Antigua and Barbuda

Energy Balances
2010 - 2012

CELAC
Comunidad de Estados Latinoamericanos y Caribeños

CAF

olade
Organización Latinoamericana de Energía
Latin American Energy Organization
Organisation Latino-americaine d'Energie
Organização Latino-Americana de Energia

Antigua and Barbuda Energy Balances (2010 - 2012)

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November 2015

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List of Acronyms

bbl	Barrel
boe	Barrel Oil Equivalent
kBoe	Kilo Barrel of Oil Equivalent
tn	Tones
GW	Gigawatt
MW	Megawatt
kw	Kilowatt
kWh	Kilowatt hour
Ha	Hectare
GDP	Gross Domestic Product
USD	United States Dollar
EEZ	Exclusive Economic Zone
GHG	Greenhouse gas emissions
GTZ	German Agency for Technical Cooperation
CAF	Development Bank Of Latin America
CO_2	Carbon Dioxide
CARICOM	Caribbean Community Secretariat
CARILEC	Caribbean Electric Utility Service Corporation
CDB	Caribbean Development Bank
CEIS	Caribbean Energy Information System
CELAC	Community of Latin American and Caribbean States
CIPPET	Caribbean Information Platform on Petroleum
CREDP	Caribbean Renewable Energy Development Program
DO	Diesel Oil
EC$M	East Caribbean Dollar
ECCB	Eastern Caribbean Central Bank
ECCs	Eastern Caribbean Countries
ECCU	Eastern Caribbean Currency Union
ECERA	Eastern Caribbean Energy Regulatory Authority
FAO	Food and Agricultural Organization of the United States
GDP	Gross Domestic Product
GX	Gasoline
JF	Jet Fuel
LA&C	Latin American and the Caribbean
LPG	Liquefied Petroleum Gas
NEP	National Energy Policy
OAS	Organization of American States
OECS	Organization of Eastern Caribbean States
OLADE	Latin American Energy Organization
WIOC	West Indies Oil Company
APUA	Antigua Public Utilities Authority
APC	Antigua Power Company

Chapter I. Country Description, Socio-Economic and Energy sector

1. Introduction

As stated in the Lima Action Plan adopted during the First Meeting of Energy Ministers of CELAC, OLADE was requested to participate as Technical Advisor. Subsequently, during the V Meeting of Energy Ministers of OLADE, the OLADE's Cooperation with CELAC was approved. The agreement included a study project for developing Energy Balances of six Caribbean Member Countries of CELAC that are Non-Member Countries of OLADE. The Development Bank of Latin America (CAF) funded the project (CELAC, 2013 and OLADE, 2013).

Considering the need to analyze and enhance knowledge related to the regional energy integration debate and real options, the preparation of energy balances is fundamental to rise up a baseline about supply and demand on the energy sector. Energy balances will permit "the identification of surpluses or deficits, potential of exchanges of energy, prospects for energy demand and possibilities for change of the energy matrix from which it is possible to establish development plans and regional energy policies, imply the availability of up-to-date official information, homogeneous and consistent to allow an adequate knowledge of the characteristics of the energy systems of the countries, comparative analysis and consolidation of information for built-in features of the region, whereas the national energy balances as the basic element" (OLADE, 2013).

The present report is focused on Antigua and Barbuda's Energy Balance. The country has been promoting the introduction of renewable energy and in its way it has elaborated several documents, which are very important guidelines to foster a consistent Energy Policy for the future. Some recent changes in the retail prices of fossil fuels for internal consumption have modified the figures in the demand in each subsector of the economy. Therefore the challenges in the energy sector influence the socio-economic development of the entire country.

Based on the stakeholder analysis and mapping the supply and demand structure in the energy sector, several forms and surveys were applied to the most representative public and private institutions that participate in the main phases of the energy chain of the country.

The document is divided into eight sections: The first section deals with the country's general information that includes a description on geography, climate, socio-economic characteristics, and the overall energy sector. The second section provides an overview of the concepts defined by the OLADE's Energy Balances Methodology. The third section contains the description of the data gathering process. The fourth section describes the technical visit to the country.

The fifth section provides the results on the Energy Balances that were elaborated for the periods of 2010, 2011 and 2012. The sixth section presents the country's Greenhouse Gases Emission Inventories (2010-2012) by following the technology approach. The seventh section shows economic and energy indicators built by using the energy balance results. The last section describes the final conclusions and recommendations on the Antigua and Barbuda's Report.

2. Background

The First Meeting of Energy Ministers of CELAC was held in Lima, Peru, on November 16, 2012, where the Lima Action Plan was adopted and OLADE was requested to participate as Technical Advisor. Subsequently, the V Meeting of Ministers of the Latin American Energy Organization (OLADE) was held in Quito, Ecuador, on May 17, 2013, approving the participation of OLADE as a Technical Advisor of the Meeting of Ministers of CELAC. This meeting of Ministers also accepted the working program (OLADE's cooperation to CELAC), which was presented previously at the V Meeting of Coordinators of CELAC on May 9-10, in Havana, Cuba.

The working program approved by the 5th extraordinary meeting of Ministers of OLADE included the Reduction of asymmetries in the CELAC energy sector information. Since there isn't a source of consistent information that could be used to analyze the supply and demand situations of some CELAC's Member States and to develop projects to diversify their energy matrix.

OLADE presented the action plan for the elaboration of the Energy balance of Saint Lucia, Antigua & Barbuda, Bahamas, Dominica, Saint Kitts and Nevis, Saint Vincent and the Grenadines. This project has the financial support of the non-refundable technical cooperation with the Development Bank of Latin America – CAF" (OLADE, 2013).

Antigua and Barbuda is totally dependent on fossil fuels imports to generate energy. All electricity is generated entirely by fossil fuels. Fluctuating world oil prices constantly influence electricity generation costs. Considering this situation the country has promoted the research of the potential of the renewable energies potential. The results shown that Antigua And Barbuda has one of the greatest potentials in solar power situation that has led to the use of water heaters and photovoltaic within the country.

Furthermore, Antigua servers as a major operation center for 7 passenger and cargo airlines, including LIAT Airline which is based in Antigua. Therefore, air transit is large compared to other similar countries. Antigua possess large infrastructure for fuel storage. It serves as a pivotal point for storing and shipping fossil fuel to close islands. There is one oil refinery, which is property of West Indies Oil Company (WIOC), It is not currently operating. Several studies in different areas of Antigua and Barbuda concluded that it has one of the greatest potential for solar photovoltaic technologies in the Caribbean. Although, up to date there is approximately 1MWp distributed PV and 3MWp utility scale PV installed and a few off-grid systems.

The Ministry of Tourism, Economic Development, Investment and Energy is in charge of the energy matters of the country. Antigua and Barbuda has already elaborated its National Energy Policy and also the National Sustainable Energy Policy. Both documents are the guidelines of the Energy Planning of Antigua and Barbuda. A National Energy Task Force was also commissioned to elaborate the Energy Policy. For the present report, these documents are taken in account to update the figures and the structure of the Energy sector in Antigua and Barbuda.

Based on the country's necessity of having a sustainable energy development and a tool to aid its decision-making, and the readiness of CELAC in having a deeper understanding of the energy sector in the Eastern Caribbean Member Countries, OLADE has prepared the following report hoping to fulfill both, Antigua and Barbuda and CELAC's requirements.

3. Country description

3.1. General profile

Country	Antigua and Barbuda
Capital city	Saint John
Head of State	Queen Elizabeth II
Head of Government	Gaston Browne (since 13 Jun. 2014)
Government Structure[1]	Constitutional monarchy with a parliamentary system of government and a Commonwealth realm. Council of Ministers appointed by the governor general on the advice of the prime minister. The administrative division consists in 6 parishes, Saint George, Saint John, Saint Mary, Saint Paul, Saint Peter, Saint Philip and 2 dependencies: Barbuda, Redonda.
Languages[1]	English
Currency[1]	Eastern Caribbean Dollar (EC$)
Exchange rate (2014)[1]	1 US$: EC$ 2.7169
Economy (2013)[1]	Agriculture (2%), Industry (16%), Tourism and Services (82%)
Population [2]	86,069 inhabitants
GDP (Constant 2005 US$ MM) (2013)[3]	2,800.26

Sources: (1) CIA World Fact book, visited in 2015 (2) Census Report Antigua and Barbuda, 2011 (3) Eastern Caribbean Central Bank, GDP 2000-2014 for all The Eastern Caribbean Countries, Official Figures.

The first habitants of the island of Antigua were the Caribs, a tribe that lived there before the 16th century and later abandoned the island because of the lack of fresh water. Christopher Columbus visited the island of Antigua in 1493 and named it according to the church of Santa María de la Antigua in Seville, Spain. Later on, in 1623 the island was colonized by the British and then, the French took control in 1666. By that time, the first tobacco plantations started; however sugar resulted more profitable and it began its expansion in the island of Antigua.

One year later, in 1677 the British finally take control of Antigua and ceded it to the Codrington Family. In 1860 Barbuda was annexed as a part of Antigua. The sugar industry began to grow rapidly, situation that led to the importation of African slaves to the Islands. In Antigua the slavery trade ended in 1807, however, in Barbuda the Codrington Family established a slave farm where African children were considered as labor force. This situation, among other things, led to the slave's emancipation in1834.

The labor force in the country began to get organized and its movement was the main instrument of development in the country. In the year 1939 Vere C Bird, who will later become the leader of the Antigua Labor Party, formed the first Trade Union. This party won the first elections when the first adult suffrage took place in 1951.

In 1967, under the West Indies Act, Antigua and Barbuda with its internal self-governance became an associate member with the United Kingdom, which remains in charge of the international affairs as well as the defense sector. In 1971 the Labor Party was defeated in the elections by the Progressive Labor Movement.

The Labor Party returned to power in 1976´s elections, after that its leader V.C. Bird obtained the country independence in 1981. The same year Antiguan and Barbuda became a member of the Eastern Caribbean Countries.

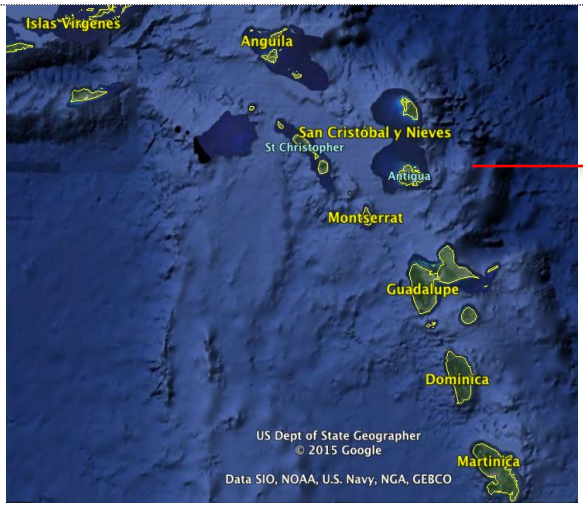
3.2. International profile

Relevant Memberships	CP, AOSIS, Caricom, CDB, CELAC, FAO, G-77, IBRD, ICAO, ICC (NGOs), ICRM, IDA, IFAD, IFC, IFRCS, ILO, IMF, IMO, IMSO, Interpol, IOC, IOM, ISO (subscriber), ITU, ITUC (NGOs), MIGA, NAM, OAS, OECS, OPANAL, OPCW, PetroCaribe, UN, UNCTAD, UNESCO, UPU, WFTU (NGOs), WHO, WIPO, WMO, WTO

Sources: Antigua and Barbuda country profile, CIA World Fact book (visited on 26th January 2015)

3.3 Geography

Region	Eastern Caribbean
Location	North of the Leeward Islands in the Eastern Caribbean
Latitude	13º 59' N
Longitude	61º 00' W
Surface area	617 km^2 (238 sq ml)



Map1. Eastern Caribbean (1)

Map2. Antigua and Barbuda (2)

Sources: (1) Google earth (web page visited January, 27th2015) (2) embasyworld.com (web page visited January, 27th2015)

Antigua and Barbuda is located in the leeward in the Eastern Caribbean. It is a twin-island nation of 442.6km^2 of which 280 km^2 correspond to Antigua and 161 km^2 to Barbuda. Antigua is from volcanic origins, with the highest point called Boggy Peak at 1,319 ft.

Antigua and Barbuda has little remains of natural vegetation as the island was formerly

cleared for sugar planting. However it possesses the largest expanse of freshwater in the Caribbean. Barbuda has tremendous diversity of native habitats, as yet unthreatened by development. This island keeps ecological resources, consisting in scenery, beautiful beaches, lagoons and abundant wildlife (The Commonwealth Yearbook, 2013)[1].

3.4 Climate

Antigua and Barbuda's climate is classified as tropical maritime. The country has an annual temperature of 26ºC, which varies from 16.7ºC to 28.3ºC. Average annual precipitation is 1,100mm but variable throughout the year with a rainy season from October to November. The country is susceptible to severe earthquakes and hurricanes (Claude Davis & Associates, 2010).

4. Socio-Economic Characteristics

4.1. General description

The economy of Antigua and Barbuda is small and vulnerable to external shocks such as oil market prices, financial crisis, natural disasters and others, who directly influence tourist activity. The main economic activity is tourism and its related activities, which have replaced sugar as the principal entrance of foreign exchange and the primary source of employment. Investment banking and financial services play also a key role[2]. Public and private construction has driven growth. The country has also a small-scale industry and agriculture subsector (Claude Davis & Associates, 2010).

Antigua and Barbuda is a member of the Eastern Caribbean Currency Union, therefore maintained a common currency exchange in relation with the Us Dollar of 2.7 since 1976. This agreement has created certain stability into the country, considering its situation of fully dependent on imports of fossil fuels for energy generation.

The Eastern Caribbean Bank is the institution in charge of monitoring the monetary policy of the country as well as national commercial banking institutions. It is very common that the growth of the country is closely correlated to the economic situation in the United Sates and some of the European Union Countries. (Government of Antigua and Barbuda Prospectus, 2012).

In the last decade, there have been constant efforts to promote the diversification of the economic activities, moving towards financial and also online gaming activities. It is important to notice that on a GDP per capita basis, Antigua and Barbuda has the highest rates compared with the rest of the OECS countries, it contributes 27% to the regions income, considering that the country has only the 14% of the population of the OECS countries (Government of Antigua and Barbuda Prospectus, 2012)[3].

Since the 90s decade, the economy of Antigua and Barbuda started to slow down. In 1995 the country was affected by the Hurricane Luis, which according to the government figures, led to a 1.4% of an economy contraction. In 2003 the United States imposed restrictions over the online gaming activities, which also affected severely to these economic activities that never came to recover totally since then (Government of Antigua and Barbuda Prospectus, 2012).

[1] http://www.commonwealthofnations.org/wp-content/uploads/2012/10/antigua_barbuda_country_profile.pdf
[2] http://blogs.iadb.org/ (web page visited Feb, 21th 2014).
[3] http://www.ab.gov.ag/pdf/finance/GOAB_prospectus_december_2011.pdf

Current Macroeconomic results

The 2009 global crises severely affected the economy of Antigua and Barbuda and created the worst recession in history. During the years 2009 to 2011 the GDP of the country contracted by 24%. The tourist arrivals decreased as well as the foreign investment, the wholesale and retail sector along with the construction sector declined over 46% and 31% respectively during those years. The contraction affected all the sectors that participate on the GDP.

However, by the year 2012 the economy of the country started to show a recovery, supported by the International Monetary Fund. The agriculture sector has experienced a constant growth of 24%, even during the international crisis (Government of Antigua and Barbuda Prospectus, 2012).

4.2. Residential

In the Year 2001 the Population of Antigua and Barbuda was 70,737 habitants. According to the 2011 Census Report the population for that year was 87,774 habitants. The population is divided in 40,007 males and 43,271 females. In the island of Barbuda there were recorded 1,810 habitants. According to the census in Antigua there are 776.5 habitants per square mile and in Barbuda 29.2. The 2011 Census holds that the population in Antigua and Barbuda has growth 15% between the years 2001 to 2011.

The St. John Parish contributes with 60.5% of the population, while St. Paul, St. George and St. Mary contribute with the 27.6%. On the other side, Barbuda´s population has grown 13.8% and currently has the characteristic of having more males than females. Most of the Parishes, except St. City and St. Phillip, have increased its population since 2001.

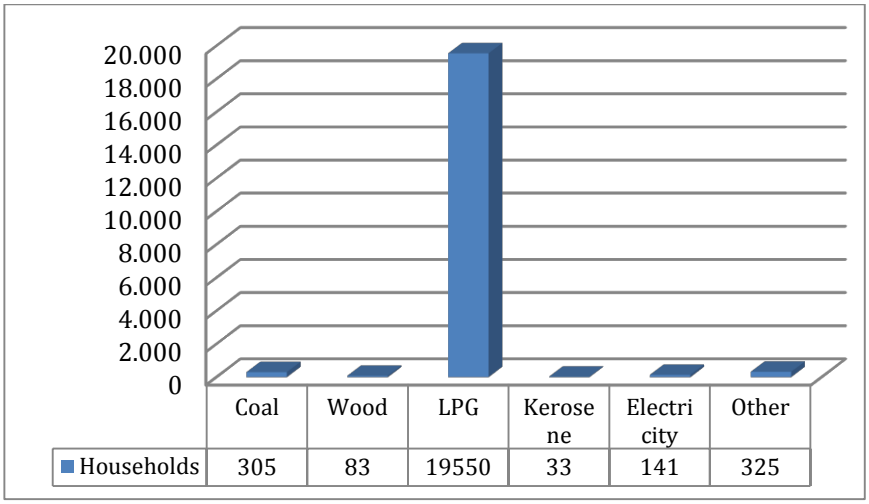
According to the 2011 Census there are 29,051 households, which represent an increase, compared with the 24,462 households from the 2001Census. The average household size in Antigua and Barbuda is 3 persons in 2011, compared with 3.1 in 2001 and 3.2 in 1991. St. John Rural is the parish that has augmented its households very rapidly, moving from 6,861 in 2001 to 10,040 in 2011, a growth of 46.3%. By 2011 Barbuda had 544 households, with an increase of 19.3% compared with 456 from the 2001 Census (Census Report of Antigua and Barbuda, 2011).

Parish	N. Of Households	Resident Population
St. John City	7,635	22,193
St. John Rural	10,041	29,054
St. George	2,719	7,838
St. Peter	1,815	5,307
St. Phillip	1,011	3,49
St. Paul	2,834	8,809
St. Mary	2,452	7,794
Barbuda	544	1,81

In terms of the electricity generation the Government has implemented an important program to change every incandescent light bulb and replace it by a compact fluorescent

light; the program was led from 2006 to 2008 with the support from the Cuban Government (Antigua and Barbuda Mitigation Assessment Report, 2010).

In terms of the energy consumption, this sector uses LPG as the main fuel for cooking; the use of charcoal, wood and kerosene are recorded to be minimum, most of them used LPG as well as in the rest of the OECS countries.



Graph 1. Type of fuel used for cooking

Source: Antigua & Barbuda 2001 Census Report[4]

Number of Households (2011) (1)	29,051
Number of persons per Households (2011) (1)	3
Electricity consumption (GWh) (2012) (2)	74,335

Table 1. Residential Summary – 2010 - 2011

Source: (1) Census Preliminary release Antigua and Barbuda, 2011; (2)

4.3. Industry and Manufacturing

The industry sector in Antigua and Barbuda is small; in terms of the GDP, the contribution is around 1.85% for the year 2014. The main industries in the country are distilled liquors, pottery and textiles. For exportation the main products are related to bedding, handicrafts and electronic components.

According to the Rank of the World Bank in the section Doing Business, Antigua and Barbuda is ranked 71 of 185, based on the regulatory economic policy as well as the situation of local firms (World Bank, Doing Business, 2014).

The high cost of labor, as well as high cost of energy, are the main reasons why the industry sector is limited. According to the Commonwealth Network, the country has the highest costs of labor force in the region. This situation led to the decrease on the potential investors focusing on the country. They are more attracted to the labor prices in the neighboring region (World Bank, Doing Business, 2014).

Despite this situation, the Government is constantly trying to support with initiatives and conventions that gave local manufacturers access to international markets, especially

[4] http://www.ab.gov.ag/pdf/statistics_reports/complete_census_summary_report.pdf

for Europe and United States. According to the Antigua and Barbuda E-Readiness Business Survey Report 2008 there were approximately 102 companies in the country. However for the Manufacturing sector there were only 7 (that responded to the survey and that are considered as principal stakeholders for this subsector) (Antigua and Barbuda E-Readiness Business Survey Report 2008, pp. 11)[5]

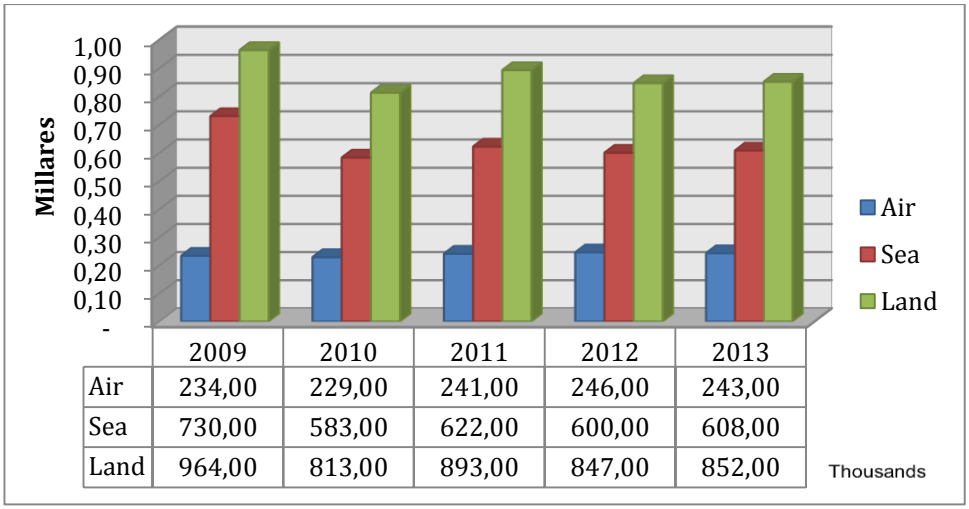
Manufacturing Added Value (EC$M) Constant (2012)(1)	54.21
Added Value as % of GDP (2012) (1)	2.34
Electricity consumption (GWh) (2012)(3)	5,575

Table 2. Industrial Summary – 2012
Source: Eastern Caribbean Central Bank, GDP 2000-2014 for all The Eastern Caribbean Countries, Official Figures.

4.4. Tourism

Since 2002, tourism sector has been growing 5% on an annual basis; until 2008 when the global crisis started. The most important tourism markets for Antigua and Barbuda are the United States and some members of the European Union. According to the Government, between 2007 and 2009 the country received 900,000 visitors, however by 2010, this figure decreased by 16%. By 2011, the sector started to show a quick recovery increasing the visitors in 17% (Government of Antigua and Barbuda Prospectus, 2012).

The Government of Antigua and Barbuda has important agreements with the Antigua Tourist and Hotel Association, which gives incentives to this important sector of the economy. This support is also related to the realization of important projects such as a 20-room training hotel at the Antigua Barbuda Hospitality Training Institute and several hotels including the Half Moon Bay development and the Crystal Bay development.



	2009	2010	2011	2012	2013
Air	234,00	229,00	241,00	246,00	243,00
Sea	730,00	583,00	622,00	600,00	608,00
Land	964,00	813,00	893,00	847,00	852,00

Graph 2: Number of visitor by type of arrival
Source: Statistics Division Government of Antigua and Barbuda[6]

The Government has constantly supported tourism sector, especially the medical tourist activities, which gave the country a special international status on health care; which is

[5] http://www.ab.gov.ag/pdf/statistics_reports/ebusiness_survey_report.pdf
[6] http://ab.gov.ag/media/Tourism_Stats/yearinreview2013.pdf

also attracting for the rest of the tourists. It is important to note that the Cruise ships sub sector is another important instrument to promote tourism, as it is also an important source of employment. The yacht sector is another tourist sub sector that generates important income to the country.

Hotels+Restaurants Added Value (EC$M) Constant (2012)[1]	360.09
Added Value as % of GDP (2012) [1]	15.54
Electricity consumption (GWh) (2012)[3]	98,493

Table 3. Tourism Summary – 2012
Source: Eastern Caribbean Central Bank, GDP 2000-2014 for all The Eastern Caribbean Countries, Official Figures.

4.5. Agriculture and Fishing

According to the Inter-American Development Bank, Agriculture is one of the sectors that has an interesting prospectus in growing in the near future, therefore this sector is considered as a priority for the country. Constant efforts from the Government have been done to obtain an increase in the production of agriculture and agro processing (Caribbean Community Secretariat, visited 2014).

The Government offers several incentives offered to national and international investors in the agriculture sector. The main institution that regulates investment in agriculture activities in the country, is called The Antigua and Barbuda Investment Authority. This institution has promoted several new policies in the last years. The more important are related to the use of electronic agriculture information for training in agriculture specific activity and also to help the administrative matters in this sector (Antigua and Barbuda Private sector Assessment Report, 2014).

Internal demand is very important to consider. The government is currently trying to promote it with a linkage in the tourism sector as well as the agro processing and manufacture sector. This connection may boost an increase agriculture production, which is very important considering that most of the agriculture products are produced to supply the domestic demand.

Crop production, mainly vegetables, root crops, hot pepper and limited production in a range of fruit crops mango, melon, cantaloupe, citrus, sour sop and guava, contributes about 30% to agriculture value-added. The livestock include Cattle, poultry and small ruminant production (especially goats), provide important contributions to the total agricultural contributions (19%) (Caribbean Community Secretariat visited 2014).

Another important program that the Government has in this area is called “The Backyard Garden Program”. The objective is to promote the production of food for the own consumption in the backyard of the houses. In 2014 the Ministry of Agriculture, with the continued support of the FAO, worked together to increase household participation in this program. The program will also distribute seeds and other inputs as well as technical advice on starting and maintaining a backyard garden (Budget statement Antigua and Barbuda, 2014).

Added Value Agriculture+Fishing (EC$M) Constant (2012)[1]	44.47

Added Value as % of GDP Agriculture+Fishing (2012)(1)	1.92
Agriculture main products (2013) (2)	Vegetables, root crops, hot pepper, mango, melon, cantaloupe, citrus, sour sop and guava, Cattle, poultry and small ruminant production (especially goats)
Agricultural area (ha)(2013) (3)	Some 30% of land is arable, with 18% in use.

Table 4. Agriculture, Fishing and Mining Summary

Source: (1) Eastern Caribbean Central Bank, GDP 2000-2014 for all The Eastern Caribbean Countries, Official Figures. (2) Budget Statement A&B, 2014, http://www.ab.gov.ag/pdf/antigua_barbuda_budget_speech_2014.pdf (3) Antiguan and Barbuda Investment Authority, http://investantiguabarbuda.org/investment-opportunities/agriculture/

4.6. Transport

According to the Initial National Communication on Climate Change of Antigua and Barbuda, transport sector represents the country second main source of GHG emissions, after electricity production. Light duty vehicles represent 82% of the total of vehicles registered in the country (Latin America and the Caribbean Passenger vehicles and standard fleets, 2011).

According to the International Panel of Climate Change, Antigua and Barbuda has put its efforts in reducing traffic congestion in commercial areas as an instrument for improving productivity, but more important, reducing costs and minimizing growth in GHG emissions (Initial National Communication on Climate Change, 2001).

In terms of the highways, there are almost 1,165 km of roads in the entire country of which, paved roads represents 384 km and unpaved 781 km (CIA World Factbook, 2002).

According to the 2001 Census Report, in the country there are 13,931 private cars, plus companies and the government that owned another 4,017 vehicles and the public transport that has 7,771 vehicles[7].

Transport and Storage (GDP 2012) (EC$M)	158.03
Road Transport (GDP 2012) (EC$M)	99.39
Sea Transport (GDP 2012) (EC$M)	1.79
Air Transport (GDP 2012) (EC$M)	35.21
Added Value as % of GDP (2012)(1)	6.82

Table 5. 2012 Transport Sector Gross Domestic Product In Constant Prices (EC$M) 2012

Source: (1) Eastern Caribbean Central Bank, GDP 2000-2014 for all The Eastern Caribbean Countries, Official Figures.

In terms of air transport, the Leeward Island Air Transport (LIAT) is headquartered at the V.C. International Airport, Antigua´s main airport. Currently, it operates high frequency inter-island flights connecting 17 destinations in the Caribbean. Furthermore, there are other 7 airlines operating flights out of Antigua.

4.7. Construction

[7] http://www.ab.gov.ag/pdf/statistics_reports/complete_census_summary_report.pdf

Construction is closely related to the tourism activities. This sector is one of the main contributors to the economy of Antigua and Barbuda. Construction sector, as well as in the rest of the OECS countries, stimulates and built confidence to the economy. In 2011 the government promoted the Construct Antigua and Barbuda Initiative, which helped to boost growth in the construction sector by 15.4%, and also creates employment for the people of the country Antigua and Barbuda (Investment Authority, 2015).

The initiative gives incentives such as no duty payments or discounts on building material produced locally, as well as low rates in Banks and insurance institutions. This program applies for future homeowners in the country. The mining and quarrying sector also grew significantly by 21.7% in 2013 as compared to about 6% in 2012. Currently the Government receives technical support from Cuban engineers in the areas of hydraulics, quarrying and road construction (Antigua and Barbuda Budget Speech, 2014)[8].

Added Value (EC$M) Constant (2012)	204.92
Added Value as % of GDP(2012)	8.84

Table 6 . Constructions and Others Summary – 2012
Source: Eastern Caribbean Central Bank, GDP 2000-2014 for all The Eastern Caribbean Countries, Official Figures.

5. Energy sector

The Ministry of Tourism, Economic Development, Investment and Energy is in charge of the energy matters of the country; also to elaborate the National Sustainable Energy Action Plan and the Renewable Energy ACT. Both documents are the guidelines of the Energy Planning of Antigua and Barbuda. A National Energy Task Force was also commissioned to elaborate the Energy Policy (Energy Policy and Sector Analysis in the Caribbean, 2010-2011).

The Government created the Sustainable Energy Desk (SED) as well as the National Energy Task Force (NETF) in 2010. With the assistance of the Organization of the American States, the NETF was commissioned to elaborate the National Sustainable Energy Policy for Antigua and Barbuda. It has also received the support of the public utilities, as well as the financial institutions, business and several stakeholders. Furthermore, the Ministry of Tourism, Economic Development, Investment and Energy is the main government body in charge of the Energy Policy and Framework as serves a focal point for all energy related investments and regulations.

For electricity generation, the institution in charge is the Antigua Public Utilities Authority (APUA). It is a Government owned institution, which distributes electricity to both islands and also produce a part of it. Independent producers are allowed to exist with a license from APUA. One of the most important independent producers is the Antigua Power Company (APC), which has been selling electricity to APUA´s grid since 1996 (Energy Policy and Sector Analysis in the Caribbean, 2010-2011).

The public utility as well as APC operates with combustion diesel engines and in 2010 the total installed capacity in the country was around 90.2MW. It is important to notice that the peak demand in the same year was around 52.9MW and that the country has a forecast of 3.3% annual growth from 2009 to 2023 (Energy Policy and Sector Analysis in the Caribbean, 2010-2011).

[8] http://www.ab.gov.ag/pdf/antigua_barbuda_budget_speech_2014.pdf

On the other hand, for the distribution of hydrocarbons, there are three companies currently operating in the country. The first one is the West Indies Oil Company (WIOC) with a regional terminal that operates in the country. Second, PetroCaribe, which is an initiative with the Venezuelan Government, that started in 2005 and supplies hydrocarbon in several countries in the Eastern Caribbean region. Third Shell, which used to be part of the distribution of fuels. Although as today is not operation in the country (Energy Policy and Sector Analysis in the Caribbean, 2010-2011).

Antigua and Barbuda does not have any fossil under its land; fuel and almost 100% of its energy resources are imported from international markets. Those spending represents near 12% of GDP and one third of the country's foreign exchange (IDB, 2013).

5.1. Institutional structure

National Level

- **Office of the Prime Minister:** Prior to 2014, it was responsible for providing leadership on the energy sector through the Sustainable Energy Desk (SED), as well as the National Energy Task Force (NETF). Both were created in 2010 by the Government, with the assistance of the Organization of the American States, the NETF was commissioned to elaborate the National Sustainable Energy Policy for Antigua and Barbuda (National Energy Policy, 2010).
- **Minister of Tourism, Economic Development, and Investment & Energy: As of June 2014, the Ministry** coordinates specific activities related to Government's renewable energy and energy efficiency initiatives. The Government is constantly undertaking efforts to strengthen the knowledge of its staff on all energy- related issues[9].
- **Ministry of Works and Transport:** has the responsibility to manage policies related to vehicle transport as well as the Port Authority. Considering that transport sector is one of the major consumers of energy in the country, policies in this sector are very important.

Regional Level (Eastern Caribbean)

Electricity Sector

- **Caribbean Electric Utility Services Corporation –CARILEC–**[10]: The CARILEC Secretariat strives to enhance communication among its members and to serve as the focal point for general and technical information. The Secretariat takes the lead in advocating for change in the electric utility industry in the Caribbean and in this regard produces a number of information products and provides a range of services to members.
- **The Caribbean Renewable Energy Development Programme –CREDP–**[11]: The CREDP is a joint project of CARICOM and the German International Cooperation GIZ. It is financed by the German Federal Ministry of Economic Cooperation and Development BMZ and implemented by the consortium of Project-Consult GmbH, Germany and Entec AG, Switzerland, on behalf of the GIZ. CREDP seeks to remove barriers for the use of Renewable Energy and application of Energy Efficiency measures in the Caribbean Region.

[9] http://ablp.ag/press-statement-by-the-honourable-asot-michael-minister-of-tourism-economic-development-investment-and-energy-to-commemorate-caricom-energy-week-2014/

[10] http://carilec.com/ (web page visited Nov, 25th 2013)

[11] http://credp-gtz.org/ (web page visited Nov, 25th 2013)

- **Eastern Caribbean Energy Regulatory Authority –ECERA–[12]:** ECERA is *expected* to provide arms-length regulation and oversight of the electricity utilities to achieve cost efficiency in electricity supply and by extension lower electricity rates to consumers in the medium to long term. Another associated benefit of ECERA is the provision of advisory services to Governments on renewable energy development, electricity sector plans and cross border interconnection, which is critical for geothermal development within the OECS.

Oil Sector

- **The Caribbean Information Platform on Petroleum –CIPPET–[13]:** CIPPET was developed by the Scientific Research Council **–**SRC**–**, located in Kingston Jamaica, as a regional focal point for the **Caribbean Energy Information System –CEIS–**. The CEIS is a network of 18 Caribbean Countries with responsibility for the coordination, gathering and dissemination of energy information for these countries to facilitate sharing of energy information among each other and to aid policy decision**–**making

5.2. Legal and Policy Framework

- **National Energy Policy –NEP–:** Drafted by the National Energy Desk, which was created by the Office of the Prime Minister. This document has as key objective the creation of an institutional and regulatory framework for the introduction of renewable energy; diversify the energy matrix and achieving energy security and independence (National Energy Policy, 2010).
- **Sustainable Energy Action Plan:** Elaborated by the Department of Sustainable Development of the General Secretariat of the Organization of American States in 2013, with the advice of IT Power Group –European Division under the European Union funded initiative "Caribbean Sustainable Energy Program (CSEP). It is a guideline document that states three specific strategies to improve the energy planning in the country:
    - Work on the institutional and regulatory barriers for the energy sector.
    - Energy conservation and Energy efficiency
    - Education and Awareness on energy matters
    - Renewable energy efficiency
- **Renewable Energy ACT from this list:** Elaborated by the Parliament of Antigua and Barbuda in 2015, this bill seeks to establish legal, economic and institutional basis to promote the use of renewable energy resources and for connected matters. It aims to reduce foreign exchange spent on petroleum fuel imports, and to allow engineers to build expertise in the renewable energy technologies and the APUA to become involved in the renewable energy sector.
- **The Environment Bill:** On April 23, the Parliament of Antigua and Barbuda unanimously passed the Environmental Protection and Management Act. The Environment Division is currently working based on this regulation, for the EAG, and for every citizen to ensure that we live in a healthy environment.

- **Power Purchase Agreement:** Gives APUA the legal monopoly for the generation, distribution and sale of electricity in Antigua and Barbuda. Every independent producer must act according this document[14].
- **Public Utilities Act of 1973:** in this document, APUA was set up as a "tripartite government statutory agency" which controls and regulates telecommunications,

[12] http://www.oecs.org/our-work/projects/ecera(web page visited Nov, 25th 2013)

[13] http://www.ceis-caribenergy.org/(web page visited Nov, 25th 2013)

[14] http://www.commonwealthofnations.org/sectors-antigua_and_barbuda/business/electricity_and_power/

electricity and water services. APUA holds the exclusive right for the generation, distribution, transmission and selling of electricity. It can grant permission to Independent Power Producers to generate and supply electricity and has done so as part of long-term power purchase agreements to meet peak demand[15].

- ***Petroleum Act (1949):*** The Act provides rules for the importation and storage of petroleum in Antigua and Barbuda. The document states that the Minister is responsible for providing storage for imported petroleum. It indicates where petroleum may or may not be stored, and empowers the Comptroller of Customs to grant licenses to "any person to deal in or sell petroleum in accordance with the prescribed regulations" (Energy Policy and Sector Analysis in the Caribbean, 2010-2011)
- **Minerals (Vesting) Act (1949):** The Act provides that all minerals, including coal and lignite, in, on, or under the land regardless of ownership or tenure, belongs to the Crown, and any mining of such minerals requires a license from the Cabinet (Energy Policy and Sector Analysis in the Caribbean, 2010-2011)

5.3. Electricity

Antigua and Barbuda almost relies exclusively on fossil fuels for electricity generation. The generation is made by a combination of leased generators, independent producer´s capacity and the utility's own capacity. The two main stakeholders at electricity generation and supply are:

- **The Antigua Public Utilities Authority**: is a tripartite government statutory agency, which supplies and regulates Telecommunications, Electricity and Water services. It has its own generation capacity. The institution is run by a General Manager, who is assisted by a Management Team (APUA web page, visited January 2015)[16].

- **Antigua Power Company:** It's an independent electricity producer that sells electricity to APUA´s grid. In 2012, APUA registered that the Antigua Power Company supplies around 60% of the total daily demand of the country (APUA web page, visited 2014)[17].

The total shares of electricity production contracted by APUA have increased in this last decade. A part of the leased generators are from the West Indies Oil Company (WIOC), which also supplies fuels in the country. The other part comes from Aggreko, which is a power generator rental company (Energy Policy and Sector Analysis in the Caribbean, pp.15).

In 2004 the utility contracted a capacity of 40% of the total. By 2009 APUA contracted 61% of the total electricity generation. The supply offered by the Antigua Power Company has increased in the last years by several reasons. One of the most important is that, according to the National Energy Policy, APUA has chosen that Antigua Power Company replace its own old plants and APUA stays more focused on the distribution to generate incomes to renew its own equipment.

According to the National Energy Policy, in 2010 there were 8 operating internal combustion diesel engines in the country. Together, they generate an installed capacity of 83MW. The losses are accounted in 25% as technical situations in the generation, transition and distribution process as well as in the economics.

[15] http://www.apua.ag/about-us/
[16] http://www.apua.ag/
[17] http://www.apua.ag/1550-2/

From 2007 to 2010 electricity generation has growth in 16% from 200 GWh in 2007 to 232 GWh in 2010. Since that year, the demand remained stable. However, in 2013 the recorded peak demand was 49.2MW. (An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Antigua and Barbuda, 2013).

The installed capacity of the country for the year 2012 was 118MW and the production capacity was 93MW. In 2011 Antigua and Barbuda integrated a new power plant called Wadadli. It is important to notice that this plant operates with heavy fuel oil.

According to CELAC, during 2012 the net electricity generation in Antigua and Barbuda was 329GWh. There is also some electricity generated by solar power, which is also connected to the grid. The capacity is 3kW and it supplies 4.8MWh. (An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Antigua and Barbuda, 2013).

Consumers

One hundred percent of the citizens in Antigua and Barbuda have access to electricity. In 2009 the largest consumer sectors in the island of Antigua were tourism with 101,493 MWh, followed by the domestic sector with 86,502 MWh, the Governmental sector with 20,860 MWh and the industrial sector with 6,104 MWh.

On the other side, at Barbuda, the largest consumers were in first place the domestic sector with 1,385 MWh, followed by the tourist and commercial sector with 355 MWh and finally, the Governmental sector with 186 MWh (Energy Policy and Sector Analysis in the Caribbean, 2010-2011)

According the figures from APUA, between the years 2005 and 2010 the domestic sector has accounted for around 40% of the billed electrical units. The Governmental sector has 8% and the rest goes to the tourism sector, with a little of billed electrical units in the industries (National Energy Policy, 2010).

Self-producers

According to the Public Utilities Act, APUA can give any individual the right to generate its own electricity, but if someone generates without APUA´s permission, it will be considered as an infraction. Mainly, the licenses are given to the principal independent producers in the country, who also have electricity purchase agreements with the public utility, which are necessary to meet the peak demand. By 2010, the peak demand of Antigua and Barbuda was 51MW.

One of the major independent producers in the country is the Antigua Power Company, which has a total capacity of 78MW. One of the reasons that led to this situation is that the cost of production of APUA exceeds the ones of the independent producers. Therefore APUA is more into the distribution and led a big amount of the generation process to other institutions. (National Energy Policy, pp.12).

Electricity rates

The cost of electricity, as well as in the rest of the OECS countries, is relatively high. However, it is important to notice that for several years the Government has subsidized fuel prices. It is recently that the Government decided to establish a normal retail price for every fossil fuel purchase. Currently hydrocarbon prices are almost similar to the rest

of the OECS countries (Inter-American Development Bank, web page visited, January, 2015)[18].

A fuel surcharge is included in the price in each unit of electricity. There are specific tariffs for the residential, commercial and industry sector. The average electricity rate by the end of 2012 was EC$ 1.20/kWh.

5.4. Renewable Energies

Currently, electricity generation via renewable energies remains fairly low in Antigua and Barbuda. Photovoltaic technologies are the most widely used systems to generate renewable energy.

Antigua and Barbuda is well known for its capacity of solar potential. The use of Water heaters has augmented along the country. Several solar panels were installed at government buildings, at the Ministry of Tourism and Education. There are also some photovoltaic panels installed at the V.C. Bird International Airport.

There is a small photovoltaic wind farm, which generated 4.8MWh during 2012 and it has an installed capacity of 3kW (An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Antigua and Barbuda, 2013).

A study led by the Organization of American States (OAS), The Caribbean Renewable Energy Development Programme(CREDP), the German Corporation for International Cooperation (GIZ) and financed by APUA in 2008, showed that Antigua and Barbuda in its highland has an important potential for building a wind farm. The study states that there can be installed turbines that can handle 400MW to finally generate 900 GWh per year. In the past, the country used wind power to produce sugar, however currently this renewable energy resource is not exploited.

The Environment Division of the Ministry of Agriculture, Lands, Housing and Environment (MALHE) is exploring a project to generate 15 MW of electricity from wind through a combined wind and pumped hydro facility. The pumped hydro component will use stored seawater to generate electricity when the wind component is unable to operate at capacity (An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Antigua and Barbuda, 2013).

Currently APUA´s Interconnection Policy, elaborated in 2011, regulates the participation of renewable energies in Antigua and Barbuda. The utility allows for a maximum distributed renewable energy power penetration level of 15% of yearly maximum demand.

5.5. Hydrocarbons

These are main stakeholders that make the importation and the distribution of fossil fuels.

- **West Indies Oil Company**: Antigua and Barbuda has one regional terminal of the West Indies Oil Company. The WIOC was established in 1965 in Antigua and Barbuda as an oil refinery and distribution company. In 1976 the company was

[18] http://blogs.iadb.org/caribbean-dev-trends/2013/12/12/antigua-and-barbudas-energy-market/

sold to the Government of Antigua and Barbuda, which then in 1980 sold 75% of the shares to National Petroleum Ltd. The WIOC has a capacity of storage of 200,000 barrels. Half of this storage capacity is leased to PetroCaribe from Venezuela; from there, they distribute to other islands. During the 2010 to 2012 period, in which this study was conducted, an average of 18.000 Gasoline barrels and 19.000 Diesel Barrels were exported to Dominica from WIOC storage facilities. (Energy Policy and Sector Analysis in the Caribbean, 2010-2011)

- **PetroCaribe:** Antigua and Barbuda is also part of the PetroCaribe Initiative. This agreement with the Venezuelan government is renewable every year since 2005. The agreement gives the country the possibility to purchase fuels under long financial terms. According to the National Energy Policy, Antigua and Barbuda has got the possibility to provide funds to several social programs due to this agreement. It is also important to notice that currently PDVSA leases a storage facility with a capacity of 260,000 barrel in St. John's, Antigua, which it uses to transport diesel and fuels to Saint Vincent and the Grenadines, Saint Kitts and Nevis and Dominica. (PDVSA eyes key oil terminal facilities for expansion, Bunker index webpage, visited on January, 2015)19.

- **Others: Rubis** is the second largest distributor and retailer, selling directly to the final consumers. **Carib LPG Trading**: important main LPG distribution and retailer. Owns small LPG storage facilities. **Themba Biofuels:** small private enterprise currently piloting production of Biofuels. Both **GioDist and Supply, Derrick** are lubricants and asphalt retailers.

The main fossil fuels that are used in the country are Gasoline, Diesel Oil, LPG, Jet Fuel, And Heavy Fuel Oil. According to the National Energy Policy, the energy costs related to the GDP in Antigua and Barbuda are higher, compared with the rest of the OECS countries. For the period 2005-2009 the country spend 12% on the GDP.

As presented before, for several years the government maintained a fixed price trough a subsidy scheme and in 2009 announced that it will be fixed to normal and real prices. Currently Antigua and Barbuda has more comparable prices of fuels with the OECS region.

	Retail Prices					
Product	**Anguilla**	**A&B**	**Dominica**	**SK&N**	**St. Lucia**	**SV&G**
Gasoline	10.99	11,5	11,09	11,56	10,25	10,61
Diesel	9,4	10,9	9,82	14,25	10,95	8,44
LPG 20 LB	59	32	27,26	30	26	37
LPG 100 LB	220	155	131,3	140	195	173,5

Table 7. Retail Prices for fuels in the OECS countries (EC$)
Source: National Energy Policy, Antigua and Barbuda, 2010

Transport sector is the major consumer of hydrocarbons in the country, including air and sea transport. In the year 2005 there were registered 23,930 vehicles in the country. A few years later in 2009, this figures increased to 30,525, an increase of around 28%. In total, the fuel consumed by the transport sector (air, sea and ground) was 54% of the total of fuels consumed in the country during 2013 (An assessment of fiscal and regulatory barriers to deployment of energy efficiency and renewable energy technologies in Antigua and Barbuda, 2013).

[19] http://www.bunkerindex.com/news/article.php?article_id=1414

Chapter II. Definition, Importance and Structure of the Energy Balance

6. Energy Balance Methodology

6.1. Definition and Importance of the Energy Balance

In line with OLADE's Methodology, Energy Balances are prepared in terms of physical and calorific units (kBoe).

Conceptually, the energy balance is the accounting of the energy flow between the various transformation processes and economic activities of the energy chain and its balancing relations, for which energy is produced, exchanged with the outside, transformed and consumed; taking as analysis unit, a given country, for an established period (usually one year).
The energy balances are instruments that measure the annual energy sources and consumptions in different economic sectors.

It is adequate to bring up to the basic goals of an Energy Balance (OLADE, 2004):

- To centralize the energy information and figures in order to determine the status of the sector
- To assess the dynamics of the energy system in concordance with the economy of each country, determining the major economic–energy relations between the different sectors of the national economy.
- To serve as an instrument for energy planning
- To understand in detail the structure of the national energy sector
- To determine the competitive and non–competitive uses of each energy source, in order to promote substitution processes wherever feasible.
- To create the appropriate bases that will lead to energy information enhancement and systematization.
- To be utilized to enable energy forecasts and outlooks on the short, medium and long term.

6.2. General structure of the Energy Balance

According the OLADE Methodology for Preparing Energy Balances, the energy balance of OLADE is comprised by a double–entry matrix where the columns indicate the energy sources and the rows correspond to the activities, which form part of the energy system.

A barrel of oil equivalent (boe) is the calorific unit used to display the energy balance.

The basic components of the energy balance are:

- Energy sources
  - Primary energy
  - Secondary energy
- Activities
  - Supply

- Transformation
- Demand

The energy balance matrix developed by OLADE, in terms of final energy, reflects the relations among all of the stages of the energy process.

In Table , three stages described below can be distinguished:

• Supply	Energy supply through the combination of production, importation, exportation and variation in stocks.
• Transformation	Physical, chemical and/or biochemical modification of one energy source or form to another, in a transformation center.
• Demand	Consumption of energy sources by final consumers in the different sectors, priori to some chemical or physical conversion of energy.

		PRIMARY SOURCES										SECONDARY SOURCES												TOTAL
		NON RENEWABLE SOURCES				RENEWABLE SOURCES																		
		Petroleum	Natural Gas	Coal	Fission Fuels	Hydroenergy	Geothermal	Firewood	Sugar Cane Products	Other Primary	Total Primary	Electricity	L.P.G.	Gasoline / Alcohol	Kerosene	Diesel Oil	Fuel Oil	Coke	Charcoal	Gases	Other Secondary	Non-Energy	Total Secondary	
		kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe	kBoe
SUPPLY	PRODUCTION (PP)																							
	IMPORT (IM)																							
	EXPORT (X)																							
	INVENTORIES (IV)																							
	UNUSED (UN)																							
	TOTAL SUPLY																							
TRANSFORMATION	REFINERY																							
	POWER PLANTS																							
	SELF PRODUCERS																							
	GAS TREATM.PLANT																							
	CHARCOAL PLANT																							
	COKE/BLAST FURNAC																							
	DISTILLERY																							
	OTHER CENTERS																							
	TOTAL TRANSFORMATION																							
FINAL CONSUMPTION	OWN CONSUMPTION																							
	LOSSES																							
	ADJUSTMENT																							
	TRANSPORTATION																							
	INDUSTRY																							
	RESIDENTIAL																							
	COMMERC.,SERV.PUB																							
	AGRIC.,FISH.MIN.																							
	CONSTRUCTION,OTH.																							
	ENERGY CONSUMPTION																							
	NON ENERGY CONSUM																							
	FINAL CONSUMPTION																							

Table 8. Structure of an Energy Balance

Source: OLADE (2004)

6.2.1. Sources

Primary energy sources

Primary energy sources are obtained directly from nature or following an extraction process. Directly: water energy, solar energy, wind, firewood and other vegetable fuels. After an extraction process: petroleum, natural gas, coal, geothermal energy, etc.

The primary energy sources considered in this methodology are listed and defined as follows:

Non–renewable energy sources

- Crude oil: This is a complex mixture of hydrocarbons having different molecular weights, in which there are usually a small proportion of compounds containing sulphur and nitrogen. The composition of petroleum is variable and may be divided into three types, according to distillation residues: paraffin, asphalt or a mixture of both.
  Crude oil is used as a feedstock in refineries, where it is processed to obtain derivatives.

- Natural gas (free and associated): This is a mixture of gaseous fuels and includes both free natural gas and it is present in coal mines or geopressure zones. Herein, both (the net free and associated gas produced) are placed under the same heading due to their similar nature and uses.

  - Free Natural Gas

  A gaseous mixture of hydrocarbons made up primarily of methane obtained from gas fields. Since it generally does not contain condensates, it is commonly called “dry gas”.

  - Associated Natural Gas:

  This is a gaseous mixture of hydrocarbons that is produced in association with crude oil. It generally contains fractions of light liquid hydrocarbons (condensates), so is frequently called “wet gas”.

- Coal: This is a black or dark brown solid fuel mineral that essentially contains carbon, as well as small amounts of hydrogen and oxygen, nitrogen, sulfur and other elements. It results from the degradation of the remains of plant organisms during long periods, due to the action of heat, pressure, and other natural physical–chemical phenomena.

  Due to the different degrees of change in the process, coal is not a uniform mineral and is classified by ranks according to its degree of degradation, in series that range from lignites and anthracites, which have considerable differences in their volatile contents, fixed carbon and caloric value.

- Fissionable Fuel or Nuclear Energy: This energy is obtained from the mineral uranium following a purification and/or enrichment process. What is considered

primary energy as “nuclear fuels” is not the mineral uranium in and of itself, but the contents of the fissionable material that is what feeds the nuclear plants.

Renewable Energy Sources

- Hydroenergy: The energy potential of a water flow

- Geoenergy: Geothermal energy is stored under the earth’s surface in the form of heat, which can be transmitted to the surface through a fluid that is in contact with the heated rock. This fluid is generally made up of water in liquid state, steam, or a combination of both. Only the portion of this energy source that is used in power generation is considered.

- Wind energy: This energy is produced by the wind and can be used jointly with a turbine–generator

- Firewood: This energy is obtained directly from forest resources. It includes tree trunks and branches, but excludes timber industry wastes, which are included under the definition of “plant wastes” used for energy purposes.

- Sugarcane products (molasses, juice, and bagasse for energy purposes): These include sugar cane products for energy purposes. They include bagasse, the sugarcane juice and the molasses.

- Other primary sources (animal waste and other vegetable waste, recovered energy, etc.)

    - Animal Wastes: This refers to wastes from farm activities and urban wastes. These may be used directly as a fuel in dry form or converted to biogas, through a process of fermentation or decomposition method.

    - Vegetable wastes: These are energy sources obtained from farm and forestry wastes. This includes all farm wastes (except for sugarcane bagasse), such as: rice husks rice husks, coffee husks, palm nut husks, etc., sawmill wastes (not included under the heading of firewood nor bagasse, etc.), for energy purposes.

    - Industrial or Recovered Wastes: Substances with energy contents produced in industrial plants as a byproduct of the production process, such as black pulp liquor, chemical industry wastes (except for petrochemicals, which should be considered secondary products because they come from natural gas or petroleum derivatives), etc.

    - Other Primary Energy Sources: These include solar (water heating in households and hotels, grain drying, lighting with photovoltaic cells), urban wastes (garbage or liquid wastes) and any other primary source that is not mentioned in the descriptions above, but are relevant to the energy structure of the country.

Secondary energy sources

Secondary energy refers to the different energy products whose origin is the different transformation centers, after undergoing a physical, chemical or biochemical process, and whose destination are the diverse consumption sectors, and/or other transformation centers.

The secondary energy sources considered in this methodology are listed and defined bellow.

- Liquefied gas (LPG): This consists of a combination of light hydrocarbons that are obtained from distilling oil and/or treating natural gas.
  They can be of three types:
  a) Combination of hydrocarbons from the C3 group (propane, propene, propylene)
  b) Combination of hydrocarbons from the C4 group (butane, butylene)
  c) Combination of C3 and C4 in any proportions

- Gasoline and Naphtha (aviation gasoline, motor gasoline, natural gasoline and naphthas): A combination of light liquid hydrocarbons obtained by distilling oil and/or treating natural gas, whose boiling range is generally between 30–200 degrees Celsius. It also includes the alcohol obtained from distilleries that is used as an energy product. This group includes:
  - *Aviation Fuel*: This is a combination of reformed naphthas of high–octane, high volatility and stability, and high freezing point, used in propeller–driven aircraft with piston motors.
  - *Motor Gasoline*: A complex mixture of relatively volatile hydrocarbons used, with or without additives (such as lead tetra–ethyl) for operating internal combustion engines.
  - *Natural Gasoline*: A product of natural gas processing, used as a raw material for industrial processes (petrochemical) in refineries or mixed directly with naphthas.

- Alcohol: Includes both ethanol (ethyl alcohol) and methanol (methyl alcohol) used as fuels.
  - *Ethanol:* is a colorless liquid that can be produced by fermentation of plant materials with a high sugar content, such as sugarcane juice or molasses; plant materials with high starch content, such as cassava, corn, etc.; and materials with high cellulose content: firewood, plant wastes. It can be used as anhydrous or hydrated alcohol, alone or mixed with gasoline in internal combustion engines.
  - *Methanol:* is also a colorless liquid that can be produced from several raw materials such as firewood, plant wastes, methane, natural gas, coal, etc. It is used in internal combustion engines.

- Kerosene and Jet fuel*:*
  - *Kerosene*: A liquid fuel made up of the oil fraction that is distilled between 150 and 300 degrees Celsius. It is used as a fuel for cooking foods, lighting, in motors, in refrigeration equipment, and as a solvent for domestic waxes and insecticides.
  - *Jet fuel*: This is kerosene with a special degree of refining, with a freezing point below that of common kerosene. It is used in reaction motors and turbo propellers.

- Diesel oil *(also including gas oil*): Liquid fuels obtained from atmospheric distilling of oil from 200 to 380 degrees Celsius, are heavier than kerosene and are utilized in diesel engines and other compression–ignition engines.

- Fuel Oil or Heavy Fuels: This is waste from refining oil, which includes all heavy products and is generally used in boilers, power plants and navigation.

- Coke*:* The general term "coke" applies to a solid, non–smelting material with high carbon content, obtained as a result of the destructive distilling of coal, oil and other carbon materials. There are different types of coke that are normally identified by adding the name of the material of origin to the end. Included in this source are oil coke and coke oven coke.

- Electricity: This is energy transmitted by electrons in movement. It includes electric energy generated with any resource, whether primary or secondary, in hydroelectric, thermal, geothermal or nuclear plants.

- Charcoal: This fuel is obtained from the destructive distilling of wood in absence of oxygen, in charcoal plants. This product absorbs humidity rapidly, and often contains 10 to 15 % water, besides 0.5 to 1.0 % hydrogen and 2 to 3 % ash, with lower caloric power of around 6,500 Kcal / Kg. These characteristics may vary according to the quality of the firewood of origin. In some cases it can substitute coke in foundry processes, and be consumed in industries such as brick making, and in the residential sector for cooking.

- Gases (biogas, coke gas, furnace gas, refinery gas): Included in this category are gaseous fuels obtained as by–products of refining activities, coke ovens and blast furnaces. It also includes the gas obtained in bio–digesters.
  - *Refinery Gas:* Non–condensable gas obtained from refining crude oil. Consists primarily of hydrogen, methane and ethane used mostly in refining processes.
  - Blast furnace Gas: Obtained as a by–product of steel production in blast furnaces, being used generally as a fuel for heating purposes in the plant.
  - Coke Oven Gas: The gas obtained as a by–product in the intense heating of coal or coke, with a combination of air and steam, in coke ovens. Composed of carbon monoxide, nitrogen and small amounts of hydrogen and carbon dioxide.
  - Urban Gas: Gas produced by the total carbonization or gasification of petroleum derivatives, with or without enrichment. Used fundamentally for food cooking in households, although it may have some industrial type uses.
  - Biogas The gas, primarily methane, obtained from the anaerobic fermentation of biomass wastes.
  - Other Gases All those not mentioned, having an energy use.

- Other Energy Fuels: All the secondary energy products that have not been included in the above definitions and have a share in the energy structure of a country.

- Non–Energy Products All products that are not used for energy purposes, although they contain a considerable energy content, among which are the asphalts, solvents, naphthas, oils and greases, lubricants, etc.
  - Naphtha: A volatile liquid obtained from processing oil and/or natural gas. Used as a raw material in refineries, as a solvent in manufacturing paints and

varnishes, and as a cleansing agent. Also used in petro chemistry and the production of fertilizers.

6.2.2. Activities

Supply

Production

i. **Primary Energy Production**
All energy, extracted, exploited, harvested, etc., is considered to be of importance to country, and of course that it has been produced within the national territory.

ii. **Secondary Energy Production**
It refers to the amount of energy that is generated from primary energy processing and/or in transformation plants before accounting for self–consumption. If any part of the production is recycled to the same transformation center that it comes from, this should be deducted from production.

All secondary energy production should be accounted at the transformation center where each energy product is produced..

Imports and Exports of Primary and Secondary Products

This explanation is valid for any energy source that can be imported and/or exported. The most common ones that are exchanged among countries are oil, natural gas, coal, nuclear fuel, other primary sources, electricity, liquefied gas, gasoline / alcohol, kerosene / jet fuel, diesel oil, fuel oil, charcoal, non–energy sources, and other secondary products.

i. **Imports**
It includes all primary and secondary energy sources originated outside the borders and that come into the country to be part of the total energy supply system.

ii. **Exports**
It is the amount of primary and secondary energy that a country spends on the foreign trade. Some countries follow the practice of considering the aviation gasoline and jet fuel sold to foreign aircraft, as well as the bunker sold to foreign ships as exports. OLADE does not recommend this procedure, because in order to be consistent, it would have to take what domestic ships and craft load abroad as imports.

According to OLADE's conception, the amount purchased by a consumer within a country is assumed to be part of final consumption although the physical process of consumption may take place in international spaces or waters. The same occurs when a vehicle loads gasoline in one country and then crosses the border consumes it in a neighboring country.

Stock change

Stock change is the difference between initial stocks (at January 1) minus final stocks (at December 31) for a given year, in the storage facilities for different products.

Inventory variation is considered according to its nature. Thus, an inventory increase means a reduction in the total supply and vice–versa.

Unused

This unused energy is the amount of energy that is presently not being used due to the

technical and/or economic feasibility of developing it. Those most commonly dealt with under this heading are:

- Spilled crude oil
- Unused natural gas In countries that are large producers of oil–associated gas, it is common for a large part of that gas to be burned in the open. This is the unused natural gas, and the reasons for its non–use may be:
- Insufficient market
- The market exists, but there is no gas pipeline to transport the gas to the user's doors
- The market and the gas pipeline exist, but oil extraction requires that the amount of gas produced be greater than the demand can use

In any of these cases, unused natural gas represents a waste of an energy product that is highly valued by consumer sectors. Other Unused Primary Energy Sources You should take into account the amounts of "other primary sources" that have been considered as production but that do not reach final consumption.

Transformation Centers

This refers to energy that enters special processors called transformation centers for modification; these centers produce physical or chemical changes from one energy source to another or others, seeking in this way to improve the use of energy.

One of the paths that TOTAL SUPPLY can follow is as feed for transformation centers. In the case of primary energy, the flow is called TRANSFORMATION; if it is secondary, RECYCLING.

Refinery

It is a processing plant where oil is transformed into derivatives. Refineries basically separate crude oil into its different components (Figure No. 4). This methodology will treat all refineries as if they were a single processing unit. Although this representation does not allow you to completely describe the transformation center in terms of refining, or analyze the internal flexibility of each refinery, it suffices to establish the input and output ratios for the balance that proposed herein. There are different types of refineries with different types of processes, which do not always obtain the same products.

Power Plants

Depending on the case, these transformation centers may consist of hydroelectric plants, conventional thermoelectric plants with steam turbines, gas turbines and internal combustion engines, nuclear power plants and geo–thermoelectric plants.

Gas Treatment Center

In treatment plants, natural or associated gas is processed for the primary purpose of recovering compound liquid hydrocarbons such as gasoline and naphthas, pure hydrocarbons such as butane, propane, ethane or a combination thereof, and non–energy products such as carbon through a process of physical separation of gas components.

Charcoal Plants

This is essentially a furnace where partial combustion of firewood is achieved, producing charcoal, non–volatile and volatile products, and generally the latter are not used. Note that wood, in the form of charcoal, has a greater caloric value.

Coke/Blast furnaces

These are found in the foundry industry. Coal is transformed into coke and coke oven gas in the coke oven. The coke then goes to a blast furnace, from which pig iron and blast furnace gas are obtained. Coke ovens for coal treatment produce coke, coke oven gas and non–energy products (benzols, tars, etc.). Part of the coke is obtained in the production of blast furnace gas, and the other part is consumed in the mineral reduction process in the blast furnace.

Distillery

These are centers where mostly sugarcane juice is treated to produce alcohol. Likewise, they include alcohol distilleries that process other raw materials such as beets, cassava, or other products with high starch or cellulose contents.

Other Centers

These may the anaerobic digesters and pyrolysis furnaces, etc., which take farm, animal, forest, Agro-industrial, and urban wastes, plus those from energy plants or any other transformation centers that are included in the country's balance and that are not among the above.

Total Transformation

The total transformation is the sum of both primary and secondary energy for all inputs into transformation centers. When there is no energy source feed to transformation centers, the total is zero.

Note: OLADE's Energy Balance uses the negative sign as a convention for inputs from energy sources to transformation centers to transform them into other energy sources. Inputs for power generation are an example.

Self–Consumption

This is one of the four possible paths for SUPPLY. Self–consumption is the part of primary and secondary energy that the energy sector itself uses for its operations.

Statistical Adjustment

This line serves primarily, in some cases, to make up for differences due to conversion of different sources, from their original measurement units to units that are compatible for preparing the balance; and in other cases to make up for differences that are imperceptible and very difficult to find. In all cases, adjustment should not be greater than 5 % of the total supply.

Adjustment = Domestic Supply – Total Transformation – Losses – Total Final Consumption

6.2.3. Demand

Transportation Sector

The final consumption of a country's transportation sector is the total amount of fuel required to move its vehicle fleet. The modes of transportation may be: a) Highway, b) Railroad, c) Air, d) River, and e) Maritime.

Industrial Sector

An industry is an establishment classified as such in the "large division 3" of the Standard Industrial Classification.

Final consumption of the industrial sector consists of any energy source used in

the processes that are carried out within the limits of the establishment, in which certain raw materials are transformed into final products.

This definition leaves out certain fuels that the industries purchase to facilitate delivery of their products to the market. It is common for certain industries such as beverages to distribute their products using their own vehicle fleet. However, that consumption belongs to the transportation sector.

Sometimes the distinction between industry and agriculture may not be very clear: the recommended criteria to solve doubtful cases is to consider as agricultural all activities carried out within the farm and as industry otherwise.

Residential Sector

The final consumption of this sector pertains to a country's urban and rural households. A household is what the population census defines as such, and there are as many households as the census and derivative mechanisms have determined. It is important to emphasize that the energy balance has no particular definitions for population parameters, and is based on the definitions of available demographic studies, even when those definitions may be or appear incorrect.

Commercial, Service and Public Sectors

The sector information unit is an establishment belonging to one of the following groups from the Standard Industrial Classification:

Div. 4 = Electricity, gas and water; Note: Electricity and gas are not counted here, as they belong to the energy sector (self– consumption), which leaves only water.

Div. 6 = Wholesalers, retailers, restaurants, and hotels.

Div. 7 = Transportation and communications; only business establishments but not vehicle fleets, whether or not they belong to the above.

Div. 8 = Financial establishments (banks), insurance companies, and services provided to other companies.

Div. 9 = Social and community services, such as schools, universities, health, churches, movies, theaters, repair businesses, public administration, defense, etc.

Final consumption for this sector is that of all establishments listed above, provided it is produced within the building where the establishment is located. This excludes vehicle consumption. For a complete description, consult the Standard Industrial Classification (revision 2).

Agriculture, Fishing and Mining Sectors

The informational unit of the farming, fishing and mining sectors is an establishment defined as follows in the Standard Industrial Classification data code:

Div. 11 = Agriculture and hunting

Div. 12 = Forestry and saw mills

Div. 13 = Fishing

Div. 2 = Extraction of minerals and metals

When it is difficult to separate agriculture from agroindustry, fishing from the fishing industry, and mining from metallurgy, the Standard Industrial Classification method supposes that the establishment is classified according to the group that most of its activities fall under. The best recommendation is to adopt the rule followed by the office in charge of developing national accounts.

Construction and Other Sectors

This sector consists of two sub–sectors: Construction and Other Sectors.

Construction includes:

- New buildings and remodeling of old buildings;
- New industrial establishments;
- Civil works, such as bridges, reservoirs, tunnels, etc.;
- New roads and maintenance of the existing road system.

Other Sectors refers to any energy consumer that is not specified in the identified sectors; this item is generally used to complete consumption and as such should not be very large. If it were over 5 % of all final consumption, for example, this would mean that your country's balance is not well disaggregated.

Final Energy Sector Consumption

This refers to the total amount of primary and secondary products used by all the aforementioned consumption sectors to meet their energy needs, and is therefore the sum total of all energy consuming sectors.

Final Non–Energy Consumption

This sector is defined by the consumers that use energy sources as raw material for the manufacture of non–energy source goods. Here are some examples:

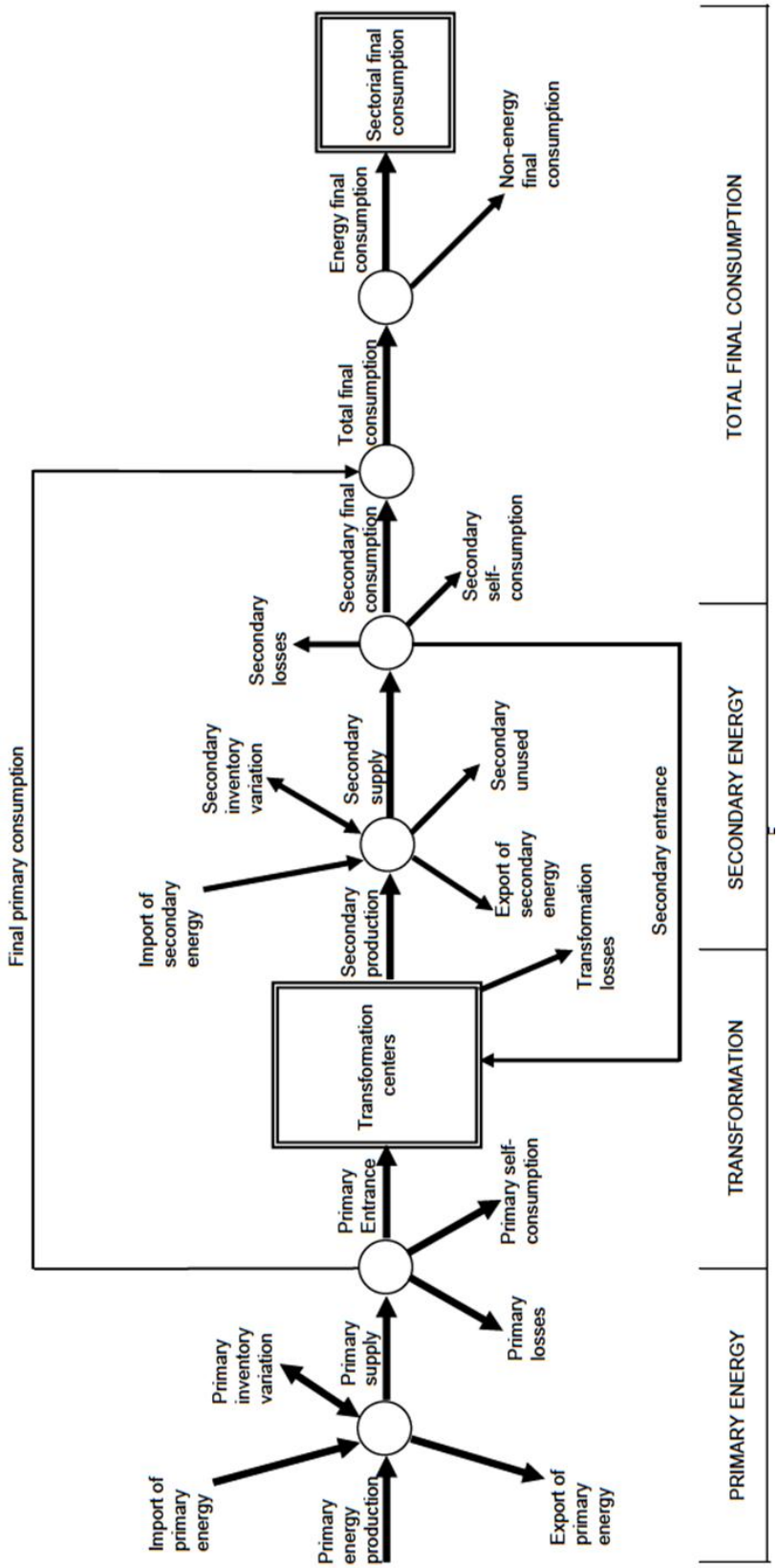
- Natural gas and petroleum derivatives (naphtha, reformatting, refinery gas, etc.), consumed in petro chemistry to make plastics, solvents, polymers, rubber, etc.
- Bagasse for making paper or pressed board
- Animal waste as fertilizers
- Plant wastes as feed for cattle

Total Demand

This is all energy that is delivered to the consumption sectors, both for use as energy sources and as non–energy sources. The sum of all energy consumption (Line No 25) plus non–energy consumption (Line No 26) is the result of this sum

6.3. Energy Chain

Figure 1. Energy Chain



Chapter III. Data Gathering Process

Following OLADE's methodology for Energy Balances, the questionnaires designed for data collection purposes consider the three stages of the energy chain: supply, transformation and consumption.

7. Data collection -

The process of data collection consists of:

a) Characterize the energy sector:
   - Energy sources
   - Energy facilities
   - Energy consumers
   - Key stakeholders

b) Identify the most important sources and data requirements of information that will permit to build the metadata, so as to ensure the transparency, traceability, reliability and replicability of Energy Balance preparation;

c) Design the contact list and agenda for OLADE's technical visit to Saint Vincent and the Grenadines with help of the Focal Point; and,

d) Develop the templates and data collection surveys according to the defined OLADE's methodology for Energy Balances.

7.1. Surveys Description

General Energy Variables

Survey 1. Q1_F03_A&B_2015

Oil and Products (Section 1)

This form enables to collect annual *Oil* data by *Activity* and *Energy Source*. Activities are disaggregated in *Production, Exports, Imports* and *Consumption*, each of which divided into energy sources; *Oil, LPG, Gasoline, Kerosene and Jet Fuel, Diesel Oil* and *Fuel Oil*. Physical units are expressed in barrels (kbbl). *Natural Gas* is disaggregated in *Production* (Without reinjection or flaring), *Flaring* (Burned into the atmosphere), *Exports, Imports* and *Consumption*. In this last case, classification includes *Power generation, Transportation, Residential, Commercial, Industrial, Agriculture, Fishing and Mining* and *Others*. Physical units are expressed in millions of cubic meters (MMm^3).

Other Energy Sources (Section 2)

As in the previous case, *Other Energy Sources* sheet permit to collect data from *Other Energy Sources* and some *relevant activities* as follows: *Coal* (*Production, Exports, Imports* and *Consumption*), *Alcohol* (*Production* and *Consumption*), *Biodiesel* (*Production, Exports, Imports* and *Consumption*), *Firewood* (*Consumption*), *Sugar Cane Products* (*Production* and *Consumption*), and *Agricultural Wastes* (*Production* and *Consumption*). Depending on the type of energy source, physical units are expressed in tones (t), barrels (bbl.) and barrels of oil equivalent (boe).

Electricity (Section 3)

Data collection of annual *Electricity* variables is disaggregated in five activities: *Production, Exports, Imports, Consumption* and *Losses*. In the case of *Production*, the information is classified into two categories: *Public Generation* (By technology: *Hydro, Thermal, Geothermal, Wind, Photovoltaic* and *Nuclear*) and *Self-Producers' Generation* (By technology: *Hydro* and *Thermal*). *Consumption* is divided in economic sectors such as *Transportation, Residential, Commercial, Industrial, Agriculture, Fishing and Mining,* and *Others*. Units are expressed in GWh.

Potential and Storage (Section 4)

This sheet is intended to collect data about *Reserves*, –in the case of *Oil, Natural Gas* and *Coal*; *Capacity*, –in the case of *Alcohol Distillery* and *Biodiesel Plants*; and *Potential*, –in the case of *Electricity* (*Estimated* and *Installed*).

Survey 2. Q2_HC_ A&B_2015

Storage (section 1)

The *Hydrocarbons Survey –HC–* permit to collect information about *Storage Capacity, Supply* and *Sales* of each energy source. In the first case, data include the identification of *Facilities* (name and location), and its *Storage Capacity* reported for each of its energy sources (*Oil, Gasoline, Diesel Oil, Fuel Oil, Kerosene and Jet Fuel, LPG, Asphalts, Lubricants* and *Greases*), expressed in physical units (kbbl).

Supply and Other Variables (section 2)

This section is oriented to determine the amount of *Production, Imports, Exports, Initial/Closing Stocks, Unused* and *Losses* of each energy source previously mentioned, expressed in physical units (kbbl).

Hydrocarbons' Total Sales (section 3)

Section 3 enables to identify *Total Sales* of each energy source, previously mentioned, among different economic sectors, expressed in physical units (kbbl).

Survey 3. Q3_EE_ A&B_2015

This form is designed to identify the general characteristics of the Electricity Sector, including annual key variables such as *Power Plants General Characteristics* including a range of information from the *Name* and *Location* (**section 1**), to *Technology Type*, *Installed Capacity, Plant Factor, Electricity Generation, Fuel Consumption, Own Consumption* and *Losses* (**section 2**). On the other hand, **section 3** refers to *Hydroenergy Technical Specifications* (*Reservoir Name, Capacity* and *Flow*, *Average Flow, Precipitation Flow, Turbine Flow*, among others).

Survey 4. Q4_CTR_ A&B_2015

The CTR Survey allows collecting Transportation Sector characteristics both in general terms like *Added Value* and *Total Fleet* by type of each transportation category (*Road, Sea* and *Air*).At more detailed level, information includes *Consumption* by relevant energy sources and *Characterization of Vehicle Fleet* in *Public* and *Private*(By fossil fuel used), and *Annual Average of Kilometers Travelled* (km/year).

Survey 5. Q5_CIN_ A&B_2015

Characterization of Industrial Sector (section 1)

This Form is oriented to the Industrial Sector and has three sections. This one includes general information such as *Number of Industrial Facilities, Added Value, Production* and *Number of Employees*.

Consumption by Energy Sources (section 2)

This section provides information on Energy Consumption of each industry category (Food products, beverages and tobacco; Textiles and Clothing, Footwear and Leather, Wood and Furniture, among others), by energy source (Electricity – *Purchased* and *Self-Generated*–, *Crude Oil, Gasoline, Diesel Oil, Fuel Oil, Kerosene, LPG, Coke, Charcoal*, *Firewood* and *Others*).

Great Energy Consumers (section 3)

In order to establish a detailed level of data collecting, information is based on a *List of Great Industries*, which include *Facility Name* and *Category of Industrial Subsector, Location, Added Value, Production* and *Number of Employees*.

Self–Generators (section 4)

The *Characterization of Self–Generators* is based on the Inputs used for self – generation: *Hydro*, *Diesel Oil, Fuel Oil, Photovoltaic, Bagasse* and *Others,* and a final column added for *Self–Generated Electricity*.

Survey 6. Q6_CIN2_ A&B_2015

The Form 6 was designed with the purpose to be an *Energy Survey of Industry Sector,* which allows to access key information from *Major Energy Consumers*.

Survey 7. Q7_CCO_ A&B_2015

General Information of the Commercial Sector (section 1)

This form aims to collect information about *General Characteristics of Commercial Sector*, by providing information on *Number of Beds and Rooms, Occupation Factor of Beds and Rooms* and *Added Value.*

Electricity and Fossil Fuel Purchases (section 2)

In that case, it is needed to report the annual Amount (Physical units) and Sales (Currency), made by overall sector for each single energy source(*Diesel Oil, Fuel Oil, Charcoal*, *Firewood, LPG, and subtotal on Electricity Purchased, Self–Generated* and *Others*).

Survey 8. Q8_CCOH_ A&B_2015

The form correspond to the same structure than the described below, but instead of being addressed to the total Commercial Sector it is oriented to each Hotel Facility, constituting on a particular *Energy Survey of Hotel Industry*.

Survey 9. Q9_CCOR_ A&B_2015

The form corresponds to the same structure than the described for the Form 6, but instead of being addressed to the total Commercial Sector it is oriented to each Restaurant Facility, constituting on a particular *Energy Survey of Restaurant Industry*.

Survey 10. Q10_CRW_ A&B_2015

General Information of the Agricultural Sector (section 1)

This form is designed to identify the general characteristics of the Agricultural Sector. Annual key variables include *Added Value, Production*, *Number of Agricultural Production Facilities, Area Harvested* and *Level of Mechanization.*

Consumption by Energy Sources (section 2)

The section provides information on Energy Consumption of each Agriculture category (Crops 1, 2, etc., and Livestock), by energy source (Electricity –*Purchased* and *Self-Generated*–, *Crude Oil, Gasoline, Diesel Oil, Fuel Oil, Kerosene, LPG, Coke, Charcoal*, *Firewood* and *Others*). In Fishing activity, consumption of energy sources are focused on four of them: *Gasoline, Diesel Oil, Electricity* and *Others*.

Characterization of the Level of Mechanization (section 3)

This sheet compiles information on the level of mechanization, typically based on a percentage of the technology involved on agricultural processes such as *Irrigation, Tractors, Harvester and Fumigation,* among others, or a *Global Level*.

Survey 11. Q11_NV_ A&B_2015

Information from the National Variables

This Form corresponds to the compilation of National Variables, related to social and economic data. **Section 1** compiles information about *Information Units* (Hotels, Restaurants, Public Sector and Services), whilst **Section 2** on *Energy Consumption* by energy source.

Survey 12. Q701_CCOSC_A&B_2015

General Information for the Shopping Centers

This questionnaire is designed to identify the main characteristics of shopping centers General Characteristics of the Mall by providing information on the name or company, contact details, and size of Shopping centers among others. It gathers data about energy consumption by each Energy Sources (Electricity, LPG, Diesel Oil, Charcoal, Firewood, Fuel Oil and Others).

Survey 13. Q41_CTR2_A&B_2015

General information from Individual Drivers

It was designed to collect data from individual drivers within the country. It obtains the total kilometers or miles that a common citizen does per day, also the amount of gallons that are pumped to the vehicle, the age of the vehicle, brand and classification. This survey is delivered to public transportation drivers as well.

Chapter IV. Technical Visit

As OLADE experienced some difficulties in order to obtain and gather all of the necessary information that is required to build the Energy Balance, one primary technical visit was held in the country. During this technical visit, held from August 31st to September 4th, 27 institutions were visited, including private and public organizations. Most of the difficulties were related to the lack of relevant information, directly from the main importers and industries and major energy consumers..

Before the technical visit to the country, OLADE researched and performed an analysis of the economy and the energy sector of Antigua and Barbuda. Therefore, by establishing a framework, which became essential to get the required inputs, OLADE obtained the necessary data for every subsector regarding the supply and the demand of energy.

In order to determine the institutions that were necessary to be visited, OLADE prepared a general contact list of 43 institutions from a wide range of selected stakeholders from industry, tourism (hotels and restaurants), agriculture, fisheries, transport, government agencies, private hydrocarbon importers, public utilities, among others. In this sense, only the Antigua Island was visited, due to the fact that all of the vital information, the facilities and the stakeholders, were in this island.

Once the institutions were identified, a pre-analysis of the type of information that could be collected was defined and a specific survey to collect the information was prepared for each case. Once the surveys were delivered to each contact, OLADE visited 27 contacts from the General Contact list, to elaborate the Technical Visit Agenda.

The objective was to interview, in a participative way, the stakeholders in order to obtain the most accurate information possible. Some of the main stakeholders are the West Indies Company, Antigua Public Utility Company, government agencies and the biggest hotels among others.

Each interview was held with the support of the Ministry of Tourism, Economic Development Investment & Energy, Public Works, and Energy & Public Utilities. At each visit, the project was introduced to the stakeholder and each completed survey was pair-reviewed with them, in order to get specific information related to the supply or the demand of energy, on a personal basis. For each day, four to five appointments were scheduled according to the geographical characteristics of the country.

Finally, within all this gathering process, OLADE consolidated crucial information that was found to be relevant to the energy sector and performed its report according to the OLADE´s Energy Balance Methodology.

8. Technical Visit Agenda

N	INSTITUTION	TYPE OF INFORMATION
	Monday, August 31	
1	Minister of Tourism, Economic Development, Investment & Energy:	Q1_F03_A&B_2015 Q7_CCO_ A&B_2015
2	Antigua Public Utility Authority (APUA)	Q3_EE_ A&B_2015
3	Civil Aviation	Q4_CTR_ A&B_2015
4	Minister of Finance, the Economy and Public Administration	Q11_NV_ A&B_2015 Q1_F03_A&B_2015
5	Eastern Caribbean Central Bank	Q11_NV_ A&B_2015
6	Ministry of Public Works	Q4_CTR_ A&B_2015
	Tuesday, September 1	
7	The West Indies Oil Company	Q2_HC_ A&B_2015
8	Transport Board	Q4_CTR_ A&B_2015
9	Ministry of Agriculture	Q10_CRW_ A&B_2015
10	Statistics Division	Q4_CTR_ A&B_2015 Q5_CIN_ A&B_2015 Q6_CIN2_A&B_2015 Q7_CCO_ A&B_2015 Q8_CCOH_ A&B_2015 Q9_CCOR_ A&B_2015 Q10_CRW_ A&B_2015 Q11_NV_ A&B_2015 Q701_CCOSC_A&B_2015
11	Minister of Tourism, Economic Development, Investment & Energy:	Q7_CCO_ A&B_2015
	Wednesday, September 2	
12	Minister of Tourism, Economic Development, Investment & Energy:	Q4_CTR_ A&B_2015
13	APUA	Q3_EE_ A&B_2015
14	Customs	Q1_F03_A&B_2015 Q2_HC_ A&B_2015 Q3_EE_ A&B_2015 Q4_CTR_ A&B_2015
15	PDV Caribe	Q1_F03_A&B_2015 Q2_HC_ A&B_2015
16	Rubis	Q1_F03_A&B_2015 Q2_HC_ A&B_2015
	Thirsday, September 3	
17	Antigua Hotels & Tourist Association - AH&TA	Q7_CCO_ A&B_2015
18	Sandals Hotel	Q8_CCOH_ A&B_2015 Q9_CCOR_ A&B_2015
19	Antigua Brewery Limited	Q6_CIN2_A&B_2015
21	Derrick VA Lubricants	Q1_F03_A&B_2015
20	G I O Distribution & Supplies Ltd	Q2_HC_ A&B_2015
	Friday, September 4	
22	Themba Biofuels	Q1_F03_A&B_2015
23	Motor Pool	Q4_CTR_ A&B_2015
24	Epicurean Supermarket	Q701_CCOSC_A&B_2015
25	Ministry of Public Works	Q4_CTR_ A&B_2015
27	Woods Mall	Q701_CCOSC_A&B_2015

Table 9. Antigua and Barbuda Technical Visit Agenda 2015

8.1. Developed Activities

- In every visit to each stakeholder, a brief explanation of the objective of the project was presented, as well as the importance of the final results to Barbuda and Antigua.

- Hydrocarbon, electricity and renewable energy sector institutions responsible for policies, regulations, prices, production, trade, distribution or supply, were visited.

- The Statistic department of Antigua and Barbuda was visited in order to get information of the residential sector, related to the number of households in the country, the type of dwelling as well as the specific fuel used for cooking and lightning.

- In order to get information of the transport sector, in accordance with statistic department, OLADE visited the licensing authority in order to obtain the number of vehicles and their characteristics for the years 2010-2012. OLADE also visited the maritime terminal, to obtain information about the fuel consumption of this type of transportation.

- Technical visits were made to the institutions that provided information on GDP, agriculture, fishing, industrial, wholesale and retail establishments, hotels, restaurants, among others.

As a result of the Technical Visit, OLADE elaborated two-flow matrix. The first energy flow matrix contains the relationship between the energy sources and activities performed in the country.

PARAMETERIZATION OF THE ENERGY INFORMATION SYSTEM OF ANTIGUA & BARBUDA
DEFINITION OF THE ENERGY BALANCE MATRIX

Updated: August, 2015

								Petroleum and Natural Gas Products						
		Firewood	Wind	Solar	Sugarcane Products	Electricity	LPG	Gasolines	Kerosene & Jet Fuel	Diesel Oil	Fuel Oil	Charcoal	Non Energy Products
		Unit:	Unit:	Unit:	Unit:	Unit:	Unit:	Unit:	Unit:	Unit:	Unit:	Unit:	Unit:
		kt	GWh	GWh	GWh	KWh	Kbbl	Kbbl	Kbbl	Kbbl	Kbbl	kt	Kboe
Production													
Imports													
Exports													
Unused													
Stock Change													
Bunker													
Transfers													
Refinery													
Power Plants	Thermal												
	Hydro												
	Geothermal												
Self- producers													
Charcoal Plant													
Gas Plant													
Transport sector													
Industrial sector													
Residential sector													
Commercial, Services and Public													
Farming, Forestry and Fishing													
Mining and Quarring													
Construction sector and Others													
Non Energy Consumption													
Own Consumption													
Losses													

Table 10. Parameterization of the Energy Balance Variables

The second energy flow matrix identifies the information units or data providers' relationship with the energy sources that they are involved with.

PARAMETERIZATION OF THE ENERGY INFORMATION SYSTEM OF ANTIGUA & BARBUDA

DEFINITION OF TYPE OF INFORMATION UNITS, INFORMATION UNITS, PROFILES AND USERS

September, 2015

		STAKEHOLDERS SUPPLY										
	FUELS	WIOC	PDV Caribe	Rubis	Carib LPG Trading	Themba Biofuels	Abeetee Limited	GIO Dist & Supply	Derrick VA	APUA	APC	RENEWABLES
1	SOLAR											
2	LPG											
3	JET FUEL & KERO											
4	GASOLINE											
5	NATURAL GAS											
6	DIESEL OIL											
7	FUEL OIL											
8	NON ENERGY PRODUCTS (Asphalt, Lubricants, etc)											
9	BIO DIESEL											

Table 11. *Energy Sources and Stakeholders Identification*

8.2. Additional results of the technical visit:

- As OLADE introduced the project to the decision makers in the energy sector, the Government of Antigua and Barbuda recognized the importance of the data gathering process and the benefits of having accurate Energy Balances and GHG Emissions inventory for policy making in the energy sector.

- The contacts that were visited understood the importance of having specific sector information to elaborate the Energy Balance.

- Twenty seven public and private institutions were visited and data collection surveys were performed by most of them.

- Additional information and documentation related to the supply and demand of energy was obtained from other institutions, including the Ministry of Tourism, Economic Development, Investment & Energy.

- A technical inventory of the power plants and fuel storage facilities were obtained directly from the hydrocarbon importers as well as from the Electricity public utilities.

- The macro energy consumers in each sub sector (residential, commercial, manufacture, agriculture, fishing, transport, tourism, electricity) were identified and their consumption was calculated for the three years.

- Fuel consumption of the sea transport sector was estimated with important information obtained directly from the fisheries and the maritime authority.

- The use of charcoal and Firewood were estimated for the years 2010-2012 based on the information provided by the Statistics Department on national census, showing a minimal usage of this resource, due to the increasing participation of LGP for cooking purposes.

8.3 Data processing

During the process of gathering information, OLADE had the opportunity to obtain information related to the supply, demand and transformation processes that are needed to build the Energy Balance (EB) of Antigua and Barbuda. The information available to calculate the EB was the following:

- The major oil company and solely importer of hydrocarbons was the West Indies Oil Company who filled out specific hydrocarbons questionnaires. There are a few small enterprises that, distribute and store gasoline, diesel oil, LPG, jet fuel/kerosene and non-energy products. This information was reviewed by Ministry of Tourism, Economic Development Investment & Energy to crosscheck with the official import values of both the Antigua and Barbuda islands. Finally, with this information, it was possible to determine the final consumption of the different sectors (residential, commercial, industrial, agricultural, mining, electricity generation and gas stations) by the use of each energy source;

- Additional information on supply, transformation and consumption of electricity came from the National Energy Policy 2010 and also from the questionnaires related to the electricity information of the years 2010 – 2012 filled by The Antigua Public Utilities Authority (APUA);

- Residential consumption of firewood and charcoal was calculated according to the information provided by the Statistics and Census Department and also estimated on the basis of OLADE's residential consumption model, using data about population and housing distribution, family size and living arrangements and housing statistics (lighting and cooking), contained in population censuses published by the Central Statistics Office;

- Energy consumption in the transport sector was calculated using the number of vehicles and vessels registered in the country with the information provided by the importers in terms of the total sales of the fuel stations and also the storage tanks for filling the sea transportation. OLADE have also provided individual questionnaires to citizens, including taxi drivers and official Government vehicles. With these questionnaires, it was possible to obtain information related to the vehicle transportation in terms of the type of vehicle, the fuel that it is used and their distance in annual basis.

- To calculate the consumption in different sectors and economic activities, OLADE has also provided specific questionnaires to each of those sectors. The industry sector, commercial & public services, the agriculture, fishing and mining and the construction were asked about their energy consumption in terms of electricity consumption, fuels used and size of each enterprise (hotels, restaurants, industries, and commercial businesses).

Chapter V. Energy Balance Processing

9. Energy Balance of Antigua & Barbuda

9.1. Energy Balance sheets

All the data that was gathered during the first technical visit, later on were processed per each Energy Source and located in each one of the following tables that are divided into: Energy Balance Main Sheet, Main Supply Sheet, Main Transformation Sheet, Main Consumption Sheet, and the Auxiliary Sheets.

Main Balance Sheet

It registers horizontal subtotals of the matrix of Energy Balance.

MAIN FORM: BALANCE						
SOURCE		UNIT	kt	COUNTRY		
YEAR	1 TOTAL SUPPLY	2 TOTAL TRANSFORMATION	3 OWN CONSUMPTION	4 LOSSES	5 FINAL CONSUMPTION	1-2-3-4-5 ADJUSTMENT
2005	-	-			-	-
2006	-	-			-	-
2007	-	-			-	-
2008	-	-			-	-
2009	-	-			-	-
2010	-	-			-	-
2011	-	-			-	-
2012	-	-			-	-
2013	-	-			-	-

Table 12. Main Energy Balance Sheet

Main Supply Sheet

Considers the internal energy supply flows formed by: Production, Import, Export, Stock Changes and Unused.

MAIN FORM: SUPPLY						
SOURCE	LPG	UNIT	kbbl	COUNTRY	SAINT VINCENT AND THE GRENADINES	
YEAR	1 PRODUCTION	2 IMPORTS	3 EXPORTS	4 STOCK CHANGE	5 UNUSED	1+2-3+4-5 TOTAL SUPPLY
2005						-
2006						-
2007						-
2008						-
2009						-
2010						-
2011						-
2012						-
2013						-

Table 13. Main Energy Balance Sheet

Main Transformation Sheet

The sheet registers data about loads and production coming from processing centers, such as refineries, power plants,–or self-producers–, gas plants, Charcoal plants, cookeries and distilleries.

MAIN FORM: TRANSFORMATION										
SOURCE	Charcoal	UNIT	kt	COUNTRY						
YEAR	1 REFINERIES	2 POWER PLANTS	3 SELF PRODUCERS	4 GAS PLANTS	5 CHARCOAL PLANTS	6 COKE PLANTS / BLAST FURNACE	7 DISTILLERY	8 OTHER PLANTS	TOTAL TRANSFORMATION	TOTAL PRODUCTION
2005										
2006										
2007										
2008										
2009										
2010										
2011										
2012										
2013										

Table14. Main Transformation Sheet

Main Consumption Sheet

It aims to register the final energy consumption in economic sectors: Industry, Transportation, Residential, Commercial, Public and Services, Agriculture, Fishing and Mining, and Construction and Others.

MAIN FORM: FINAL CONSUMPTION								
SOURCE	Charcoal	UNIT	kt	COUNTRY				
YEAR	1 TRANSPORT	2 INDUSTRY	3 RESIDENTIAL	4 COMMERCIAL	5 FARMMING, FISHING AND MINING	6 CONSTRUCTION OTHERS	7 NON ENERGY CONSUMTION	1+2+3+4+5+6+7 FINAL CONSUMPTION
2005								-
2006								-
2007								-
2008								-
2009								-
2010								-
2011								-
2012								-
2013								-

Table15. Main Consumption Sheet

Auxiliary Sheet

This form is designed to consolidate data from previous forms when information is available at a more disaggregated level.

AUXILIARY WORKSHEET:								
SOURCE	-	UNIT		COUNTRY	-			
YEAR	1	2	3	4	5	6	7	TOTAL
2005								
2006								
2007								
2008								
2009								
2010								
2011								
2012								
2013								
2014								

Table16. Main Auxiliary Sheets

9.2. Results of the Antigua & Barbuda Energy Balances 2010-2012

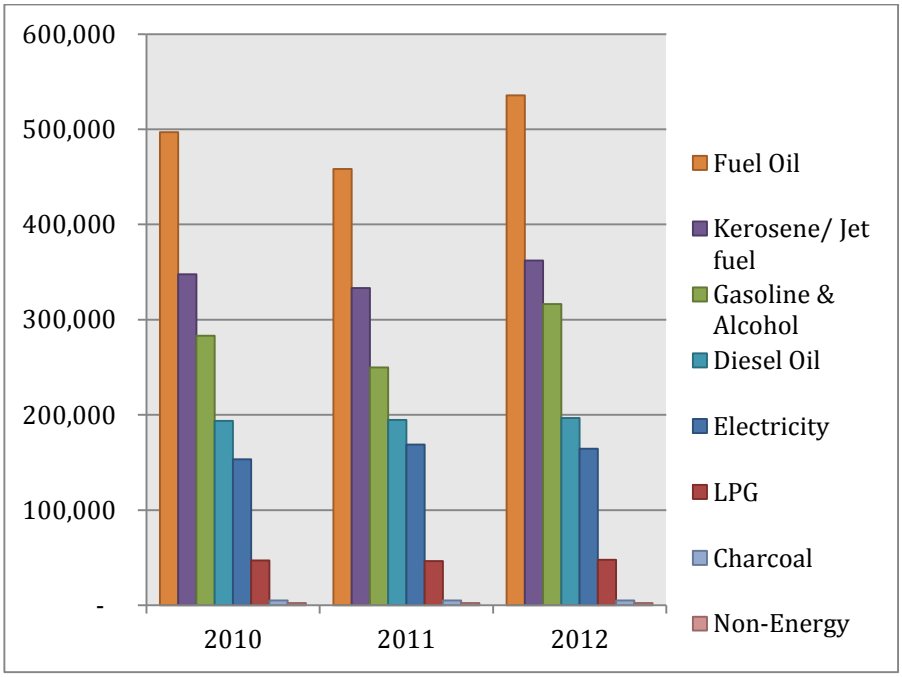
The Energy Balances of Antigua & Barbuda allowed the elaboration of a wide range of analyses, graphs and tables in which it is possible to appreciate key energy inputs. Such inputs were obtained by applying the methodology in a consistent matter. This lead to the creation of a solid platform for designing, evaluating and understanding the processes in this specific sector.

As seen in the Energy Balance 2010 – 2012 (from page. 57-62), the country is a net importer of energy. The total energy supply was based on imports of fossil fuels, especially Jet fuel/kerosene, diesel oil, fuel oil, gasoline/alcohol and LPG.

Supply

Energy Imports and total supply

According to the results obtained from the Energy Balance of Antigua & Barbuda (2010-2012), basically the country relies almost a 99% on secondary energy sources and less than 1% on primary energy sources, which are all imports The units of those secondary sources have been transformed into calorific units (kBoe), in order to standardize the information and for consistent analysis in a percentage basis. The following results were obtained:



Graph 3. Secondary Energy Matrix

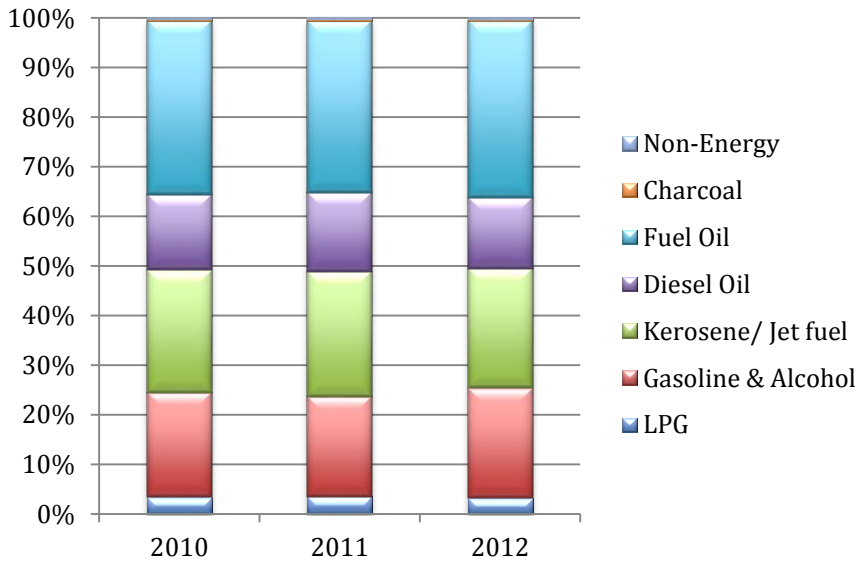
Source: Antigua & Barbuda Energy Balances 2010 – 2012

As Graph 3 shows, Fuel oil, primary used for electricity production, had a major participation in the secondary energy matrix of the country, with an average of 32,29 % of the supply and an average of 496,99 kBoe in the 2010-2012 period. The second most used energy source is Jet Fuel/Kerosene which accounts an average of 22,59 % of participation with 347,66 kBoe. Generally, countries with similar characteristics would not have such levels of Jet Fuel/Kerosene consumption. Therefore, this trend is further

analyzed into more detail in the sections below. Gasoline accounts an average of 18,39% of the energy matrix and 283,09 kBoe. Then, followed by Diesel Oil with an average of 12,67% and 195,00 kBoe along with Electricity, with 10,53 % and 162,16 kBoe participation. The rest of the participation is divided between LPG, Non Energy products and Charcoal.

In terms of the primary sources of energy, the only source used during this period was firewood with a 1,73 kBoe.

Based on the information reveled by this study, we can determine that the country relies entirely on hydrocarbon imports. In terms of the exports, during the 2010 to 2012 period, in which this study was conducted, an average of 18.000 Gasoline barrels and 19.000 Diesel Barrels were exported. Therefore, in this case the imports less exports equal the secondary energy sources without the electricity, since it is generated within the country. As shown in Graph 4, Fuel Oil is the largest energy source, which is almost entirely used for electricity generation.

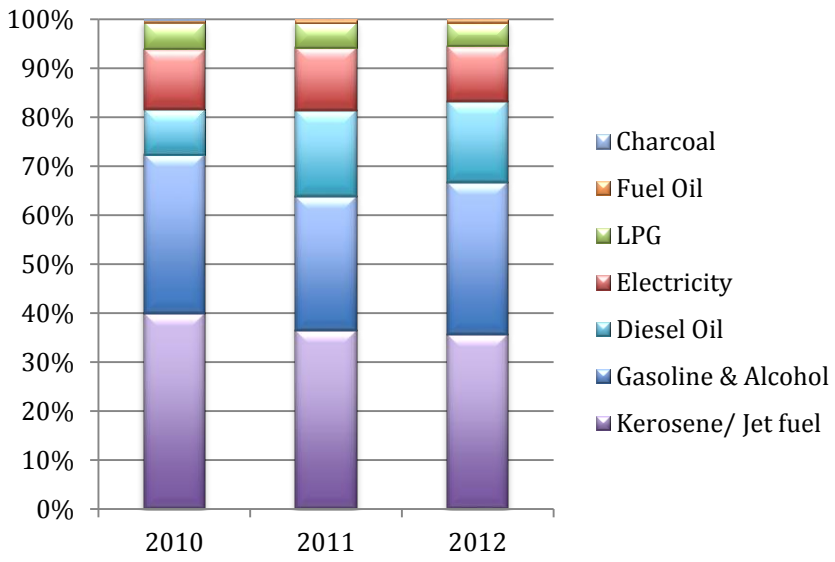


Graph 4. Imports by Energy Source
Source: Antigua & Barbuda Energy Balances 2010 – 2012

Consumption

Final Consumption

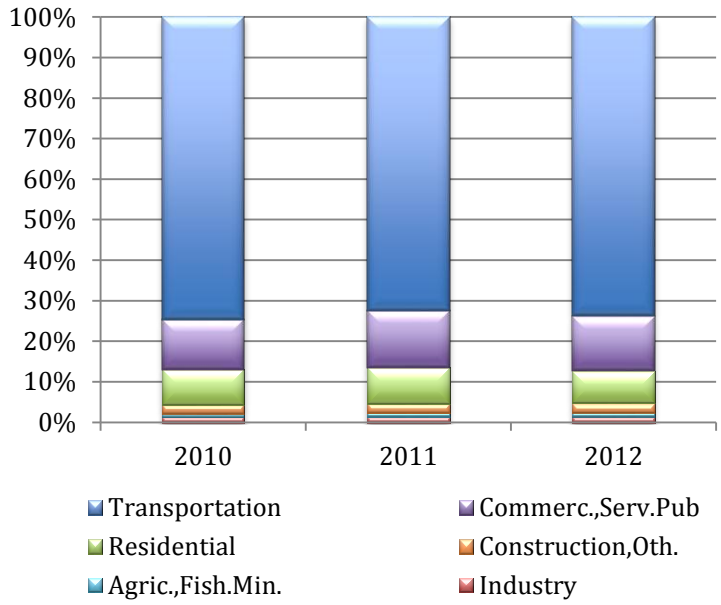
According with the current results, as Graph 5 shows, Jet Fuel/Kerosene has the largest share in terms of energy consumed from the total amount of energy used in the country. Jet Fuel/Kerosene had an average share of 37,4 % and it is followed very closely by Gasoline with 29,1 % for the years 2010-2012. Diesel Oil had an important share with a 13,5% participation, followed by electricity with a 11 % share. The smallest share of the energy consumed is divided between LPG, Fuel Oil Firewood and Charcoal.



Graph 5. Final Consumption

Source: Antigua & Barbuda Energy Balances 2010 – 2012

According to the results of the Energy Balance of Antigua And Barbuda, the final consumption of each energy source varies depending on the specific activity. Therefore, there are some activities that we can determine as major players in the consumption matrix of the country, which will be further explained in this section of the report.



Graph 6. Consumption by Economic Activity

Source: Antigua & Barbuda Energy Balances 2010 – 2012

In order to have a more detailed understanding of the energy consumption of Antigua and Barbuda, it is imperative to dissect the data by economic activity. Graph 6 shows, that the sector that consumed most energy was transport, which accounted an average of 73,58% of the total share and 691,63 kBoe, for the 2010-2012 period. This is a general trend among most nations since transportation is one of the most energy intense activities. This sector is followed by the commercial and public services sector which is related to the tourism sector with a 13,38 % share and 125,76 kBoe. This is due to the

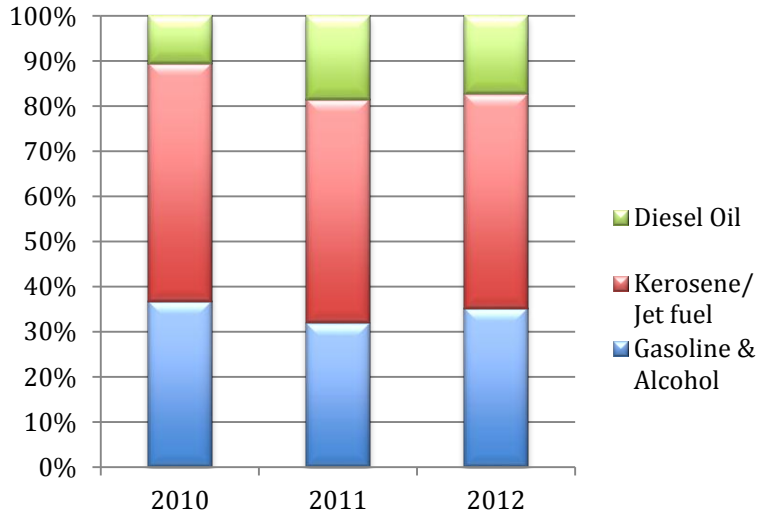
fact that Antigua and Barbuda economy is disproportionally dominated by the tourist sector.

The residential sector is the next economic sector that consumed an average of 8,49% of the total of the energy consumed in Antigua and Barbuda with 79,78 kBoe. The rest of the energy is consumed by the construction (2,20 %) sector along with the industry (1,44 %) and the agriculture and fishing (0,92 %) sectors.

Transport sector

According to the results of the Energy Balance of Antigua and Barbuda, the transport sector represents the major consumption of energy. According to the official records held at the Department of Transport of both islands, there were 27.381 registered in 2011. Approximately, around 60% of those vehicles used Gasoline.

By 2010, Antigua and Barbuda had about 1.165 km of roads, of which 384 km were paved; the main roads circle each island. From the total of vehicles registered for 2011, 10.974 were in the category of motorcars, such as private cars, taxi cars, taxi SUVs, rental cars and pick-ups. The rest of the vehicle fleet comprises by: two wheel vehicles (251), Mini buses and Vans (1942), Trucks (1097), Buses (1181) and others (367). In Graph 11 we can appreciate the different use of each fuel in the transport sector.



Graph 7. Fuel used in the Transport sector

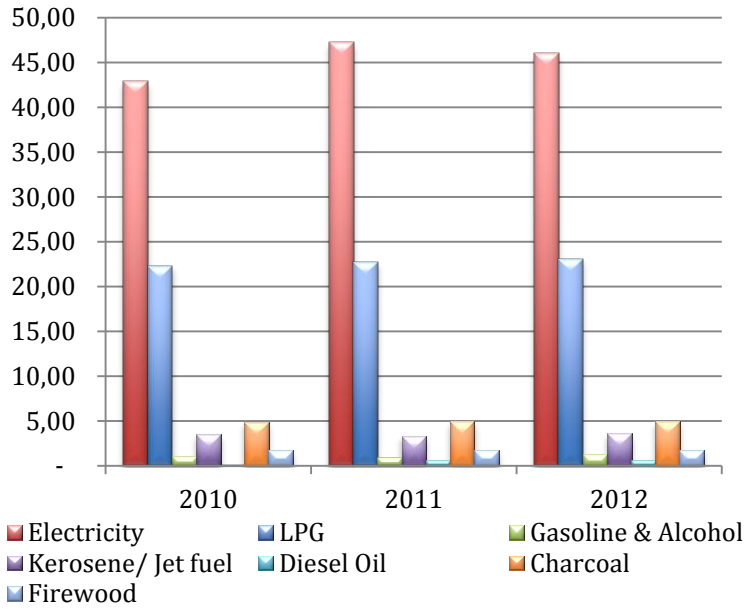
Source: Antigua & Barbuda Energy Balances 2010 – 2012

As Graph 7 shows, Kerosene/Jet Fuel is used in an average of 45% in the Transport sector due to airlines commercial activities. Gasoline follows this fuel with a share of 35% and Diesel oil fuel with a share of 20%. Most of the land vehicle fleet used gasoline during the years 2010-2012.In terms of the consumption of Jet Fuel, in the case of Antigua is highly disproportional given that serves as fueling center for LIAT and other airlines. Given that most of the Jet Fuel consumption takes place off Antigua and Barbuda´s airspace, emission produced by this economic activity should be accounted as bunker and not accounted as part of the total country emissions.

Residential Consumption

As Graph 8 shows, the Residential sector consumption is mainly composed by two sources of energy. Electricity is the most relevant source, which is primarily used for

Lighting. Furthermore, LPG accounts for the second most used energy source, which is almost solely used for cooking purposes. Other energy sources are used in very low amounts for cooking purposes or to run small back-up, diesel or gasoline, electricity generators. Electricity represents an average of 61,5% of the residential consumption matrix, followed by LPG with 25.6 % for the years 2010-2012.



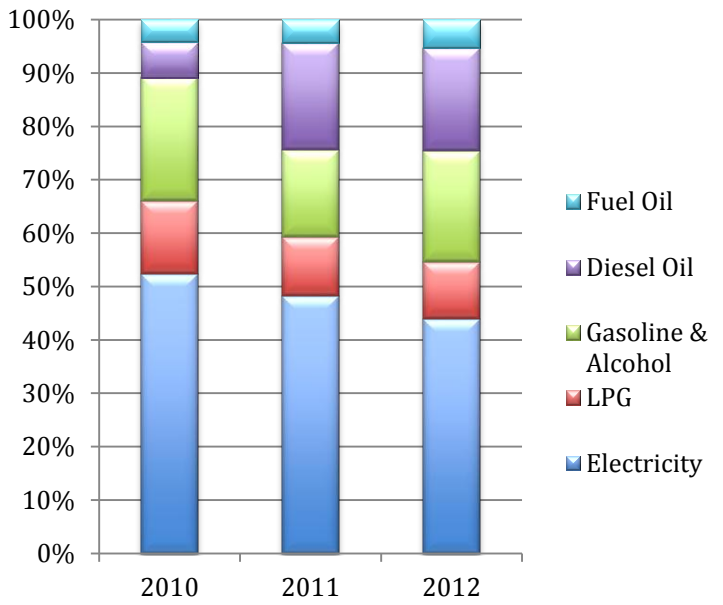
Graph 8. Energy Source used in the Residential sector

Source: Antigua & Barbuda Energy Balances 2010 – 2012

Commercial and Public Services

The commercial sector is the largest energy consumer in Antigua and Barbuda. It consists mainly in tourism services, restaurants, businesses and government consumption. Electricity is the largest energy source since it is an energy intense economic activity.

Electricity accounts an average of 46.7% in terms of the total energy consumptions in this sector. Gasoline and Diesel Oil represent a share of 16.5% and 11.2% respectively. Both energy sources are mainly used to power small medium in-house electricity generators. This is a common practice in large touristic installations where they are used as back-up power and for support generation.

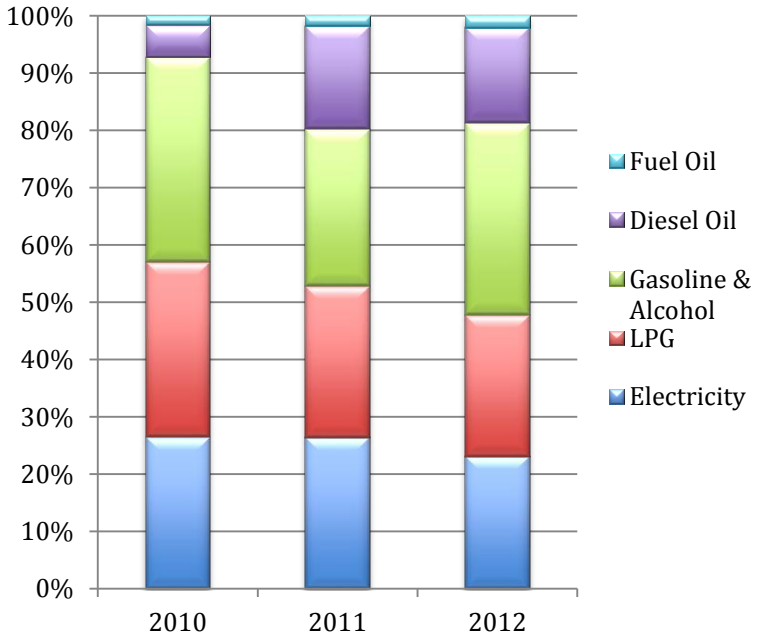


Graph 9. Sources used at the Commercial and Public services sector

Source: Antigua & Barbuda Energy Balances 2010 – 2012

Industry

Compared with the rest of the OECS countries, Antigua & Barbuda has a small industrial sector. This sector mainly consumes Electricity, Gasoline, LPG and Diesel oil. As Graph 10 shows, Electricity represents an average of 30.5% participation. LPG, Gasoline and Diesel Oil accounted for a 21%, 27.4% and 15.7% participation respectively.

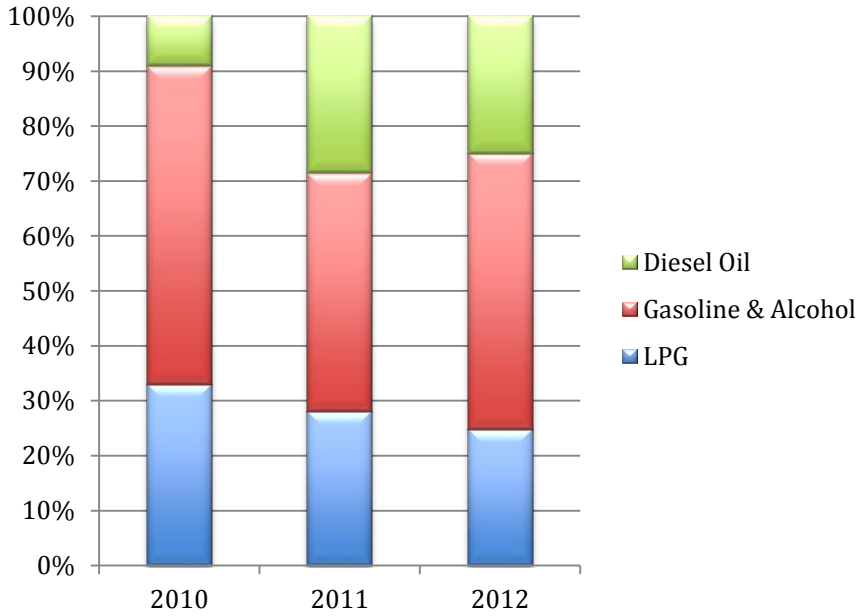


Graph 10. Sources used at the Industry sector

Source: Antigua & Barbuda Energy Balances 2010 – 2012

Agriculture, Fishing and Mining

In terms of the relevance as an economic activity and energy consumer, the Agriculture, Fishing and Mining sector represents a very small share. Energy sources consumption were estimated using several industrial benchmarks and economic indicators. Given the small size of the industrial sector, information was not fully available. Estimates are presented in Graph 11. Gasoline represents an average of 54.5% participation. LPG, and Diesel Oil accounted for a 26%, and 20% respectively.

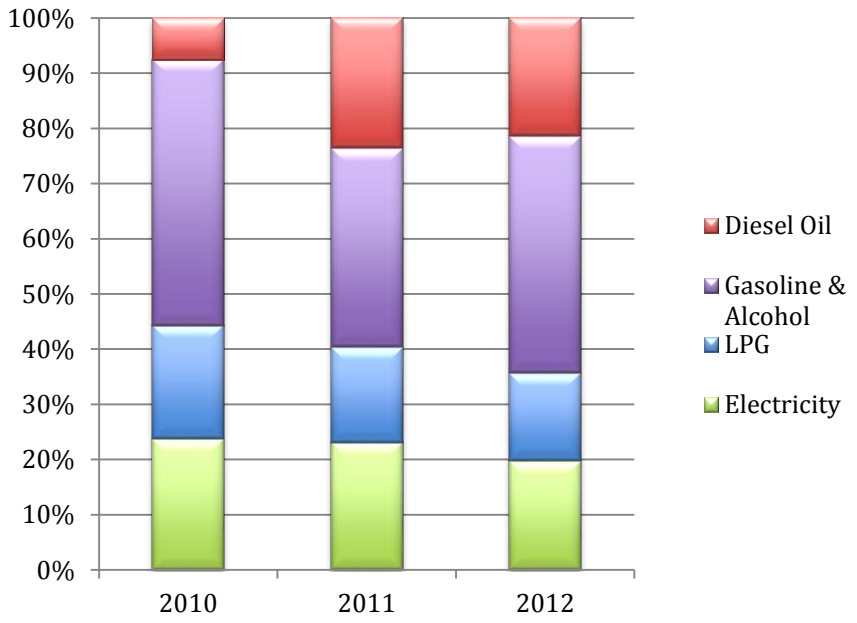


Graph 11. Sources used at the Agriculture & Fishing sector

Source: Antigua & Barbuda Energy Balances 2010 – 2012

Construction & others

The construction sector has experience an expansion as an economic activity due to its direct relation with the tourism sector. Graph 12, represents the sources of energy as a share of the total consumption in the construction sector. It is important to notice that this sector also consumed asphalts, which are listed into the Non-Energy Products.



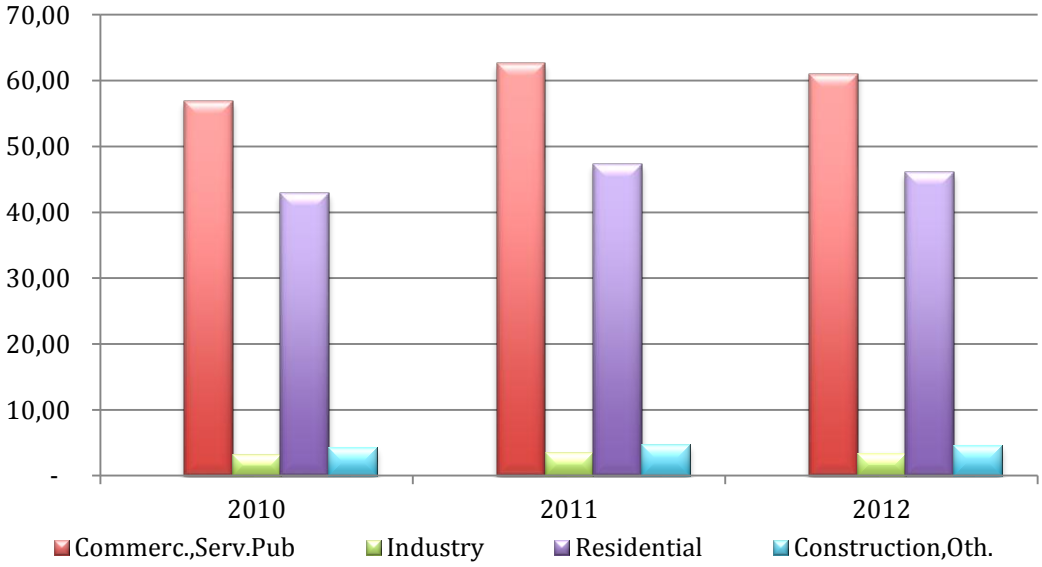
Graph 12. Fuel used at the Construction & Others sector

Source: Antigua & Barbuda Energy Balances 2010 – 2012

As Graph 12 shows, Electricity represents an average share of 21.5 %. LPG, Gasoline and Diesel Oil accounted for a 16%, 40.5% and 22 % respectively. Diesel consumption increase during this period, which replaced partially gasoline imports.

Electricity consumption

In Antigua & Barbuda, the commercial and public services, is the sector that consumed the most electricity generated, followed very closely by the residential sector. This pattern is very common in non-industrialized nations. According to the results of the Energy Balance for 2010-2012 periods, the commercial and public services sector consumed around 53% of the total electricity generated. As Graph 13 shows, the residential sector represented 40% of the total electricity consumption, Industry and the construction sectors consumed 3% and 5% of the electricity produced respectively.



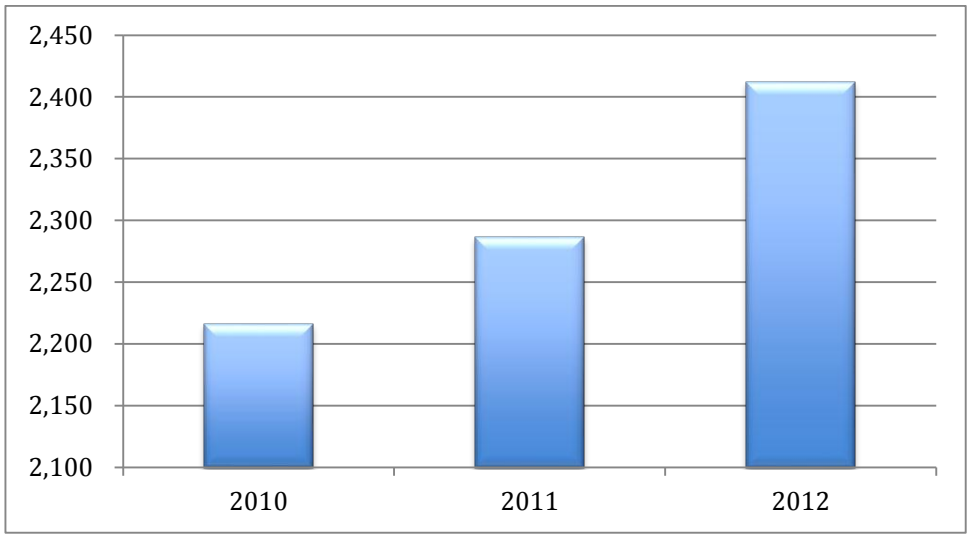
Graph 13. Electricity consumption by each sector

Source: Antigua & Barbuda Energy Balances 2010 – 2012

The share of electricity consumed by each sector, from the period 2010 to 2012, did not vary extensively.

Non Energy Product consumption

Regarding the consumption of the non-energy products, which comprises lubricants and asphalts, there have not been any significant variations . The consumption of non-energy products have increased during this period of time. However changes are minimal. As Graph 14 shows, in 2010 the country consumed an amount of 2,2 kBoe. In 2011, 2,2 kBoe was consumer and in 2012 consumption was 2,4 kBoe. The slight increase of non-energy products consumption is due to the increase of motor vehicles therefore the consumption of lubricants,

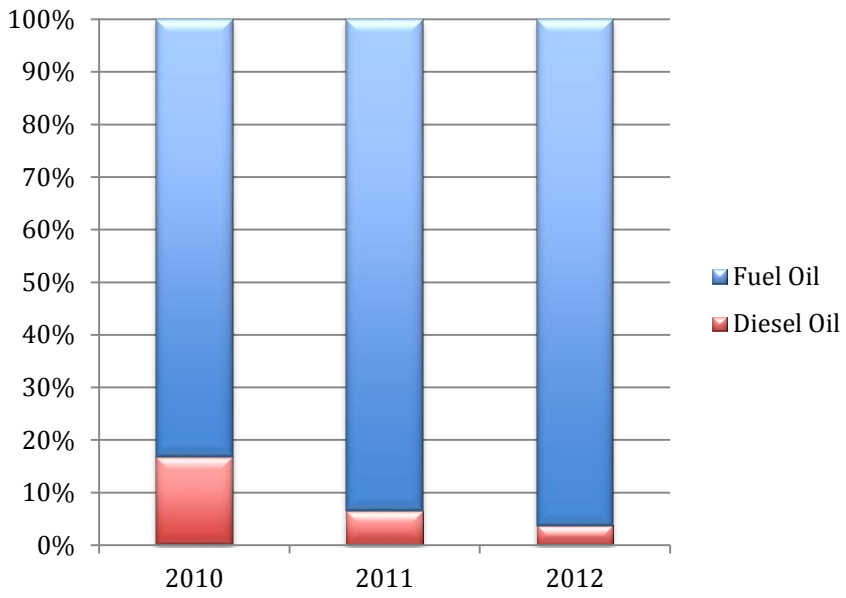


Graph 14. Supply of Non energy products

Source: Antigua & Barbuda Energy Balances 2010 – 2012

Electricity Generation

Antigua & Barbuda solely used Fuel oil and Diesel Oil as fuels for electricity generation. Fuel Oil accounted about 93% of the fuel used and Diesel Oil 7 %. This is a normal tendency in countries like Antigua and Barbuda where the Energy matrix entirely relies on fossil fuels for electricity production. However, the government is strongly encouraging to diversify its energy matrix towards implementation of renewable energy as a primary energy sources.



Graph 15. Sources for Electricity Generation

Source: Antigua & Barbuda Energy Balances 2010 – 2012

Energy Balance 2012
Physical units

	ACTIVITY			SECONDARY							
		FIREWOOD	OTHER PRIMARIES	ELECTRICITY	LPG	GASOLINE ALCOHOL	JET FUEL KEROSENE	DIESEL OIL	FUEL OIL	CHARCOAL	NON-ENERGY PRODUCTS
		kt	Kboe	GWh	kbbl	kbbl	kbbl	kbbl	kbbl	kt	kBep
SUPPLY	PRODUCTION	0,668	0,000	265,481						0,100	
	IMPORT				71,299	372,599	377,825	215,078	519,750	0,902	2,412
	EXPORT					-18,410		-18,750			
	INVENTORIES										
	UNUSED										
TOTAL	SUPPLY	0,668	0,000	265,481	71,299	354,189	377,825	196,328	519,750	1,002	2,412
TRANSFORMATION	REFINERY										
	POWER PLANTS		0,000	250,414				-19,545	-489,786		
	SELF PRODUCERS		0,000	15,067				-8,684	-22,473		
	GAS TREATM.PLANT										
	CHARCOAL PLANT									0,100	
	COKE/BLAST FURNAC										
	DISTILLERY										
	OTHER CENTERS										
TOTAL	TRANSFORMATION	0,000	0,000	0,000	0,000	0,000	0,000	-28,228	-512,259	0,000	0,000
END CONSUMPTION	OWN CONSUMPTION										
	LOSSES			79,644							
	ADJUSTMENT	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	TRANSPORTATION					298,079	374,047	130,730			
	INDUSTRY			5,575	5,528	5,611		2,491	0,300		
	RESIDENTIAL	0,668		74,335	34,443	1,403	3,778	0,623		1,002	
	COMMERC.,SERV.PUB			98,493	22,114	32,263		26,782	7,191		
	AGRIC.,FISH.MIN.				3,686	5,611		2,491			
	CONSTRUCTION,OTH.			7,433	5,528	11,222		4,983			
CONSUMPTION	ENERGY SOURCE	0,668	0,000	185,837	71,299	354,189	377,825	168,100	7,491	1,002	0,000
	NON ENERGY CONSUM										2,412
CONSUMPTION	FINAL	0,668	0,000	185,837	71,299	354,189	377,825	168,100	7,491	1,002	2,412

Table 17. Antigua & Barbuda Energy Balance 2012 (Physical units)

Calorific units (kBoe)

					SECONDARY									
	ACTIVITY	FIREWOOD	OTHER PRIMARIES	TOTAL PRIMARY	ELECTRICITY	LPG	GASOLINE ALCOHOL	JET FUEL KEROSENE	DIESEL OIL	FUEL OIL	CHARCOAL	NON-ENERGY	TOTAL SECONDARY	TOTAL
SUPPLY	PRODUCTION	1,732	0,000	**1,732**	164,492						0,497		**164,989**	**166,721**
	IMPORT					47,777	332,880	362,070	215,401	535,551	4,482	2,412	**1500,572**	**1500,572**
	EXPORT						-16,447		-18,778				**-35,226**	**-35,226**
	INVENTORIES												**0,000**	**0,000**
	UNUSED												**0,000**	**0,000**
TOTAL	SUPPLY	**1,732**	**0,000**	**1,732**	**164,492**	**47,777**	**316,432**	**362,070**	**196,623**	**535,551**	**4,979**	**2,412**	1630,336	1632,068
TRANSFORMATION	REFINERY												**0,000**	**0,000**
	POWER PLANTS				155,156				-19,574	-504,675			**-369,093**	**-369,093**
	SELF PRODUCERS				9,336				-8,697	-23,156			**-22,517**	**-22,517**
	GAS TREATM.PLANT												**0,000**	**0,000**
	CHARCOAL PLANT										0,497		**0,497**	**0,497**
	COKE/BLAST FURNAC												**0,000**	**0,000**
	DISTILLERY												**0,000**	**0,000**
	OTHER CENTERS												**0,000**	**0,000**
TOTAL	TRANSFORMATION	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**-28,270**	**-527,832**	**0,000**	**0,000**	-556,102	-556,102
END CONSUMPTION	OWN CONSUMPTION												**0,000**	**0,000**
	LOSSES				49,348								**49,348**	**49,348**
	ADJUSTMENT	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
	TRANSPORTATION						**266,304**	**358,449**	**130,926**				**755,679**	**755,679**
	INDUSTRY				**3,454**	**3,705**	**5,013**		**2,495**	**0,309**			**14,976**	**14,976**
	RESIDENTIAL	**1,732**		**1,732**	**46,058**	**23,080**	**1,253**	**3,621**	**0,624**		**4,979**		**79,615**	**81,347**
	COMMERC.,SERV.PUB				**61,027**	**14,818**	**28,824**		**26,822**	**7,410**			**138,901**	**138,901**
	AGRIC.,FISH.MIN.					**2,470**	**5,013**		**2,495**				**9,978**	**9,978**
	CONSTRUCTION,OTH.				**4,606**	**3,705**	**10,026**		**4,990**				**23,326**	**23,326**
CONSUMPTION	ENERGY SOURCE	**1,732**	**0,000**	**1,732**	**115,144**	**47,777**	**316,432**	**362,070**	**168,352**	**7,719**	**4,979**	**0,000**	1022,474	1024,206
	NON ENERGY CONSUM											2,412	**2,412**	**2,412**
CONSUMPTION	FINAL	**1,732**	**0,000**	**1,732**	**115,144**	**47,777**	**316,432**	**362,070**	**168,352**	**7,719**	**4,979**	**2,412**	1024,886	1026,618

Table 18. Antigua & Barbuda Energy Balance 2012 (Calorific units)

Energy Balance – 2011

Physical units

	ACTIVITY			SECONDARY							
		FIREWOOD	OTHER PRIMARIES	ELECTRICITY	LPG	GASOLINE ALCOHOL	JET FUEL KEROSENE	DIESEL OIL	FUEL OIL	CHARCOAL	NON-ENERGY PRODUCTS
		kt	Kboe	GWh	kbbl	kbbl	kbbl	kbbl	kbbl	kt	kBep
SUPPLY	PRODUCTION	0,661	0,000	272,308						0,100	
	IMPORT				69,308	297,769	347,742	210,977	444,901	0,892	2,287
	EXPORT					-18,290		-16,700			
	INVENTORIES										
	UNUSED										
TOTAL	SUPPLY	0,661	0,000	272,308	69,308	279,479	347,742	194,277	444,901	0,992	2,287
TRANSFORMATION	REFINERY										
	POWER PLANTS		0,000	254,355				-30,099	-421,933		
	SELF PRODUCERS		0,000	17,953				-4,689	-17,226		
	GAS TREATM.PLANT										
	CHARCOAL PLANT									0,100	
	COKE/BLAST FURNAC										
	DISTILLERY										
	OTHER CENTERS										
TOTAL	TRANSFORMATION	0,000	0,000	0,000	0,000	0,000	0,000	-34,788	-439,159	0,000	0,000
END CONSUMPTION	OWN CONSUMPTION										
	LOSSES			81,692							
	ADJUSTMENT	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	TRANSPORTATION					238,215	344,265	123,266			
	INDUSTRY			5,718	5,317	4,126		2,415	0,230		
	RESIDENTIAL	0,661		76,246	33,863	1,032	3,477	0,604		0,992	
	COMMERC.,SERV.PUB			101,026	21,267	23,727		25,960	5,512		
	AGRIC.,FISH.MIN.				3,545	4,126		2,415			
	CONSTRUCTION,OTH.			7,625	5,317	8,253		4,830			
CONSUMPTION	ENERGY SOURCE	0,661	0,000	190,616	69,308	279,479	347,742	159,489	5,742	0,992	0,000
	NON ENERGY CONSUM										2,287
CONSUMPTION	FINAL	0,661	0,000	190,616	69,308	279,479	347,742	159,489	5,742	0,992	2,287

Table 19. Antigua & Barbuda Energy Balance 2011 (Physical units)

Calorific units (kBoe)

					SECONDARY									
	ACTIVITY	FIREWOOD	OTHER PRIMARIES	TOTAL PRIMARY	ELECTRICITY	LPG	GASOLINE ALCOHOL	JET FUEL KEROSENE	DIESEL OIL	FUEL OIL	CHARCOAL	NON-ENERGY	TOTAL SECONDARY	TOTAL
SUPPLY	PRODUCTION	1,715	0,000	**1,715**	168,722						0,497		**169,219**	**170,934**
	IMPORT					46,443	266,027	333,241	211,294	458,426	4,437	2,287	**1322,155**	**1322,155**
	EXPORT						-16,340		-16,725				**-33,065**	**-33,065**
	INVENTORIES												**0,000**	**0,000**
	UNUSED												**0,000**	**0,000**
TOTAL	SUPPLY	**1,715**	**0,000**	**1,715**	**168,722**	**46,443**	**249,687**	**333,241**	**194,569**	**458,426**	**4,934**	**2,287**	**1458,309**	**1460,023**
TRANSFORMATION	REFINERY												**0,000**	**0,000**
	POWER PLANTS				157,598				-30,144	-434,759			**-307,305**	**-307,305**
	SELF PRODUCERS				11,124				-4,696	-17,750			**-11,323**	**-11,323**
	GAS TREATM.PLANT												**0,000**	**0,000**
	CHARCOAL PLANT										0,497		**0,497**	**0,497**
	COKE/BLAST FURNAC												**0,000**	**0,000**
	DISTILLERY												**0,000**	**0,000**
	OTHER CENTERS												**0,000**	**0,000**
TOTAL	TRANSFORMATION	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**-34,840**	**-452,509**	**0,000**	**0,000**	**-487,350**	**-487,350**
END CONSUMPTION	OWN CONSUMPTION												**0,000**	**0,000**
	LOSSES				50,617								**50,617**	**50,617**
	ADJUSTMENT	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
	TRANSPORTATION						**212,821**	**329,909**	**123,451**				**666,181**	**666,181**
	INDUSTRY				**3,543**	**3,563**	**3,687**		**2,418**	**0,237**			**13,448**	**13,448**
	RESIDENTIAL	**1,715**		**1,715**	**47,242**	**22,691**	**0,922**	**3,332**	**0,605**		**4,934**		**79,726**	**81,441**
	COMMERC.,SERV.PUB				**62,596**	**14,251**	**21,197**		**25,999**	**5,680**			**129,723**	**129,723**
	AGRIC.,FISH.MIN.					**2,375**	**3,687**		**2,418**				**8,480**	**8,480**
	CONSTRUCTION,OTH.				**4,724**	**3,563**	**7,373**		**4,837**				**20,497**	**20,497**
CONSUMPTION	ENERGY SOURCE	**1,715**	**0,000**	**1,715**	**118,106**	**46,443**	**249,687**	**333,241**	**159,729**	**5,917**	**4,934**	**0,000**	**918,056**	**919,770**
	NON ENERGY CONSUM											2,287	**2,287**	**2,287**
CONSUMPTION	FINAL	**1,715**	**0,000**	**1,715**	**118,106**	**46,443**	**249,687**	**333,241**	**159,729**	**5,917**	**4,934**	**2,287**	**920,342**	**922,057**

Table 20. Antigua & Barbuda Energy Balance 2011 (Calorific units)

Energy Balance – 2010

Physical units

	ACTIVITY			SECONDARY							
		FIREWOOD	OTHER PRIMARIES	ELECTRICITY	LPG	GASOLINE ALCOHOL	JET FUEL KEROSENE	DIESEL OIL	FUEL OIL	CHARCOAL	NON-ENERGY PRODUCTS
		kt	Kboe	GWh	kbbl	kbbl	kbbl	kbbl	kbbl	kt	kBep
SUPPLY	PRODUCTION	0,654	0,000	247,349						0,100	
	IMPORT				70,304	335,184	362,784	213,028	482,326	0,883	2,216
	EXPORT					-18,260		-19,520			
	INVENTORIES										
	UNUSED										
TOTAL	SUPPLY	0,654	0,000	247,349	70,304	316,924	362,784	193,508	482,326	0,983	2,216
TRANSFORMATION	REFINERY										
	POWER PLANTS		0,000	236,334				-96,264	-464,095		
	SELF PRODUCERS		0,000	11,015				-17,825	-13,673		
	GAS TREATM.PLANT										
	CHARCOAL PLANT									0,100	
	COKE/BLAST FURNAC										
	DISTILLERY										
	OTHER CENTERS										
TOTAL	TRANSFORMATION	0,000	0,000	0,000	0,000	0,000	0,000	-114,089	-477,768	0,000	0,000
END CONSUMPTION	OWN CONSUMPTION										
	LOSSES			74,205							
	ADJUSTMENT	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	TRANSPORTATION					268,147	359,156	69,191			
	INDUSTRY			5,194	5,553	4,878		0,682	0,182		
	RESIDENTIAL	0,654		69,258	33,282	1,219	3,628	0,170		0,983	
	COMMERC.,SERV.PUB			91,766	22,213	28,047		7,329	4,375		
	AGRIC.,FISH.MIN.				3,702	4,878		0,682			
	CONSTRUCTION,OTH.			6,926	5,553	9,755		1,364			
CONSUMPTION	ENERGY SOURCE	0,654	0,000	173,144	70,304	316,924	362,784	79,418	4,558	0,983	0,000
	NON ENERGY CONSUM										2,216
CONSUMPTION	FINAL	0,654	0,000	173,144	70,304	316,924	362,784	79,418	4,558	0,983	2,216

Table 21. Antigua & Barbuda Energy Balance 2010 (Physical units)

Calorific units (kBoe)

					SECONDARY									
	ACTIVITY	FIREWOOD	OTHER PRIMARIES	TOTAL PRIMARY	ELECTRICITY	LPG	GASOLINE ALCOHOL	JET FUEL KEROSENE	DIESEL OIL	FUEL OIL	CHARCOAL	NON-ENERGY	TOTAL SECONDARY	TOTAL
SUPPLY	PRODUCTION	1,697	0,000	**1,697**	153,257						0,497		**153,755**	**155,452**
	IMPORT					47,110	299,453	347,655	213,347	496,988	4,392	2,216	**1411,163**	**1411,163**
	EXPORT						-16,313		-19,549				**-35,863**	**-35,863**
	INVENTORIES												**0,000**	**0,000**
	UNUSED												**0,000**	**0,000**
TOTAL	SUPPLY	**1,697**	**0,000**	**1,697**	**153,257**	**47,110**	**283,140**	**347,655**	**193,798**	**496,988**	**4,889**	**2,216**	**1529,054**	**1530,752**
TRANSFORMATION	REFINERY												**0,000**	**0,000**
	POWER PLANTS				146,432				-96,409	-478,204			**-428,180**	**-428,180**
	SELF PRODUCERS				6,825				-17,852	-14,088			**-25,115**	**-25,115**
	GAS TREATM.PLANT												**0,000**	**0,000**
	CHARCOAL PLANT										0,497		**0,497**	**0,497**
	COKE/BLAST FURNAC												**0,000**	**0,000**
	DISTILLERY												**0,000**	**0,000**
	OTHER CENTERS												**0,000**	**0,000**
TOTAL	TRANSFORMATION	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**-114,261**	**-492,292**	**0,000**	**0,000**	**-606,553**	**-606,553**
END CONSUMPTION	OWN CONSUMPTION												**0,000**	**0,000**
	LOSSES				45,977								**45,977**	**45,977**
	ADJUSTMENT	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
	TRANSPORTATION						**239,563**	**344,179**	**69,295**				**653,036**	**653,036**
	INDUSTRY				**3,218**	**3,721**	**4,358**		**0,683**	**0,188**			**12,168**	**12,168**
	RESIDENTIAL	**1,697**		**1,697**	**42,912**	**22,302**	**1,089**	**3,477**	**0,171**		**4,889**		**74,840**	**76,538**
	COMMERC.,SERV.PUB				**56,859**	**14,885**	**25,057**		**7,340**	**4,508**			**108,649**	**108,649**
	AGRIC.,FISH.MIN.					**2,481**	**4,358**		**0,683**				**7,521**	**7,521**
	CONSTRUCTION,OTH.				**4,291**	**3,721**	**8,715**		**1,366**				**18,093**	**18,093**
CONSUMPTION	ENERGY SOURCE	**1,697**	**0,000**	**1,697**	**107,280**	**47,110**	**283,140**	**347,655**	**79,537**	**4,696**	**4,889**	**0,000**	**874,309**	**876,006**
	NON ENERGY CONSUM											2,216	**2,216**	**2,216**
CONSUMPTION	FINAL	**1,697**	**0,000**	**1,697**	**107,280**	**47,110**	**283,140**	**347,655**	**79,537**	**4,696**	**4,889**	**2,216**	**876,524**	**878,222**

Table 22. Antigua & Barbuda Energy Balance 2010 (Calorific units)

Chapter VI. Greenhouse Emissions Methodology

10. Greenhouse Gas Emissions

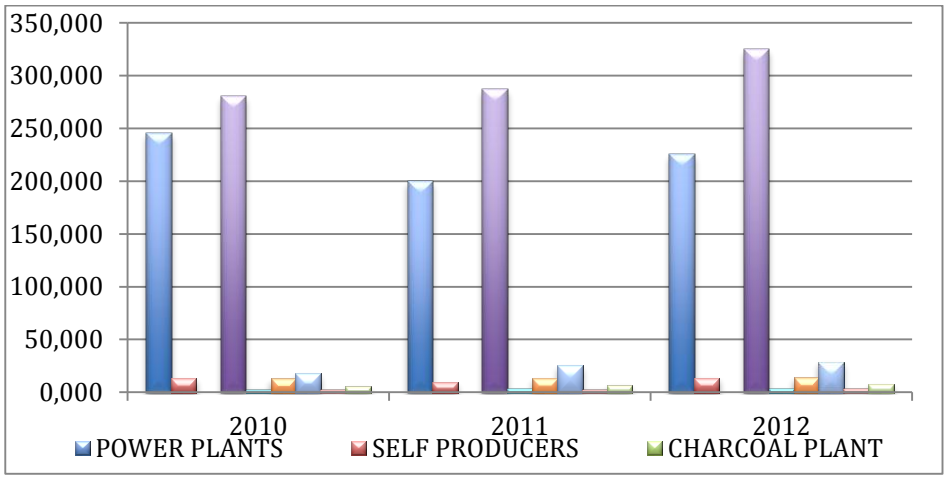
The Inventory of Greenhouse Gases is a double entry matrix that provides relevant information on the contribution of Greenhouse Gas Emissions of the country, by energy sources, activities and/or subsectors.

Two methodologies could be applied to obtain Greenhouse Gas Emissions: Technology approach and Reference approach.

10.1. Technology approach

This IPCC[20] Methodology is based on the calculation of emissions by pollutants and according to the following variables: country, energy source, energy activity during the 2010 to 2012 timeframe. The results of this methodology are presented on pages 63-65.

The methodology of the technology approach used the values reported by the countries, on the fundamental data, according to the energy source used in each economic activity. Those are operated with the factors of contamination of a given technology and applied according to the pollutant in mention, therefore emissions are obtained by source. This report will consider only the CO_2 emissions. Therefore, the Graph 16 shows that Transportation is the activity that produces the most representative part of the emissions, with a participation of 50.94% as an average for the three years. Electricity generation accounted as the second activity that produces the most CO2 emissions with 38,27% share.



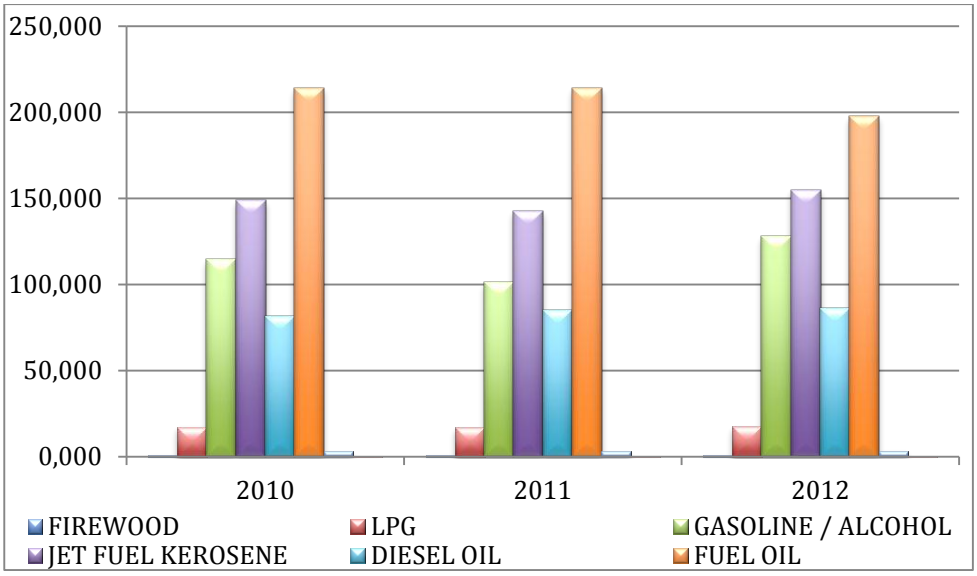
Graph 16. CO2 Emissions by Economic Activity

Source: Antigua & Barbuda Energy Balances 2010 – 2012

[20]Intergovernmental panel on Climate Change (IPCC), is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. http://www.ipcc.ch/index.htm#.Utm37DlziqQ (web page visited on Jan, 16th 2014).

If we dissect the data by emissions generation by energy source, the largest source of emissions is Fuel Oil which accounts an average of 36,09%. Fuel Oil is primary used for large scale electricity generation. Jet fuel/Kerosene accounted for the second largest source of emissions which accounts an average of 35,73%, which is not common among countries with similar socio-economic characteristics. Disproportional consumption of this energy source would be further explained in the Energy and Economic Indicators section below.

Gasoline, Diesel oil and LPG accounted an average of 19,84%, 14,56% and 2,99% respectively. Non-energy products, Charcoal and firewood account for less than 1%.



Graph 17. CO2 Emissions by Energy Source

Source: Antigua & Barbuda Energy Balances 2010 – 2012

Based on this approach, most of the emissions are produced due to transport activities and electricity production. As mentioned earlier and explained in further detail in the following chapter, a large share of the emissions accounted in this study are produced by Jet Fuel consumption in foreign or international airspace. Furthermore, usages of motor vehicles are the second largest producers of emissions in the transport sector. As cars and other vehicles employ internal combustions engines, they burn fossil fuels to produce energy and other by products such as CO2.

Electricity production was the activity that generated the most emissions. This is due to the conventional thermal generating stations employed in the production of electricity. Fuel Oil in the most common fuel used.

10.2. Reference approach

Procedure of calculation of Emissions of CO2 based on basic indicators of Apparent Consumption, Content of Coal and non-energy Consumption of the energy sources. The obtained results are emissions in Gg CO2. The factors can also be consulted used in the calculation process (See, Greenhouse Gas Emissions calculated by Reference Approach on page 90).

For the purposes of this chapter, presented results are related to Technology approach. Results may be revised in Annex Greenhouse Gas Emissions by Reference Approach, page 90.

10.3. CO2 Emissions According to Technology approach

ENERGY SOURCE		FIREWOOD	OTHER PRIM	TOTAL PRIMARY	LPG	GASOLINE / ALCOHOL	JET FUEL KEROSENE	DIESEL OIL	FUEL OIL	CHARCOAL	NON-ENERGY	SECONDARY	TOTAL
SUPPLY	PRODUCTION			-								-	-
	IMPORT			-								-	-
	EXPORT			-								-	-
	INVENTORIES			-								-	-
	UNUSED			-								-	-
TOTAL	SUPPLY	-	-	-	-	-	-	-	-	-	-	-	-
TRANSFORMATION	REFINERY			-								-	-
	POWER PLANTS			-				7,956	217,397			225,35	225,35
	SELF PRODUCERS			-				3,488	10,210			13,70	13,70
	GAS TREATM.PLANT			-								-	-
	CHARCOAL PLANT			-						0,144		0,14	0,14
	COKE/BLAST FURNAC			-								-	-
	DISTILLERY			-								-	-
	OTHER CENTERS			-								-	-
TOTAL	TRANSFORMATION	-	-	-	-	-	-	11,44	227,61	0,14	-	239,19	239,19
END CONSUMPTION	OWN CONSUMPTION			-								-	-
	TRANSPORTATION			-		112,737	153,551	58,307			0,428	325,02	325,02
	INDUSTRY			-	1,448	1,385		1,014	0,133			3,98	3,98
	RESIDENTIAL	0,935		0,94	7,884	0,366	1,472	0,274		2,785		12,78	13,72
	COMMERC.,SERV.PUB			-	5,792	7,963		11,690	3,267			28,71	28,71
	AGRIC.,FISH.MIN.			-	0,965	1,385		1,111				3,46	3,46
	CONSTRUCTION,OTH.			-	1,457	4,244		2,222				7,92	7,92
CONSUMPTION	FINAL	0,94		0,94	17,55	128,08	155,02	86,06	231,01	3,22	0,43	621,36	622,30

Table 23. Antigua & Barbuda Gas Inventory 2012 (Technology Approach)

ENERGY SOURCE		FIREWOOD	OTHER PRIM	TOTAL PRIMARY	LPG	GASOLINE / ALCOHOL	JET FUEL KEROSENE	DIESEL OIL	FUEL OIL	CHARCOAL	NON-ENERGY	SECONDARY	TOTAL
SUPPLY	PRODUCTION			-								-	-
	IMPORT			-								-	-
	EXPORT			-								-	-
	INVENTORIES			-								-	-
	UNUSED			-								-	-
TOTAL	SUPPLY	-	-	-	-	-	-	-	-	-	-	-	-
TRANSFORMATION	REFINERY			-								-	-
	POWER PLANTS			-				12,252	187,279			199,53	199,53
	SELF PRODUCERS			-				1,883	7,826			9,71	9,71
	GAS TREATM.PLANT			-								-	-
	CHARCOAL PLANT			-						0,144		0,14	0,14
	COKE/BLAST FURNAC			-								-	-
	DISTILLERY			-								-	-
	OTHER CENTERS			-								-	-
TOTAL	TRANSFORMATION	-	-	-	-	-	-	14,14	195,11	0,14	-	209,38	209,38
END CONSUMPTION	OWN CONSUMPTION			-								-	-
	TRANSPORTATION			-		90,096	141,325	54,978			0,428	286,83	286,83
	INDUSTRY			-	1,392	1,018		0,983	0,102			3,50	3,50
	RESIDENTIAL	0,925		0,93	7,751	0,269	1,355	0,265		2,756		12,40	13,32
	COMMERC.,SERV.PUB			-	5,570	5,856		11,331	2,504			25,26	25,26
	AGRIC.,FISH.MIN.			-	0,928	1,018		1,077				3,02	3,02
	CONSTRUCTION,OTH.			-	1,401	3,121		2,154				6,68	6,68
CONSUMPTION	FINAL	0,93		0,93	17,04	101,38	142,68	84,92	197,71	3,19	0,43	547,35	548,28

Table 24. Antigua & Barbuda Gas Inventory 2011 (Technology Approach)

ENERGY SOURCE		FIREWOOD	OTHER PRIM	TOTAL PRIMARY	LPG	GASOLINE / ALCOHOL	JET FUEL KEROSENE	DIESEL OIL	FUEL OIL	CHARCOAL	NON-ENERGY	SECONDARY	TOTAL
SUPPLY	PRODUCTION			-								-	-
	IMPORT			-								-	-
	EXPORT			-								-	-
	INVENTORIES			-								-	-
	UNUSED			-								-	-
TOTAL	SUPPLY	-		-	-	-	-	-	-	-	-	-	-
TRANSFORMATION	REFINERY			-								-	-
	POWER PLANTS		0,000	-				39,185	205,993			245,18	245,18
	SELF PRODUCERS		0,000	-				7,159	6,212			13,37	13,37
	GAS TREATM.PLANT			-								-	-
	CHARCOAL PLANT			-						0,144		0,14	0,14
	COKE/BLAST FURNAC			-								-	-
	DISTILLERY			-								-	-
	OTHER CENTERS			-								-	-
TOTAL	TRANSFORMATION	-		-	-	-	-	46,34	212,21	0,14	-	258,69	258,69
END CONSUMPTION	OWN CONSUMPTION			-								-	-
	TRANSPORTATION			-		101,416	147,438	30,860			0,428	280,14	280,14
	INDUSTRY			-	1,454	1,204		0,278	0,081			3,02	3,02
	RESIDENTIAL	0,916		0,92	7,618	0,318	1,413	0,075		2,729		12,15	13,07
	COMMERC.,SERV.PUB			-	5,817	6,922		3,199	1,988			17,93	17,93
	AGRIC.,FISH.MIN.			-	0,970	1,204		0,304				2,48	2,48
	CONSTRUCTION,OTH.			-	1,463	3,690		0,608				5,76	5,76
CONSUMPTION	FINAL	0,92		0,92	17,32	114,75	148,85	81,67	214,27	3,16	0,43	580,46	581,38

Table 25. Antigua & Barbuda Gas Inventory 2010 (Technology Approach)

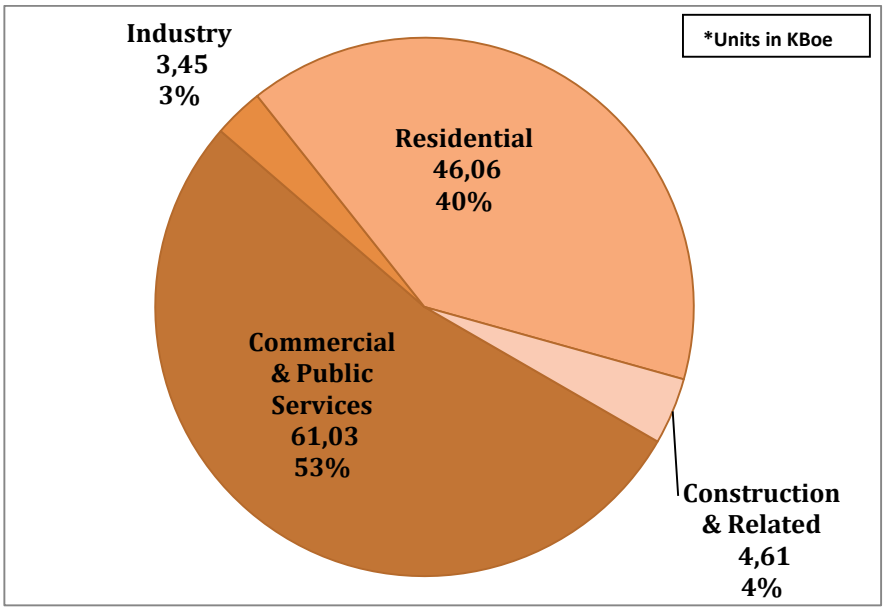
Chapter VII. Energy and Economic Indicators

The economy of Antigua and Barbuda is one of the most robust when compared to the other Caribbean countries. Such economic benefits have managed to widespread to Antigua's citizens by improving their living standards, through increasing their purchase power. According to the World Bank´s 2014 World Development Report, Antigua and Barbuda was ranked fourth Nation in the Caribbean in terms of its Gross National Income per capita (GNI per Capita) $12,640. Such indicator is the gross national income of a country divided by its total population. It highlights the Individual's income when compare to other countries. Antigua and Barbuda's utility rates are approximately $0.37 U.S. dollars (USD) per kilowatt-hour (kWh),which is above the Caribbean regional average of $0.33 USD/kWh.

To further understand the energy economic performance of Antigua and Barbuda, table 30 compares different economic and energy indicators of Antigua with the average Latin American and Caribbean countries, by using available data already processed in the OLADE´s Energy Balances for the 2010-2012 period.

Based on the information presented in table 30, we can see that Antigua has a higher Energy consumption per capita than other countries with similar socio-economical characteristics. This can be attributed mainly to two major factors:

Firstly, Antigua and Barbuda is one of the most well off countries in terms of economic conditions compared to other Caribbean countries. Higher income and more developed economies tend to have higher electricity consumption. In the case of Antigua the main driver, behind such higher levels, is the tourism sector, which the largest economic activity. Tourism is a service industry with intense electricity consumption, particularly in the case of Antigua due to the large development of a world class tourism infrastructure and services. Additionally, such facilities also have secondary electricity generation by self-producing part of their electricity. This also increases the consumption level of fuels such as diesel and LPG.

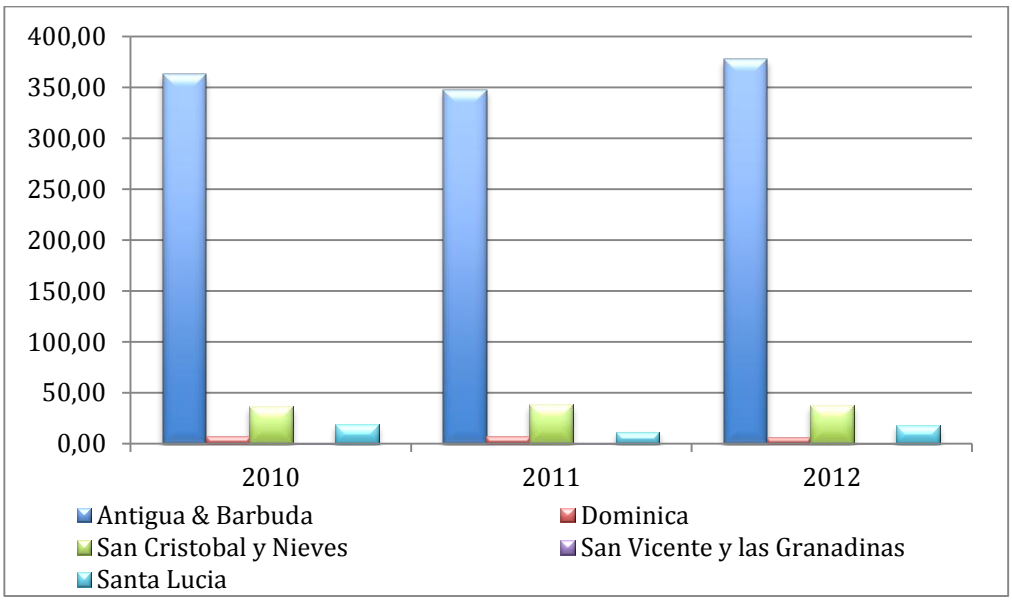


Graph 18. CO2 Emissions by Energy Source

Source: Antigua & Barbuda Energy Balances 2010 – 2012

Secondly, Antigua and Barbuda has a fairly large Jet fuel consumption, when compared to other countries. This is due to the fact that Antigua is home to the LIAT airlines, which home operations are based on the V. C. Bird international Airport. Therefore, Antigua serves as a focal point to most fueling operations of the LIAT´s airlines flights. Furthermore, 7 additional international, regional, domestic, passenger and cargo airlines operate in Antigua & Barbuda which also contribute to higher than expected Jet fuel consumption.

This offsets the data and creates the impression that Antigua consumes all of this fuel and therefore its energy and emissions. According to the used energy balance methodology, this energy source consumptions and emissions must be accounted to Antigua and Barbuda. However, policy makers and industry experts should consider this energy consumption and emissions as an international factor, simply because they contribute to an international economic activity that should be accounted as a regional factor.



Graph 19. 2012 - Jet Fuel Consumption per country

Source: Antigua & Barbuda Energy Balances 2010 – 2012

Like many island nations, Antigua and Barbuda is almost entirely reliant on imported fossil fuels, leaving it vulnerable to global oil price fluctuations that directly impact the cost of electricity. As recent events have shown, such dependency makes Antigua vulnerable to exogenous economic, political and climatological events. The most prominent example has been the global economic downturn and consequent sharp decline in tourism which pushed the economy sharply into recession, shrinking by some 12 per cent in 2009.

In light of these events, the government of Barbuda has launched a series of excellent initiatives to improve the economic competitiveness of the country, to attract international investment and improve the resilience of the economy to external shocks. Along those initiatives the government seeks to aggressively improve the energy efficiency, costs and implementation of renewable energy into its energy matrix. Such change would make Antigua a more economically competitive nation and therefore improve its economy and citizens living standards.

	Final Energy Consumption per capita	Total Electricity Consumption per capita	Total Energy Consumption in Residential Sector per capita	Total Electricity Consumption in Residential Sector per capita	Energy Intensity	Industrial Energy Intensity	Total CO2 Emissions per capita	Intensity of CO2 Emissions in Electricity Sector / Generation
Year	(kbep/10(3)inhab)	(GWh/10(3)inhab)	(kbep/10(3)inhab)	(kWh/inhab)	(bep/10(3) EC$)	(bep/10(3) EC$)	(Gg CO2 /bep/10(3)inhab)	(Gg CO2/GWh)
Antigua and Barbuda								
2010	9,24	1,49	0,46	0,26	1,34	1,87	3,51	0,63
2011	8,82	1,64	0,49	0,29	1,28	2,13	3,31	0,46
2012	9,82	1,60	0,49	0,28	1,43	2,43	3,74	0,54
Average	9,29	1,58	0,48	0,27	1,35	2,14	3,52	0,55
Dominica								
Average	3,65	1,85	0,76	0,35	0,22	1,84	1,75	0,55
St. Lucia								
Average	4,63	1,43	0,69	0,42	0,71	0,12	1,29	0,72
St. Vincent & The Grenadines								
Average	3,20	1,19	0,63	0,55	0,19	0,43	1,79	0,62
Latin America and Caribbean								
2011	7,38	1,21	1,14	0,52	1,29	2,82	2,70	0,22

Table 26. Antigua & Barbuda Energy and Economic Indicators (2010 – 2012)

Along the most successful government programs can be highlighted:

- Improvement of non-technical and distribution electricity loses from 30% in 2000 to 17% in 2012.
- Full implantation of solar weather heather technologies, which translated into reduction of residential LPG consumption.
- The government's internal goal of reducing public sector energy consumption and expenditures by 30% by 2020.

In terms of the implementing renewable energies into the Antigua and Barbuda energy matrix. The government seeks to reduce energy costs by diversifying away from fossil fuels and driving development of new technologies and sectors.

The Sustainable Energy Action Plan, released in 2013, seeks to meet the following Renewable Energy Goals:

- 5% of electricity from renewable sources by 2015.
- 10% of electricity from renewable sources by 2020.
- 15% of electricity from renewable sources by 2030.
- 25% reduction in greenhouse gas emissions below 1990 value by 2020.

Antigua and Barbuda has proven to have outstanding resources for renewable energy production. Studies have shown high wind and solar resource potential in Antigua and Barbuda, with the most prominent example being the estimated 400 MW of wind energy potential in the Highlands region of Barbuda. That estimate is nearly three times the country's total energy consumption.

However, despite the abundant wind and solar resources in Antigua and Barbuda, the installed capacity of those technologies remains low due to lack of expertise when promoting such technologies.

Chapter VIII. Conclusions and recommendations

- OLADE performed an extensive assessment in terms of the data gathering process for the 2010-2012 Antigua and Barbuda Energy Balance. Crucial information was collected, reviewed and analyzed from several key private and public institutions. OLADE performed technical visits to 27 institutions as a part of an effort for compiling relevant data. As a result, OLADE hold a unique data set that integrates the different actors and characterizes the dynamics behind the energy resources of Antigua and Barbuda.

- Meticulous data processing allowed generating extensive findings and more accurate estimations. For example, the National Department of Motor Transportation kindly provided detailed information regarding their number of vehicles registered in the country, including characteristics of their size and engines. Such level of detailed allowed generating very accurate estimations of the level of hydrocarbons consumption in the Transport sector. This makes these study findings better in terms of its relevance.

- One of the main challenges presented in the data gathering process was posed due to the fact that private and public institutions manage their own information separately. For example, West Indies Oil Company (WIOC) keeps a detailed record of the quantities of fossil fuels imported into the country. However, detailed

information of the consumption of their major clients and their further distribution lines was not provided. This posed a statistical challenge in terms of devising the energy flows presented in this report. Although, this issue was solved by obtaining further relevant data from a series of other stakeholders. This highlights one of the major issues for policy makers and industry experts when trying to uncover the characterization of the energy framework and infrastructure. Furthermore, it validates the importance of the Antigua and Barbuda Energy Balance when consolidating information from a large number of institutions and dissecting it into crucial information than otherwise could not have been produced. This Energy Balance Report has become an important instrument with which, the country could take the first steps in order to centralize all the information related to energy. It is very important to centralize all the information regarding the supply, demand and transformation activities. In order to promote the energy planning process, with a base of research and accurate data.

- Evaluation of key economic and financial indicators of Antigua and Barbuda, play a major role in the development of this report. In terms of its economic standards, Antigua and Barbuda has better living standards compared to other Caribbean nations. When looking the variables in detail, we concluded that the Antigua and Barbuda economy is more energy intense. Also, the energy consumption per capita is higher. This is correlated to the GDP per capita. Antigua and Barbuda has one of the largest GDP per capita, compared to other Caribbean nations, therefore as a more advance economy is it conclusive that energy consumption per each citizen would be greater. This trend can be seen in developed nations where historically, as they increased the living standards, energy demand per person would rise accordingly. Firstly, this is because a more develop economy requires more sophisticated and energy intense economic activities. Secondly, as individuals improve the purchasing power, they tend to demand more energy intense goods and services, such as motor vehicles and household appliances.

- OLADE also found one major statistical outliner in this study. Antigua and Barbuda presented an out of range consumption of Jet Fuel. The level of consumption is about 10 times larger than similar countries, considered in this report, and has a major impact in the Energy Matrix. When looking into further detail, this variance is due to the large participation of the airline industry in Antigua. Particularly, LIAT airlines which is based in Antigua‘s main airport, where it performs most of its logistical operations. Due to the accountability methods used in the elaboration of this report. All jet Fuel consumption and emissions must be accounted to Antigua and Barbuda. Even despite the fact that most of the flights contribute to international transportation. On the other hand, OLADE is currently implementing new accounting methodologies which would consider fuels used for international transportation as a separate standardized international indicator, which would not be part of the emissions produced in the country. Furthermore, OLADE advices policy makers and industry experts to take a critical view of this fact, because any policy given to this economic activity must be considered at an international level, rather than a local level.

- In terms of the economic impact and relation with the energy sector, this study highlights some key findings for guidance for policy makers. The energy markets of Antigua and Barbuda posed a major challenge due to its high cost to the final consumers. 0.37 USD/kWh is a price far above the average Latin American electricity cost and the Caribbean average price. This directly undermines on the economic competitiveness of Antigua and Barbuda. Additionally, the energy sector has failed to diversify its energy matrix as the energy production is solely based on fossil fuel imports.

- In light of these challenges, the government of Antigua and Barbuda has taken an aggressive stand towards the improvements of its energy sector. The major accomplishment by the local officials, has been the improvement of their distribution network. Over the last 10 years, APUA has successfully decreased non-technical and distribution energy loses from 30% in 2001 to 17% in 2012. This represents major economic savings as electrical generation and distribution becomes for efficient. It also creates a more reliable electric system for all economic activities national wide. Secondly, government officials have encouraged highly effective programs such as in-house solar thermal water heathers. As this technology became widely accepted in this nation, it directly decreased the level of emissions and energy consumption that otherwise would have been produced. In the case of Antigua and Barbuda, this technology replaced the daily usage of LPG or firewood for residential water heating.

- Furthermore the largest government attempt to promote optimization of the energy usage, energy efficiency and diversification of the energy matrix, has been through the implementation of the Sustainable Energy Action Plan. This initiative seeks to aggressively incorporate renewable energy technologies in electricity generation by setting ambitious targets. This is a logical step when taken into consideration the resource assessments performed for renewable energy production. Such studies have concluded that Antigua and Barbuda largely would benefit from the abundance of resources for electricity production. Particularly, solar and wind assessments have yield outstanding potential. The most prominent example being the estimated 400 MW of wind energy potential in the Highlands region of Barbuda. That estimate is nearly three times the country's total energy consumption.

- Successful implementation of renewable energy into Antigua and Barbuda´s energy matrix would have extensive positive economic and social externalities. Renewable electricity generation would lead to a more distributed matrix, which would save large costs to APUA in distribution infrastructure. Given the current prices of such technologies would also decrease the price of electricity generation and would lead to diversification from fossil fuels.

- Finally, a more elaborate and centralized data gathering permanent process would contribute to better results and should be considered in terms of national and regional policies. OLADE advices to continue with the process of elaboration of the Energy Balances, which would create the groundwork for consistent energy forecasts and better policy implementation. Planning at a state level must be based on Energy Balances, as a platform for simulating different energetic scenarios and forecasting at a national level. As this report has proven to be a powerful tool in terms of assessing the current situation of the energy sector in this country, it very well serves a benchmark for measuring results of undergoing government policies.

ANNEX

Forms

Antigua & Barbuda Contact List

N	INSTITUTION	TYPE OF INFORMATION
	Monday, August 31	
1	Minister of Tourism, Economic Development, Investment & Energy:	Q1_F03_A&B_2015 Q7_CCO_ A&B_2015
2	Antigua Public Utility Authority (APUA)	Q3_EE_ A&B_2015
3	Civil Aviation	Q4_CTR_ A&B_2015
4	Minister of Finance, the Economy and Public Administration	Q11_NV_ A&B_2015 Q1_F03_A&B_2015
5	Eastern Caribbean Central Bank	Q11_NV_ A&B_2015
6	Ministry of Public Works	Q4_CTR_ A&B_2015
	Tuesday, September 1	
7	The West Indies Oil Company	Q2_HC_ A&B_2015
8	Transport Board	Q4_CTR_ A&B_2015
9	Ministry of Agriculture	Q10_CRW_ A&B_2015
10	Statistics Division	Q4_CTR_ A&B_2015 Q5_CIN_ A&B_2015 Q6_CIN2_A&B_2015 Q7_CCO_ A&B_2015 Q8_CCOH_ A&B_2015 Q9_CCOR_ A&B_2015 Q10_CRW_ A&B_2015 Q11_NV_ A&B_2015 Q701_CCOSC_A&B_2015
11	Minister of Tourism, Economic Development, Investment & Energy:	Q7_CCO_ A&B_2015
	Wednesday, September 2	
12	Minister of Tourism, Economic Development, Investment & Energy:	Q4_CTR_ A&B_2015
13	APUA	Q3_EE_ A&B_2015
14	Customs	Q1_F03_A&B_2015 Q2_HC_ A&B_2015 Q3_EE_ A&B_2015 Q4_CTR_ A&B_2015
15	PDV Caribe	Q1_F03_A&B_2015 Q2_HC_ A&B_2015
16	Rubis	Q1_F03_A&B_2015 Q2_HC_ A&B_2015
	Thirsday, September 3	
17	Antigua Hotels & Tourist Association - AH&TA	Q7_CCO_ A&B_2015
18	Sandals Hotel	Q8_CCOH_ A&B_2015 Q9_CCOR_ A&B_2015
19	Antigua Brewery Limited	Q6_CIN2_A&B_2015
21	Derrick VA Lubricants	Q1_F03_A&B_2015
20	G I O Distribution & Supplies Ltd	Q2_HC_ A&B_2015
	Friday, September 4	
22	Themba Biofuels	Q1_F03_A&B_2015
23	Motor Pool	Q4_CTR_ A&B_2015
24	Epicurean Supermarket	Q701_CCOSC_A&B_2015
25	Ministry of Public Works	Q4_CTR_ A&B_2015
27	Woods Mall	Q701_CCOSC_A&B_2015

Table 27. Antigua & Barbuda Contact List 2014

Note:

Completed forms

Balance Forms

Diesel Oil Energy Balance forms

Balance

AÑO	1 TOTAL SUPPLY	2 TOTAL TRANSFORMATION	3 OWN CONSUMPTION	4 LOSSES	5 FINAL CONSUMPTION	1-2-3-4-5 ADJUSTMENT
2005	0,00	0,00			0,00	0,00
2006	0,00	0,00			0,00	0,00
2007	0,00	0,00			0,00	0,00
2008	0,00	0,00			0,00	0,00
2009	0,00	0,00			0,00	0,00
2010	193,5078	-114,09			79,42	0,00
2011	194,2774	-34,79			159,49	0,00
2012	196,3281	-28,23			168,10	0,00
2013	0,00	0,00			0,00	0,00

Supply

AÑO	1 PRODUCTION	2 IMPORTS	3 EXPORTS	4 STOCK CHANGE	INITIAL STOCK	FINAL STOCK	5 UNUSED	1-2+3+4-5 TOTAL SUPPLY
2005	0,00			0,00				0,00
2006	0,00			0,00				0,00
2007	0,00			0,00				0,00
2008	0,00			0,00				0,00
2009	0,00			0,00				0,00
2010	0,00	213,03	19,52	0,00				193,51
2011	0,00	210,98	16,70	0,00				194,28
2012	0,00	215,08	18,75	0,00				196,33
2013	0,00			0,00				0,00

Transformation

AÑO	1 REFINERY	2 POWER PLANTS	3 SELF PRODUCERS	4 GAS PLANTS	6 CHARCOAL PLANTS	7 COKE	8 DESTILERY	9 OTHER PLANTS	TOTAL TRANSFORMATION	TOTAL PRODUCTION
2005									0,00	0,00
2006									0,00	0,00
2007									0,00	0,00
2008									0,00	0,00
2009									0,00	0,00
2010		-96,26	-17,82						-114,09	0,00
2011		-30,10	-4,69						-34,79	0,00
2012		-19,54	-8,68						-28,23	0,00
2013									0,00	0,00

Consumption

AÑO	1 TRANSPORT	2 INDUSTRY	3 RESIDENTIAL	4 COMERCIAL	5 AGRO FISHING MINING	6 CONSTRUCTION	7 NON ENERGY CONSUMPTION	1+2+3+4+5+6+7 FINAL CONSUMPTION
2005								0,00
2006								0,00
2007								0,00
2008								0,00
2009								0,00
2010	69,19	0,68	0,17	7,33	0,68	1,36		79,42
2011	123,27	2,41	0,60	25,96	2,41	4,83		159,49
2012	130,73	2,49	0,62	26,78	2,49	4,98		168,10
2013								0,00

Gasoline Energy Balance forms

Balance

AÑO	1 TOTAL SUPPLY	2 TOTAL TRANSFORMATION	3 OWN CONSUMPTION	4 LOSSES	5 FINAL CONSUMPTION	1-2-3-4-5 ADJUSTMENT
2005	0,00	0,00			0,00	0,00
2006	0,00	0,00			0,00	0,00
2007	0,00	0,00			0,00	0,00
2008	0,00	0,00			0,00	0,00
2009	0,00	0,00			0,00	0,00
2010	316,92	0,00			316,92	0,00
2011	279,48	0,00			279,48	0,00
2012	354,19	0,00			354,19	0,00
2013	0,00	0,00			0,00	0,00

Supply

AÑO	1 PRODUCTION	2 IMPORTS	3 EXPORTS	4 STOCK CHANGE	INITIAL STOCK	FINAL STOCK	5 UNUSED	1-2+3+4-5 TOTAL SUPPLY
2005	0,00			0,00				0,00
2006	0,00			0,00				0,00
2007	0,00			0,00				0,00
2008	0,00			0,00				0,00
2009	0,00			0,00				0,00
2010	0,00	335,18	18,26	0,00				316,92
2011	0,00	297,77	18,29	0,00				279,48
2012	0,00	372,60	18,41	0,00				354,19
2013	0,00			0,00				0,00

Transformation

AÑO	1 REFINERY	2 POWER PLANTS	3 SELF PRODUCERS	4 GAS PLANTS	6 CHARCOAL PLANTS	7 COKE	8 DESTILERY	9 OTHER PLANTS	TOTAL TRANSFORMATION	TOTAL PRODUCTION
2005									0,00	0,00
2006									0,00	0,00
2007									0,00	0,00
2008									0,00	0,00
2009									0,00	0,00
2010									0,00	0,00
2011									0,00	0,00
2012									0,00	0,00
2013									0,00	0,00

Consumption

AÑO	1 TRANSPORT	2 INDUSTRY	3 RESIDENTIAL	4 COMERCIAL	5 AGRO FISHING MINING	6 CONSTRUCTION	7 NON ENERGY CONSUMPTION	1+2+3+4+5+6+7 FINAL CONSUMPTION
2005								0,00
2006								0,00
2007								0,00
2008								0,00
2009								0,00
2010	268,15	4,88	1,22	28,05	4,88	9,76		316,92
2011	238,22	4,13	1,03	23,73	4,13	8,25		279,48
2012	298,08	5,61	1,40	32,26	5,61	11,22		354,19
2013								0,00

Electricity Energy Balance forms

Balance

AÑO	1 TOTAL SUPPLY	2 TOTAL TRANSFORMATION	3 OWN CONSUMPTION	4 LOSSES	5 FINAL CONSUMPTION	1-2-3-4-5 ADJUSTMENT
2005	0,00	0,00			0,00	0,00
2006	0,00	0,00			0,00	0,00
2007	0,00	0,00			0,00	0,00
2008	0,00	0,00			0,00	0,00
2009	0,00	0,00			0,00	0,00
2010	247,35	0,00		74,20	173,14	0,00
2011	272,31	0,00		81,69	190,62	0,00
2012	265,48	0,00		79,64	185,84	0,00
2013	0,00	0,00			0,00	0,00

Supply

AÑO	1 PRODUCTION	2 IMPORTS	3 EXPORTS	4 STOCK CHANGE	INITIAL STOCK	FINAL STOCK	5 UNUSED	1-2+3+4-5 TOTAL SUPPLY
2005	0,00			0,00				0,00
2006	0,00			0,00				0,00
2007	0,00			0,00				0,00
2008	0,00			0,00				0,00
2009	0,00			0,00				0,00
2010	247,35			0,00				247,35
2011	272,31			0,00				272,31
2012	265,48			0,00				265,48
2013	0,00			0,00				0,00

Transformation

AÑO	1 REFINERY	2 POWER PLANTS	3 SELF PRODUCERS	4 GAS PLANTS	6 CHARCOAL PLANTS	7 COKE	8 DESTILERY	9 OTHER PLANTS	TOTAL TRANSFORMATION	TOTAL PRODUCTION
2005									0,00	0,00
2006									0,00	0,00
2007									0,00	0,00
2008									0,00	0,00
2009									0,00	0,00
2010		236,33	11,02						0,00	247,35
2011		254,36	17,95						0,00	272,31
2012		250,41	15,07						0,00	265,48
2013									0,00	0,00

Consumption

AÑO	1 TRANSPORT	2 INDUSTRY	3 RESIDENTIAL	4 COMERCIAL	5 AGRO FISHING MINING	6 CONSTRUCTION	7 NON ENERGY CONSUMPTION	1+2+3+4+5+6+7 FINAL CONSUMPTION
2005								0,00
2006								0,00
2007								0,00
2008								0,00
2009								0,00
2010		5,19	69,26	91,77		6,93		173,14
2011		5,72	76,25	101,03		7,62		190,62
2012		5,58	74,33	98,49		7,43		185,84
2013								0,00

Greenhouse Gas Emissions calculated by Reference approach

Gg CO2	Diesel Oil	LPG	Gasoline & Alcohol	Kerosene/ Jet fuel	Fuel Oil	Charcoal	Non-Energy	Total Energy
2010	82,56	17,09	112,86	142,98	198,10	0,73	-	554,327
2011	82,89	16,85	99,53	137,05	182,73	0,74	-	519,787
2012	83,77	17,33	126,13	148,91	210,40	0,75	-	587,281

Table 28. Antigua & Barbuda Greenhouse Gas Emissions by Technology Approach 2010-2012

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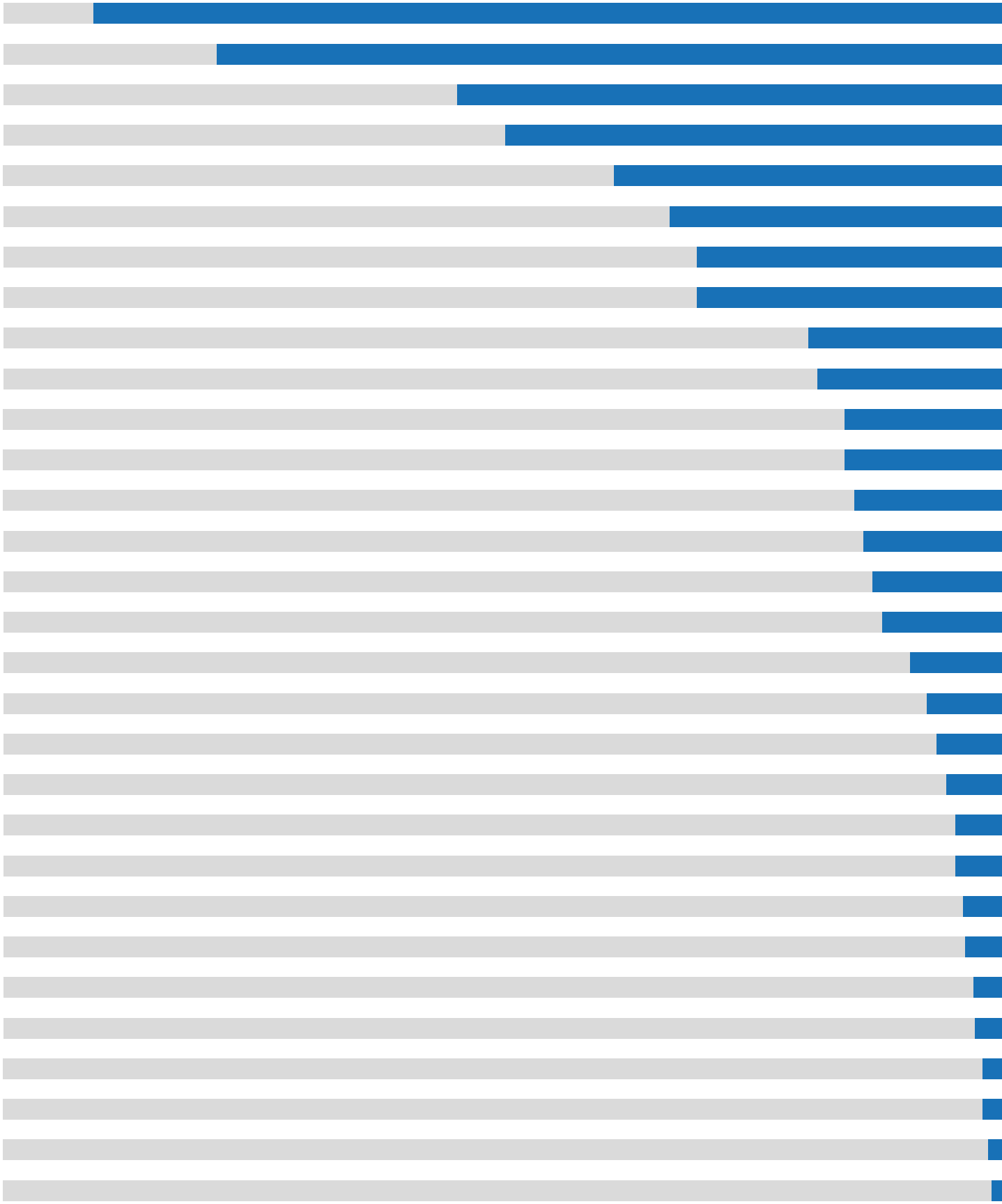

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