotels to conduct energy audits;
- Obligation of public institutions to conduct energy audits;
- Special 50-50-projects;[13] and
- Awareness campaign on EE in schools.

Sustainable Energy Unit (SEU)

To implement RE and EE promotion policies, a Sustainable Energy Unit (SEU) should be established. The Unit should form part of the ministry responsible for the energy policy, and it should be empowered to direct national efforts in support of the implementation of the National Energy Policy.

Beyond its own activities, the SEU should serve as a catalyst for activities, which are the responsibility of other government agencies (see Annex 3a). This way, the SEU would ensure that all efforts toward more RE and EE are coordinated and achieved. Further, the Unit should be charged with the responsibility to execute any additional actions identified as the energy usage sectors evolve and the national policy requires modification. In this sense, it would serve as an operational branch of the ministry responsible for the energy sector, reporting on a quarterly basis.

Additional detail on the SEU is provided in Annex 3b.

[13] The concept behind a 50-50 project is creating a win-win situation for both parties through savings in total energy consumed, which is achieved from energy efficiency measures implemented by one party (e.g., schools, clinics) and the other party (e.g., Government or a public authority) sees savings on fuel bills paid.

Policy targets and objectives

SHORT-TERM TARGETS (1-5 years)

- Completion of data gap analysis
- Complete phase-out of incandescent light bulbs and their replacement with reduced mercury compact fluorescent light bulbs (CFL)
- Investigation and implementation of waste-to-energy technology for New Providence
- Investigate the option of combining heat and power and cogeneration type technologies
- Explore the use of biofuels
- Develop a common basis to measure and compare the average annual unit cost of each form of energy consumed by sector and geographic area ($/gallon, $/kWh, $/bbl)
- Develop a means to measure and track the annual national energy bill and the impact on the economy
- Develop a regulatory framework to monitor, assess fossil fuel leakage, reduce losses of imported products and conserve resources of products imported for domestic consumption
- Develop a means to measure the economic impact of the annual national expenditure on fossil sources of energy e.g., portions multiplied locally: number of jobs and estimated payroll; percentage of raw materials and other consumed goods and services procured locally; and percentage of industry locally owned
- Initiate public buildings energy usage reduction strategies
- Explore interconnections between islands to enhance efficiency and promote the potential for RE
- Assess the Commonwealth's wind potential as well as identify potential sites for pilot and or demonstration facilities
- Assess the feasibility of CNG
- Develop a means to measure the economic impact of the annual national expenditure on renewable sources of energy e.g., portions multiplied locally: number of jobs and payroll; percentage of raw materials and other consumed goods and service procured locally; and the percentage of industry locally owned
- Initiate energy efficiency activities in public (BEC, Bahamas Telecommunications Company, Water & Sewerage Corporation) and private utilities, implement and report to the public

MEDIUM-TERM TARGETS (5-10 years)

- Increase the penetration of renewable energy sources in the Commonwealth to 15% of supplies,
- Deploy renewable energy technologies in several small communities, aiming towards >50% of power from renewable sources
- Reduce dependence on imported fuel oils by:
    - Increased building energy efficiency by introducing standards in public buildings for cooling public spaces, heating water, lighting and the deployment of the highest energy star ratings of equipment
    - Increased use of solar hot water systems to 20 to 30% of all households
    - Increased efficiency of cooling systems and increasing SEER ratings
    - Increasing the deployment and usage of energy efficient lighting systems and fenestration systems (windows) in public buildings
    - Increased public awareness and education on RE potential and usage

- Requiring all Government financed homes and buildings use, install, operate and maintain solar hot water systems

- Develop pilot and demonstration systems for residential cooling using reverse thermal gradient in low cost housing estates
- Initiate a pilot or demonstration project for ocean thermal energy conversion potential, starting with taking measurements at Clifton, New Providence and North Eleuthera
- Assess the Commonwealth's wave and tide potential as well as identify potential sites for pilot and or demonstration facilities
- Develop a means to estimate the average annual unit cost of renewable sources of energy
- Develop filters to achieve the optimum level of local participation in any energy entity that should be pursued during a period of ownership transition, e.g., cost and pace of change of technology, capital requirements, existence of qualified Bahamian resources, access to supporting supply and technical resources, compliance with multi-national treaties

LONG-TERM TARGETS (10-20 years)

- All installations of water heaters are solar water heaters
- Develop a programme to pursue cost-effective opportunities in reducing energy consumption
- Develop a programme to minimize greenhouse gas emissions
- Establish a funding mechanism, sources for energy use and constant technology innovations and the engagement of the private sector through private/ public partnerships in the expansion, upgrade and renewal of the energy services infrastructure
- Develop extended targets for changes in the energy mix based on extended unit cost and economic impact estimates by energy source, informed by local experiences and historical data

SHORT-TERM POLICY OBJECTIVES

- Energy Conservation
  - Develop and implement a public sector energy conservation programme and marketing campaign. This programme must be an aggressive campaign that includes a comprehensive energy audit of the various government agencies and holdings, with the goal of achieving energy-consumption reduction targets. This programme must be transparent and will require a marketing scheme to promote the programme, to lead both the private sector and the public by example, to encourage and influence private sector participation (starting with government vendors and service providers) and competition.
  - Develop and implement a consumer-oriented energy conservation campaign. Such a campaign should include consumer education on "wise" energy use and conservation (and consequently monetary saving) tips, and an outreach component to advise the public of its role in strengthening national self-sufficiency and energy security. In order to maintain enthusiasm and reinforce the importance of consumer energy conservation, the campaign also requires a marketing campaign that demonstrates the consumer savings achieved through the various tips promoted in the overall campaign.
  - Develop and execute an implementation strategy for the economic incentives announced in the 2008/9 budget cycle. This includes working with the Customs Department to ensure customs officers are able to identify the energy-saving goods subject to tax-rate reduction or exemption. Consumers should also be advised of these goods. (This may be a component of the consumer-oriented energy conservation campaign.)

- Energy production management
  - Review and establish a guideline for independent power production.
  - Explore the option of combining heat, power and cogeneration type technologies to support the ongoing effort of capacity deferment.
- Assess renewable potential
  - Identify the data gaps, and then formulate and implement solutions for closing the gaps and setting realistic targets.
  - Investigate the potential exploitability of various renewable energy sources and technologies, including waste-to-energy, wave, tide, wind, photovoltaic systems, and solar water heating units.

MID-TERM POLICY OBJECTIVES

- Renewable energy implementation plan
  - Develop and implement a renewable energy programme. This programme should encourage the private sector to develop projects to produce electricity using renewable sources (e.g., solar, wind, ocean-thermal) for possible exploitation by the Bahamas Electricity Corporation. The programme can be used to establish targets for renewable electricity sales.
- Energy commission
  - Establish a permanent energy commission, responsible for overseeing the implementation of select national energy initiatives, stemming from the national energy policy.
- Fill data gaps (IDB projects)
  - Identify the data gaps, and then formulate and implement solutions for closing the gaps and setting realistic targets.
- Develop energy efficiency standards
  - Establish energy efficiency standards (e.g., building standards) for incorporation into the existing regulatory regimes. Stakeholder consultation on the proposed standards should be done, as well as compliance promotion and enforcement.

LONG-TERM POLICY OBJECTIVES

- Reduce the rise in energy consumption and reduce use on a per capita basis
  - Develop and implement a programme to pursue cost-effective opportunities to reduce further energy consumption by various target sectors and individual consumers.
  - Develop and implement a programme to minimize greenhouse gas emissions.
  - Establish funding mechanisms for identifying, implementing and promoting sustainable energy use and technology innovation that support efforts to achieve the targets outlined in the national energy action plan.

Transport Sector Policy Agenda

As with the electricity sector, the transport sector also requires analysis in order to fill gaps in critical data and produce concrete recommendations for the sector. The suggested policy targets and objectives identified below should be reviewed after completion of the sector analysis.

Policy targets and objectives

SHORT-TERM TARGETS (1-5 years)

- Introduce an integrated traffic management system and public transport system:
    - Reduce average commute times on New Providence by 20%
    - Increase ridership of public transport to 10-20%
    - Employ advanced energy efficient lighting systems in public spaces supported by signage and traffic management systems
- Conduct a gap analysis to generate consistent data sets, which include passenger vehicle numbers, types, model years; commercial land vehicle numbers, types, model years; passenger, recreational, cargo and commercial marine vessel numbers and types; passenger and private aircraft numbers and types; mileage and consumption data of all fuel types and vehicle categories and classes; existing traffic control systems; public transit statistics; petroleum product pricing and marketing trend factors; petroleum product shipping, delivery and distribution frequencies and practices
- Conduct national market and consumer research to secure data on pricing and other socio-economic and market trends affecting the sector

MEDIUM-TERM TARGETS (5-10 years)

- Increase fuel efficiency of motor vehicles to 30–35 mpg for 70% of licensed vehicles through the application of incentives to import and use more efficient vehicles in private and private sector transport

SHORT-TERM POLICY OBJECTIVES

- Complete a study of the sector energy demand and consumption:
    - Identify the data gaps, and then formulate and implement solutions for closing the gaps and setting realistic targets.
    - Investigate the potential exploitability of various options for improving the sector.

MID-TERM POLICY OBJECTIVES

- Fuel economy transport
    - Develop and implement a programme to increase the average fuel economy of vehicles. This programme could include periodic (e.g., once every two or three years for private vehicles and annually for commercial vehicles) vehicle emission testing as a part of the vehicle registration process, a ban on the import of vehicles older than five (5) years, improved enforcement of road traffic and safety legislation.
    - Improve the quality of diesel oils imported for local consumption to reduce particulate emissions in order to improve air quality in urban centres
    - Develop and implement a national strategy for integrated traffic and transportation system management

LIST OF ABBREVIATIONS AND ACRONYMS

bbl	barrel
BEC	Bahamas Electricity Corporation
CFL	compact fluorescent light bulb
CREDP	Caribbean Renewable Energy Development Programme
EE	energy efficiency
GDP	gross domestic product
GoBH	Government of The Bahamas
GWh	gigawatt-hour
IDB	Inter-American Development Bank
IPP	independent power producer
kW	kilowatt
kWh	kilowatt-hour
MOF	Ministry of Finance
MOTE	Ministry of the Environment
MOWT	Ministry of Works & Transport
mpg	miles per gallon
MSW	municipal solid waste
MW	megawatt
NEP	national energy policy
NEPC	National Energy Policy Committee
OAG	Office of the Attorney General
OTEC	ocean thermal energy conversion
PPA	purchase power agreement
RE	renewable energy
SEER	seasonal energy efficiency ratio
SEU	Sustainable Energy Unit
TWh	terawatt-hour
URCA	Utilities Regulation and Competition Authority
US	United States
USA	United States of America
WIREC	Washington International Renewable Energy Conference

ANNEX 1a: NATIONAL ENERGY POLICY COMMITTEE (NEPC) MEMBERS

Chair
Mr. Philip S. Weech, Bahamas Environment, Science and Technology Commission

Members
Mr. Keith Bishop, Islands by Design

Mr. Hugh Chase, Ministry of Finance

Mr. Gilles Deal, Ministry of the Environment

Mr. Anthony Dean, Abadean Engineering

Mr. Kevan Dean, Bahamas Hotel Association

Mr. Jerome Elliott, Bahamas Electricity Corporation

Mr. Cyprian A. Gibson, Bahamas Society of Engineers

Mr. Keith Glinton, Esso Ltd.

Ms. Danielle Hanek-Williamson, Ministry of the Environment

Mr. Earlston McPhee, Ministry of Tourism & Aviation

Mr. Oswald F. Moore, Texaco Bahamas Ltd

Mr. Rudolph Pratt, Maritime Affairs

Captain Vernon Ritchie, Marine Tankers

Technical Secretary
Loraine Cox, Bahamas Environment, Science and Technology Commission

ANNEX 1b: NEPC RESOURCE PERSONS

Name	***Area of Expertise***
Dr. Richard Cant	Oil & Gas Resource Potential in The Bahamas
Mr. Glen Laville	Energy Technical Cooperatives Project Manager
Mr. Arthur Rolle	Renewable Energy Resource Potential in The Bahamas

ANNEX 2: THE NATIONAL ENERGY PLEDGE

SUMMARY TITLE:	Development of an Energy Policy for the Commonwealth of The Bahamas
MAIN OBJECTIVES:	To establish a National Energy Committee whose primary objective is to review and implement measures to reduce The Bahamas' dependency on the use of fossil fuels
EXPECTED RESULTS/ IMPACTS:	▪ A reduction in the use of fossil fuels ▪ Increased efforts to slow global warming and reduce greenhouse gas emissions ▪ A rise in the sale of energy efficient equipment
PLEDGE TARGET AREA:	The entire country
TIME FRAME:	To be implemented within the next two years
MONITORING PROCESS:	Utilisation of techniques that are compliant with internationally set monitoring standards

ANNEX 3a: PUBLIC SECTOR ACTIVITIES OF THE SEU

Responsible Agency	Target	Activity
Ministry of Housing Ministry of Works & Transport (MOWT)	All low-cost housing units to be designed to efficiently use energy and water	▪ Design low cost homes to provide solar water heaters and use of energy-saving light bulbs and fixtures. ▪ Ministry of Housing to consider requiring contractors to bulk purchase solar hot water systems, CFLs and light fixtures, and energy-saving appliances, as well as use of reflective paints to coat roofs. ▪ MOWT to consider instituting a redesign of low-cost housing to provide for reduced energy usage, energy efficiency and energy usage ratings ▪ Provide specifications for size of solar water heating, window glazing, low-flow plumbing fixtures, impact-resistant windows and/or provide for the installation of hurricane shutters. ▪ Develop guidelines for construction that builds upon knowledge of the beneficial use of natural vegetation to insulate homes, location of windows to reduce heat gain etc, ▪ Develop a national policy that will ensure energy conservation, reduce spillage, leakage and unaccounted losses of imported fossil fuels in storage and disbursement facilities across the Bahamas

Responsible Agency	Target	Activity
Ministry of Finance (MOF)	Across the public service, energy usage reduction of 15 %	▪ Institute a fleet management policy that incorporates retiring older, less efficient vehicles with vehicles of the highest fuel economy in their respective classes, as well as routine servicing of vehicles and training of staff to check tyre pressures and monitor fuel usage by vehicle. ▪ Provide for a systematic auditing of public buildings for energy usage and develop programmes to monitor, track and reduce usage. ▪ Provide incentives for staff to reduce energy usage, provide targeted funding to Ministries to implement proposed measures, based on the energy audit. ▪ Create the means of tracking energy usage and identify less efficient accommodations. Use this data to prioritize process of relocations and upgrades of office accommodations. ▪ Monitor energy used in the cooling of public buildings and provide for the use of timers and on/off switches to control energy used. Set average maximum temperature at a predetermined comfort level (75-78 °F). ▪ Replace inefficient CFT computer monitors with LCD panels across the public service. ▪ Require financial officers to monitor, track and audit all water as well as energy usage and track efforts to reduce and conserve.

Responsible Agency	Target	Activity
MOF	Measure and monitor the economic impact of national expenditures on energy sources	▪ Develop a means to measure the average annual unit cost of each form of energy consumed by sector and geographic area ($/ gallon, $/kWh, $/bbl) ▪ Develop a means to estimate the average annual unit cost of renewable sources of energy being considered: - renewable and other locally produced energy - fossil sources ▪ Develop a means to measure and track the annual national energy bill and the impact on the economy including the resulting changes from the NEP initiatives. ▪ Develop a means to measure the economic impact of the annual national expenditure on fossil sources of energy e.g., - Portions multiplied locally: • number of jobs and estimated payroll • percentage of raw materials and other consumed goods and service procured locally • percentage of industry locally owned ▪ Develop a means to estimate the potential economic impact of renewable sources of energy being considered - Portions multiplied locally: • number of jobs and estimated payroll • percentage of raw materials and other consumed goods and service procured locally • percentage of industry locally owned ▪ Develop filters to achieve the optimum level of local participation in any energy entity that should be pursued during a period of ownership transition e.g., - Cost and pace of change of technology ▪ Capital requirements

Responsible Agency	Target	Activity
Department of Social Services	All subsidized housing to reduce energy usage 15 % by the end of the next fiscal year	▪ Provide for the routine monitoring of energy usage in subsidized public housing, replacement of lighting units, accommodate CFL units. Retrofit of water and toilets to provide for low water usage and low-flow flushing. ▪ Design of senior citizen facilities to provide for the most efficient cooling and heating systems required in elderly accommodations.
Statutory Agencies (Hospitals, Post Office, etc.)	Improve energy usage 15 % by the end of the next fiscal period	▪ Create a mechanism to coordinate efforts to cost effectively undertake a comprehensive energy audit and develop a system for improving energy efficiency by coordinating; - Audits of all large motors, a replacement programme for older less efficient ones and standards for the acquisition of new motors; - Assessments of vehicle fleet efficiency and implement standards for replacement of vehicles using as one of the criteria fuel efficiency; - Replacement of old, air-conditioning units and systems with energy efficient HVAC systems in customer service centres, offices and other open spaces.
Department of Road Traffic	Reduce average commute times on all major arteries at peak travel times by 15 – 30%	▪ Assess average commute times on major arteries on New Providence ▪ Provide and implement as early as possible an integrated traffic management system for New Providence including, traffic lights, rush-hour regulations, staggered business hours, access and use of heavy vehicles during rush hours

Responsible Agency	Target	Activity
Public Hospital Authority	Reduce energy usage by 25% by retrofitting lighting and cooling systems in all hospitals and clinics Design new public hospital using defined EE and EC standards	▪ Assess energy usage in public hospitals and clinics, implement replacement and upgrading programmes, define EE standards for all major institutional elements ▪ Assess opportunities in new and existing facilities to conserve water, reduce energy use make use of energy efficient design principles
MOWT	Assess applicability of employing Leadership in Energy and Environmental Design (LEED) principles in all public buildings and facilities	▪ Accomplish the following: - Define a Bahamian "green building" standard by establishing a common standard of measurement - Promote integrated, whole-building design practices - Recognize environmental leadership in the building industry - Stimulate green competition - Raise consumer awareness of green building benefits - Transform the building market in the major areas of: water efficiency, energy usage (lighting and cooling), materials (doors windows, hurricane shutters) and site selection (orientation, vegetative buffering)

Responsible Agency	Target	Activity
Ministry of the Environment (MOTE) Ministry of Education	Design and implement a nationwide public education and awareness programme on EE, EC and sustainable energy and water usage Design and implement a 50-50 project involving private and public schools	▪ Input from BEC, Water & Sewerage Corporation, Ministry of Works & Transport, Bahamas Information Services, Ministry of Tourism in identifying options and individual habits, outlining tips, and developing a marketing strategy ▪ Sensitize students to sustainable energy use and energy efficiency, e.g., students learn to close windows if the air-conditioning is running, switch off lights in empty classrooms. As an incentive 50% of the achieved annual energy savings (measured against a baseline) should be given to the school for its use; the remaining 50% goes to the public authority that pays the school's energy bills. ▪ Train a selected teacher to be the 50-50 project energy mentor. The teacher shall be trained by an energy auditor, train students participating in the project (with the assistance of the energy auditor) and shall be the contact person for all energy related questions in the school. ▪ Each class participating in the 50-50 project shall name an energy detective, who will be responsible for the progress made by the class.
MOTE, in concert with Bahamas Electricity Corporation (BEC); Utilities Regulation & Competition Authority (URCA); Grand Bahama Power Company; Office of the Attorney General (OAG)	Review of the regulatory framework of The Bahamas	▪ MOTE, BEC, Grand Bahama Power Company, URCA and the OAG to review the existing regulatory framework to assess potential for increased access by the private sector to the national grid, feasibility of buy-in tariffs and other instruments, approach for establishing an energy commission and its mandate ▪ Cooperate with other Ministries and Departments in the implementation of the National Energy Policy

ANNEX 3b: ADDITIONAL DETAIL ON THE TASKS AND ROLES OF THE SEU

Task	Primary responsibility	SEU role	Priority	Time horizon
Designing, initiating and operating energy efficiency promotion programme households	SEU	Design and administrate	+++	short
Energy audits for households	SEU	Auditor as SEU staff	++	short
Duty exemptions for energy efficient equipment	Ministry of Finance	catalyst	++	short
Minimum energy efficiency standards for new buildings	Ministry of Works & Transport	catalyst	++	short
Introduce Solar Ordinance	GoBH	Draft ordinance	+++	medium
Solar water heater promotion programme	SEU	Design and administrate		short
Energy auditing for hotels	Bahamas Hotel Association	Supervision of auditor	+++	short
Monitor energy demand in public buildings	Energy Manager	Energy manager report to SEU; SEU publish benchmarks	+++	medium
Energetic review of existing and planned new public buildings	SEU	approval	++	short
Public institutions only to purchase Energy Star labeled appliances	SEU	SEU to develop and constantly update list of Energy Star labeled appliances to be distributed to procurement managers	++	short
50-50 project for schools	SEU	Design and administration	+	medium
Change Article 15 of the Electricity Act to allow connection of RE and energy efficient CHP	GoBH	catalyst	+++	short
Establish Net-Metering/ Billing	GoBH	Draft scheme	++	medium
Establish Feed-in Tariff	GoBH	Draft scheme	++	short
Establish Tendering scheme for RE	BEC	Draft scheme Monitor annual tender process	+++	short
Duty exemptions for RE equipment	Ministry of Finance	catalyst	++	short
National strategy for coordinating research in RE	SEU	draft	+	medium
Establish National Renewable Energy Fund	SEU	manage	+	medium