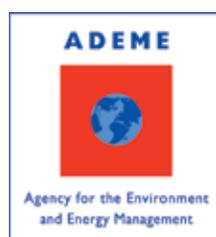


National energy efficiency monitoring report of Guyana

Shevon Wood

Candice Rowena



Thank you for your interest in this ECLAC publication



Please register if you would like to receive information on our editorial products and activities. When you register, you may specify your particular areas of interest and you will gain access to our products in other formats.



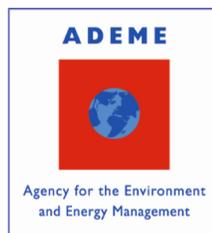
www.cepal.org/en/publications



www.cepal.org/apps

National energy efficiency monitoring report of Guyana

Shevon Wood
Candice Rowena



This document was prepared by officials of the Energy and Energy Statistics Division of the Guyana Energy Agency (GEA) and the consultant, Candice Rowena Ramessar. Shevon Wood, Head of the Energy and Energy Statistics Division of GEA, was responsible for the executive coordination and technical revision of the document. This document was produced within the framework of the Regional Observatory on Sustainable Energies (ROSE) initiative as part of the Energy Efficiency Indicators Database (BIEE) for the Caribbean programme, carried out by the Economic Commission for Latin America and the Caribbean (ECLAC), with the support of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), and funded by the German Federal Ministry for Economic Cooperation and Development (BMZ), the French Cooperation Programme and the French Environment and Energy Management Agency (ADEME). The ECLAC officials responsible for the programme were Rubén Contreras Lisperguer of the Natural Resources Division and Willard Phillips of the ECLAC subregional headquarters for the Caribbean.

The authors wish to thank ADEME and Didier Bosseboeuf, Senior Expert in charge of International Studies, for the technical support provided. Sincere thanks are also extended to Enerdata and, in particular, its Vice-President, Bruno Lapillonne, who carried out the periodic revisions of the data and analysis.

The views expressed in this document, which has been reproduced without formal editing, are those of the authors and do not necessarily reflect the views of the Organization.

United Nations publication
LC/TS.2020/27
Distribution: L
Copyright © United Nations, 2020
All rights reserved
Printed at United Nations, Santiago
S.20-00163

This publication should be cited as: S. Wood and C. Rowena, "National energy efficiency monitoring report of Guyana", *Project Documents*, (LC/TS.2020/27), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC), 2020. Applications for authorization to reproduce this work in whole or in part should be sent to the Economic Commission for Latin America and the Caribbean (ECLAC), Publications and Web Services Division, publicaciones.cepal@un.org. Member States and their governmental institutions may reproduce this work without prior authorization but are requested to mention the source and to inform ECLAC of such reproduction.

Contents

Introduction	5
A. Background to the data base of energy efficiency indicators (BIEE) project	5
B. Data collection approach and methodology.....	6
C. History of energy efficiency in Guyana	7
D. The overall assessment of energy efficiency trends in Guyana.....	7
I. Energy efficiency trends in the energy sector	9
A. Solar energy	12
B. Wind energy.....	12
C. Bioenergy.....	12
II. Energy efficiency trends in the manufacturing and industry sector	15
III. Energy efficiency trends in the tertiary sector.....	19
IV. Energy efficiency in households.....	21
V. Energy efficiency in transport.....	25
VI. Energy efficiency in services.....	27
VII. Energy efficiency trends in agriculture.....	29
VIII. Conclusion.....	33
Bibliography.....	35

Table

Table 1	Selected production indicators– manufacturing	15
---------	---	----

Figure

Figure 1	Final consumption and GDP (1997 – 2015)	8
Figure 2	Power generation efficiency (2003 – 2016)	10
Figure 3	Consumption rates of fuels in households	11
Figure 4	Power transmission and distribution losses	12
Figure 5	Percent of dwelling with biomass as a main cooking fuel	13
Figure 6	Energy intensity of industry	16
Figure 7	GDP structure	16
Figure 8	Value added structure by industrial branches	17
Figure 9	Value of output in the services sector	19
Figure 10	Energy intensity of tertiary industry	20
Figure 11	Trends in households ownership of electrical appliances	21
Figure 12	Energy consumption and number of households	22
Figure 13	Energy consumption and number of households	23
Figure 14	Energy intensity of transport and vehicle sales	26
Figure 15	Energy intensity of transport.....	26
Figure 16	Total consumption of electricity in private offices.....	28
Figure 17	Total consumption of public offices, administrations and government services	28
Figure 18	Consumption of electricity for public lighting	28
Figure 19	Production of sugar.....	29
Figure 20	Energy consumption of agriculture, forestry and fisheries	30
Figure 21	Energy intensity by sector	31

Diagram

Diagram 1	Data flow for supporting BIEE database	6
-----------	--	---

Introduction

A. Background to the data base of energy efficiency indicators (BIEE) project

Recognizing the vulnerability of the economies of the Caribbean to heavy reliance and dependence on fossil fuels to support economic activities and social wellbeing, the Economic Commission for Latin America and the Caribbean (ECLAC) with the support of the German Agency for International Cooperation (GIZ) and the French Environment and Energy Management Agency (ADEME) is currently developing a Database of Energy Efficiency Indicators (BIEE) for the Caribbean. The objective of the BIEE programme is to strengthen the capacity of energy authorities in Latin America and the Caribbean to monitor their energy efficiency and to improve data reliability thereby resulting in improved evidence-based decision making on energy policy.

The programme of activities was undertaken in stages the first being a data compilation of basic information which is usually undertaken by the focal point in each country, in coordination with ECLAC. Energy efficiency indicators were then identified for the 7 sectors being considered by the project: Macro/Energy Balance, Households, Industrial, Services/Tourism, Agricultural/Fisheries, Transportation, and Energy.

The BIEE tool provides a template to gather national data for assessing and analyzing policies and programmes on energy efficiency (EE). It also facilitates the regional comparability of the energy sector, and promotes the implementation, monitoring and standardization of EE policies and programmes. It seeks to define a common baseline of energy metrics and standards which can be used to inform the implementation of EE policies and programmes.

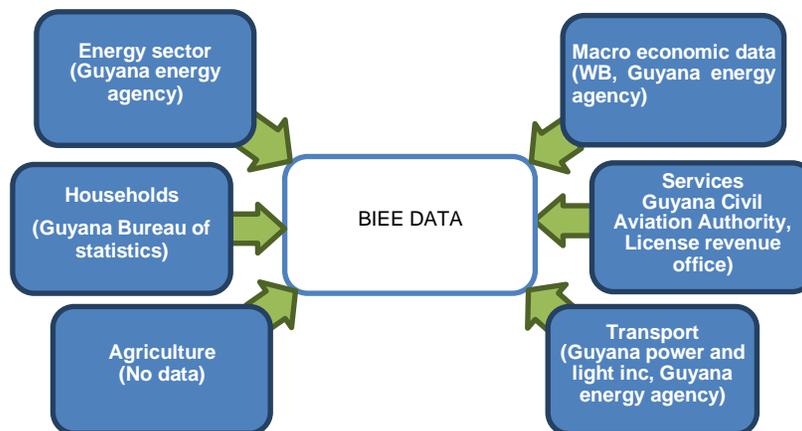
Guyana is one of the 19 countries in Latin America and 4 countries in the Caribbean regional that have formally participated in the project through the development of an Energy Efficiency Database. This report is based on the indicators of that database developed for Guyana as one of the Caribbean participating country.

B. Data collection approach and methodology

The data collection process in Guyana was a collaborative effort between the focal point agency and the consultant hired to assist in the development of the database. Since the majority of the holders of the energy information required were governmental and private sector stakeholders, it was decided to commence with a general informational session with the heads of the entities. The focal point agency, the Guyana Energy Agency (GEA) initiated the stakeholders meeting, by invitational letters, to the major governmental, quasi-governmental agencies and private sector entities that are the holders of energy and economic data in Guyana. The agencies represented at the meeting were: The Ministry of Finance, Ministry of Tourism, Guyana Civil Aviation Authority, Transport and Harbours Department, and Ministry of Agriculture. The informational session consisted of an introduction of the project by the GEA Focal point and a presentation from the National Consultant on the specific indicators that were required for the project's 7 thematic/focal areas namely, macro-economic data, energy sector, industry, transport, households, services and agriculture. A discussion on what data the agencies possessed and the timeline that the data can be provided to the GEA and the consultant followed. The bureaucratic and other hurdles in acquiring the data were discussed and a strategy developed for acquiring the data in the least possible time.

The collection of the data resulted from the consultant and an assistant following up with the agencies through personal meetings, telephone and email communications. The data were provided in various formats and the information for the necessary indicators for each section was extracted or extrapolated with the assistance of ADEME. The flow of data from the various entities in Guyana is summarized in Diagram 1.

Diagram 1
Data flow for supporting BIEE database



Source: Author.

C. History of energy efficiency in Guyana

In the 1970s, the international markets experienced steep increases in the price of energy which resulted in governments according energy efficiency and conservation a central place in policy formulation. By 1981, the Government of Guyana established the Guyana National Energy Authority (GNEA) through the Energy Act of 1981.¹

GNEA's mission was 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, within and outside of Guyana; report thereon to the Minister and recommend to the Minister such measures as it considers necessary or in the public interest for the control, supervision, use, marketing, and development of energy and sources of energy" (National Development Strategy, 1996).

In 1997, the Guyana Energy Agency Act was developed and the Guyana Energy Agency (GEA) was thereon established. Its mission was "to ensure the rational and efficient use of imported petroleum-based energy sources, while encouraging where economically feasible and environmentally acceptable, increased utilization of indigenous new and renewable sources of energy".² The primary functions of the Agency as stated in the Act of 1997, includes:

- (i) 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 encourage the development and utilization of sources of energy other than those presently in use;
- (ii) 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 utilization of energy and sources of energy;
- (iii) to develop a National Energy Policy and secure its implementation;
- (iv) to monitor the performance of the energy sector in Guyana, including the production, importation, distribution and utilization of petroleum and petroleum products; and
- (v) to disseminate information relating to energy management, including energy conservation and the development and utilization of alternative sources of energy.³

The GEA Act was amended in 2004, 2005 and 2011 to foster harmonization with other policies and laws, and to enhance monitoring, regulation and enforcement in the energy sector.

D. The overall assessment of energy efficiency trends in Guyana

The main sources of energy in Guyana are imported petroleum products, bagasse and fuelwood. According to the Guyana Energy Agency (GEA, 2013), Guyana consumed approximately 6.1 million barrels of oil equivalent (boe) from a variety of energy sources in 2012. Among these were diesel, fuel oil, gasoline, kerosene, liquified petroleum gas (LPG), fuel wood, charcoal, bagasse, rice husk, and biogas. Imported fossil fuel sources constituted 79 per cent or over 4.8 million boe, which represents approximately US\$ 600 million in imports at US\$ 123 per barrel for oil.

In 2014, Guyana imported 4.9 million barrels of petroleum-based products (13 531 barrels per day) – an increase of 4.14 percent compared to 2013 – consisting of diesel, fuel oil, gasoline, aviation fuel, kerosene and liquefied petroleum gas. In 2014, petroleum imports alone amounted to approximately 31.6 percent of total imports (US\$562 million) and accounted for approximately 21 percent of the country's gross domestic product (GDP).

¹ National Development Strategy, 1996.

² GEA, 2007.

³ GEA, n.d.

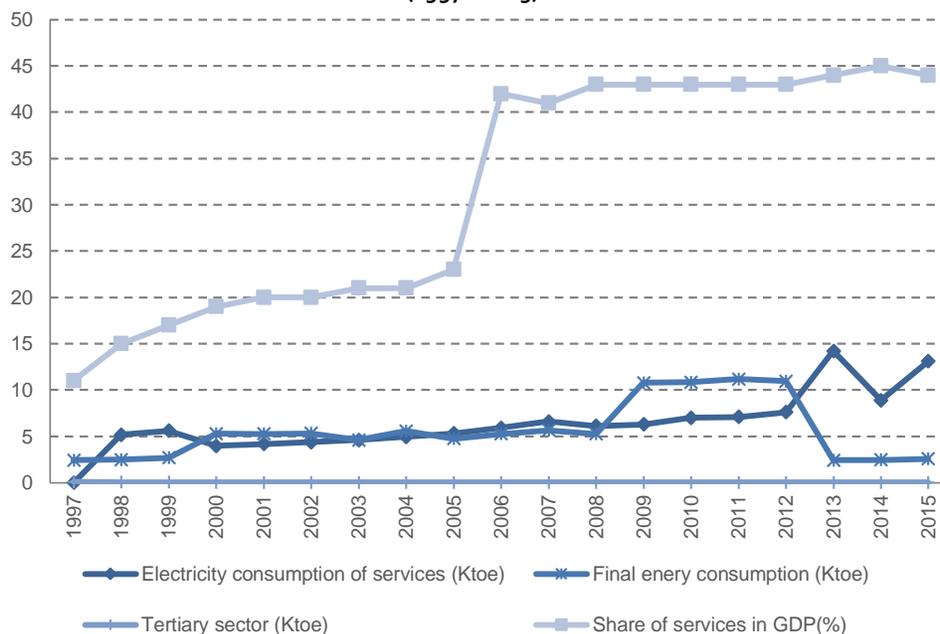
This is consistent with a decidedly upward trend since 1994. However, with oil price reduction during 2015-2016, the cost of imports significantly reduced, amounting to 24% and 23% of imports. During the same period, the share of energy imports also fell to 13% and 11% of GDP respectively. For petroleum products, gasoil accounted for the largest fuel imported in 2014 (43 percent), followed by fuel oil, 26 percent; and gasoline (mogas), 24 percent (GEA, n.d.).

Currently, almost three quarters of the total petroleum products in Guyana goes toward the transportation and power generation (electricity) sectors. The power generation sector was recorded as the country's largest energy user in 2014, accounted for 36 percent of petroleum products with the main consumers being the national electric utility (Guyana Power and Light Inc.) and a number of other small generation facilities (including self-generation) across the country. The second largest energy user in 2014 was the transport sector 35 percent; followed by the agriculture, fishing and mining sectors, 21 percent; residential sector, 4 percent; and industry/manufacturing sector, 3 percent.

According to GEA, the total electricity generation in 2014, from an estimate of self-generation and other generation assets across the country, was 979.36 GWh, of which 91.8 percent was from fossil fuels, 8.0 percent from bagasse-based cogeneration and the remaining 0.2 percent from solar photovoltaics and wind powered sources. This reflects an increased demand for power as a result of a 6.5% increase in the number of consumers of the Guyana Power and Light Inc. from 2012.

The final energy consumption of the country is in a synergized flow with the consumption of electricity in services, indicating the dependence and correlation of the two factors. However, this relationship was not maintained with respect to the shares of GDP over the period (figure 1). As shown, initially this share was less than 20%, but was boosted significantly after 2005, indicating the diversification of the economy and an increasing role of services. Electricity consumption in the country is almost constant from 1997-2015 with only marginal decreases and increases in some years. The early years of 1997-1999 saw an increase in the consumption of electricity, which may be due to the fact that, at the time, there were no energy efficient technologies installed. However, the turn of the new millennium saw a constant share of the electricity consumption which possibly indicates increased awareness of energy efficiency among consumers.

Figure 1
Final consumption and GDP
(1997 – 2015)



Source: BIEE program.

Subsequently, an increase was seen from 2013 onwards where the percent of electricity consumption has been on the rise. This can be explained by the increased use of electrical appliances within homes, which is a result of improved spending power of consumers as a result of improved economic growth.

I. Energy efficiency trends in the energy sector

The single electricity utility, Guyana Light and Power (GPL), is a vertically integrated government owned company. Power generation for households is dominated by thermoelectric plants with engine driven generators that are based on liquid fossil fuels (diesel and Heavy Fuel Oil). In 2012, GPL had generation facilities at ten locations and a total installed capacity of 156.9 MW of which 51.6 MW is based on diesel generation and 105.3 MW is derived from Heavy Fuel Oil (HFO). A significant portion of the Guyana energy economy constitutes the power sector that is characterized by small, generation plants with limited efficiency and distribution losses of around 31-32 per cent. Meanwhile, the demand for electricity from residential, commercial and industrial consumers continues to rise and it has been estimated that Guyana experiences an average of 31 power outage days per year. Part of the response to this situation is a recent US\$ 42 million Infrastructure and Development Project, a new 26 MW HFO fired power plant (US\$ 32 million) and a frequency standardization project (US\$ 9.4 million). GPL is also in the process of converting the network frequency in several areas from 50 Hz to 60 Hz.

In keeping with the Government's stated policy of achieving a green economy, several initiatives are underway to realize this objective, with particular emphasis placed on renewable energy sources. In this regard, the Guyana Energy Agency's has implemented a number of the initiatives towards energy efficiency. These include the following:

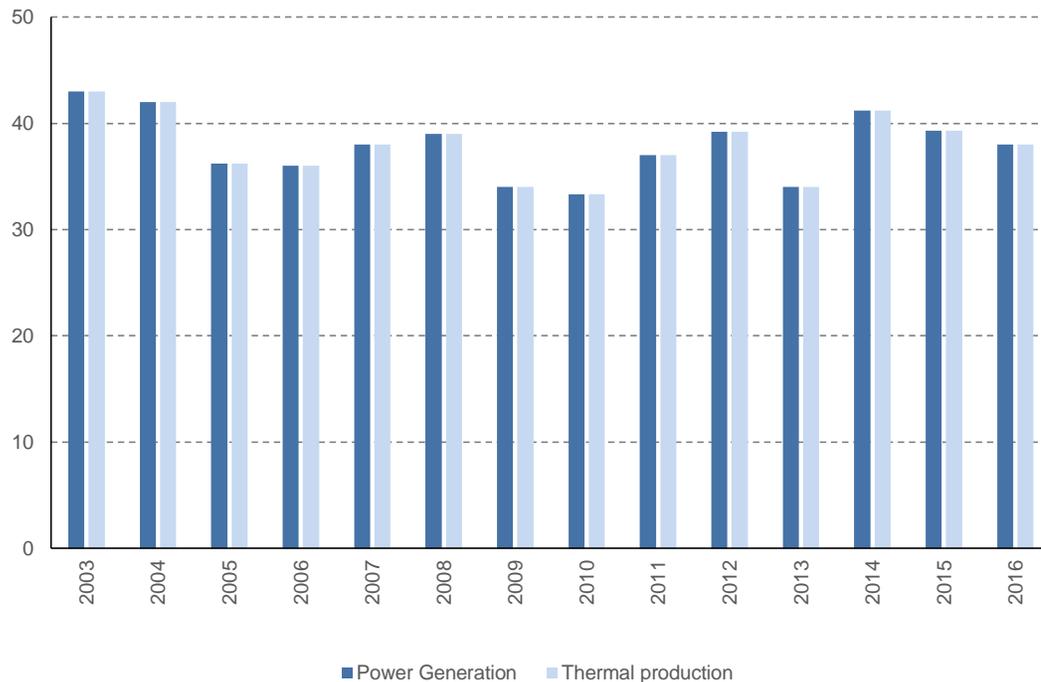
- Incandescent Bulb Replacement Programme – this programme started in 2006, urging persons to replace incandescent light bulbs with fluorescent lamps or CLFs which can save up to nine thousand dollars per year for each bulb replaced. Exemption from Import Duties and VAT – In August 2012, the relevant Acts were amended, and relevant Orders laid in the National Assembly on October 22, 2012 which allows for energy efficient products to be fully exempt from Customs Duty and VAT.⁴

⁴ GRA, 2016.

- **Energy Efficient Street Lighting** – Guyana has approximately 9,254 streetlights which consume approximately 5.967GWh of energy per year at a cost of US\$1.5 million annually. Defective photocells and lamps have resulted in some areas being underlit and some lamps remaining lit 24 hours per day, which sums up to energy wasted per lamp costs approximately G\$54,859 per year. As of 2014, a total of 1,950 defective photocells were replaced – saving approximately G\$118.8 million in energy.
- **Energy Efficient Wood Stoves** - The energy efficient wood stove was designed under the United Nations Development Programme (UNDP) Project, to provide energy services, electricity or cleaner fuels in rural areas. The stove, constructed from indigenous materials (clay, clay bricks and banana sucker) was promoted in areas such as Shulinab, Rupertee, Powaikoru, Kangaruma and Tuseneng.

Additionally, efforts have been made to improve overall power generation efficiency since the early 2000's. As shown in figure 2, both power generation and thermal production appears to be in sync with energy production generally, with the early years of 1997 to 2002 experiencing high fluctuation in both levels, possibly caused by the heavy reliance on the primary industries and its production. However, beginning in 2000, there was decreased levels in both sectors, indicating the possible implementation of energy efficient production methods in the relevant sectors.

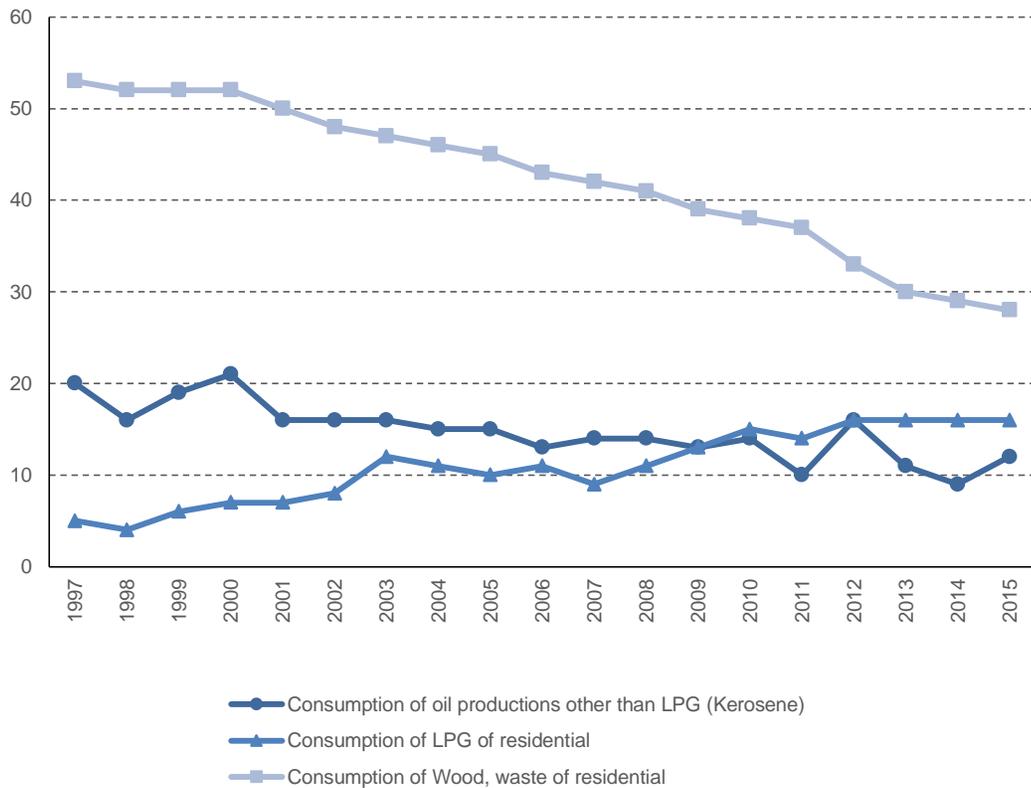
Figure 2
Power generation efficiency
(2003 – 2016)
(Percentage)



Source: BIEE program.

Energy efficiency improvements have also been achieved with respect to household energy use for cooking. Figure 3 illustrates that the consumption of wood and other residential wastes for use as cooking fuel has decreased over the years. This has been matched by a gradual increase in the use of LPG as the preferential fuel source among households. There has also been a shift from traditional wood and kerosene stoves, as is to be expected with greater use of LPG. The trends in household fuel use are related to increase in GDP and improvement in living conditions of households.

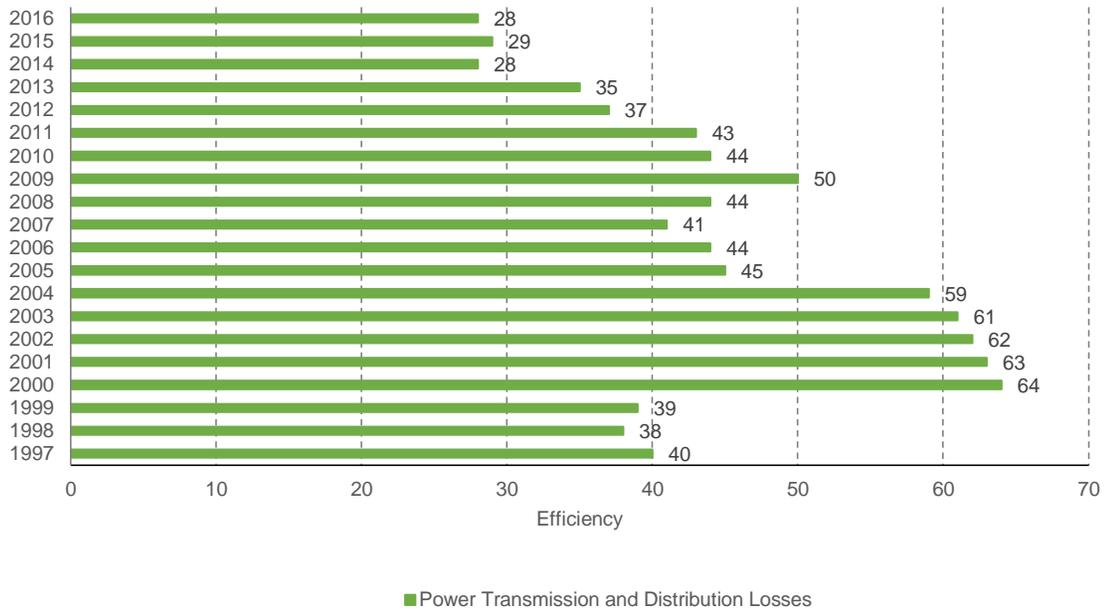
Figure 3
Consumption rates of fuels in households
(ktoe)



Source: BIEE program.

Guyana has also seen efficiency improvements in terms of power transmission and distribution. As indicated in figure 4, the trends in power transmission and distribution losses within the country throughout the years can best be described as fluctuating. The years 1997-2000 saw relatively low percentages (30-40%) of energy efficiency within the country, indicating the regular occurrences in power loss. The turn of the millennium has seen improved efficiency in delivery of power, with the figures almost doubling (60% and upwards), notwithstanding some continuing fluctuations.

Figure 4
Power transmission and distribution losses
(percentage)



Source: BIEE program.

In addition, the country has made progress towards the implementation of Renewable Energy sources in the country through the following initiatives:

A. Solar energy

Recently, 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 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, resulting in a total of 1,750 solar systems being installed in homes, schools and other community buildings across 21 hinterland villages.

B. Wind energy

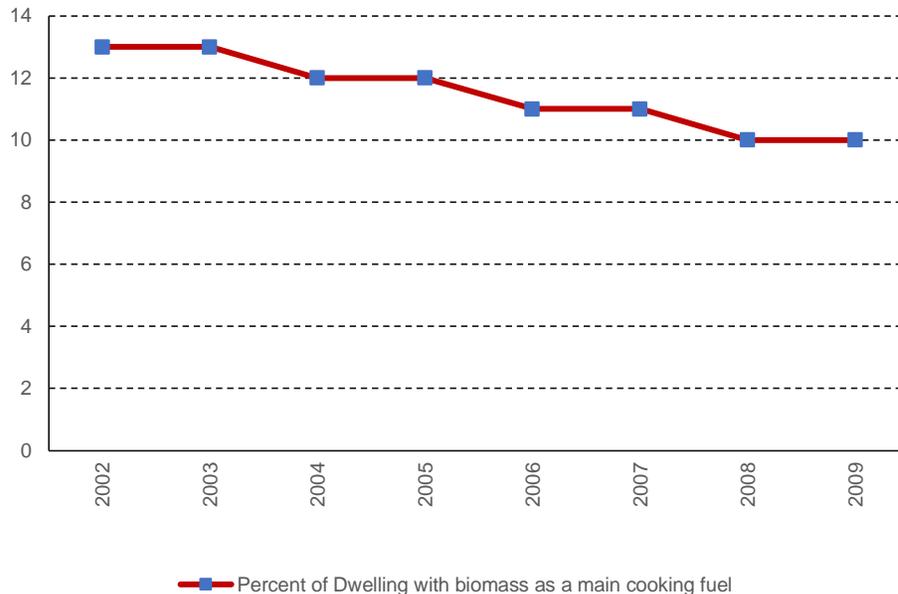
Wind is a clean, free, and readily available renewable energy source. Guyana started wind data collection in the hinterland regions under the Unserved Areas Electrification Programme in villages such as: Orealla, Region 6; Jawalla, Region 7; Campbelltown, Region 8; and Yupukari, Region 9.

C. Bioenergy

Bioenergy is energy produced from organic matter. In Guyana, such energy is produced from bagasse, rice husk, firewood and charcoal, wood-waste and biogas.

The percentage of individuals in households using biomass as a main cooking fuel has decreased over the years (from 13% to 10%), indicating a shift for more efficient and faster burning fuels for use in the household (figure 5).

Figure 5
Percent of dwelling with biomass as a main cooking fuel
(Percentage)



Source: BIEE program.

Sugar factories in Guyana have traditionally burnt bagasse as a source of energy to produce steam for factory operations and to produce electricity required for factory and surrounding housing areas. In 2014, 0.95 million boe of bagasse was produced, but only 8 percent was converted to electricity for sale to the grid and factory operations, while the remaining 92 percent was burnt to produce process steam for other factory operations.

Rice husk, the outer most layer of the paddy grain, is a form of biomass and accounts for about 20 percent of the paddy's weight. In 2014, approximately 202,883 tons of rice husk energy value of 212,021 boe, was generated based on Guyana's rice production of 700,230 tons.

Data from 2013 revealed that 47 percent of the rice husk is used for paddy drying, parboiling and electricity generation while the remaining 53 percent is disposed as waste.

Wood waste is regarded as a troublesome by-product of the sawmilling operation, resulting in disposal as landfill or by burning, with both having negative environmental consequences. The utilization of wood waste as a source of energy can address such issues. According to the GEA, approximately 176,498.78 m³ of biomass is used as input from the saw mill industry which produced approximately 64,882.83 m³ of woodwaste in 2012. This approximates to a total energy value of 25,872 boe. Moreover, approximately 17,603 tons of wood, equivalent to 45,244 boe, was used for commercial production of firewood and charcoal. An estimated 93,433 tons of fuelwood (equivalent to 219,871 boe) were produced after considering non-commercial firewood.

II. Energy efficiency trends in the manufacturing and industry sector

Output from the manufacturing sector increased by 9.9 percent in 2017 compared with a 14.1 percent decrease for the previous year. This was primarily due to increased rice milling (29.7 percent) while there was lower value-added of sugar (12.4 percent). There were also estimated increases in the production of liquid pharmaceuticals, paints, alcoholic & non-alcoholic beverages and stock-feed by 14.2 percent, 10.0 percent, 8.1 percent, 5.2 percent and 0.5 percent respectively. Electricity generation also expanded by 2.3 percent compared with the 7.0 percent increase at end-June 2016. At the same time, there were decreases in the production of ointments, oxygen and ice-cream by 28.9 percent, 14.0 percent and 10.8 percent respectively. Table 1 shows production indicators for selected outputs for 2015 – 2017.

Table 1
Selected production indicators– manufacturing

Commodity	2015	january - june	
		2016	2017
Alcoholic beverages ('000 litres)	11 871	11 889	10 436
Malta ('000 litres)	230	238	201
Non-alcoholic beverages ('000 litres)	21 147	22 781	19 701
Liquid pharmaceuticals ('000 litres)	283	250	230
Paints ('000 litres)	1 070	1 119	1 231
Electricity ('000 litres)	361	387	329

Source: BIEE program.

Generally, the industrial sector in Guyana is one that is primarily energy intensive owing to its nature of being mainly involved in primary production- the processing of raw materials from natural resources. As Figure 6 indicates, the sharp increase of energy intensive activity seen from 1997-2005 is due to the energy use in the agricultural industries these being mainly sugar and rice, along with bauxite mining. However, as indicated above, the recent years have seen a steady decline of energy intensive activity, with a significant decline in both sugar and rice, especially the sugar industry. This problem is also exacerbated by market issues which plague the rice and sugar industries. Further, it reflects the changing structure of the economy from an agricultural one to a service economy with reduced use energy use and enhanced energy efficiency.

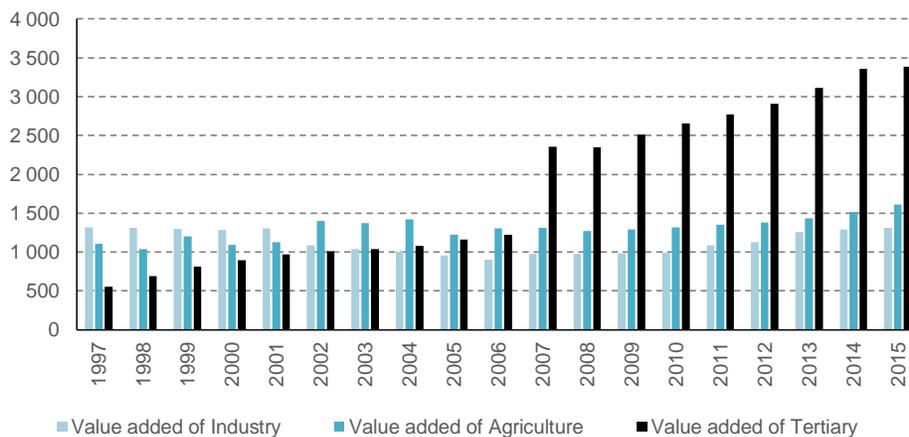
Figure 6
Energy intensity of industry
(koe/\$oo)



Source: BIEE program.

Figure 7 shows the previous dominance of the industrial and agricultural sectors in GDP, with gradual increases from 2000 throughout to 2015. However, the previous insignificant services sector from 2005 and the decade onwards, has emerged as force, indicating a transition from agrarian and industrial practices to tertiary services and a diversification of the economy with activities such as such as telecommunications, ICT, Hospitality and Tourism becoming significant.

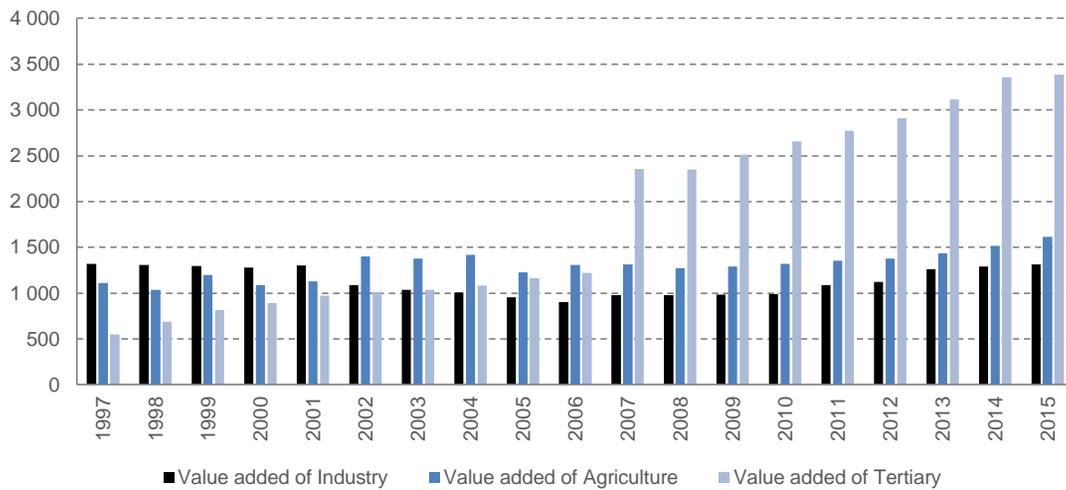
Figure 7
GDP structure
(m\$oo p)



Source: BIEE program.

In terms of value-added, the performance of the various sectors has been sporadic with periods of both growth and decline (Figure 8). Beginning from 1997 to 2000, the industry sector has been subject to increased value-added components, followed by the agriculture sector, which indicates the high priority placed on these commodities in building value for both local and international markets. Presently, the tertiary industry, comprising of services has seen rapid development in diversifying its market value, hence the increased levels of value added from 2006. Consequently, from 2005 onwards, agriculture has value added has remained largely constant, albeit at a higher level than the industry sector in terms of value-added products, but not as marginal as the tertiary industry.

Figure 8
Value added structure by industrial branches
(m\$00 p)

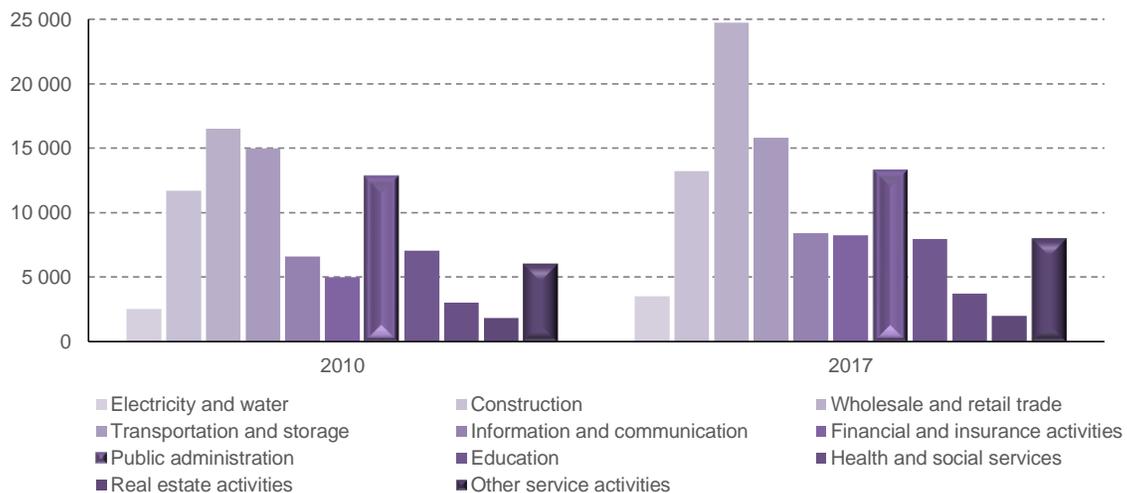


Source: BIEE program.

III. Energy efficiency trends in the tertiary sector

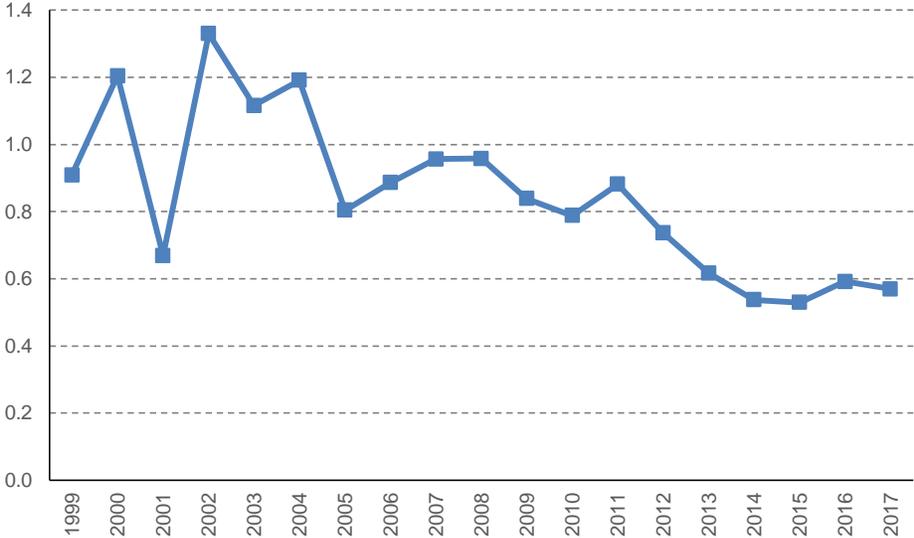
As indicated in Figure 9, there has been significant growth of a diverse range of economic services in the Guyana economy over the past decade. This has meant that energy intensities within the tertiary industry in Guyana for the past decade has been fluctuating (see Figure 10). The early years of 1999-2001 saw a meteoric rise in energy intensities used in the production of the tertiary industry. However, the end of the 00' decade saw a sharp decline, which does indicate the introduction of energy efficient means in operating tertiary industries. The progressive years of 2001-2005 has seen a gentle increase in intensities owing to the expansion of several businesses such as telecommunications and hospitality into the tertiary industry during this period. This was followed by a somewhat constant flow of intensity from 2009-2011. This trend reflects the shift from a mainly agricultural economy to one of services during the period.

Figure 9
Value of output in the services sector
(g\$ millions)



Source: Author.

Figure 10
Energy intensity of tertiary industry
(kcp / USD 2011 PPA)

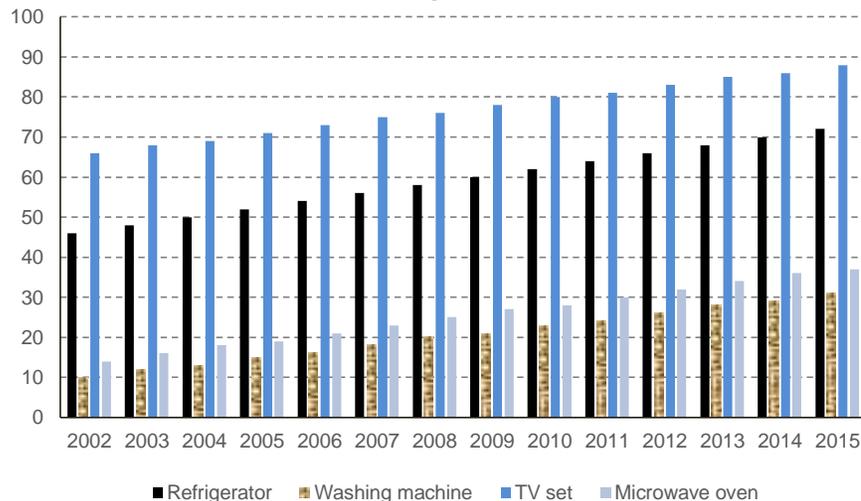


Source: BIEE program.

IV. Energy efficiency in households⁵

Over the years, there has been a gradual increase in ownership of electrical appliances in each household (Figure 11). While this may signal the increase in spending power of the consumer in the average household, it is a trend that should be a cause for concern as it indicates the increase usage of heavy energy intensive appliances, a move that is counter-intuitive to energy efficiency.

Figure 11
Trends in households ownership of electrical appliances
(Percentage)



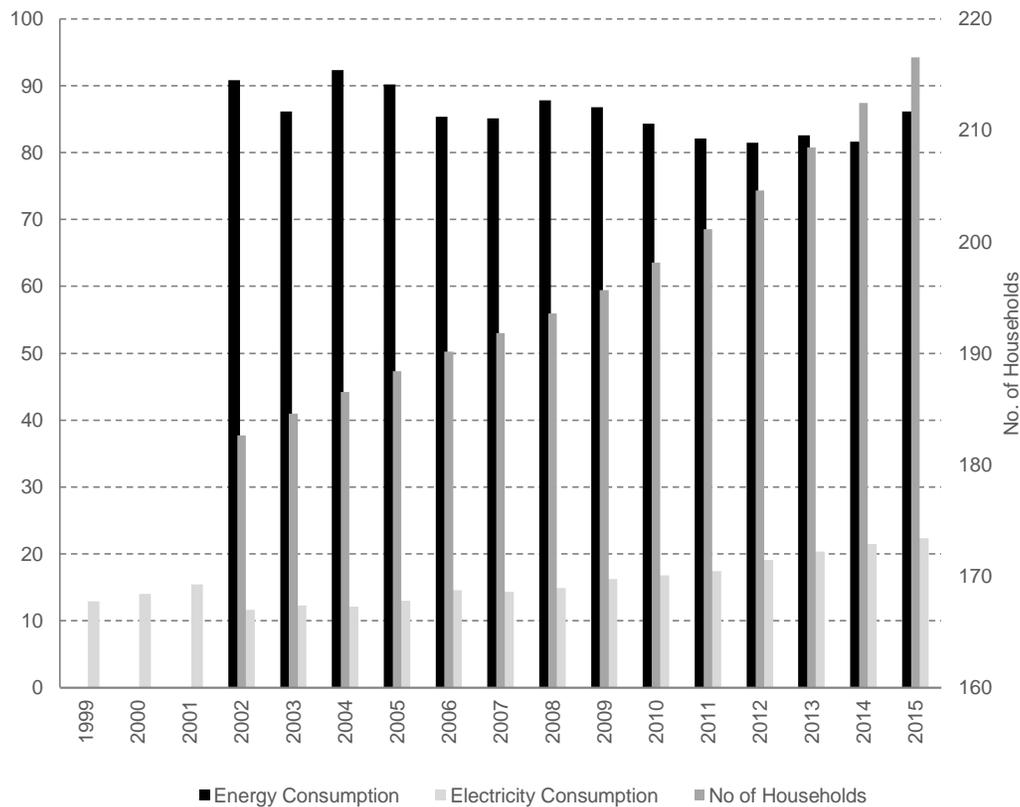
Source: BIEE program.

⁵ Information obtained from an Assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Guyana. Retrieved from https://repositorio.cepal.org/bitstream/handle/11362/35913/1/S2013857_en.pdf

In a continued effort to promote the stability and reliability of the existing power grid, \$1.38 billion⁶ has been advanced for the rehabilitation of 328 km of low and medium voltage distribution networks in the first half of 2018. Works are expected to commence in the second half which is anticipated to improve power service delivery to approximately 22,000 customers of the Guyana Power and Light Inc. (GPL) while an additional 580 km of the distribution network will be rehabilitated during the second half of the year.

As indicated in Figure 12 above, a clear trend can be observed where, as the number of households increased throughout the years, the energy and electrical consumption both increased, albeit at different rates. The former, increased steadily suggesting that there should be a corresponding increase in household energy consumption. The latter however show a slight increase, after which it remained generally constant, indicating the possible adoption of energy efficiency practices, both in use of electrical appliances and energy conservation.

Figure 12
Energy consumption and number of households
(ktoe)



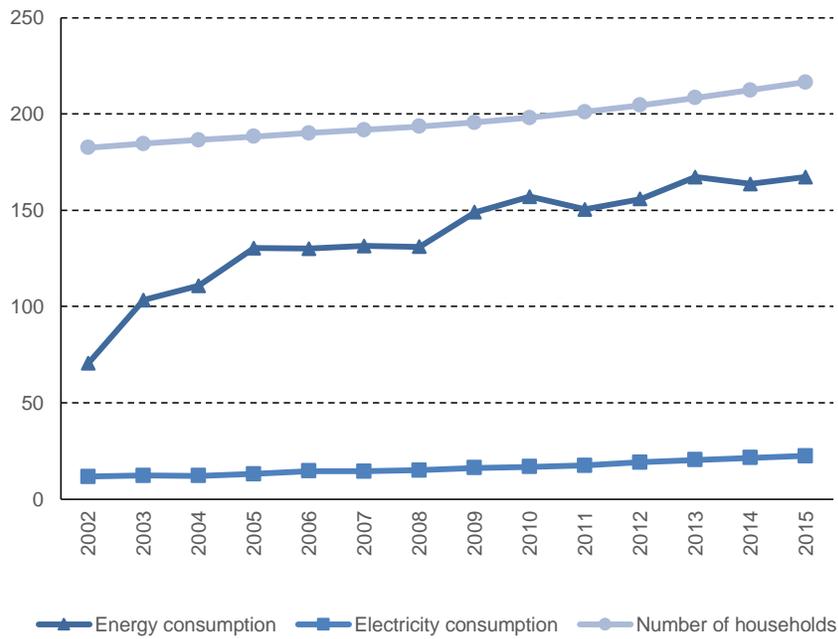
Source: BIEE program.

Electricity coverage is over 90 per cent in the coastal zone, where 90 per cent of the population is concentrated. However, the grid-based electrification of the hinterland to supply approximately 70,000 residents in around 170 small communities remains a challenge. While some communities have resorted to off grid diesel power generation, others have recently begun to produce electricity from solar photovoltaic (PV) technologies.

⁶ Note that all monetary figures in this report are in Guyanese Dollars (\$GUY). 1 \$US = \$GUY 208 as at the time of the preparation of this report.

As per Figure 13, electricity consumption has seen a gradual increase over the years, beginning from 2002 to 2015. This time period saw a move from approximately 1500kw/household to 2700kw/household. From 2002-2004, electricity consumption was fairly constant, with an average of 1500-1700 kwh being consumed by households. However, 2008-2015 saw a significant increase in consumption of electricity, consistent with improved living standards and spending power by households. At the same time, a slowing of the rate of increase of consumption does suggest an improvement in energy efficiency, with a move from power intensive equipment to more energy efficient equipment used by household consumers.

Figure 13
Energy consumption and number of households



Source: BIEE program.

V. Energy efficiency in transport

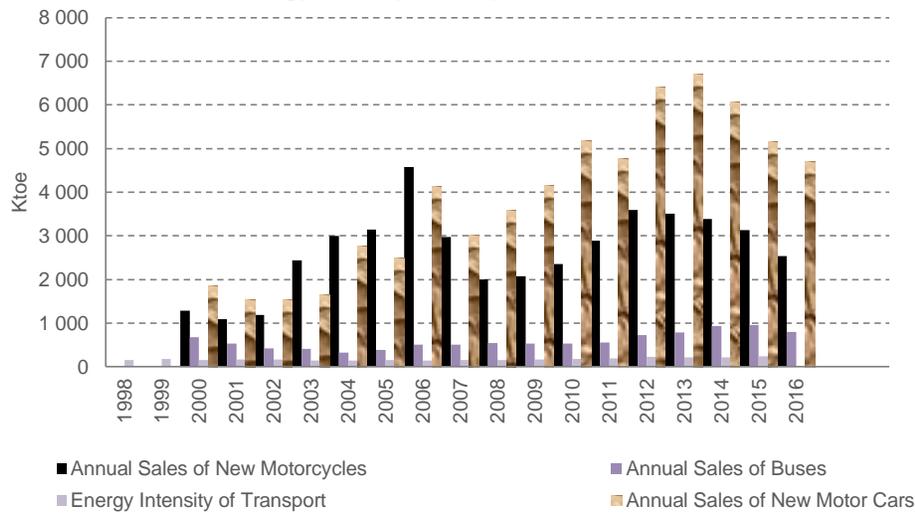
The Guyana Energy Agency (2018) reports that the transportation sector in 2012 accounted for 35% of the country's energy consumption. It also accounted for the largest portion of petroleum imports estimated at 1.7 million, of the 4.7 million barrels consumed in 2012.

According to the Ministry of Finance Mid- Year report 2017, Government budgeted \$37.2 billion to support the continuous improvement to public infrastructure. Of this amount, \$4 billion was expended on roads and \$242 million on bridges as at half year. Expenditure on roads included the rehabilitation and construction of selected roads under the Hinterland Roads Programme to the tune of \$784 million. In addition, works progressed on the upgrading of roads, with \$613 million and \$727 million expended on the West Coast Demerara highway and urban and miscellaneous roads, respectively, while works on the upgrading of the East Bank Demerara highway came to an end.

During the first half of 2017, \$2.9 billion of the \$9.6 billion allocated to improving the public air transport sector was expended. River transport services continue to be improved.

The transport sector in Guyana is one that has seen a steady increase in energy consumption throughout the years, however, this was not always the case. As indicated in Figure 14, the number of vehicles present in the country for the period (1997-2005) was not as large as the numbers easily observed today. This explains the lower levels of energy consumption for transportation observed during the earlier years (1997–2005), compared to the present period (2006-2015) where transportation energy consumption has increased significantly to match the increased number of vehicles. This is due to the improved spending power available to the average consumer to purchase automobiles. The introduction of consumer-friendly loans, an increased sense of independence by millennials who purchase cars and live on their own are key drivers in this development. Additionally, the ever-increasing numbers of internal migration of persons from the riverain and hinterland communities to urban centers in search of employment and to improve their livelihood, has seen the increase of road transportation to serve an increasingly mobile population, thereby contributing to the increased energy consumption of this sector.

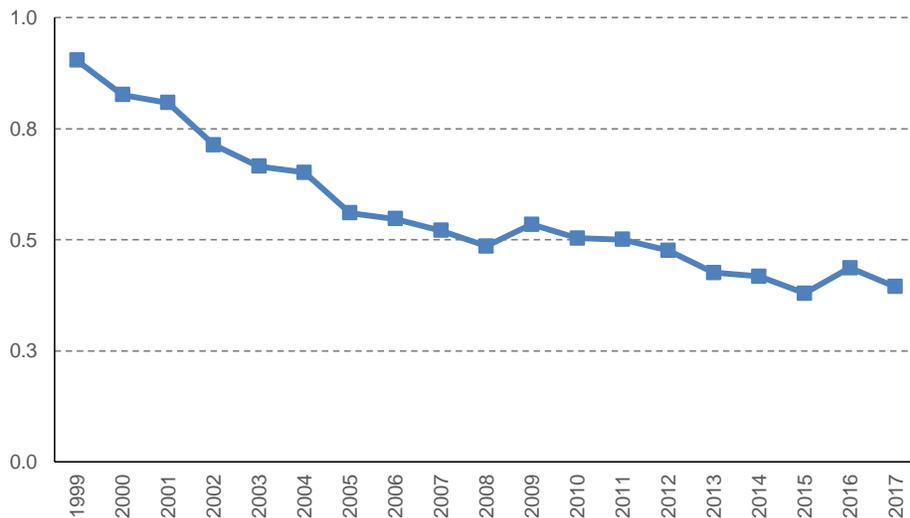
Figure 14
Energy intensity of transport and vehicle sales



Source: BIEE program.

This trend notwithstanding, as is the case where the consumption of energy is high, the intensity of this sector manifests as the contrary. As was indicated for the previous graph where the period (2006-2015) saw an increase in the consumption, this same period has seen a steady decrease in the intensity of energy produced from the transport sector (figure 15). This can be possibly explained by the move from robust energy intensive vehicles to more energy efficient vehicles by the consumer.

Figure 15
Energy intensity of transport
(ktp/USD 2011 PPA)



Source: SIELAC-OLADE.

VI. Energy efficiency in services

The services sector experienced growth of 1.4 percent relative to a revised 1.3 percent fall at the end of June 2016. There were increases in the activities of transportation and storage, wholesale and retail trade, information and communications and public administration by 2.5 percent, 2.1 percent, 1.2 percent and 0.5 percent respectively. The rate of electricity and water remained constant throughout the years, with only a slight increase noted from 2015 onwards. However, financial and insurance activities contracted by 1.8 percent. The wholesale and retail trade industry grew by 2.7 percent compared with a decrease of 11.3 percent at end-June 2016 attributed to import growth in consumption and intermediate goods. Activities in the information and communications industry grew by 1.2 percent relative to a 2.1 percent growth at end-June 2016 as a result of greater business process outsourcing (BPO) activities in 2017.

Financial and insurance activities contracted by 1.8 percent owing to the decline in private sector credit by 1.0 percent compared with 0.6 percent decrease at the end of half year 2016 coupled with higher nonperforming loans.

The pattern of energy consumption in the services sector is reflected in the profile of energy use for both private and public offices in Guyana. As Figure 16 shows, energy use in private offices of the country has seen a constant increase in the total consumption of electricity over the past decade. The first years of 2000-2003 saw decreased consumption within offices, however, over time, as the number of private companies increased, the consumption has also increased.

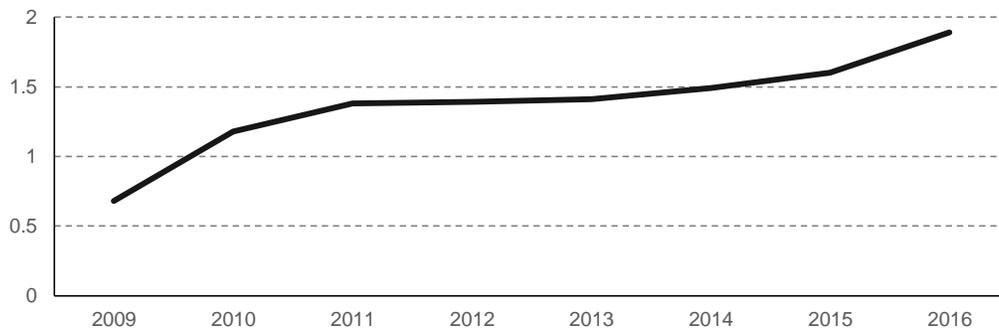
Figure 16
Total consumption of electricity in private offices
(ktoe)



Source: BIEE program.

Similarly, the public offices, along with their respective administrations and government services have seen similar trends, albeit more measured (Figure 17). The past decade has seen a steady increase in consumption, but not as high as private offices, signifying the difference in quality of energy appliances and services present at these offices rather than in the public arena.

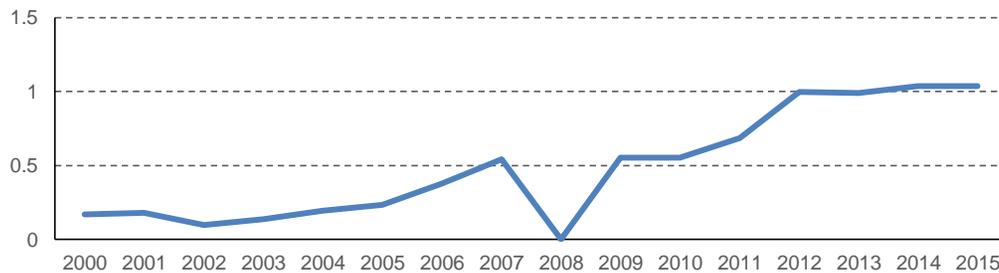
Figure 17
Total consumption of public offices, administrations and government services
(ktoe)



Source: BIEE program.

As was observed above from the public offices, the consumption of electricity for public lighting has also followed a general trend of a steady increase (Figure 18). This indicates that there is a lower level of energy efficiency in the public and private sector. As one strategy to improve this situation, the government of Guyana is presently embarking on the use of solar power in some of its offices.

Figure 18
Consumption of electricity for public lighting
(ktoe)

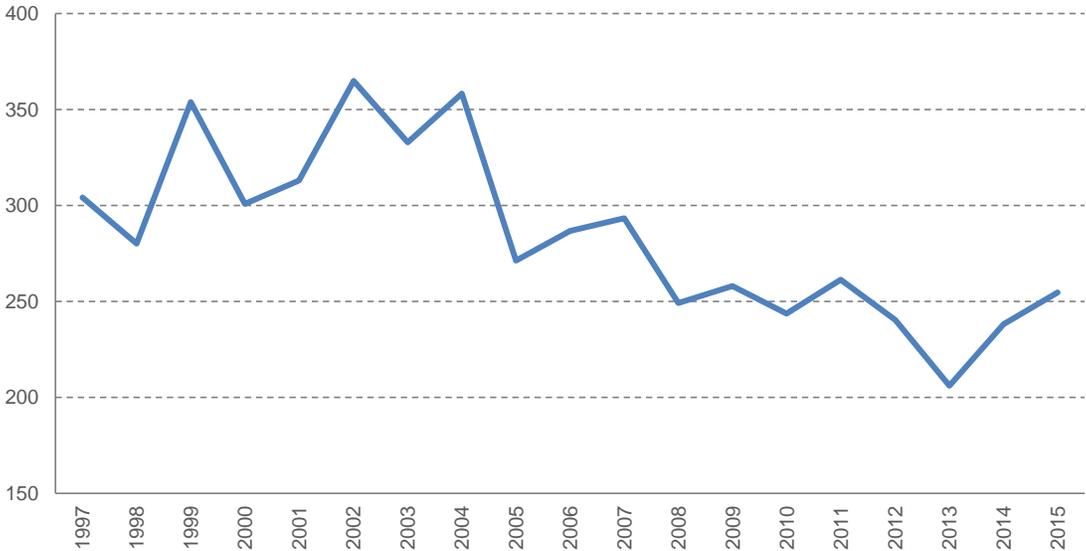


Source: BIEE program.

VII. Energy efficiency trends in agriculture

The agriculture sector increased by 6.4 percent in 2018, compared with the revised 10.0 percent increase for the previous year. This performance was due to increases in the output of rice, fishing and other crops. There were however contractions in the output of sugar (Figure 19), forestry and livestock.

Figure 19
Production of sugar
(tons)



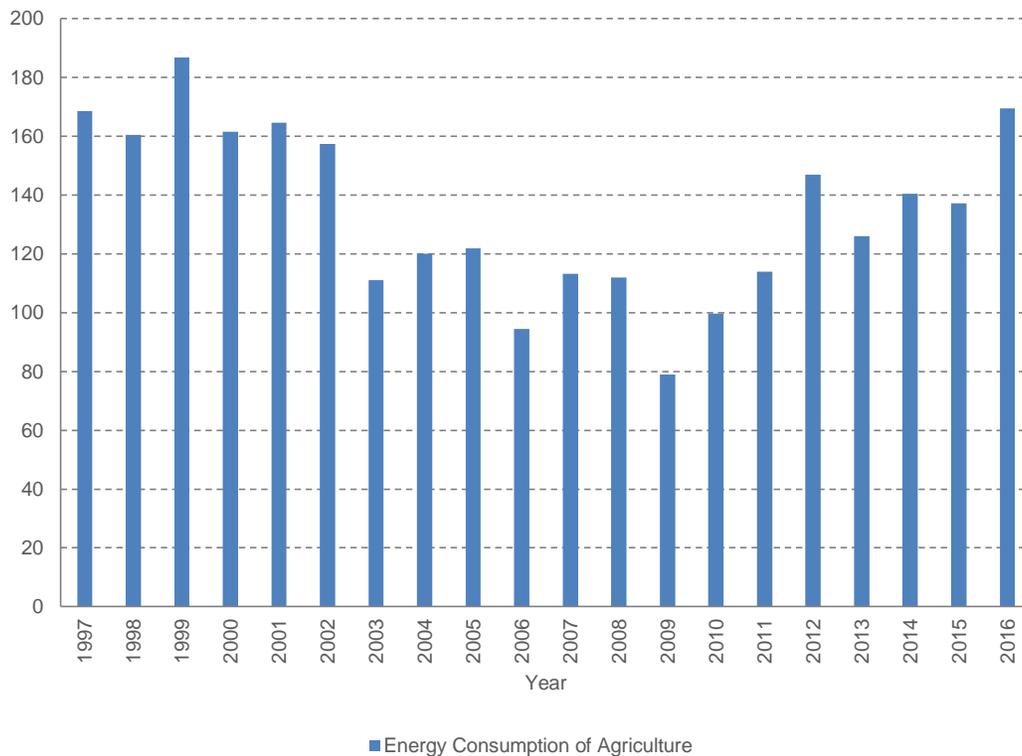
Source: BIEE program.

In the case of sugar, output was 54,681 tons, 12.4 percent lower than the corresponding period of 2017, and represented 30.6 percent of the revised 178,574 tons targeted for 2017. This outcome was due to inadequate supply of quality canes, industrial unrest and operational deficiencies. Rice output was 385,662 tons, 31.6 percent higher than the corresponding June 2016 level and represented 59.3 percent of the revised 650,363 tons targeted for 2017. This outturn resulted from greater acreage cultivated and higher yield of 91.8 bags per hectare from 88.5 bags per hectare for the corresponding period last year.

The fishing sub-sector recorded 33.2 percent growth compared with the revised increase of 2.1 percent for the corresponding period last year. This outturn was on account of estimated increases in prawns and small shrimp catches by 47.2 percent and 24.2 percent respectively, which were bolstered by the impact of enhanced monitoring and regulatory measures in offshore waters. Output in the livestock industry contracted by 10.9 percent compared with a 0.8 percent increase at end-June 2016. This outcome was due to estimated declines in poultry meat and mutton by 9.9 percent and 7.9 percent respectively. However, there was an increase in egg production by an estimated 88.9 percent attributable to increased local demand.

As indicated by figure 20, the early years of 1997-2001 saw agriculture as a sector that heavily consumed energy, which is justified by the then high production of sugar and rice. There was subsequently a gradual decrease from 2003-2009 with the increasing role of services in the economy

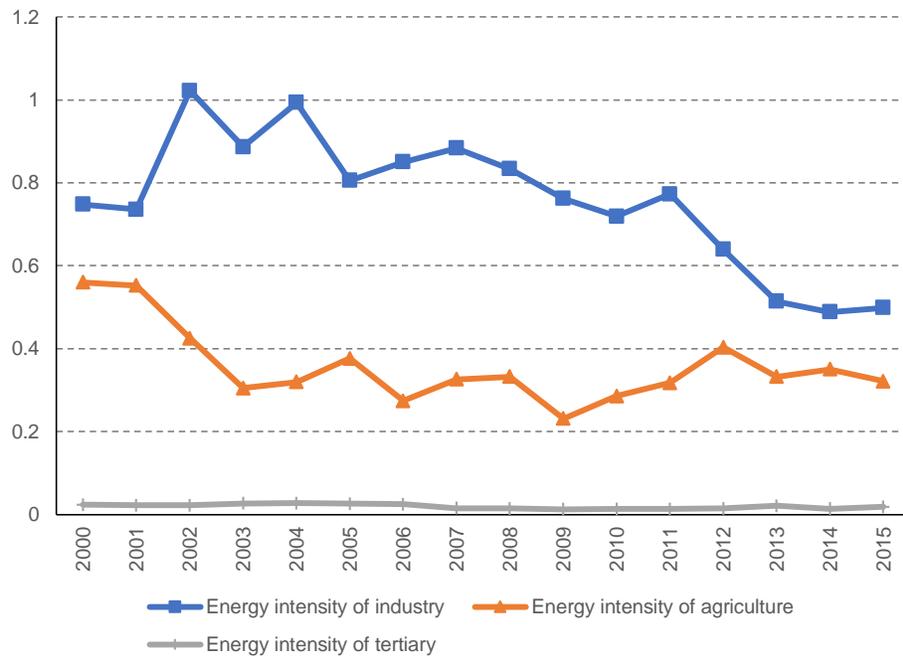
Figure 20
Energy consumption of agriculture, forestry and fisheries
(ktoe)



Source: BIEE program.

In summarizing the overall energy consumption across all economic sectors in Guyana, that of the industrial sector consumes the highest among the main sectors in terms of GDP, owing to the heavy intensive production industries of raw materials, namely gold and bauxite. However, during the latter years of 2012-2015, this consumption has decreased due to a decline in both gold and bauxite production. The agriculture sector has followed a similar trend, albeit with a significantly less amount of energy consumed. As stated before this is as a result of declined production in sugar and rice, the two main crops. With respect to energy intensity, all main sectors have over time also shown a general reduction (Figure 21) reflecting varying degrees in energy efficiency in the Guyana economy.

Figure 21
Energy intensity by sector
(koe/\$oo)



Source: BIEE program.

VIII. Conclusion

Guyana in 2020 will begin to receive economic returns from production of oil. The advent of the oil industry will have many implications for the GDP of the country, and its use of energy. It is expected that the GDP will increase significantly which should lead to investment in public projects including infrastructure. These investments will have energy implications include the increased use of energy. With an increase in GDP and expected increase in income and consequent spending power of the population, improvements in living conditions is expected to result in increased household energy consumption. The increasing role of the services sector in the economy along with declines in energy intensive agriculture projects should also result in an overall decline in energy consumption.

The Government of the Republic of Guyana has articulated an overarching development strategy for the country, the Green State Development Strategy (GSDS). Environmental and sustainability concerns are key in this strategy and are integrated in all sectors. It is therefore expected that the fledgling national efforts towards energy efficiency will not only continue but will be expanded under the GSDS. The challenge for the country will be to mainstream energy efficiency with improved economic growth and increase in GDP. In this regard, the BIEE database should prove to be a useful tool in supporting the implementation of long-term sustainable energy policies in Guyana.

Bibliography

- Bank of Guyana. (2017). Bank of Guyana Half Year Report 2017. Georgetown: Bank of Guyana.
- Bureau of Statistics. (2018). National Accounts Department. Retrieved from Bureau of Statistics: A Government Agency of Guyana: <http://www.statisticsguyana.gov.gy/nataccts.html>
- Dr. Paulette Bynoe. (2012). RIO +20 National Report - A Green Economy and Institutional Framework for Sustainable Development: The Guyana Context. Georgetown.
- Global Finance. (2017). Guyana GDP and Economic Data. Retrieved from Global Finance: <https://www.gfmag.com/global-data/country-data/guyana-gdp-country-report>
- Guyana Energy Agency. (2018). Guyana Energy Agency. Retrieved from Guyana Energy Agency.
- IDB. (2018). Guyana. Retrieved from IDB Improving Lives: <https://www.iadb.org/en/countries/guyana>
- Information Technology Associates. (2018). Guyana Economy 2017. Retrieved from Countries of the World: https://theodora.com/wfbcurren/guyana/guyana_economy.html
- International Monetary Fund. (2017). IMF Data Mapper. Retrieved from International Monetary Fund: http://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD/GUY
- International Trade Administration. (2016, September 19). Export.gov. Retrieved from export.gov: <https://www.export.gov/article?id=Guyana-Agricultural-Sector>
- Ministry of Finance. (2017). Mid- Year Report 2017. GEOREGETOWN.
- Nations Encyclopedia. (2018). Guyana- Economy. Retrieved from Nations Encyclopedia: <http://www.nationsencyclopedia.com/Americas/Guyana-ECONOMY.html>
- National Development Strategy. (1996). National Development Strategy. Retrieved from <http://www.guyana.org/NDS/chap39.htm>
- The Commonwealth. (2018). Guyana: Economy. Retrieved from The Commonwealth: <http://thecommonwealth.org/our-member-countries/guyana/economy>
- Trading Economics. (2018). Guyana Exports. Retrieved from Trading Economics: <https://tradingeconomics.com/guyana/exports>



Although oil production is just starting in Guyana, the Government of Guyana is well aware that fossil fuels are a finite resource and do not last forever. It therefore continues to take a strategic approach to the development of a sustainable and cleaner energy sector, and the Guyana Energy Agency (GEA) is considering energy efficiency measurements as a tool for strengthening energy security, securing a long-term reduction in greenhouse gas emissions and increasing revenue and cost savings. With the support of the Regional Observatory on Sustainable Energies (ROSE), GEA has built a database of energy efficiency indicators that allows for their subsequent analysis. Most of the indicators are based on data available from the Guyana Bureau of Statistics, Guyana Power and Light Inc., the Guyana Civil Aviation Authority and many other stakeholders.

This report analyses the information collected on the main sectors of the country, including energy, industry, transportation, agriculture and services, as well as households, and explains the energy efficiency trends in Guyana.

This research seeks to strengthen institutional capacities not only to collect, collate and analyse energy efficiency data, but also to strengthen national, evidence-based policymaking capacities.