GEA

GUYANA ENERGY AGENCY

STRATEGIC PLAN

2016 - 2020

Reliable energy – economically, environmentally and socially sustainable – for all in Guyana

Table of Contents

Acknowledgements 4

Foreword 5

Acronyms and Abbreviations 6

Introduction 9

Policy, Legislative and Organizational Framework 10

- Mission Statement 13
- Core Values 13

Institutional Framework 15

Performance Review and Analysis 18

- Energy from Fossil-based Fuels 18
  - Incandescent Bulb Replacement Programme 21
  - Exemption from Import Duties and VAT 21
  - Energy Efficient Street Lighting 21
  - Awareness and Information Dissemination 22
  - Energy assessments/audits 22
  - Energy Efficient Cooking 22
- Hydropower 24
  - History of Hydropower in Guyana 24
- Solar Power 27
- Wind 28
- Bio-Energy 29
  - Bagasse 29
  - Rice Husk 29
  - Firewood and Charcoal 30
  - Woodwaste 30
  - Energy Efficient Wood Stoves 31
  - Biofuels 31
  - Biogas 32

Policies and Strategies 34

SWOT Analysis 36

Guyana's Current Energy Policy 37

New and Renewable Energy 40

Hydropower 40
Strategic Objectives 40
Strategic Actions 40
Solar Power 42
Strategic Objectives 42
Strategic Actions 42
Wind 43
Strategic Objectives 43
Strategic Actions 43
Bioenergy 44
Strategic Objectives 44
Strategic Actions 44
Energy Conservation and Efficiency 46
Strategic Objectives 46
Strategic Actions 46
Public Education Campaigns 51
Strategic Objectives 51
Strategic Actions 51
Licensing 52
Current Situation 52
Strategic Objectives 52
Strategic Actions 53
Fuel Marking Programme 54
Current Situation 54
Programme Indicators 55
Strategic Objectives 58
Strategic Actions 62
Organizational Structure, Capacity and Infrastructure 63
Current Situation 63
Strategic Objectives 63
Strategic Actions 63
Budget 64
Key Strategic Actions (KSAs) 65

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Completion of this Strategic Plan required the involvement of many people with a wide variety of contributions. I wish to thank the various institutions involved for the generous and timely reviews.

I am especially grateful for the contribution and support of my fellow members of the GEA Board of Directors, in particular the Chairman of the Board, Mr. Lance Hinds, for his invaluable support and encouragement throughout the process.

I would also like to express my gratitude to the hardworking staff of the Guyana Energy Agency who worked tirelessly and remained committed to ensuring a high quality document was produced.

Foreword

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Last, but certainly not least, I would very much like to thank the Honourable Minister, Mr. David Patterson who has provided direction on the general outlook of the Energy sector.

Lance Hinds
Chairman, Board of Directors
Guyana Energy Agency

Acronyms and Abbreviations

bbls	Barrels
boe	Barrel of Oil Equivalent
CANU	Customs Anti-narcotics Unit
CARICOM	Caribbean Community
CFC	Chlorofluorocarbons
CJIA	Cheddi Jagan International Airport
COTED	Council for Trade and Economic Development
CO_2	Carbon Dioxide
ECELP	Eastern Caribbean Energy Labelling Project
ECLAC	Economic Commission for Latin America and the Caribbean
EPA	Environmental Protection Agency
GEA	Guyana Energy Agency
GDF	Guyana Defence Force
GHG	Greenhouse Gases
GDP	Gross Domestic Product
GNBS	Guyana National Bureau of Standards
GoG	Guyana of Guyana
GPL	Guyana Power and Light Inc.
GWh	Gigawatt hour
GWI	Guyana Water Inc.
HCFC	Hydro-chlorofluorocarbons
HFC	Hydro-fluorocarbon

IADB	Inter-American Development Bank
IAST	Institute of Applied Sciences and Technology
IPCC	Intergovernmental Panel on Climate Change
IPED	Institute of Private Enterprise Development
IPP	Independent Power Producers
ISO	International Organisation for Standardization
kW	kilowatt
kWh	kilowatt hour
LCDS	Low Carbon Development Strategy
LED	Light emitting diode
LNG	Liquefied Natural Gas
MDG	Millennium Development Goal
MEP	Minimum Energy Performance
MNRE	Ministry of Natural Resources and Environment
MoA	Ministry of Agriculture
MW	Megawatt
MWh	Megawatt hour
MOU	Memorandum of Understanding
OAI	Ogle Airport Inc.
OCC	Office of Climate Change
OLADE	Latin American Energy Organization
OPM	Office of the Prime Minister
OP	Office of the President
PETROCARIBE	Energy Agreement between Venezuela and Caribbean States
PDVSA	Petróleos de Venezuela SA

PPA	Power Purchase Agreement
PUC	Public Utilities Commission
PV	Photovoltaic
RE	Renewable Energy
TBD	To be determined
UAEP	Unserved Areas Electrification Programme
UNDP	United Nations Development Programme
USGS	United States Geological Survey
W	Watt

Introduction

Access to affordable and reliable energy to provide services such as lighting, cooking, transportation, communication, entertainment and to drive production, is central to all aspects of human welfare. As societies continue to grow, the demand for energy and associated services also grow to meet social and economic development[1].

Since around the 1850's, the global utilisation of fossil fuels has dominated energy supply, leading to a rapid increase in carbon dioxide (CO_2) emissions. The IPCC Fourth Assessment Report concluded that "Most of the observed increase in global average temperature since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations." According to the IPCC, consumption of fossil fuels accounts for the majority of global anthropogenic GHG emissions.

Regionally, one of the priorities identified by "CARICOM Heads of Government is for the Region to embark on a more sustainable pattern of energy supply, and end-use for the future, through greater utilisation of renewable and sustainable energy sources, reduced dependence on fossil fuels and greater efficiency and conservation in the use of energy, within the context of energy security and the desire for a low carbon approach to development."[2]. Sustainable energy, often defined as '*the provision of energy that meets the needs of the present generation without compromising the needs of future generations'*, is an important aspect of Guyana's Low Carbon Development Strategy (LCDS) and is essential for the achievement of sustainable development.

The purpose of this 2016 to 2020 Strategic Plan is to guide the activities of the Guyana Energy Agency for the next five years to ensure that stable, reliable and affordable energy is provided to all persons in Guyana within an economically, environmentally and socially sustainable framework. The Strategic Plan provides a roadmap to help navigate a changing environment and incorporates the organization's status, vision, method and means of measuring progress. The Strategic Plan is deployed through a number of key strategic actions along with performance indicators and targets where appropriate.

[1] Renewable Energy Sources and Climate Change Mitigation: Special Report of the Intergovernmental Panel on Climate Change
[2] Caricom Energy Policy

Policy, Legislative and Organizational Framework

The GEA, a body corporate, was established in 1997 by the Guyana Energy Agency Act 1997 (Act No. 31 of 1997). The GEA Act has been amended over the years to foster harmonization, increased monitoring, better regulation and greater enforcement in the energy sector.

The GEA falls under the purview of the Minister of Public Infrastructure as the Minister responsible for energy and electricity. GEA's organization structure consists of a Board of Directors, Chief Executive Officer, Deputy Chief Executive Officer (unfilled), Secretariat and the following five Divisions:

i) Energy & Energy Statistics Division,
ii) Legal & Licensing Division,
iii) Fuel Marking Division,
iv) Administration/Human Resource Division, and
v) Finance Division.

The mandate and activities of the Guyana Energy Agency (GEA) are governed by the following legislation:

- Guyana Energy Agency Act 1997,
- Energy Sector (Harmonisation of Laws) Act 2002,
- Guyana Energy Agency (Amendment) Act 2004,
- Guyana Energy Agency (Amendment) Act 2005,
- Guyana Energy Agency (Amendment) Act 2011,
- Petroleum and Petroleum Products Regulations 2014,
- Hydroelectric Power Act and Regulations 1956,
- Hydroelectric Power (Amendment) Act 1988,
- Hydroelectric Power (Amendment) Act 2013,
- Electricity Sector Reform Act 1999,
- Public Utilities Commission Act 1999,
- Electricity Sector Reform (Amendment) Act 2010, and

- Public Utilities Commission (Amendment) Act 2010.

The GEA Act of 1997 established the Guyana Energy Agency (GEA) as a body corporate. The core functions listed in section 5 of the principal Act are:

- to advise and make recommendations to the Minister regarding any measures necessary to secure the efficient management of energy and the source of energy in the public interest and to develop and encourage the development and utilisation of sources of energy other than sources presently in use;
- to develop a national energy policy and secure its implementation;
- to carry out research into all sources of energy including those sources presently used in Guyana for the generation of energy, and securing more efficient utilisation of energy and sources of energy;
- to monitor the performance of the energy sector in Guyana, including the production, importation, distribution and utilisation of petroleum and petroleum products;
- to disseminate information relating to energy management, including energy conservation and the development and utilisation of alternative sources of energy.

Section 6 of the Act further outlines several advisory functions of the Agency:

- to study and keep under review matters relating to the exploration for, production, recovery, processing, transmission, transportation, distribution, sale, purchase, exchange and disposal of energy and sources of energy;
- to report thereon to the Minister and recommend to the Minister such measures as the Agency considers necessary or in the public interest for the control, supervision, conservation, use and marketing and development of energy and sources of energy;
- to prepare studies and reports at the request of the Minister on any matter relating to energy or any source of energy, including research into alternative sources of energy, or the application of such research, and to recommend to the Minister the making of such arrangements as the Agency considers desirable for cooperation with governmental or other agencies in or outside Guyana in respect of matters relating to energy and sources of energy;
- to advise the Minister or assigned authority on matters relating to the administration and discharge of the functions of the *Electricity Sector Reform Act 1999.*

On March 31, 2004 the **GEA (Amendment) Act 2004** was assented to and published in an Extraordinary Issue of the *Official Gazette* which made provisions for the implementation of the fuel marking system, creation of offences and also for the grant and issue of the various classes of licences, viz- Import Licence; Wholesale Licence; Importing Wholesale Licence; Retail Licence; Bulk Transportation Carrier Licence; Storage Licence; and Consumer Installation Licence.

The Fuel Marking Programme was charged with the responsibility of ensuring that all gasoline, diesel and kerosene are properly marked at a known concentration at all legitimate import points and also collecting and testing samples of fuel from various parts of the country including wholesalers, retailers, distributors, transporters, commercial consumers and any person in possession of fuel for the relevant marker(s).

The **Petroleum and Petroleum Products Regulations 2004** were published in the October 23, 2004 Extraordinary Issue of the *Official Gazette*, providing the framework for the marking of petroleum and petroleum products, the licensing of sites and related offences. In 2014, these Regulations were amended to reflect changes in the Licensing Division and provide a suitable environment for encouraging business and investment. This included the granting of multiple year and Conditional licences and the creation of the Export Licence.

On August 4, 2005 the **GEA (Amendment) Act 2005** was assented to and published in the *Official Gazette*. That Act clarified the definition of "*illegal petroleum*" and provided a definition for "*markers*". This Amendment also paved the way for the appointment of a Gazetted Analyst, employed for the purpose of testing and identifying petroleum and petroleum products which do not contain the fuel marker in the required concentration.

The Guyana Energy Agency Act was further amended in 2011 to include provisions for the seizure and disposal of various items. Prior to the amendment, the GEA was required to transfer seized items to the GRA for disposal. Further, the amended Act, among other things, increased the limitation period from six months to seven years for the institution of charges and made provisions for settlement of matters out of court.

The GEA's organization structure underwent a major revision during 2010 to accommodate the following new positions: Energy Economist, Energy Engineer, Hydropower Support Engineer, Licensing Administrator, Internal Auditor, Public Communications Officer, Human Resource Officer, [additional] Legal Officer, Field Operations Coordinator, Senior Investigator and Investigator. The organization continues to strengthen its capacity and has since increased the number of Energy Engineer and Hydropower Support Engineers to three and two, respectively.

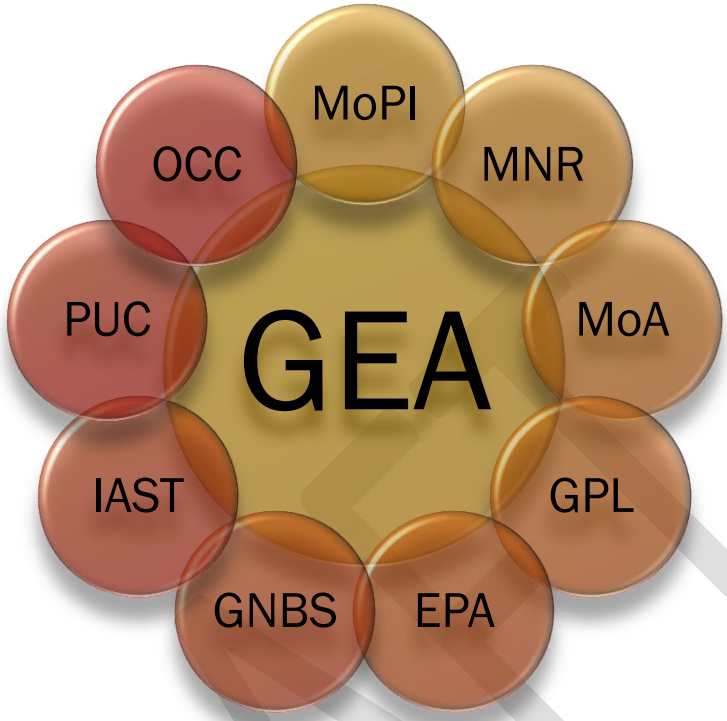
Mission Statement

To ensure the rational and efficient use of imported petroleum-based energy sources, while encouraging where economically feasible and environmentally acceptable, increased utilisation of indigenous new and renewable sources of energy.

Core Values

1. Accountability: Responsibility for actions that influence the lives of customers and fellow workers.
2. Balance: Maintaining healthy life and work balance.
3. Collaboration: Collaborating within and outside the Agency to give the best.
4. Commitment: Commitment to outstanding service and other initiatives that impact lives both within and outside the organization.
5. Community: A sense of responsibility and contribution to society.
6. Consistency: Be consistent in offering the best service and experience.
7. Diversity: Respecting diversity and individuality.
8. Efficiency: Being efficient and effective to give the best solution each time.
9. Fun: Having fun and celebrating small successes in the journey to achieve greatness.
10. Innovation: To come out with new creative ideas which have the potential to change the world.
11. Integrity: To act with honesty and integrity without compromising the truth.
12. Leadership: The courage to lead from front and follow when necessary.
13. Passion: Putting the heart and mind into the work to get the best results.
14. Quality: Giving the best and unmatched results for all round satisfaction.
15. Respect: Giving due respect to self and others and maintain the environment of team work and growth.
16. Safety: Ensuring the safety of people and making sure to give them trouble free experience.
17. Service Excellence: Giving the best service and achieving excellence each passing day.

Institutional Framework



Minister of Public Infrastructure (MoPI):

The Minister of Public Infrastructure is the Minister responsible for energy and electricity and gives directions as to the policy to be followed by the GEA in the performance of its functions.

The Minister of Public Infrastructure has principal policy-making and regulatory responsibility in the sector, including for granting licences to the public utilities and independent power producers and approval of development and expansion plans and of operating standards and performance targets for Guyana Power & Light Inc. (GPL), the principal supplier of electricity.

Office of Climate Change (OCC)

The Office of Climate Change (OCC), which was established in June 2009, operates within the Ministry of the Presidency. The Office coordinates all climate change activities and streamlines the Government of Guyana's efforts to address climate change. The OCC is also responsible for, and coordinates, the implementation of Guyana's Low Carbon Development Strategy (LCDS). In general, OCC works across

Government to support work on climate adaptation, mitigation, forest conservation and serves to bring together and align efforts of various government agencies that are already underway and to co-ordinate efforts by multilateral and non-governmental organizations assisting Guyana's climate change agenda.

Ministry of Natural Resources:

The Ministry of Natural Resources has responsibility for forestry, mining, environmental management, wildlife, protected areas, land use planning and coordination and climate change. As such, several government agencies including the Guyana Geology and Mines Commission (GGMC) and the Guyana Forestry Commission (GFC) are subsumed under this Ministry. Moreover, the GGMC is charged with oversight of Guyana's oil and gas sector.

Ministry of Agriculture (MoA)

The Ministry of Agriculture is the policy making body of Guyana's agriculture sector. The MoA takes the lead on bio-energy and is responsible for articulating Guyana's agro-energy policy. The Hydro-meteorological Service attached to the MoA is responsible for monitoring and evaluating the weather and water resources in Guyana.

Institute of Applied Sciences and Technology (IAST):

The Institute of Applied Science and Technology is an industrial research organisation, which has as its mandate the development and/or adaptation of appropriate technology for the utilisation of Guyana's natural resources, so that these resources can be gainfully developed and exploited for the benefit of the people of Guyana.

Environmental Protection Agency (EPA):

The Environmental Protection Agency (EPA) oversees the effective management, conservation, protection and improvement of the environment and takes the necessary measures to ensure the prevention and control of pollution, assesses the

impact of economic development on the environment and the sustainable use of natural resources.

Guyana National Bureau of Standards (GNBS):

The Guyana National Bureau of Standards (GNBS), a semi-autonomous agency, governed by a National Standards Council, has a mandate to promote standardisation for economic development and consumer protection through standards development, promotion and implementation, metrology services and Conformity Assessment.

Public Utilities Commission (PUC):

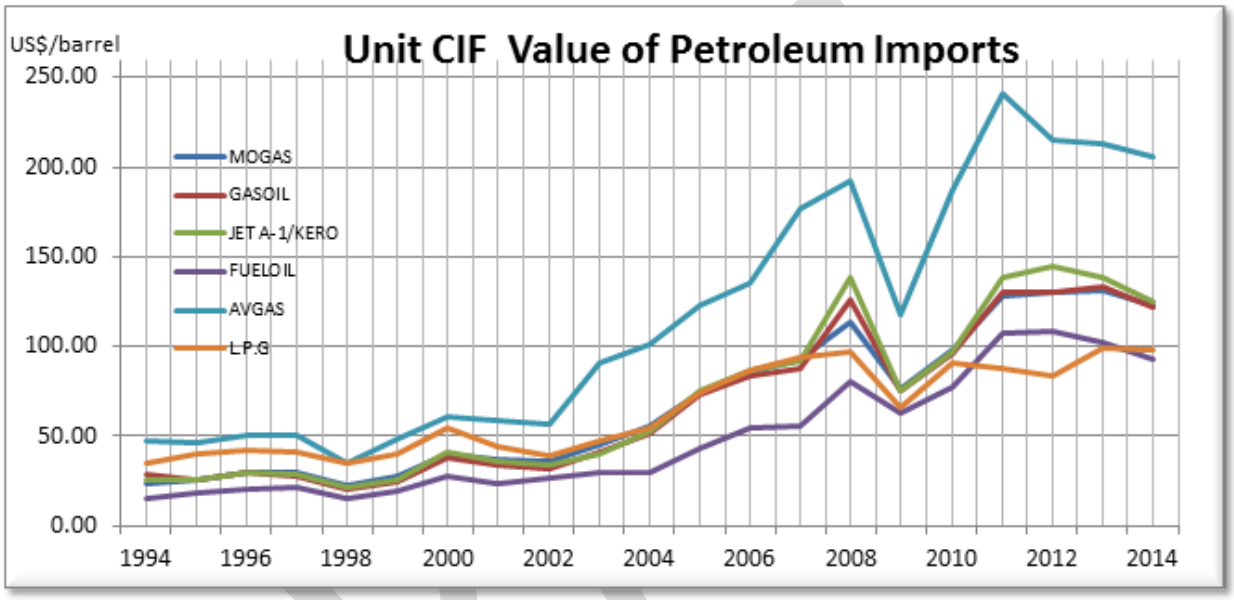
The Public Utilities Commission is responsible for monitoring and enforcing operators' compliance with commitments to customers emanating from licences and standard terms and conditions for operations, including operating standards and performance targets and development of expansion plans; handling consumers' complaints; and advising OPM on these issues. PUC also is responsible for confirming and approving tariffs charged by public suppliers.

Guyana Power and Light Inc. (GPL):

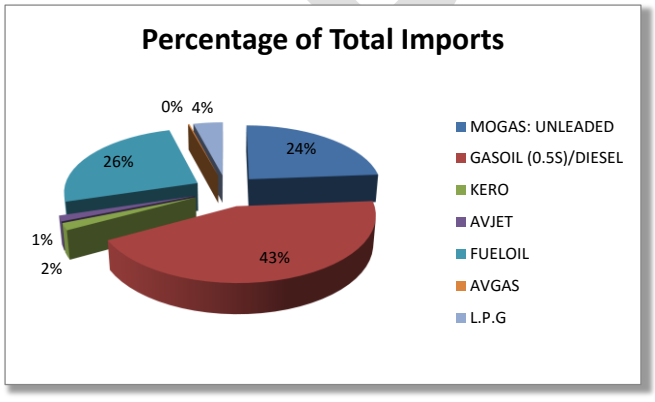
The Guyana Power & Light Company Inc. (GPL) is the main power company in Guyana and is responsible for the generation, transmission and distribution of electricity to residential, commercial and industrial customers.

Energy from Fossil-based Fuels

Historically, Guyana has been dependent on imported petroleum-based fuels as its primary source of energy. Guyana imported 4.9 million barrels of petroleum-based products in 2014 (13,531 barrels per day) consisting of diesel (gasoil), fuel oil, gasoline (mogas), avjet, avgas, kerosene and liquefied petroleum gas (LPG). The volumes imported in 2014 represented a 4.14% increase when compared to 2013. Petroleum imports for 2014

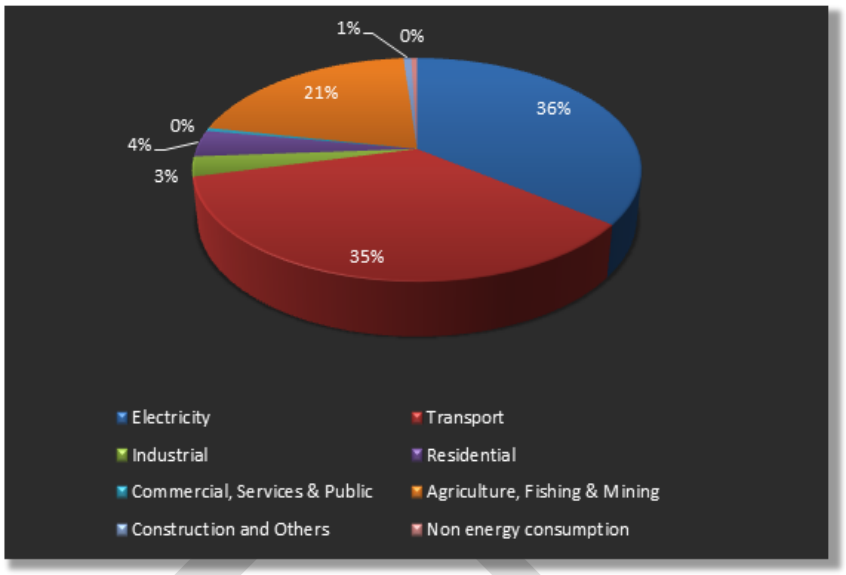


were acquired at a cost, insurance and freight (CIF) value of approximately US$562 million (31.6% of total imports) and accounted for about 21% of the country's gross domestic product (GDP). While the average CIF value of petroleum products may fluctuate, the upward trend of prices since 1994 is indubitable. It should be noted however that from the latter half of 2014, oil prices have considerably declined due to contraction in demand along with record growth in non-OPEC supply. The International Energy Agency (IEA) predicts that import prices would remain under US$80 per barrel for the next 5 years.

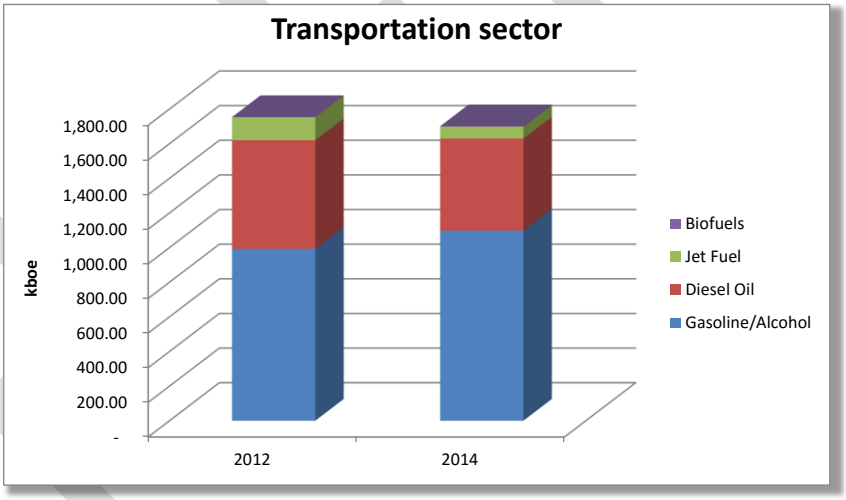


Gasoil accounted for 43% of total fuel imports and represented the largest share of petroleum products, followed by fuel oil and gasoline (mogas) at 26% and 24%, respectively.

The Transportation and Power (electricity) sectors consumes almost three-quarters of total petroleum products; with the latter being the country's largest energy user by a slight margin (36%); followed by the Transport sector (35%); Agriculture, Fishing and Mining (21%); Residential sector (4%); and Industry/Manufacturing (3%).



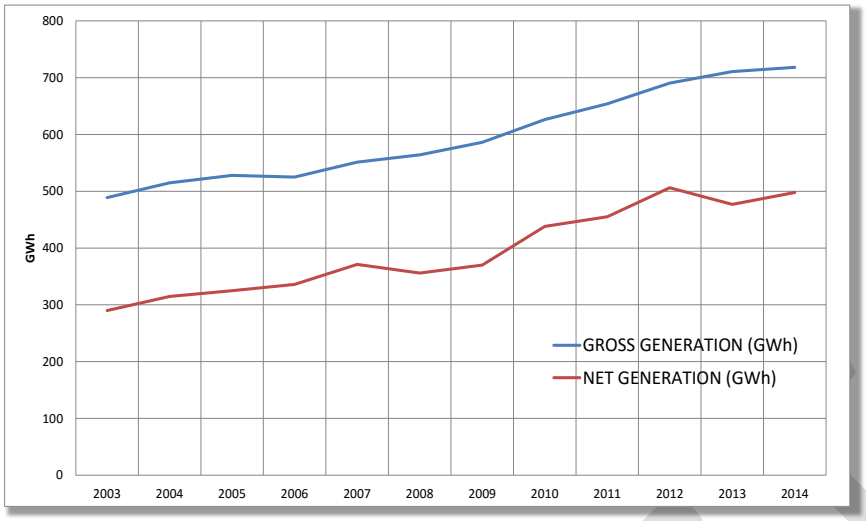
Accounting for the second largest share of petroleum imports, transport sector consumption is driven mainly by the need for gasoline (mogas) and diesel (gasoil) due primarily to the growing vehicle fleet in the country.



The power sector, which accounted for an estimated 36% of petroleum imports in 2014, comprises electricity generation mainly from the country's national electric utility and a number of other small generation facilities (including self-generation) across the country.

Based on an estimate of self-generation and other generation assets across the country, the total electricity generation in 2014 was estimated to be 979.36 GWh: 91.8% from fossil fuels, 8.0% from bagasse-based cogeneration and the remaining 0.2% from solar photovoltaics and wind powered sources.

The principal public supplier of electricity, Guyana Power and Light Inc. (GPL), expanded its customer base to 177,780 customers in 2014, a net increase of 6.5% since 2012.



GPL generated 667 GWh of electricity from fuel oil (90%) and diesel (10%) which together accounted for about 1.04 million barrels of fuel in 2014.

The increasing demand for energy, rising costs of fossil fuels and the large capital investments required to install fossil-fuel generators underscore the need for measures to secure the efficient management of energy in the public's interest.

Global warming, anthropogenic emissions, increasing prices for fossil fuels, environmental concerns, energy supply constraints, low carbon growth trajectories and sustainable development initiatives provide the impetus and importance for energy efficiency. According to the World Energy Council, "Energy efficiency improvements refer to a reduction in the energy used for a given service or level of activity. The reduction in the energy consumption is usually associated with technological changes, but not always since it can also result from better organisation and management or improved economic conditions in the sector (non-technical factors)." Efficiency improvements in the electricity sector can enjoy two main benefits:

- Provision of electrical energy to more consumers while utilizing the same generation capacity; and
- Reduction in the demand for electricity and reduction in the investment needed for expansion of the electricity services.

The rational and efficient use of energy requires behavioural changes to avoid unnecessary energy consumption and make wise equipment choices without decreasing individual welfare. The Guyana Energy Agency's strategy to influence energy efficiency focuses on two key areas:

1. Conservation and careful use of energy.

2. Education of the general public on the importance and actions required to achieve energy saving and substitution.

Incandescent Bulb Replacement Programme

Between 2006 and 2007, 446,796 energy saving bulbs were distributed to 110,000 households across Guyana through the kind courtesies of the Cuban Government.

Exemption from Import Duties and VAT

In 2012, Government of Guyana Zero-rated the VAT and made fully exempt from Import Duties, the following:

Machinery and equipment for obtaining, generating, and utilizing energy from renewable energy sources, including Solar panels, Solar Lamps, Deep-Cycle Batteries, Solar Generators, Solar Water heaters, Solar Cookers, DC Solar Refrigerators, DC Solar Freezers, DC Solar Air Conditioners, Wind Turbines, Water Turbines, Power Inverters, Compact Fluorescent Lamps (CFL) and Light Emitting Diode (LED) Lamps.

Energy Efficient Street Lighting

- Guyana has approximately 9,254 street lights which consume approximately 5.967GWh of energy per year at a cost of G$316.25 million (US$1.5 million) annually. Defective photocells and lamps have resulted in some areas being underlit and some lamps remaining continuously lit (24 hours per day). Based on the current Street Lighting tariff of G$50.10 per kWh, for each lamp remaining lit during the day, the energy wasted per lamp costs about G$54,859 per year. To conserve energy, GEA's Engineers, with support from the Ministry of Public Works, Work Service Group (WSG), conducted a series of photocell replacement activities on the street lamps remaining lit during the day with the objective of replacing some 2,000 defective photocells. As at 2014, a total of 1,950 defective photocells were replaced which translates into annual energy savings of approximately G$118.8 million.

- An LED Street Light Pilot Project, undertaken in 2013, aimed to demonstrate the suitability, benefits and savings associated with LED street lamps by replacing 41 high pressure sodium (HPS) lamps with 41 LED street lamps. The estimated annual savings will be G$1.53 million and based on a capital investment of G$3.1 million, the resulting simple payback period is 2.03 years. It is estimated that a 52 % reduction in annual cost and energy consumption would be achieved and 16,341.78 kg of CO_2 emissions would be avoided.

- Engineers from the Guyana Energy Agency installed two (2) stand-alone solar powered 40W LED street lights to demonstrate energy efficient street lighting using solar energy.

Awareness and Information Dissemination

Minor adjustments in daily routines and choices can save money and achieve greater levels of energy conservation, but people need to be aware of what adjustments need to be made. Awareness about individual and national benefits of energy conservation is therefore necessary to secure more efficient utilization of energy and sources of energy.

GEA's continued public awareness campaigns to sensitize the public on energy efficiency and conservation programs are assisted by GPL's sensitization efforts through the following:

- Brochures, posters, booklets, newspaper advertisements, ebooks, radio and television energy information tips, infomercials, documentaries, quizzes, live panel discussions, exhibitions, presentations to schools, seminars and workshops on energy, energy efficiency, energy conservation and sustainable energy.

Energy assessments/audits

GEA's engineers undertook the energy assessments/audits of 63 buildings in the public and private sectors at the end of 2014 with the objective of reducing energy consumption and improving energy awareness. In addition to providing a report identifying energy conservation opportunities, costs and payback estimates, efficient lighting was installed to demonstrate the benefits of energy efficient choices. A 4-person team (gender-balanced) referred to as the "Energy Champions" was established in each building to champion the energy conservation efforts and influence behavioural change within the organisation, with the intention of becoming a permanent feature for continued monitoring and sensitization. Employees received brochures and training sessions to help influence behavioural changes in relation to energy consumption. Energy assessments/audits will continue in 2016 with the inclusion of more hotels and businesses.

Energy Efficient Cooking

Energy is a fundamental prerequisite for achieving the Millennium Development Goals (MDGs) and is essential for social and economic development. In Guyana, it is estimated that about 100,000 persons living in Hinterland areas have little access to reliable energy services which they could afford. According to the Guyana National Bureau of Statistics, in

2002, cooking gas and kerosene accounted for more than four-fifths of total domestic cooking fuel consumption in Guyana. Wood for cooking is used primarily in the hinterland regions (1, 7, 8 and 9).

Over the years, the Government, supported by other organizations, has been implementing projects to provide energy access to some hinterland communities. Demonstration pilots have been set up to provide energy at the household and community levels, for both lighting and for productive use, as well as fuel efficient and clean stoves. UNDP and The Government of Guyana signed the project "Energy access at community level for MDG achievement in Hinterland area" in October 2010. One component of that project is improved cooking, and both efficient wood stoves and solar cookers were promoted.

Hydropower

Hydropower is a renewable energy source based on the natural water cycle. It is the most mature, reliable and cost-effective renewable power generation technology presently commercially viable on a large scale, producing around 16 % of the world's electricity and over 80% of the world's renewable electricity. Hydropower has four major advantages: it is renewable, it produces negligible amounts of greenhouse gases, it is the least costly way of storing large amounts of energy, and it can easily adjust the amount of electrical energy produced to the amount demanded by consumers. More than 25 countries in the world depend on hydropower for 90 % of their electricity supply (99.3 % in Norway), and 12 countries are 100 % reliant on hydro.

History of Hydropower in Guyana

Tumatumari Hydropower Station

The first hydropower station, ***Tumatumari***, utilising water from the Tumatumari Falls on the Potaro River, Region 8, was constructed in 1957 by British Guiana Goldfields Limited and operated until 1959 when mining operations ceased. In 1969, the Government of Guyana re-commissioned the station to serve the Guyana National Service Camps at Tumatumari and Konawaruk. The development included an embankment dam, a concrete overflow dam, and a 2-unit powerhouse with an installed capacity of 1,500 kW using (2 x 750 kW *Francis* turbines). The now defunct plant is currently being considered for rehabilitation by a private company.

Upper Mazaruni Hydro-Electric Project

The first major hydropower study was titled the ***Upper Mazaruni Hydro–Electric Project*** and was conducted by ENERGOPROJEKT, an engineering and consulting company from Beograd, Yugoslavia. The study, submitted in 1974, was a feasibility study of the hydroelectric development of the Upper Mazaruni River potential to satisfy the electric power demand of a large scale metallurgical industry planned in Guyana, as well as the demands of other local power consumers. The study proposed a 4-stage phased development consisting of four separate power plants each having a capacity of 775MW for a total of 3,100 MW (775MW x 4). In response to an invitation from the Government of Guyana, SWECO, an Engineering Consultant Firm from Stockholm Sweden, reviewed Energoprojekt's feasibility study and subsequently presented its Final Engineering Report in 1976.

In 2012, Guyana signed a Memorandum of Understanding with Brazil to conduct feasibility studies for the development of the 4,500MW hydropower project in the Upper and Middle

Mazaruni area, intended for energy exports to Brazil and potentially for industrial development.

Hydroelectric Power Survey of Guyana

Recognizing the need to understand the hydropower potential in the country, Government of Guyana, with support from the United Nations Development Programme (UNDP), conducted a hydroelectric power survey. The survey included a hydro resource reconnaissance and inventory for all Guyana, and pre-feasibility studies of a limited number of sites, with a view of developing suitable hydropower to provide low cost electric energy for mining minerals, for an aluminium smelter, for general electrification of the country and for future supply of areas already receiving electric power service. In April 1976, Montreal Engineering Company Ltd. (Monenco), the contracted consulting engineering firm, presented the final report titled ***Hydroelectric Power Survey of Guyana***. The potential power of the various basins and regions as revealed by the Survey, gave total potential as 7,200 to 7,600 MW. The following fifteen sites were selected as most promising for development:

- *Amaila, Tumatumari, Kaieteur* ***(Potaro River Basin)***
- *Turtruba, Tiboku, Apaikwa, Peaima, Aruwai, Chitigokeng, Sand landing, Upper Mazaruni Diversion Scheme, Chi Chi* ***(Mazaruni River Basin)***
- *Oko- Blue, Kamaria* ***(Cuyuni River Basin)***
- *Arisaru* ***(Essequibo River Basin)***

Amaila, Turtruba and Kaieteur were subsequently studied up to pre-feasibility level.

Guyana Power Study

In October 1982, SWECO, an Engineering Consultant Firm from Stockholm Sweden, conducted the ***Guyana Power Study.*** The aim of the study was to review all technically feasible possibilities of the defined projects and sources of energy and to prepare various sequences of development of power generation and transmission systems for meeting the projected requirements for five different market scenarios over a 20-year period. The study included the following sites: *Amaila, Tumatumari, Kaieteur, Tiger Hill, Tiboku, and Upper Mazaruni*.

Moco-Moco Hydropower Station

The Moco-Moco 2 x 0.25 MW hydropower project, Region 9, was commissioned on November 22, 1999. The hydropower station was designed and built by the Chinese through

a joint arrangement between the Governments of Guyana and China. The Moco-Moco hydropower station is a run-of-the-river, diversion-type with a high water head. The Moco-Moco hydropower plant supplied power to the community of Lethem and its environs. Severe rainstorms and subsequent landslide on July 5, 2003 resulted in a fractured penstock. Government has since been actively discussing options for its restoration.

Solar Power

Guyana has been actively installing solar photovoltaic systems in remote hinterland communities and schools that do not have access to grid power. Under the ***Unserved Areas Electrification Programme (UAEP)*** four (4) solar energy demonstration projects were originally planned to be implemented in Kurukubaru, Yarakita, Capoey, and Muritaro; but due to the positive responses, the project was extended to other remote hinterland communities. A total of 1,750 solar systems were installed in homes (65,125 watts), schools and other community buildings across 21 hinterland villages under this programme.

GEA documented about 1.1 MW of solar photovoltaic systems installed across Guyana with an estimated 2.01 GWh energy generation per year. The installed capacity of solar power was boosted in 2012 with a massive programme under the ***Low Carbon Development Strategy*** to provide about 16,540 solar photovoltaic systems to those communities without grid access.

As part of its mandate to promote the use of renewable energy, GEA, in 2011, installed an 8.46kW grid-tied solar photovoltaic demonstration project which generates about 10.9MWh of energy per year. The system is configured to provide net energy readouts using the utility's existing energy meter and net-metering platform. Subsequently, a 15.84 kW grid-tied solar photovoltaic system was installed at the head office building of the National Parks Commission and commissioned in 2014. The system is estimated to produce 20.89 MWh of energy annually, saving the Commission approximately G$1,374,770 and avoiding 15,876.4 kg of CO2 emissions.

The Guyana Energy Agency (GEA) assisted OPM in the promotion and distribution of 507 solar cooking stoves to five (5) communities, namely Shulinab (Region 9), Rupertee (Region 9), Powaikoru (Region 1), Kangaruma (Region 7) and Tuseneng (Region 8).

Wind

A wind farm with an installed capacity of 25 MW to supply electricity to the local grid was proposed by a private company for Hope Beach on the East Coast. The previous Memorandum of Understanding (MOU) with the Government of Guyana had expired and was dormant for a few years. The developer is currently seeking to have a new MOU signed.

Under the UAEP, wind speeds were monitored in the following areas: Orealla, Region 6, Jawalla, Region 7, Campbelltown, Region 8, Yupukari, Region 9 but the wind speeds were not very attractive. The measuring towers and equipment were subsequently handed over to GEA. The unit previously installed at Orealla was handed over to Guyana Water Inc (GWI) to conduct wind measurements at their facility.

GEA continued to monitor and record wind data (speed and direction) around Guyana to a gain better understanding of the available wind resource in different locations. To date GEA has conducted measurement at seven locations (Orealla, Jawalla, Yupukari, Mahdia, Kumu, University of Guyana Turkeyen and Port Mourant) across Regions 4, 6, 7, 8 and 9. In 2016 GEA will be targeting three new locations (Bartica, Kato and Annai). GEA is also currently assisting the Hinterland Electrification Company Inc. and the University of Guyana in the selection and evaluation of most promising sites along Guyana's coast. This will see wind data collection at an additional seven sites (four for HECI and three for UG), bringing the total to ten sites to be monitored in 2016.

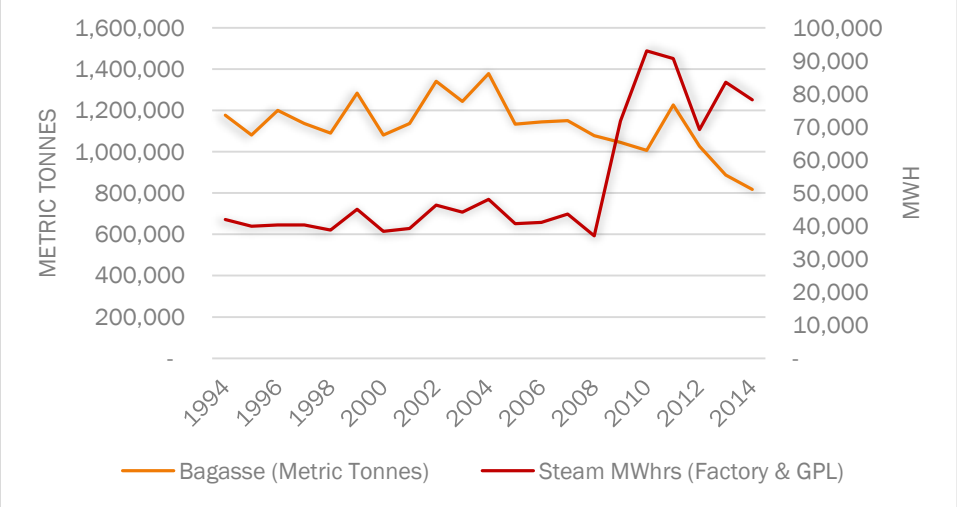
Engineers have created a database to capture the various wind energy installations in the country and have since recorded more than 40kW installed capacity.

GEA procured a wind measuring unit to measure wind speeds at its head office and other convenient locations to gain further experience, understanding of wind speed analysis and energy potential.

Bio-Energy

Bagasse

Sugar factories in Guyana have traditionally burnt bagasse (the fibrous waste generated after extracting the juice from sugar cane) as a source of energy to produce steam for factory operations and to produce electricity required for factory and surrounding housing areas.



The total energy value of all bagasse produced in the country in 2014 was 0.95 million boe, but only 8% was converted to electricity for sale to the grid and factory operations. The remaining 92% was burnt in the boilers to produce process steam for other factory operations and therefore represents a significant opportunity for harnessing energy through cogeneration to simultaneously generate heat and electricity.

The 25MW Guyana Skeldon Bagasse Cogeneration Project, consisting of a bagasse-powered cogeneration plant, was added on to the new Skeldon sugar factory design to allow the simultaneous production of electrical power for internal needs and for sale of about 8 MW of power to the electricity grid. The Skeldon cogeneration plant, under normal operating conditions, could generate about 140.6 GWh of energy per year, but in 2014, only generated 52.12GWh.

Rice Husk

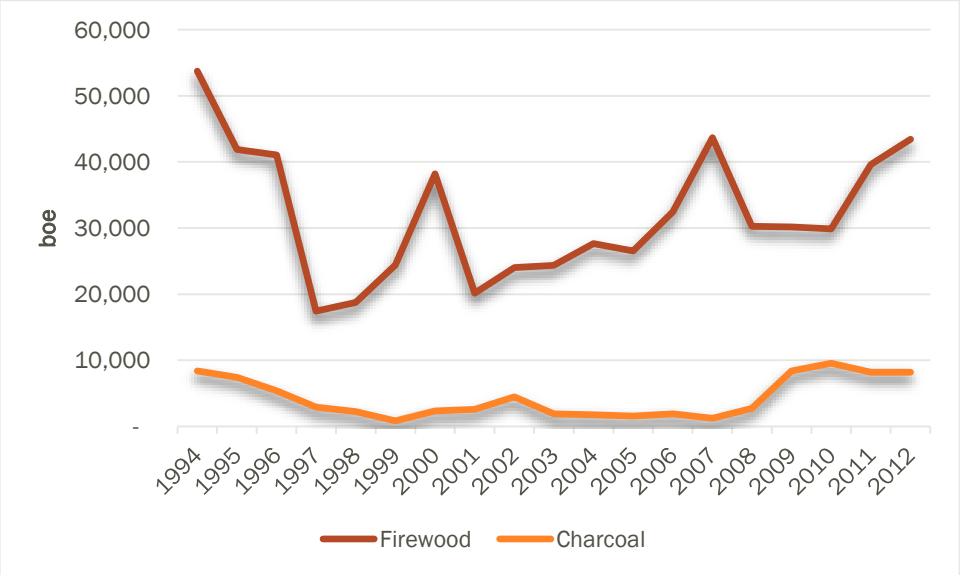
Rice has been in cultivation since around the 1750's with 635,238 tonnes produced in 2014, the highest tonnage produced in any one year in the industry's entire history. When rice is milled there are by-products such as bran, broken rice and rice husk. Rice husk, the outer most layer of the paddy grain, is a form of biomass and accounts for about 20% of the paddy's weight. Unlike the other by-products, rice husk is mostly seen as a waste disposal

problem for many mills and is usually burnt as a form of waste disposal resulting in environmental concerns.

In 2014, an estimated 184,052 tonnes of rice husk with an energy value of 212,021 boe was generated based on Guyana's rice production of 635,238 tonnes. Based on information collected in 2013, about 47% of the rice husk is used for paddy drying, parboiling and electricity generation while the remaining 53% is dumped/burnt as a means of waste disposal.

Firewood and Charcoal

In 2014, approximately 15,969 tonnes of wood, equivalent to 45,244 boe, was used for commercial production of firewood and charcoal. An estimated 84,761 tonnes of fuelwood (equivalent to 219,871 boe) were produced after considering non-commercial firewood.



Woodwaste

Guyana has approximately 18 million hectares of forest which accounts for about 80% of its land area. Guyana's forest products exports range from raw and sawn timber, to plywood, moulding and furniture products all of which produce varying types of wood waste. In the past, wood waste was regarded as a troublesome by-product of the sawmilling operation, resulting in disposal as landfill or by burning, with both having negative environmental consequences. Utilization of wood waste as a source of energy can address the problems

associated with its disposal while providing a source of energy in the form of heat or electricity to offset costs associated with grid-supplied electricity.

About 176,498.78 m^3 (62,329.68 tonnes) of biomass is used as input for the industry which produced approximately 64,882.83 m^3 of woodwaste in 2012. The total primary energy value of the wood waste produced in 2012 is 25,872 boe.

Energy Efficient Wood Stoves

The Energy Access at community level for Millennium Development Goals (MDG) achievement in Hinterland area Project, a United Nations Development Programme (UNDP) Project, implemented by Office of the Prime Minister (OPM), aims to provide energy services, electricity or cleaner fuels in rural areas to all Hinterland villages at the community level by 2015. The energy efficient wood stove was designed to achieve greater efficiency, reduce the demand for wood and reduce soot. GEA assisted OPM in the promotion of the energy efficient wood stoves in the following communities: Shulinab (Region 9), Rupertee (Region 9), Powaikoru (Region 1), Kangaruma (Region 7) and Tuseneng (Region 8).

In each community, indigenous materials (clay, clay bricks and banana sucker) were used to construct the energy efficient wood stoves. Residents were invited to witness the construction method and the advantages of the efficient wood cooking stove compared to the traditional open-flame (three-stone) design that was widely used in the communities.

Biofuels

The Ministry of Agriculture, with funds from the Special ***Japanese Fund of the Inter-American Development Bank***, had procured consulting services to:

a. Improve the capacity of GoG to identify and evaluate viable investment opportunities in the bioenergy production chain,
b. Develop a financial vehicle or instrument to promote investment opportunities and develop a strategy to harness Guyana's potential for bioenergy production,

c. Increase capacity building and the transfer of technology to build a critical mass of bioenergy technicians, operators, and demonstration programmes, and Institutional strengthening to support the Agro-energy policy of Guyana,
d. Support small scale bioenergy demonstration programmes and dissemination of results.

Biodiesel

The Institute of Applied Sciences and Technology's (IAST) research facility produces almost 40 x 45-gal barrels of biodiesel using edible oils and waste edible oils as feedstock on an annual basis. The commercial unit operating at Wauna, Region 1 ceased operations in 2012. This facility, which used palm oil as the feedstock, produced 1,122 barrels of biodiesel for power generation and transportation.

Ethanol

Guyana's first ever bioethanol demonstration plant located at the Albion Estate, Region 6, was commissioned in August 2013. The plant is expected to produce 1000 litres per day of ethanol from molasses. The anhydrous ethanol will be used by the Guyana Sugar Corporation's (GuySuCo) laboratory and industrial practices and to fuel a small number of vehicles owned by the sugar company and the Ministry of Agriculture using a blend of gasoline and ethanol (10%) to create an E-10 formulation.

In 2014, 4,355 litres of Hydrous Ethanol (95% v/v) and 2,339 litres of Anhydrous Ethanol (99.7% v/v) were produced.

BIOGAS

Guyana launched a joint experimental Biogas Programme in 1980 between the then Guyana National Energy Authority (GNEA) and the Latin American Energy Organization (OLADE). Financial and technical assistance were provided by OLADE with Guyana contributing labour and supervision for the construction of the bio-digesters. The Programme entailed the

construction of seven (7) experimental units of three types: Mexican, Guatemalan and Chinese. The Chinese Model, with some modifications to conform to local conditions, was selected as the preferred design for Guyana. Modified Chinese models were installed at Alliance farm at Coverden and the Guymine farm at Linden, but are now defunct.

The Institute of Private Enterprise Development (IPED), with funding from the Inter-American Development Bank (IADB), started an Integrated Farming Model to reduce poverty among small rural farmers in Guyana. The project incorporated the use of bio-digesters fed with manure from pigs or cattle to produce biogas. The effluent from the digester is used as liquid manure for vegetables on some farms. Twenty-eight (28) bio-digesters have been installed across Guyana.

GEA, with support from UNDP and OPM, installed an additional two bio-digesters in 2012. In an effort to promote the use of bio-digesters in farming communities, GEA has prepared a "***Guide for the Design and Construction of Low-cost Bio-digesters***" which can be used by small scale farmers to convert animal waste to energy in the form of biogas which can be used for cooking, lighting and electricity generation.

Policies and Strategies

Guyana's Energy Policy was developed in 1994 to:

- provide stable, reliable and economic supply of energy;
- reduce dependency on imported fuels;
- promote where possible the increased utilization of domestic resources;
- ensure energy is used in an environmentally sound and sustainable manner.

The National Development Strategy, covering the period 2001 to 2010, subsequently emphasized that the Energy sector plays a strategic role in the development of Guyana's economy through improving the quantity, quality and reliability of the electricity supply and set the following specific objectives:

- reducing our dependency on imported petroleum products;
- increasing the utilisation of new and renewable domestic energy resources;
- ensuring that energy is used in an environmentally sound and sustainable manner; and
- encouraging, through public awareness programmes and incentives, energy conservation practices.

Guyana, as part of its socio-economic development and poverty alleviation objective, embarked on the 2007 Unserved Areas Electrification Programme (UAEP) to extend electricity to unserved areas where extension of existing distribution networks was deemed economically feasible. UAEP initially entailed the electrification of unserved areas along the coast where Guyana's population is concentrated, but was expanded at a later stage to the Hinterland areas through the Hinterland Electrification Strategy

The Guyana Power Sector Policy and Implementation Strategy of 2010 was developed primarily for the Power Sector to ensure its viability, this Policy links renewable energy and energy efficiency as a means of reducing the country's dependence on imported fossil fuels.

The most significant step taken to address climate change in Guyana is the Development and implementation of its Low Carbon Development Strategy (LCDS) which was launched in June 2009 and revised in 2010 and 2013. The Strategy outlines Guyana's approach to promoting economic development while at the same time addressing the issues associated

with climate change. It examines how the country can move along a low carbon path and further protect the country from the effects of climate change.

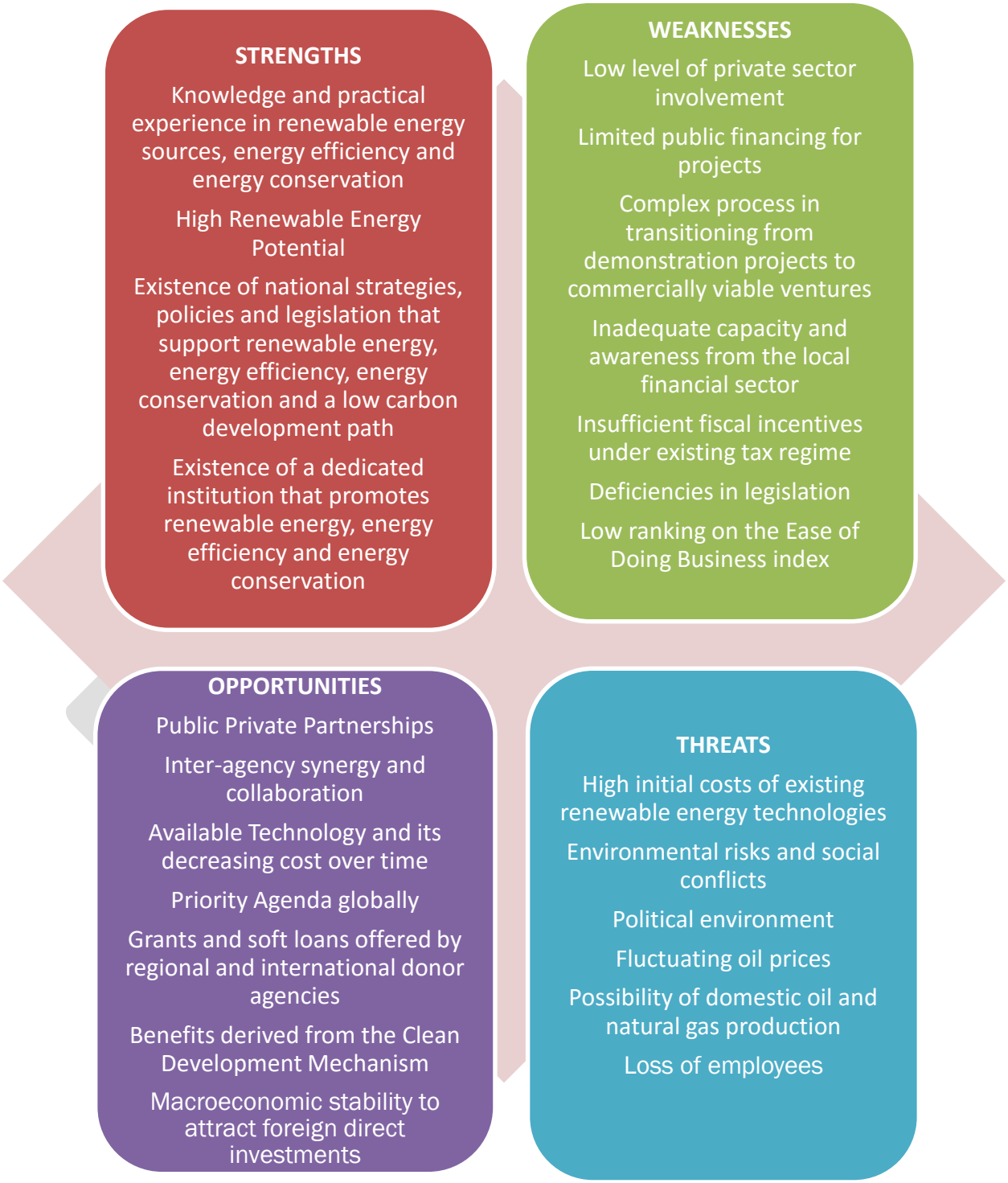
Caricom's Energy Policy, approved by the Forty-First Special Meeting of the COTED on ENERGY, held 1 March 2013, in Trinidad and Tobago, identified the need to:

- Ensure increased energy security through timely access to adequate, reliable and affordable supplies of energy.
- Secure least cost hydrocarbon resources for each Member State and ensure that appropriate standards for petroleum and petroleum related products are introduced and enforced.
- Diversify the energy sources through increased use of renewable energy in a manner that assures optimization with other sectors.
- Ensure the sustainability of the electricity sector through increased use of renewable energy, improved legislative and regulatory framework and cross border trade of electricity generated from indigenous renewable energy sources.
- Promote energy saving efforts in all sectors.
- Promote fuel switching in the transportation sector to cleaner energy sources and encourage greater efficiency of energy use in the transportation sector.
- Undertake the necessary reforms in a timely manner to encourage greater investment in the energy sector.
- Ensure fair pricing and access to hydrocarbon resources by all Member States to improve the competitiveness of regional industries.
- Ensure that energy is supplied and consumed in a manner that creates minimal adverse impact on the environment.
- Build and strengthen the human capacity and skills as well as institutional capacity within the Region, encourage research and development and increase public education and awareness to ensure energy sector development.
- Eliminate energy poverty and ensure access to clean, affordable and reliable energy supplies by all citizens of the Region.
- Encourage sustainable energy practices within all other sectors and areas where there is linkage to energy use, such as agriculture, youth and culture, etc.
- Establish regional and national targets for the reduction of greenhouse gas emissions in the energy sector and implement appropriate mitigation actions relevant to the energy sector.
- Develop strategies to ensure the availability of energy supplies and products, a strategic response to any oil spill and the sustainability of energy services during any crisis.

  Develop strategies to take advantage of opportunities for trade in energy services regionally and internationally.

SWOT Analysis

Below is an analysis of GEA's strengths, weaknesses, opportunities and threats (SWOT).



Guyana's Current Energy Policy

Guyana's current energy policy, guided by the principles of past policies, strategies and Regional policies, seeks to ensure that stable, reliable and affordable energy is provided to all persons in Guyana within an economically, environmentally and socially sustainable framework.

Guyana, with a per capita gross domestic product (GDP/capita) of US$3,606 in 2014, is supplied with energy from a variety of energy sources: diesel (gasoil), bagasse, fuel oil, gasoline, rice husk, kerosene, LPG, fuelwood, charcoal, avgas, solar photovoltaics and biodiesel. While world energy consumption in 2013 was about 66,436 million barrels of oil equivalent (boe), Guyana's energy consumption was only 4.5 million boe, representing 0.007% of world energy consumption.

The acquisition cost of imported petroleum products amounted to approximately US$562 million and represented 21% of GDP in 2014. While the country remains reliant on imported fossil-based fuels to meet its daily energy needs, many plans and developments have advanced and are set to transform the energy sector. Price volatility in international oil markets and the threat of rising temperatures from greenhouse gases necessitate the move to alternative sources of energy and integrate climate resilience.

Recognizing the need for urgent action, Guyana's Low Carbon Development Strategy, outlines Guyana's approach to promoting economic development by protecting Guyana's tropical forests while addressing global climate change. This goal is a timely one; particularly, in light of the recently concluded twenty-first session of the Conference of the Parties (COP 21) of the United Nations Framework Convention on Climate Change (UNFCCC) where developing countries, including Guyana, provided nationally determined contributions for limiting emissions to relatively safe levels. One significant and transformative goal under these contributions is the target of having 100% of electricity generation from renewable energy sources by 2025. This target will not only result in significant reductions in the consumption of fossil fuel but also improve Guyana's energy security given the need for electricity generation to match the significant growth in electricity demand that is expected in the coming years, with IDB's predictions of electricity consumption more than doubling in the next ten years. In light of the current efforts to make Bartica one of many 'Green' Towns, it is envisioned that the deployment of renewable energy will proliferate in the future.

Guyana is also actively pursuing the development of its hydropower resources as a priority of the country's energy policy.

Feasibility studies for a large hydropower development in the Mazaruni region will commence in collaboration with Brazil. Independent power producers and suppliers will be encouraged to construct energy farms and sell energy to the national grid. Guyana will construct and/or promote the construction of small hydro systems in areas such as Moco Moco, Kato and Tumatumari, and will power all of the new townships, starting with Bartica, using alternative energy sources. Guyana will also assess and keep under review the opportunities for mini and micro hydropower applications where feasible.

Guyana will continue to pursue options for higher pressure bagasse-fuelled cogeneration to increase power cogeneration capacity where feasible to meet incremental growth in demand. Power generation options from rice husk and woodwaste will also be reviewed.

Over the next five years, Guyana is expected to install more than 13 MW of solar Photovoltaic systems in the country. While still relatively expensive when compared to the cost of energy supplied by the grid, solar photovoltaic prices are decreasing and their use will be encouraged, provided the prices remain sustainable.

Importation and installation of solar water heaters will be encouraged for both residential and commercial use. The tourism and hospitality sector, still at an early stage of development, will be engaged with the objective of promoting the installation of solar water heaters.

Guyana will support the implementation of wind farms to supply energy to the national grid, provided that pricing mechanisms are competitive and sustainable. Wind energy at the residential and commercial levels for off-grid applications will also be encouraged.

Options for interconnecting renewable energy generators to the grid will be reviewed and explored towards the implementation of grid-tied systems and net-metering platform. Once proven beneficial to all parties, grid-tie options can be encouraged as a means of reducing investment in fossil-based generators and meeting incremental demand from renewable energy sources.

Government of Guyana will continue to aggressively pursue the opportunities for increased biofuels production (biodiesel and ethanol) for export and local consumption. The GEA will work closely with small farmers to encourage the use of small bio-digesters to reduce waste and produce biogas.

Energy efficient and renewable energy cook stoves will be reviewed to provide sustainable energy solutions where appropriate.

Public education and awareness programmes will continue to play a major role in providing consumers with information and tools for reducing energy consumption and expenditure for

energy. GEA will continue its campaign to educate and guide consumers in making wise energy efficient choices. Energy audits, per unit production energy consumption reports, energy "walk-through" assessments and the opportunities for energy service companies (ESCOs) will be encouraged at the residential, commercial and industrial levels. Options for energy efficient street lighting will be explored and tested.

Addressing climate change requires both mitigation and adaptation measures. Consequently, it is important to consider the potential risks of a warmer climate and its effect on the energy sector. Guyana will collect and analyse available data on past climate impacts on the energy sector and encourage adaptation measures to enhance the country's resilience.

New and Renewable Energy

Hydropower

Strategic Objectives

GEA will continue to:

- Develop and encourage the development and utilisation of sources of energy other than those sources presently in use.
- Conduct research into all sources of energy including those sources presently used will be conducted with the objective of generating energy.
- Review hydro-electric power projects to determine the suitability of design and conduct inspections during construction to ensure compliance with the plans in keeping with its mandate under the Hydroelectric Power Act.

Strategic Actions

Current Initiatives

- Hydropower is a renewable energy source that is reliable, cost-effective and produces around 16% of the world's electricity. To promote hydropower development in Guyana, the GEA has commenced a number of activities such as assessing the list of hydropower sites which has formed part of a geographic information system (QGIS) for viewing, editing and analysis capabilities of the different sites. The Agency has also embarked on the development of a feasibility study for the Kumu Falls, Region 9 and Hosororo, Region 1. With the intention of gathering information, inspections are being carried out on different sites on an annual basis, with more a total of 36 sites visited between 2012 and 2015. This effort will continue and suitable sites will be assessed for the piloting of Pico hydro systems.

- The Amaila Falls, located on the confluence of the Kuribrong and Amaila Rivers, just above the Amaila Falls, is the most advanced hydropower development and is expected to have an installed capacity of 165MW. The plant is designed to deliver electricity to Guyana's capital, Georgetown, and its second largest town, Linden, by a 230kV transmission line. Construction of the hydropower facility and electrical interconnection was anticipated to begin in 2014 and will take approximately four years to complete. Guyana's electric utility, with peak demand of about 100 MW, is currently dependent on fossil-based imports for most of its energy generation. The 165MW hydropower plant would therefore meet Guyana's electricity needs from a renewable energy source. In addition to Amaila, four (4) other sites were selected to

be assessed by IDB for hydropower development: Kamaria (180 MW), Kumarau (149 MW), Tumatumari (152 MW) and Tiger Hill (28 MW).

- Government of Guyana has signed a Memorandum of Understanding (MOU) with Brazil, which, in the first stage, provides a two-year period for Brazil to study the adjacent basins of the Mazaruni and Potaro Rivers and diversions within and between them so as to determine the most favourable arrangements and sequence for the development of hydropower sites. Presumably, power developed would be sold to Brazil along a transmission line which would be part of any such development.

- Guyana is also a party to a Memorandum of Understanding on the Northern Arc Interconnection Project which seeks to evaluate the feasibility of a possible collaboration on the energy transmission system for the electric interconnection of Guyana, Suriname, French Guiana and the northern cities of *Boa Vista* (State of *Roraima*) and *Macapá* (State of *Amapa*) (the Northern Arc Countries) with support from the Inter-American Development Bank (IADB).

- GEA will continue working with the Hydro-meteorological Department of the Ministry of Agriculture to measure and record hydrometric information in Guyana.

Regulatory Oversight

Regulatory oversight and monitoring of hydropower in Guyana will be achieved by conducting site visits, inspections and measuring the amount of energy supplied. Monitoring will also entail consideration for climate change risks by periodically conducting vulnerability assessments and collection and analysis of past climate impacts.

Hydropower Investment

In consideration of the capital intensive nature of hydropower projects, GEA will continue to support activities related to hydropower development.

Micro/Pico Hydro

GEA will seek to develop run-of-the-river type hydropower stations under 100kW to meet the energy needs of neighbouring communities. Pico-hydro (up to 5kW) options will be reviewed.

The Hosororo Hydropower Project, following a feasibility study in 1985, was being considered to supply power to a planned agricultural processing plant and a school from a 15kW hydropower plant using the water of the Hosororo Creek.

Solar Power

Strategic Objectives

GEA will continue to:

- Develop and encourage the development and utilisation of sources of energy other than those sources presently in use.
- Demonstrate, research and utilize solar photovoltaic technology as a source of renewable energy to meet energy needs where appropriate.

Strategic Actions

With the price for solar photovoltaic equipment decreasing, it is expected that there will be an increase in the number of solar photovoltaic installations throughout the country. There is also great interest within the private sector for large solar photovoltaic systems tied into the national grid under a power purchase agreement (PPA) and for offsetting energy costs at their place of business.

Options for interconnecting renewable energy generators to the grid will be reviewed and explored. Once proven beneficial to all parties, grid-tied options can be encouraged as a means of reducing investment in fossil-based generators and meeting incremental demand from renewable energy sources. GEA will therefore seek to promote the use of solar photovoltaic grid-tied technologies by using the current pilot installation as a working example of the benefits of grid-tied technology.

GEA will continue to actively support the installation of solar photovoltaic systems across the country.

Wind

Strategic Objectives

- GEA will continue to develop and encourage the development and utilisation of sources of energy other than those sources presently in use.
- Research into all sources of energy including those sources presently used will be conducted with the objective of generating energy.

Strategic Actions

GEA will support the implementation of wind farms to supply energy to the national grid, provided that pricing mechanisms are competitive and sustainable.

Wind energy at the residential and commercial levels for off-grid applications will also be encouraged.

GEA will conduct wind measurements at suitable sites with the objective of determining wind energy potential and continue to monitor installed wind generators across the country.

Bioenergy

Strategic Objectives

GEA will continue to:

- Develop and encourage the development and utilisation of sources of energy other than those sources presently in use by promoting local examples.
- Conduct research into all sources of energy including those sources presently used.

Strategic Actions

Bagasse

The employment of high pressure boilers for the cogeneration of electricity may provide an opportunity for improving the electricity output of existing sugar factories and creating an additional source of income from a renewable energy source. GEA will work with GUYSUCO to explore the feasibility of generating additional energy from bagasse at the various sugar estates for sale to the national grid.

Rice Husk

In an effort to develop and encourage the development and utilization of sources of energy other than those sources presently in use, GEA has assessed the potential of rice husk biomass for the generation of electricity. A list of locations, potential biomass quantities from rice mills and a map with the listing of all potential sources of rice husk energy sources have been completed. This will help in guiding the installation of a rice husk to energy plant by 2017.

Rice millers will be encouraged to investigate the opportunities for generating energy from rice husk. GEA will seek to establish a 20 to 30kW demonstration unit.

Woodwaste

Collaboration and support from the Environmental Protection Agency can create specific central areas for utilizing biomass to produce energy. Areas to store/dump wood-waste can be designated with the objective of sustainable waste-management practices thereby creating centralized areas from which biomass-based electricity generation can be realized.

GEA will seek to establish a small wood-waste-to-energy demonstration facility for the generation of electricity. GEA will explore the feasibility for land-fill-waste-to-energy facilities.

Biofuels

GEA will continue to support the efforts of the Ministry of Agriculture in the promotion of bio-energy.

Biogas

GEA will also actively encourage the construction and operation of bio-digesters where suitable and offer technical advice and support for the existing bio-digesters installed across the country.

Energy Conservation and Efficiency

Strategic Objectives

GEA will continue to:

- advise and make recommendations to the Minister regarding any measures necessary to secure the efficient management of energy and the source of energy in the public interest.
- carry out research into securing more efficient utilization of energy and sources of energy.

Strategic Actions

Energy Assessments/Audits

Energy assessments/audits are essential for the various sectors of the economy to promote a better understanding of final energy use and energy efficiency. Energy assessments/audits will create awareness among functional managers and highlight the importance and benefits of implementing energy efficiency activities. Energy assessments/audits can assess the energy efficiency of buildings, equipment and processes using diagnostic tools and analytical procedures, and make feasible, practical and fact-based recommendations to customers to save energy and money. The Guyana Energy Agency will continue to conduct energy assessments/audits of the various public buildings with the objective of reducing energy consumption and improving energy awareness by replacing inefficient lighting and appliances. Measurements of energy consumption will be conducted before and after to assess the effectiveness of the activities. Energy assessments/audits at the commercial and industrial level will be increased and supported by the GEA with the objective of increasing energy assessment activities across the country. The feedback and interest of energy assessments conducted were positive, both from the public and private sector. The GEA will continue its activities in this area to address awareness on energy efficiency and conservation.

Energy assessments would be done to target the reduction in energy consumption in schools across Guyana.

Energy Efficient Buildings

BUILDING CODE

Many countries are encouraging energy efficient building designs in order to reduce energy consumption. GEA will review the country's building codes with the intention of incorporating interventions such as occupancy sensors, cool roof, natural lighting, energy efficient lighting etc. The existing building code will be reviewed with the objective of incorporating energy efficient construction and designs. While some countries have opted for energy efficient building codes, an initial voluntary scheme that involves issuance of certificates for buildings and building technologies that meet the energy performance requirements and additional levels of certification for those with superior performances can be explored for Guyana.

GEA will engage in research on incorporating climate resilience while reviewing the building code and work with the relevant authorities to include guidance for retrofitting existing housing developments to integrate climate resilience.

OCCUPANCY SENSORS

Areas such as washrooms and walkways can incorporate sensors that turn lights on and off when a person enters. Energy is saved because the lighting in these areas do not need to remain on. While it would be ideal to have persons switch the lights on and off, quite often the lights are left on and energy is wasted. The automatic occupancy sensors will be tested and piloted by GEA's engineers.

COOL ROOF

Dark-coloured roofing materials easily absorb heat from the sun which causes the temperature of a building to rise. White or "light-coloured" roofing materials are very effective at reflecting heat and therefore absorb very little heat into the building. A cooler building means reduced need for cooling energy if the building is air conditioned, or lowers the inside air temperature if the building is not cooled. GEA will pilot and encourage the use of cool roof technology on roofs in Guyana.

NATURAL LIGHTING

Windows and skylights bring light from the sun into the home, reduce the need for artificial lighting and save energy. GEA will explore the use of technologies such as skylights, sunpipes and window films to maximize natural lighting and cooling opportunities.

ENERGY EFFICIENT LIGHTING

Engineers will continue to examine, test and review various energy efficient lighting technologies.

REFRIGERANT REPLACEMENT

Changing CFC, HCFC and HFC refrigerants, in keeping with the Montreal Protocol, to natural refrigerants can save 15% to 30% in energy consumption. GEA will examine the practicality and benefits of changing refrigerants to reduce energy consumption.

SOLAR WATER HEATING

Importation and installation of solar water heaters will be encouraged for both residential and commercial use. The tourism and health sectors will be engaged with the objective of promoting the installation of solar water heaters through distribution of brochures, walk through assessments and continued dialogue.

Energy-conscious Procurement Policy

Procurement decisions are often focussed on assets rather than energy services and based primarily on the least cost without taking into account the lifecycle cost of energy efficient equipment. In an effort to promote the procurement of energy efficient equipment and appliances for public buildings, the GEA would be modelling and encouraging the adoption of procurement policies that include lifecycle energy cost. Within this policy companies would be encouraged to ensure that decisions regarding the procurement of energy-using equipment are taken with full knowledge of the equipment's expected lifecycle and energy cost. GEA will enhance its efforts to educate Government entities, companies and persons on the benefits of purchasing energy efficient appliances.

Labelling Standards

GEA will investigate and review the development of Minimum Energy Performance (MEP) standards for building ratings, appliance standards and labelling in close collaboration with private sector. Energy efficiency standards and labelling schemes for household and commercial appliances and some types of equipment, such as motors, would be explored through an initial voluntary scheme that simultaneously provides guidance towards consumer awareness on energy use and benchmarks toward efficient appliance and equipment purchase.

Prioritized appliance change-out programme

Replacement of old, inefficient appliances can yield significant energy conservation benefits. According to a 2013 study conducted under the Eastern Caribbean Energy Labelling Project (ECELP), potential savings in electricity consumption through replacement of old refrigerators in St. Lucian households can vary between 49% and 61%, depending on the type and age of the refrigerator. GEA will prepare a similar analysis for domestic refrigerators in Guyana to compute the energy savings, reduction in demand, environmental and social benefits of a programme to encourage the replacement of inefficient refrigerators.

ISO 50001 Energy Management Standard

ISO 50001 supports organizations in all sectors to use energy more efficiently, through the development of an energy management system to make it easier for organizations to integrate energy management into their overall efforts to conserve resources and tackle climate change. The Standard provides a framework of requirements for organizations to develop a policy for more efficient use of energy, fix targets and objectives to meet the policy, use data to better understand and make decisions about energy use, measure the results, review how well the policy works, and continually improve energy management. GEA will actively encourage the adoption and implementation of the ISO Energy Management Standard.

Transport Sector Efficiency

The Transport sector accounts for 35% of total petroleum imports and therefore requires considerable focus.

Research will be conducted to explore opportunities for alternative transport fuels including ethanol, biodiesel, natural gas and renewable energy for powering hybrid and electric vehicles.

Energy Efficient Street Lighting

Energy efficient street lighting will continue to be explored with the objective of minimizing energy consumption, cost and carbon dioxide emissions. Different energy efficient lighting technologies would be tested and evaluated to make informed decisions on the most appropriate technology.

Photocells replacement is a low cost intervention towards energy savings. With aging and other deficiencies, photocells are failing and some lamps remain lit 24 hours per day. Continuous efforts are being made to address this situation and the GEA will continue to support the replacement of damaged photocells.

Engineers at the GEA designed and installed a solar-powered LED street light for demonstration purposes in 2014. The experiences gained from this model were used to install additional units to explore the opportunity of using alternative energy for street lighting.

Energy Efficient Cooking

GEA will continue to monitor the integration of energy efficient cook stoves in the various pilot communities with the objective of ensuring sustained successes and replicating the experiences in other communities.

Data Collection/Surveys

Greater understanding of consumer choices and habits in equipment purchasing and operation will ensure more focused interventions to reduce energy consumption. GEA will design, pilot and conduct surveys to collect end-use information on the following:

1. Transport sector consumption
2. Residential energy consumption
3. Commercial energy consumption
4. Industrial energy consumption

Public Education Campaigns

Strategic Objectives

GEA will continue to promote education and awareness of key concepts such as sustainable energy, energy management and energy conservation as well as the impact of climate change on energy systems and how to manage these impacts.

Strategic Actions

Awareness and Information Dissemination

Improved and increased information dissemination activities will help realize energy efficiency and energy conservation objectives. Over the next five years, the GEA will continue to expand and increase its efforts to design, print, distribute and publish information brochures and posters, newspaper advertisements, ebooks, radio and television energy information tips, infomercials, documentaries and conduct seminars, workshops and presentations on energy, energy efficiency, energy conservation, sustainable energy and climate change impacts to schools, ministries and other entities.

Licensing

Current Situation

The GEA Act of 1997 required the GEA to monitor the performance of the energy sector in Guyana, including the production, importation, distribution and utilization of petroleum and petroleum products. The 2014 Amendment to the GEA Regulations provided the legislative framework for GEA to grant licences for the importation, export, bulk transportation, storage, wholesale, retail, storage and own-use of petroleum and petroleum products. Over the years the GEA has been steadily improving its licensing drive as evidenced in the table below.

	2008	2009	2010	2011	2012	2013	2014
Importing/Wholesale	7	12	10	18	13	15	24
Wholesale	15	12	12	13	13	6	22
Retail	254	326	349	335	372	376	492
Consumer Installation	135	238	204	165	281	197	293
Bulk Transportation Carrier	417	453	562	672	736	738	628
Total # of Licences Issued	**828**	**1,041**	**1,137**	**1,203**	**1,415**	**1,332**	**1,459**

It is expected that in the next five years, there will be continued increase in the issuance of licences countrywide. This therefore means continued inspections of fuel sites and improved systems to monitor efficiency and compliance with the licensing requirements.

Handling, transportation, storage, testing and dispensing of aviation fuels

GEA has been tasked with the responsibility of reviewing the existing systems, procedures and guidelines at the Cheddi Jagan International Airport (CJIA) and Ogle Airport Inc. (OAI) in relation to the handling, transportation, storage, testing, and dispensing of avjet and avgas.

Strategic Objectives

The GEA will study and keep under review matters relating to the exploration for, production, recovery, processing, transmission, transportation, distribution, sale, purchase, exchange and disposal of energy and sources of energy and will report and recommend measures necessary for the control, supervision, conservation, use and marketing and development of energy and sources of energy.

In keeping with its legislative mandate, the GEA will grant and issue licences relating to petroleum and petroleum products.

The GEA will recommend the making of such arrangements as desirable for cooperation with governmental or other agencies in or outside of Guyana in respect of matters relating to energy and sources of energy.

STRATEGIC ACTIONS

Continuous review of the licensing process will be conducted annually to ensure that all sites are properly inspected and licensed. The number of licences issued and sites inspected will be monitored to ensure full compliance with legislation.

The GEA will monitor the operations of aviation fuel handlers to ensure conformity with the guidelines and procedures for the handling, storage and delivery of aviation fuels.

Fuel Marking Programme

Current Situation

Recognizing the ruinous effects of fuel smuggling on legitimate businesses, the Government in 2003 installed the Fuel Marking Programme employing the use of state of the art covert technology as a means of identifying illegal fuel. At the time of introduction, the technology was new to Guyana and the region and required specialized legislation. The GEA Act was amended in 2004 to provide specifically for licensing of the different classes of fuel dealers and for the marking of all legitimately imported fuel. Subsidiary legislation in the form of the Petroleum and Petroleum Products Regulations 2004 were created to regularize fuel operations. A review of the system later revealed deficiencies which resulted in the GEA Act being amended in 2005.

In 2007, a ***Task Force on Fuel Smuggling and Contraband*** was convened under the auspices of the Ministry of Home Affairs to coordinate the efforts of the different law enforcement agencies in the fight against fuel smuggling and contraband. Cooperation between the Guyana Police Force, Guyana Revenue Authority, Guyana Defence Force Coast Guard, and Customs Anti-Narcotics Unit (CANU) have resulted in several interdictions of illegal fuel and assistance in capturing, escorting and securing various transport vessels (both land and water). Cooperation from the Guyana Police Force in the detention of suspects and the GDF Coast Guard in securing vessels proved invaluable in combating the illegal fuel trade since GEA's lack of capacity to traverse the waterways had previously been a hindrance to interdiction. GEA is therefore grateful to its sister agencies and the work of the Task Force in providing support facilities in this regard. Reports by public-spirited citizens have also contributed to significant interdictions.

Some of the first cases prosecuted under the legislation revealed that the system required additional testing capabilities. As a result, equipment to perform these additional tests had to be sourced and same was only acquired in 2009.

The Fuel Marking Programme was bolstered in 2010 with the addition of a mechanised system to add the chemical marker into the bulk storage tanks using an automated bulk marker injector. This bulk marking system utilizes self-powered injectors to automatically inject the chemical marker concentrate at a predefined dosage during discharge of fuel from the international vessels into the bulk storage tanks. The system of bulk marking has improved security and integrity by taking the domestic marker out of the hands of the marking staff where 'losses' have been experienced in the

past. These changes have further enhanced the Fuel Marking Programme whilst minimizing impact on terminal operations.

The GEA Act was again amended in 2011 to include provisions to address the seizure and disposal of illegal petroleum and petroleum products and other items associated with illegal petroleum. The Amendment also made provisions for matters to be settled out of court and increased the statutory limitation period from six months to seven years for the institution of charges.

On a number of occasions GEA has had to terminate staff where events demonstrated leaks in the system, which in itself hampered GEA's ability to provide sufficient coverage of the length and breadth of Guyana. Many hurdles have had to be overcome and are still being overcome.

The issue of smuggled fuel not only covers evasion of taxes on fuel but also encompasses instances where tax free fuel is being utilized for unauthorized purposes. The principal objective of the Fuel Marking Programme was to enable the authorities to reduce the incidence of fuel smuggling in the country and recover revenues lost through tax evasion. The Fuel Marking Programme provides benefits in a number of areas:

- Improved and sustained sales of legitimate diesel and gasoline.
- Improved and sustained collection of excise tax.
- Assurance of fuel quality.
- Direct employment of about 50 persons.
- Confidence in the industry and the regulatory/enforcement Agencies to stamp out illegal activity.

PROGRAMME INDICATORS

The Guyana Energy Agency has realized marked reductions in fuel smuggling through its Fuel Marking Programme (FMP). It has been noted since 2006 there has been a progressive reduction in sites which were found with significant dilution in at least one tank. A noted strategy employed was testing fuel at various terminals, service stations and other sites where fuel was often found with the required concentration of marker. Investigations were carried out as well to determine specific players in the various fuel smuggling rings

particularly from information received from the public. Put together, these strategies were instrumental in the successes gained in the FMP.

Consumption of mogas (gasoline) for the year 2014 increased by 5.62% compared to 2013. Gasoil (diesel) consumption recorded a 7.22% increase in total volumes (including the large duty-free consumers) in 2014 when compared to 2013. Consumption of gasoil by the oil companies only (excluding the large duty-free consumers) increased by 6.98%. The increase in gasoil consumption correlates with the overall sustained growth of the economy and decreased availability of smuggled fuel, presumably due to the success of the monitoring and enforcement activities of the Fuel Marking Programme.

In 2014, of the 8,323 sites visited, 2,200 sites were sampled at least once. 51 (2%) of the sites sampled at least once were found with *significant dilution (defined as more than 50%)* in at least one tank. From 2006 to 2014, the percentage of sites found with significant dilution in at least one tank has progressively decreased from 34% in 2006 to 2% in 2014. Significant levels of adulteration (defined as more than 50%) were detected in only 2% of the samples analysed. With more sites visited, the data suggests that more sites are dealing in legal fuel.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
No. of Sites sampled at least once	573	763	656	566	592	1,202	1,313	1,179	1,648	2,146	2,200
No. of Sites found with significant dilution in at least 1 tank	72	240	220	128	57	73	45	21	13	35	51
% of Sites found with significant dilution in at least 1 tank	13%	31%	34%	23%	10%	6%	3%	2%	1%	2%	2%

Analysis of Site Results

With support from the Task Force on Fuel Smuggling and Contraband, the Fuel Marking Programme recorded 8 convictions in 2014. Seventeen (17) new charges were filed in 2014 compared with 9 in 2013, 4 in 2012, 13 in 2011, 27 in 2010, 7 in 2009 and 3 in 2008. At the end of 2014, there were 15

prosecutions engaging the attention of the courts.

An additional metric to evaluate the performance of the Fuel Marking programme is a measure of gasoline, diesel and kerosene consumption (excluding large duty-free consumers). For the oil companies, 3,385,595 barrels of petroleum-based products were sold in 2014 with an average of 9,276 barrels per day. This represents a 5.82% increase when compared to 2014. The upward trends of gasoil (diesel) and mogas (gasoline) correlate with economic growth and the successes of the Fuel Marking Programme.

The GEA has made previous efforts to expand its operation beyond the Coastal Plain of Guyana by establishing bases in Regions 1, 2 and 10. However, the initiative for Region 1 was short-lived as all operations there eventually ceased and the respective base is currently closed. Nevertheless, the GEA is continually assessing the strategic benefit of having other bases at strategic points across the country particularly in the traditionally populated areas where fuel is moving consistently.

Moreover, the fundamental approach of the fuel inspection arm of the GEA in the recent past has been more inclined to routine fuel testing. The rigors associated with detailed and prolonged investigations into personalities that may have linkages with criminal undertakings in fuel smuggling have stifled progress in developing some cases. Further, the lack of adequately skilled human resources has compounded this issue. Nonetheless, the Agency continues to invest in developing the skills of fuel inspectors and with consistent interventions in this area this should bring about positive changes.

Notably, there has been good governmental support for the sustained programme in fuel marking and testing, especially since it forms part of prudent economic planning. Coupled with the GEA's communication strategy, the public seems in favour of the measures the Agency has taken to combat fuel smuggling; especially since it provides everyone with good quality and a stable supply of fuel. Even though the current bilateral relationship in neighbouring Venezuela has likely affected the quantities of illegal supplies crossing into Guyana, it also raises concern of international supplies being disrupted in the near future.

With Guyana's own oil exploration programme in full swing, the nature of the inspection function of the Agency will have to eventually evolve to meet new demands.

STRATEGIC OBJECTIVES

Internally, GEA will improve the functionary hubs of activities under the Fuel Marking Programme; namely the addition of fuel markers, inspections and sampling, laboratory analyses, investigations and prosecution of offenders.

The GEA will continue to utilise the fuel marking system to add markers to diesel and gasoline and take samples, carry out tests and examinations to determine the presence or level of the markers in the samples. Also, persons dealing with illegal petroleum and petroleum products will be prosecuted.

Recognising that a single approach would not yield significant results and the need for initiatives to be taken in conjunction with others, GEA will specifically endeavour to take the following strategies:

1. Targeted Sampling

While there is no conclusive evidence as to the origin of fuel smuggling, it is believed that illegal fuel comes primarily from neighbouring countries such as Venezuela, Trinidad and Tobago, and to a lesser extent Suriname and enters Guyanese territory via geographical hotspots. The operation of the inspection unit therefore calls for employing a combination of targeted approaches to sampling fuel sites to ensure continued success. This means not just focusing on geographical hotspots but also targeting individuals that have a history of smuggling fuel. In both cases, this requires analysing data from a cross section of sources including information from sister agencies.

Also, bearing in mind the free trade zone for fuel, it is imperative that regular checks will be done on more sites further inland as the likelihood of finding the illegal commodity will increase.

2. Collaboration

Given the inter-agency support from members of the Task Force on Fuel Smuggling and Contraband, the GEA is likely to have a more robust fuel inspection unit within the short to medium term. This will not only impact land but sea operations, not just traditional but more non-traditional sites. This is especially so with the use of the floating bases of GDF and GPF. Additionally, it will be essential to seek more collaboration with members of the Task Force on Fuel Smuggling and Contraband that are based in Bartica, given GEA's more permanent presence via its established base. Collaborative efforts with other agencies like the Protected Areas Commission will also help to ensure areas restricted for fuel operations area properly monitored and covered.

It is expected within the next few years, all things being equal, the Agency will have a more significant impact on smuggled fuel entering the territory of the Republic of Guyana through a wider and more consistent coverage for monitoring, sampling and intelligence gathering activities.

The collaborative relationship between the GEA and agencies like the GRA, GDF, CANU and the GPF cannot be overstated. Since these agencies already have well developed intelligence functions, it is important that the GEA benefits from this – not just with intelligence sharing but through learning initiatives. To improve information sharing, it could be useful to create a collective database that can be accessed and periodically updated by members of the Task Force with specific interfaces can be developed to suit the intending Agency. Furthermore, through the learning initiatives, staff from the GEA can be seconded to sister agencies for specific learning such as developing investigative skills.

3. Improving Actionable Intelligence

Enhanced efforts will be directed to improving the frequency and quality of actionable intelligence. This will entail more surveillance related operations particularly on the waterways and on known personalities associated with fuel smuggling. It will entail working with a core group of inspectors based on their ability to execute such directives. Given the nature of these activities, it will require prolonged and persistent actions as good intelligence is usually developed over time and not through one-off actions. It will also

require more joint collaborations with sister agencies to share and act on intelligence gathered. While there are opportunities for interactions at multiple forums for such information exchange, it is imperative to have more systematic access from centralized systems inclusive of databases. Given that these systems will probably take some time to develop, the best use of existing forums for information exchanges must be utilized to its fullest. Further, the GEA's own internal systems must be continually scrutinized and improved accordingly. This must include assessments of its information management systems. It will also require embedding appropriate security measures in these systems to prevent breaches. Excellent intelligence will be the core objective of the Agency's inspection arm in promoting more robust measures to curbing fuel smuggling.

While collaborative approaches with sister agencies are helpful, the Agency must develop its own intelligence network. Continued emphasis must first be placed on the recruitment measures to ensure persons of this calibre are attached to the post. Secondly, it is imperative to develop contacts at strategic locations. These would not just include contacts in the North West District but also those on and across the borders of Guyana. This is imperative to develop solid, highly reliable intelligence. While it might not be practical to develop these contacts in the short term, it is important to start with manageable locations and spread outwards to the regional and international fringes.

Further, more effort has to be placed on the surveillance of known fuel smugglers. This simply means the surveillance measures have to become more targeted and persistent. Therefore, the Agency's resource structure must evolve to complement such activities. This may entail the allocation of special allowances to cover expenses for particular surveillance activities.

4. Enhanced Recruitment Measures

Given the rigors associated with being a fuel inspector for the GEA, it is important that the persons filling these posts be sufficiently capable to handle the required tasks. Therefore, the recruitment measures must be robust enough to ensure that better candidates are chosen for the work at hand. This would encompass thorough background checks of

potential employees, adequate tests in core competencies and tests of physical fitness. Even after persons would have been hired, it would be essential to critically evaluate their skills through the appraisal process, for instance, to measure their ability to function in the other aspects of the position that require more intelligence work.

5. Continued Skills Development for Inspectors

Consistent and relevant training is required to have the skills of inspectors improved to serve the needs of the GEA. This can range from basic areas such as swimming skills to more complex ones such as electronic surveillance techniques. Continual investment in the skills development of inspectors will help them to become more adept at responding to the needs of the Agency. Therefore, trainings will be explored to ensure that the inspectors are exposed to up-to-date techniques and practices relevant to their work.

Additionally, it is necessary for training to also focus on developing skills suitable for the intelligence component of the Agency's operation. As the inspectors' roles develop, it will be necessary to work with a core group for more specific operations. As such, it may become essential to focus on added training for those persons after some time and depending on how inspectors respond to the trainings.

6. Public Education / Engagement

Without the collective support of the public, all efforts undertaken by the GEA to curb fuel smuggling will ultimately fail. Therefore, there must be a conscious effort to actively engage with members of the public to gain their 'buy-in' and to foster a relationship of goodwill which can help develop a useful contact base that adds to GEA's intelligence function. Strategies in this regard would be focused on multiple approaches to not only disseminate information but also to ensure it is thoroughly understood and practiced.

Targeted interventions may be required depending on the needs of specific communities. It would involve working with younger persons through schools and youth groups. It would also entail the use of electronic and print media. This approach not just helps the Agency to get its message across but also provides an opportunity for staff to learn from the public as well.

There can be instances where forums exist for the exchange of ideas that can foster a more productive relationship between the public and the GEA.

Strategic Actions

The fuel marking system will be periodically reviewed to ensure all legally imported fuel is correctly marked. GEA will also ensure that incidents of illegal fuel are properly investigated and prosecuted accordingly to avoid procedural irregularities.

Country-wide fuel sampling will be conducted to collect and test fuel samples. Hotspots and personalities believed to be associated with fuel smuggling will be identified and periodic checks will be carried out through a collaborative process with the Task Force on Fuel Smuggling and Contraband. GEA will also monitor the transport of fuel by air in reported areas and GEA's inspectors will be periodically deployed on floating bases of the GDF and GPF.

To address the issue of improving recruiting measures for inspectors, GEA will administer tests in core competencies during recruitment process. Capacity building through training will also be emphasised, including conducting more investigatory trainings and seeking available training opportunities from GPF.

To garner community level support to fight fuel smuggling, GEA will develop a flyer focusing on 'Fuel Smuggling is a Criminal Offence' and conduct distribution exercises in communities where the act is prevalent.

Organizational Structure, Capacity and Infrastructure

Current Situation

GEA's organization structure was revised in 2010 and created the following new positions: Energy Economist, Energy Engineers, Hydropower Support Engineers, Licensing Administrator, Internal Auditor, Public Communications Officer, Human Resource Officer, Legal Officer, Field Operations Coordinator, Senior Investigator and Investigator. Once all positions are filled, the organization structure is expected to be sufficiently staffed to undertake the activities outlined in this 5-year strategic plan.

The GEA is stationed at its Head Office at 295 Quamina Street, South Cummingsburg. The extension of this building, which commenced in 2014, facilitated the consolidation of personnel which was deemed necessary to enhance resource utilization.

Strategic Objectives

The GEA will seek to expand is facilities to ensure more coordinated and efficient use of resources.

GEA will aim to build capacity through participation in professional development programmes to equip the various classes of employees with the requisite knowledge and skills to ensure the organization's mandate is achieved.

Strategic Actions

Efforts will continue to identify options for increasing office space at Quamina Street to improve the welfare of the staff and provide additional office space.

GEA will continue to organize and install suitable capacity building and professional development programmes to provide employees with requisite knowledge and skills.

Budget

The table below summarizes the historic and proposed budgetary requirements to finance the activities of this Strategic Plan:

	2014 G$	2015 G$	2016 G$	2017 G$	2018 G$	2019 G$	2020 G$
Expenditure							
GEA Recurrent	117,016,000	137,430,000	148,812,000	187,672,000	190,043,000	199,530,065	208,129,582
GEA Capital	10,000,000	10,109,000	7,975,000	83,858,000	52,395,000	128,710,000	83,410,000
GMS Recurrent	337,642,242	346,135,473	360,083,596	362,532,598	383,586,394	388,789,640	395,194,171
GMS Capital	3,059,518	26,729,172	17,642,140	17,990,000	15,316,750	12,043,250	6,041,500
Total Expenditure	**467,717,760**	**520,403,645**	**534,512,736**	**652,052,598**	**641,341,144**	**729,072,955**	**692,775,253**
Income							
GEA Revenue	46,275,000	46,704,567	52,921,000	53,206,000	54,271,000	55,356,000	56,463,000
GMS Revenue	336,726,575	356,472,771	361,123,319	617,732,746	617,732,746	617,732,746	617,732,746
Subvention	83,500,000	93,717,433	91,655,000				
Total Revenue	**466,501,575**	**496,894,771**	**505,699,319**	**670,938,746**	**672,003,746**	**673,088,746**	**674,195,746**

In 2017, it is expected that, through an increase in the Agency Fees, once approved, the GEA would no longer require subventions for its capital and recurrent expenditures.

Key Strategic Actions (KSAs)

The purpose of the Strategic Plan is to articulate a five-year vision to guide the activities of the GEA to provide reliable energy that is economically, environmentally and socially sustainable for all in Guyana. These targets are subject to annual budget approvals.

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
Energy Conservation/Efficiency											
1	Improve and increase information dissemination activities.	Number of Energy Conservation ads in the Newspapers	17	52	40	60	55	60	60	60	60
		Number of Energy Conservation ads on TV	177	29	52	97	55	60	60	60	60
		Number of Energy Conservation ads on the radio	93	1,138	582	600	600	600	600	600	600
		Number of brochures printed	30,000	0	6,000	15,800	5,000	5,000	5,000	5000	5000
		Number of booklets printed	300	1,684	2,097	1,000	1,000	1,000	1,000	1,000	1,000
		Number of posters printed	4,700	41	2,000	2,089	150	150	150	100	100
		Number of brochures distributed	13,531	10,690	12,097	7,160	5,000	5,000	5,000	6,000	6,000
		Number of booklets distributed	188	424	1,536	500	1,000	1,000	1,000	1,000	1,000
		Number of posters	3,150	26	1,187	1,300	150	150	150	100	100

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
		distributed									
		Number of infomercials broadcast	17	984	2,378	2,340	55	60	60	60	60
		Number of documentaries broadcast	0	168	709	677	50	50	50	50	50
		Number of visits to GEA's website	9.522	19,183	15,269	17,185	31,000	32,000	32,000	32,000	32,000
2	Energy Awareness Seminars and workshops	Number of seminars	1	2	3	1	2	2	2	2	2
		Number of workshops	2	3	2	3	2	2	2	2	2
3	Energy Presentation to schools	Number of presentations	1	12	35	43	45	45	45	45	45
4	Energy Presentations to Ministries, Agencies, Private Sector	Number of Presentations to Ministries/Agencies	2	1	4	3	6	5	5	5	5
		Number of Presentations to Private Sector	0	0	1	1	6	2	2	2	2
5	Energy auditing and assessment activities across the country.	Number of energy audits completed.	16	16	9	6	5	5	5	5	5
6	Reduce Energy Consumption in Schools and promote the use of Renewable Energy	Number of energy assessments		3	18	2	20	20	20	10	10
		Number of Renewable Energy Installations		4	5	4	4	2	2	2	2
		Number of schools benefitting from the				9	14	3	3	3	3

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
		installation of energy efficient lights and occupancy sensors									
7	Prepare a National Energy Balance.	Completed Energy Balance.	✓	✓	✓	✓					
8	Promote energy efficient street lighting.	Number of energy efficient street lights installed Number of solar-powered street lights installed.	2	41 1	40 2	11 11	65 4	80 10	80 10	80 10	80 10
9	Reduce energy consumption of street lights	Number of defective photocells replaced	127	920	903	300	0	750	200	200	200
10	Redesign the "traditional fireside stove" to achieve greater efficiency, reduced demand for wood and reduced soot.	Number of energy efficient stoves installed.	5	15	0	110	0	10	10	10	10
11	Removal of import duties and VAT from CFLs, LEDs, energy efficient appliances and solar-powered freezers.	Amendment of relevant legislation. Operationalizing of the amended legislation.	✓ ✓								
12	Energy Efficient Buildings: Occupancy	Revised and Finalized Building Code							X		

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Sensors, Cool Roof, Natural Lighting, Energy Efficient Lighting, Refrigerant Replacement etc.										
13	Energy Conscious Procurement Policy to support the evaluation and procurement of all appliances to include analysis of the life-cycle energy consumption comparing energy efficient alternatives.	Articulated policy.			✓						
14	Energy Efficient Labelling Standards	Labelling Standard and Minimum Energy Performance Standard adopted.							X		
15	Inefficient refrigerator replacement proposal	Approved Proposal							X		
16	Data Collection Surveys	Transport Sector Consumption survey completed						X			

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
		Residential Energy Consumption survey completed Commercial Energy Consumption survey completed Industrial Energy Consumption survey completed						X X X			
		Renewable/Alternative Energy									
17	Promote the use of solar cookers.	Number of communities. Number of homes/organizations. Number of stoves distributed or implemented.	5 262 293	 17 214							
18	Promote the use of Solar Photovoltaics where appropriate.	Installed capacity of Solar PV (kW) year to date.	974	1,046	1,105	1,164	1,411	2,011	2,220	2,450	2,650
19	Review options to interconnect renewable energy generators to the grid	Finalized policy					X				

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
20	Implement grid-tied systems and net-metering	Number of systems installed	3	0	1	1	3	7	10	20	20
21	Promote hydropower development.	Prioritized list of hydropower sites.		✓							
		QGIS database of hydropower sites.			✓						
		Number of measuring stations installed.			1		2	1	1	1	1
		Number of feasibility studies stations under 100kW completed.					1	1	1		
		Revised and updated Wamakaru feasibility study.						X			
		Revised and updated Tiger Hill study.							X		
		Revised and updated Eclipse Falls Study.								X	
		Revised and updated Tumatumari Development.						X	X		
		Revised and updated Ikuribisi Study.								X	
		Revision of the Amaila Falls Hydro development.					X				

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
		Development of a Hydropower Development Action Plan. Updating and Re-prioritizing Guyana's Hydropower Development. Number of hydropower stations rehabilitated/constructed.						X 1	X 1		1
22	Inspection of hydropower sites.	Number of site visits and reports.	3	8	10	15	12	12	10	10	10
23	Harness wind energy.	Installed capacity (kW), year to date.	31.4	34.35	40	45	50	10,060	10,065	10,370	20,375
24	Monitor installed wind generators across the country.	Updated database	✓	✓	✓	✓					
25	Determine wind energy potential in the country	Number of locations where wind measurements are being conducted.	1	3	4	4	6	10	10	10	10
26	Promote the use of solar water heaters.	Number of solar water heaters installed at hotels. Number of solar water heaters installed for residential and						TBD TBD	TBD TBD	TBD TBD	TBD TBD

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
		commercial purposes.									
27	Support the production and consumption of biofuels.	Volume of biofuels produced (bbls). Volume of biofuels consumed locally (bbls). Volume of biofuels exported (bbls).	1,122 1,122 0	62 62 0	96 96 0	TBD TBD 0	TBD TBD TBD	TBD TBD TBD	TBD TBD TBD	TBD TBD TBD	TBD TBD TBD
Waste											
28	Prepare feasibility studies and explore options for the proliferation of bagasse-based cogeneration.	Completed feasibility studies.							X		
29	Identify areas to store/dump wood waste from wood-based industries with the primary objective of sustainable waste-management practices (with support from Environmental Protection Agency). This	List of locations or potential biomass quantities from sawmills. Map and listing of all potential sources of wood waste energy sources. Feasibility studies for biomass-based electricity generation. Number of wood waste-to-energy plants installed			✓	✓	X		1		

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
	will create centralized areas from which biomass-based electricity generation can be realized.										
30	Utilization of rice husk for energy generation	List of locations or potential biomass quantities from rice mills. Map and listing of all potential sources of rice husk energy sources. Number of rice husk-to-energy plants installed.			✓ ✓	 1	 1		 1	 1	 1
31	Promote the use of biogas.	Number of bio-digesters installed.	2	0	2	0	3	3	3	3	3
					Transportation						
32	Incentivize importation of small capacity vehicles and create deterrents for large engine vehicles: possibly through the import duties and excise tax	Amended GRA legislation.					✓				

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
	mechanism.										
33	Pilot hybrid, energy efficient and flex-fuel vehicles at select Government agencies.	Demonstration vehicles implemented and tested.							X		
34	Research potential for natural gas as a transport fuel in Guyana.	Completed research paper.			✓						
35	Biofuel utilization	Volume of bio-diesel used (bbls). Volume of fuel-grade ethanol used (litres).	1,122	54 1,300	54 6,694	TBD TBD	TBD TBD	TBD TBD	TBD TBD	TBD TBD	TBD TBD
Fuel Marking Programme and Licensing Activities											
36	Review licensing process with the goal of ensuring all sites are inspected and licensed.	Number of licences granted per year. Number of inspections conducted per year.	1,415 897	1,332 965	1,451 882	1,351 959	1,600 1,099	1,650 1,154	1650 1,200	1675 1250	1700 1300
37	Implement suitable procedures and guidelines for the handling, storage and delivery of aviation fuels.	Guideline and procedures implemented. Regular monitoring and verification.	✓ ✓	 ✓	 ✓	 ✓					

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
38	Finalize and Gazette revised Petroleum and Petroleum Products Regulations.	Gazetted guidelines.			✓						
39	Fuel Storage and transportation Standards	Approved Standard					✓				
40	Review the marking system to ensure all legally imported fuels are correctly marked.	Review % marking at the various import terminals.	✓	✓	✓	✓					
41	Collect and test fuel samples country-wide.	Number of sites visited.	8,323	15,022	12,716	12,227	14,450	14,450	14,500	14,500	14,500
		Number of samples collected.	22,875	38,439	39,226	34,589	35,150	35,200	35,200	35,200	35,200
		Number of samples tested.	22,745	37,426	39,942	32,893	35,100	35,150	35,200	35,200	35,200
42	Ensure matters are properly prosecuted.	Number of completed prosecutions.	16	9	12	17	9	10	10	10	10
		Number of dismissals.	3	4	3	2	0	0	0	0	0
		Number of convictions.	13	5	8	9	8	9	10	9	8
		Number of matters settled under Section 33A.	1	10	4	6	2	3	4	6	6

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
		Number of appeals filed by GEA.	1	0	1	1	0	1	0	1	0
43	Improve and increase information dissemination activities.	Number of Fuel Smuggling Ads in the Newspapers.	19	42	60	65	70	75	75	75	75
		Number of Fuel Smuggling Ads on the radio.	122	1,176	512	550	600	650	650	650	650
		Number of Fuel Smuggling Ads on TV.	0	0	61	71	30	30	35	35	35
		Flyer created for Fuel Smuggling					X				
		Number of flyers on Fuel Smuggling distributed						TBD	TBD	TBD	TBD
44	Foster closer collaboration and coordination with sister-agencies and Ministries in relation to the exploration, production, recovery, processing, transmission, transportation, distribution, sale, purchase, exchange and disposal of energy.	Information received from sister-agencies and Ministries.	✓	✓	✓	✓					

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
45	Publish approved specifications and standards for Petroleum and Petroleum Products.	Gazetted specifications.		✓							
		Organization Structure, Capacity and Infrastructure									
46	Increase the number of engineering personnel.	A total of 5 engineers employed.		✓							
47	Organize and install suitable capacity building and professional development programmes to provide employees with requisite knowledge and skills.	Number of training programmes Number of Officers trained	16 66	31 141	35 205	42 182	20 100	20 100	20 100	30 100	30 100
48	Engage the Services of a Hydropower Expert						✓				
49	Creation of an Energy Efficiency Unit	Employment of Electrician Employment of 2 Energy Engineers Employment of 1 Energy						X		X	X

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
		Engineers and 1 Electrician									
50	Consolidate activities and personnel at Quamina Street.	Increased office space to accommodate all personnel and activities at Quamina Street. Employment of Deputy CEO Employment of IT Technician Employment of Admin/Procurement Clerk Employment of Gate Clerk		✓			X	X X	X		
51	Construct new energy efficient wing with solar PV roof, additional office space, dining area, recreation area (balcony, gym, table tennis facilities), daycare facilities, water storage etc.								X		
52	Improve	Administer tests in core					✓				

#	Action	Performance Indicator (s)	2012	2013	2014	2015	2016	2017	2018	2019	2020
	recruitment measures for inspectors	competencies during recruitment process									
53	Creation of an Intelligence Unit	Employment of 1 Intelligence Officer Employment of 1 Intelligence Officer							X	 X	