



Energy Accounts

WORKING PAPER



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BC BANCO
CR CENTRAL DE
COSTA RICA

National Council of Environmental Accounts

Costa Rica established a National Council of Environmental Accounts (CNCA for its acronym in Spanish) in order to incorporate the accounting of natural resources into public policies and to support the development of Environmental Accounts. Technical assistance and provision of data and information by Ministries and government agencies under the direction of this Council are acknowledged through its members:

Ministry of Environment and Energy (MINAE)

Ministry of Finance (MH)

Ministry of National Planning and Economic Policy (MIDEPLAN)

National Institute of Statistics and Censuses (INEC)

Central Bank of Costa Rica (BCCR)

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Disclaimer

This work is part of an ongoing, continuous improvement process of Environmental Accounts compilation. It is therefore not a final or definitive version. The Central Bank of Costa Rica (BCCR) would appreciate suggestions, comments and the submission of complementary and updated data sources, which may help improve future versions of the accounts.

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Energy and Emissions Account 2011-2015

1. Introduction

The energy account recognizes the relationship of the energetic resources with the environment and the economy by accounting its interactions and exhibiting the reciprocal influences between them. The energy account available for Costa Rica shows the use of the different energy sources since their direct retrieval from natural resources (i.e. primary energy) to the moment when they transform into energy products (i.e. secondary energy), and accounting for this use one time only: when the energy is consumed.

From the physical energy use account, the carbon dioxide (CO₂) emissions account is calculated, showing the emissions generated by the consumption of energy products in each economic activity. These emissions are presented in gross terms; thus, emission reductions generated by other activities in an equivalent way are not recorded in this account.

In the publication of the 2017 energy accounts the data of years 2014 and 2015 was added and a set of adjustments were implemented to the previously published data of years 2011-2013. The energy account is based on the methodology of the Central Framework of the System of Environmental and Economic Accounting (SEEA-CF) and on the SEEA-Energy. This report summarizes the main results of the energy accounts. The detailed accounts are available in the website of Central Bank of Costa Rica¹.

Main results

- ▣ During the period 2011-2015, the total energy requirement – in net terms – increased at an average annual rate of 0.97%.
- ▣ The use of fuels represented 60% of the total net energy use in 2015.
- ▣ In 2015, the total energy intensity decreased by 4.2% with respect to 2014.
- ▣ During the period 2014-2015, the activity that showed the greatest decline in energy intensity was electricity and water supply.
- ▣ During the period 2014-2015, total CO₂ emissions derived from the use of energy products decreased by 4.7%.

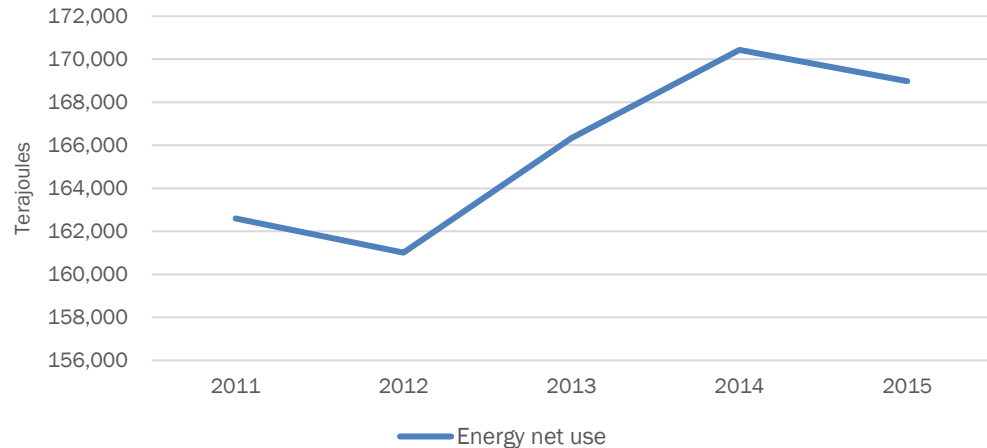
2. Energy use

Production and consumption activities require different energy resources for the development of their routines. They use energy resources both for their transformation into other energy products, as well as for their final use.

¹Website of the Environmental Accounts of Costa Rica: http://www.bccr.fi.cr/cuentas_ambientales/index.html

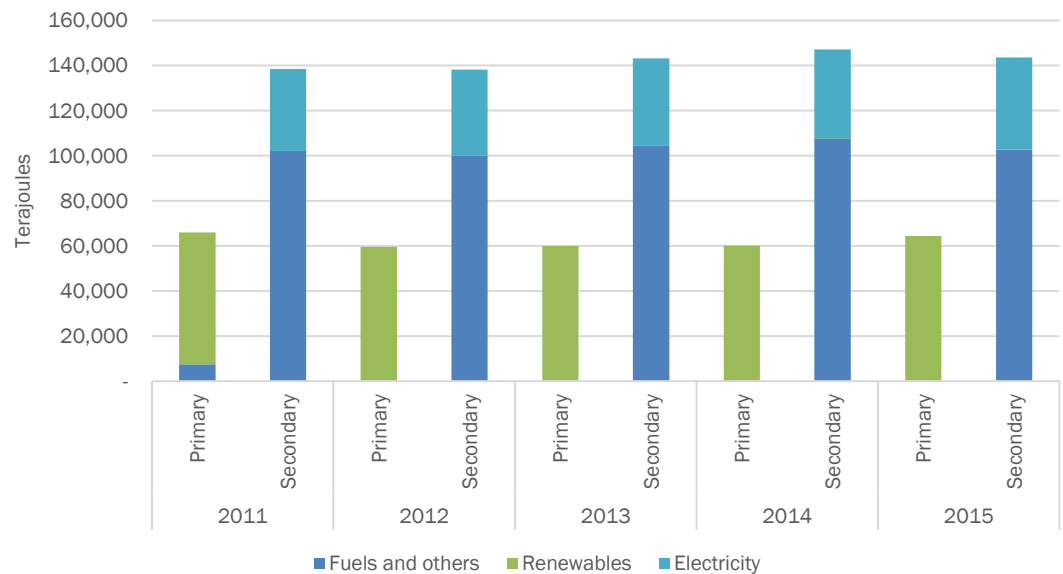
During the period 2011-2015 the total energy requirement, in net terms², increased at an average annual rate of 0.97%. This increase was mainly caused by the growth in the use of secondary energy products, which are mostly fuels.

FIGURE 1. Costa Rica: Annual total net energy use, 2011 to 2015



Source: BCCR, Costa Rica's Energy Account 2011-2015.

FIGURE 2. Costa Rica: Composition of the total gross energy requirements³ by source, 2011 to 2015



Source: BCCR, Costa Rica's Energy Account 2011-2015.

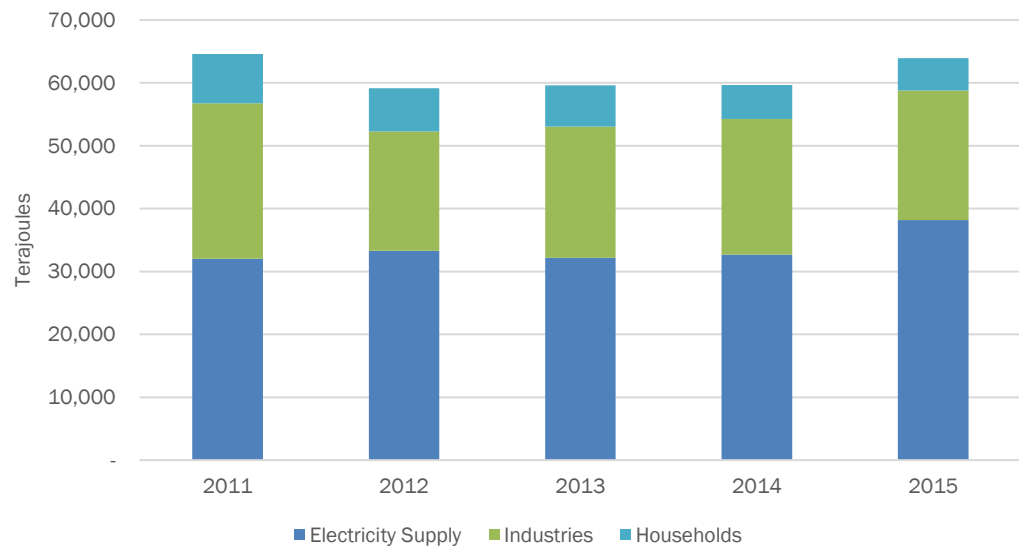
² For the calculation of the net energy use, the production of energy products, i.e. the energy used for transformation, is discounted.

³ The energy requirements include transformed energy and final energy use.

2.1 Energy use by economic activity

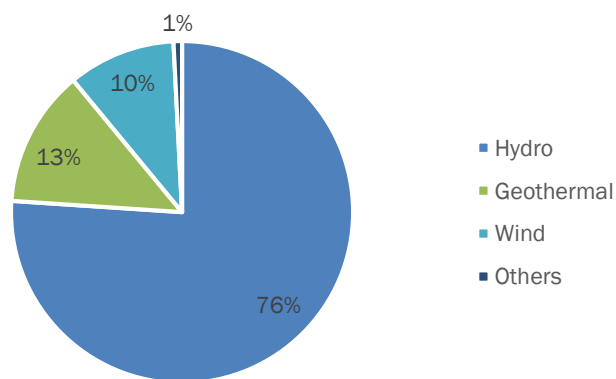
The main use of primary energy sources is associated with power generation, followed by the use of industries as intermediate inputs, and in less proportion by households as final use. Specifically, the main source of energy for electricity generation in 2015 came from hydroelectric plants, followed by geothermal power stations and wind power plants.

FIGURE 3. Costa Rica: Primary energy use by economic and consumption activity, 2011 to 2015



Source: BCCR, Costa Rica's Energy Account 2011-2015.

FIGURE 4. Costa Rica: Energy sources used for electricity supply⁴, 2015



Source: BCCR, Costa Rica's Energy Account 2011-2015.

⁴ The category "Others" includes bagasse, solar and biogas.

In relation to the secondary energy sources, fuels encompass the largest proportion of energy use. In 2015, the use of fuels represented 60% of total net energy use, being used mostly by services activities and households.

TABLE 1. Costa Rica: Net energy use per source by economic and consumption activity, 2015 ^{5, 6}

Activity / Source	Percentage (%)				
	Renewables	Electricity	Fuels	Others	Total
Agriculture, forestry and fishing	0	1	4	0	5
Manufacturing	12	3	7	2	24
Wholesale and retail trade	0	1	2	0	3
Services	1	7	22	0	30
Households	3	8	20	1	32
Exports	0	1	5	0	6
Total	16	21	60	3	100

Source: BCCR, Costa Rica's Energy Account 2011-2015.

3. Energy intensity

The energy intensity indicator allows to identify the amount of energy needed to produce a unit of gross value added (GVA). A decrease in this indicator over time contributes positively to sustainable development. The energy account allows to estimate the energy intensity, both in general terms for the country, as well as for each of the productive and consumption activities within the Costa Rican territory.

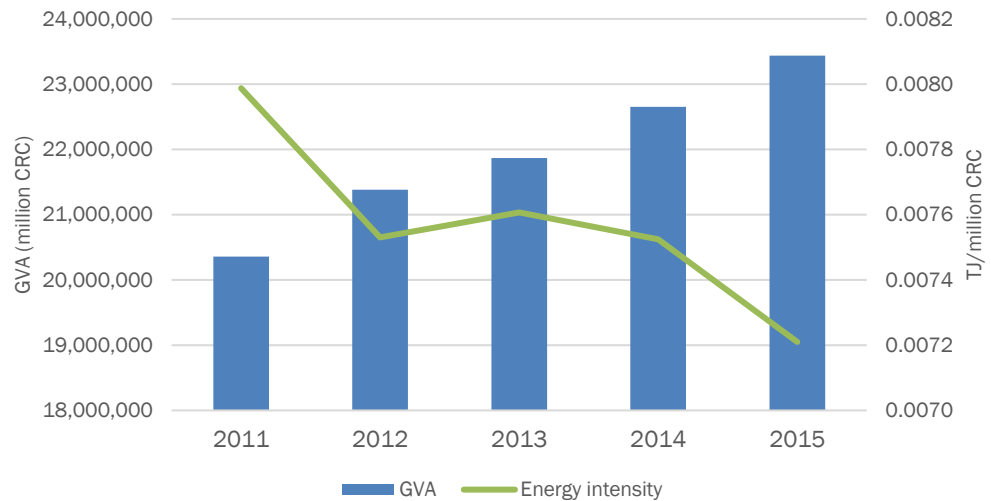
In 2015 the energy intensity⁷ was 0.0072 TJ/millions of CRC. This means that 0.0072 terajoules were required to generate 1 million CRC of gross value added, showing a decrease in the indicator of 4.2% with respect to 2014.

⁵ Energy losses and changes in inventories are not included.

⁶ "Renewables" refer to the use of: hydroenergy, geothermal energy, wind energy, solar energy, bagasse, coffee husks, other vegetal residues, biogas and firewood. The "Fuels" category includes: gasoline, diesel, bunker, AVG, jet fuel, LPG, kerosene, diesel and IFO 380. The "Others" category includes: anthracite, petroleum coke and charcoal.

⁷ The energy intensity was estimated using the gross value added series in terms of chained volume measure, at previous year prices (reference 2012), and the net energy use per year.

FIGURE 5. Costa Rica: Energy intensity, 2011 to 2015



Source: BCCR, Costa Rica's Energy Account 2011-2015.

3.1 Energy intensity by economic activity

The energy intensity by economic activity allows identifying the activities that within their production structures require a greater amount of energy resources. When comparing this indicator with the contribution of each activity to gross value added and employment, it is possible to observe how, for some cases, categories with high energy intensities have a low contribution to gross value added or to the country's employment.

In general terms, service activities have the lowest energy intensities and the highest contributions to gross value added and employment. The sugar manufacturing activity stands out as the activity with the highest energy intensity, reaching 0.142 TJ/millions of CRC in 2015. This value is associated with the use of the bagasse as an energy source.

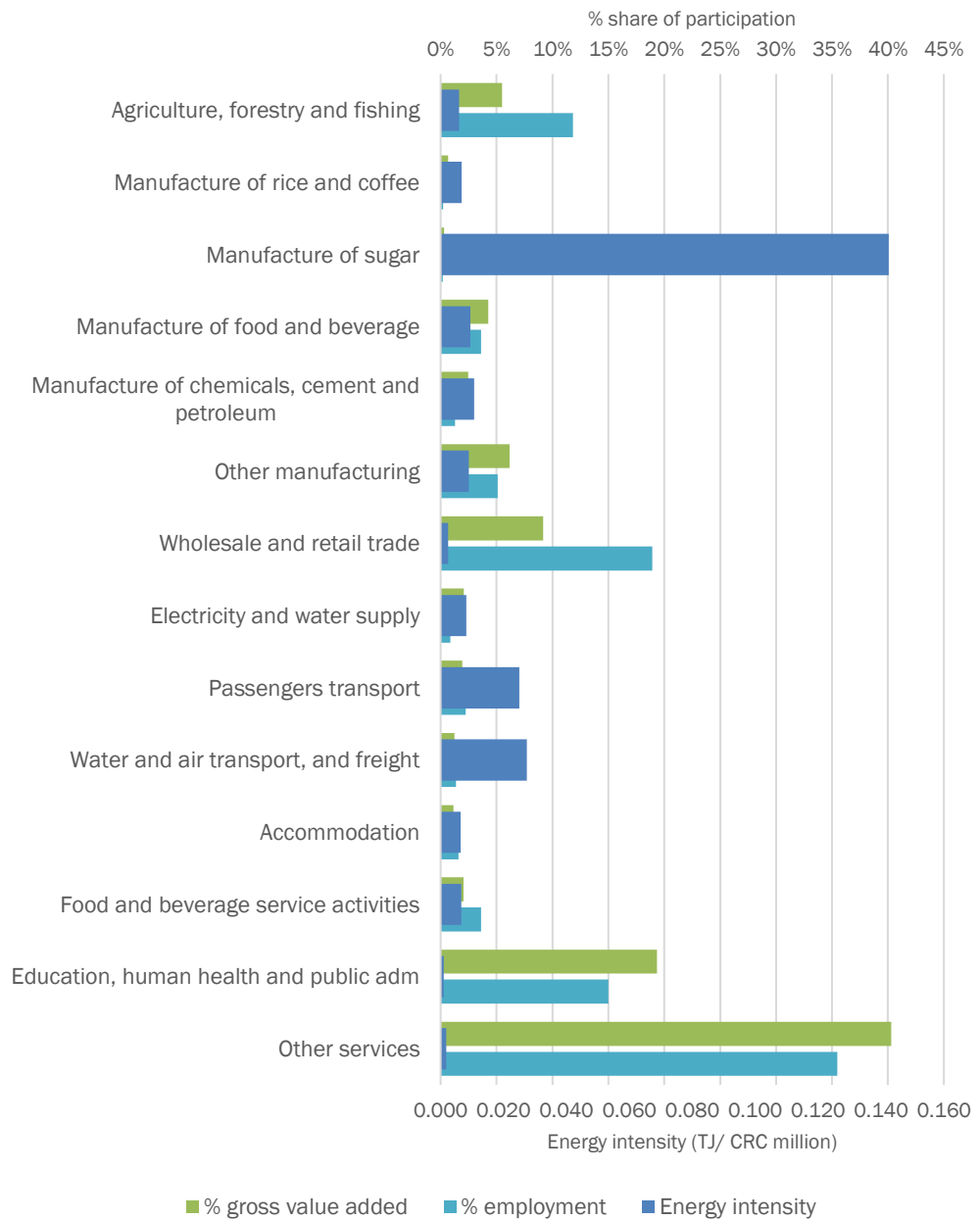
During the period 2014-2015, the activity that has shown the greatest decrease in energy intensity is electricity and water supply.

TABLE 2. Costa Rica: Inter-annual variation of energy intensity by economic activity, 2012 to 2015

Economic activity	Percentage of variation (%)			
	2012	2013	2014	2015
Manufacture of food and beverage	17.7	-2.1	-3.7	10.4
Education, human health and public administration	33.1	-5.8	4.3	5.9
Other services	19.2	-1.8	5.2	5.6
Manufacture of food and beverage	200.1	-14.7	-5.1	4.6
Water and air transport, and freight	-23.2	-9.2	-0.3	1.7
Passengers transport	16.2	-3.0	4.1	1.7
Manufacture of rice and coffee	-17.6	-20.6	-6.3	0.6
Accommodation	6.9	-22.1	0.8	0.0
Agriculture, forestry and fishing	25.0	-0.8	-0.6	-0.4
Manufacture of sugar	-4.9	-2.6	0.4	-1.6
Other manufacturing	2.9	-2.4	1.6	-3.1
Wholesale and retail trade	73.3	5.5	-22.1	-6.8
Manufacture of chemicals, cement and petroleum	-43.9	0.1	-8.6	-7.1
Electricity and water supply	-34.5	123.5	-0.2	-57.6

Source: BCCR, Costa Rica's Energy Account 2011-2015.

FIGURE 6. Costa Rica: Energy intensity and share of gross value added and employment by economic activity, 2015

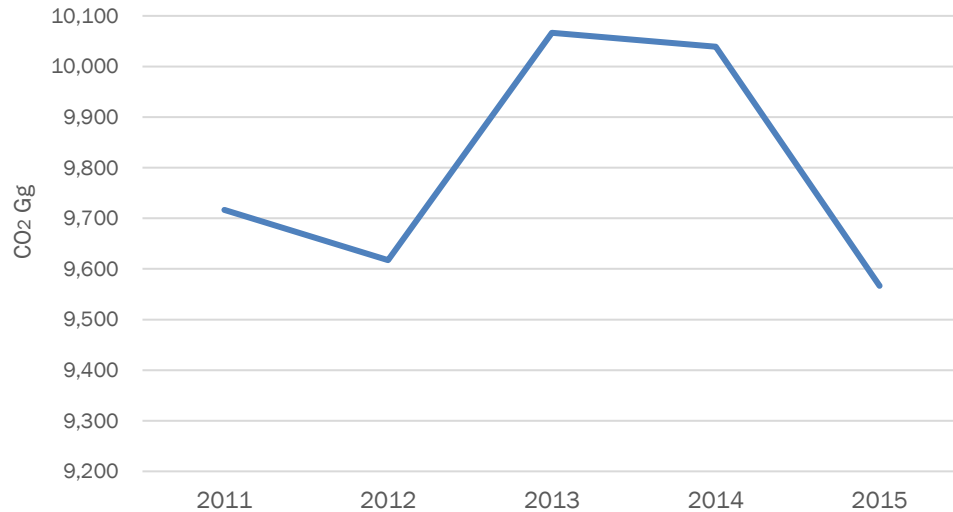


Source: BCCR, Costa Rica's Energy Account 2011-2015.

4. Emissions

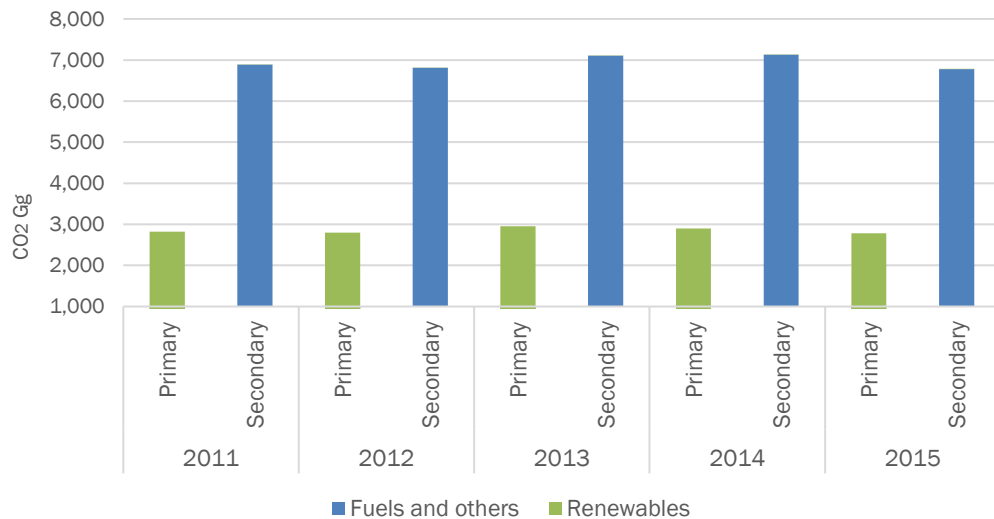
The CO₂ emissions derived from the energy use account allow to understand the environmental pressures of each economic activity related to the consumption of energy products⁸. During the period 2014-2015, CO₂ emissions decreased by 4.7%. This variation is mainly caused by the lower use of bunker as an energy product.

FIGURE 7. Costa Rica: Total CO₂ emissions by year, 2011 to 2015



Source: BCCR, Costa Rica's Energy Account 2011-2015.

FIGURE 8. Costa Rica: Total emissions by energy source, 2011 to 2015



Source: BCCR, Costa Rica's Energy Account 2011-2015.

⁸ The energy use associated with exports and inventories is not considered in the calculation of emissions.

4.1 Emissions by economic activity

In 2015, the electricity and water supply activity showed the largest decline in the level of CO₂ emissions, which is consistent with the decrease in energy intensity. Additionally, the activities of chemical manufacturing, cement and refining as an aggregate show a constant decrease in the emission levels during all the periods considered. In these activities, the lower use of products with higher emission factors (e.g. diesel and bunker) is reflected.

On the other hand, the economic activities associated to services have increased their levels of emissions. This trend is consistent with the increase in these activities' share of GDP.

TABLE 3. Costa Rica: CO₂ emissions by economic activity, 2011 to 2015

Economic Activity	Giga grams				
	2011	2012	2013	2014	2015
Manufacture of sugar	845	885	1,063	1,105	1,089
Other manufacturing	853	1,028	1,019	1,060	975
Other services	400	681	696	791	849
Passengers transport	597	748	741	809	824
Water and air transport, and freight	738	593	554	558	569
Manufacture of food and beverage	471	582	528	566	567
Agriculture, forestry and fishing	365	462	457	461	462
Manufacture of chemicals, cement and petroleum	964	493	483	467	432
Electricity and water supply	664	508	921	788	208
Wholesale and retail trade	121	292	303	247	194
Education, human health and public administration	81	148	139	149	160
Food and beverage service activities	90	123	122	127	138
Manufacture of rice and coffee.	103	105	96	92	91
Accommodation	55	62	60	62	64

Source: BCCR, Costa Rica's Energy Account 2011-2015.

5. Methodology notes

Costa Rica's energy accounts are constantly being revised and updated. Since the publication of their first exercise in May 2016, additional reviews and new sources of information have been addressed. The current publication of the energy accounts includes the review of the period 2011-2013 and the addition of the years 2014 and 2015.

This publication includes the following considerations:

1. Adjustments and corrections:

- a. Use of firewood in the activities of accommodation and food and beverages services. The values previously published used to assign a greater use of firewood to the activity of lodging and a lower use to the activity of service of foods and beverages.
- b. Fuel emissions factors. The values currently considered are those provided by the National Meteorological Institute (IMN) converted to terajoules, in accordance with the reference energy equivalence used in the Energy Balances (EB), developed by the Planning Secretariat of the Energy Subsector (SEPSE for its acronym in Spanish). The emission factors used in the first exercise of the emissions account were provided by the IMN directly and energy equivalences were not validated according to the EB.
- c. Fuel exports. This calculation is done according to the information of fuel consumption by non-residents in the embassies and in tourism activities. This information was not available before.

2. Additional information sources:

- a. The use of AVG, Jet-fuel, Gas oil, Petroleum coke and IFO- 380 were directly assigned according to the sales report of RECOPE⁹.
- b. The Annual Generation and Demand Report of the National Center of Energy Control¹⁰ was used to assign the use of bagasse in the generation of electricity.

⁹ Costa Rican Oil Refinery.

¹⁰ Under Costa Rican Electricity Institute (ICE) responsibility.

6. References

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7. Appendix

APPENDIX 1. Aggregation of economic activities

Economic activity in the report	Economic activity in the Energy Account
Agriculture, forestry and fishing	Agriculture
	Livestock
	Support activities to agriculture and postharvest crop activities
	Forestry, logging and hunting
	Fishing and aquaculture
Manufacture of rice and coffee	Manufacture of rice
	Coffee manufacturing and production of coffee products
Manufacture of sugar	Manufacture of sugar
Manufacture of food and beverage	Other food manufacturing
	Drinks and tobacco
Manufacture of chemicals, cement and petroleum	Manufacture of coke and refined petroleum products / Manufacture of basic chemicals, fertilizers and nitrogen compounds / Manufacture of other chemical products n.e.c. and manufacture of man-made fibres
	Manufacture of chemicals and chemical products
	Manufacture of cement, lime and plaster; manufacture of articles of concrete, cement and plaster; cutting, shaping and finishing of stone; manufacture of other non-metallic mineral products n.e.c.
Other manufacturing	Mining and quarrying
	Textiles
	Manufacture of wood and of products of wood and cork; manufacture of articles of straw and plaiting materials; furniture manufacturing
	Other manufacturing
Wholesale and retail trade	Wholesale and retail trade
Electricity and water supply	Electricity, gas, steam and air conditioning supply
	Water collection, treatment and supply and sewerage.
Passengers transport	Transport via railways
	Passengers land transport, except taxis
	Passengers land transport by taxis

Economic activity in the report	Economic activity in the Energy Account
Water and air transport, and freight	Water and air transport, and freight
Accommodation	Accommodation
Food and beverage service activities	Food and beverage service activities
Education, human health and public administration	Education (market production)
	Education (nonmarket production)
	Human health and social work activities (market production)
	Human health and social work activities (nonmarket production)
	Public administration and defense
	Compulsory social security
Other services	Waste management and disposal activities
	Construction
	Telecommunications
	Financial and insurance activities
	Other services

APPENDIX 2. Emission factors

Energetic source	Kg CO ₂ / TJ
Geothermal	17.74
Bagasse	100,000.00
Coffee husks	100,000.00
Other plant residues	100,000.00
Biogases	54,900.00
Firewood	112,000.00
Anthracite	95,700.00
Gasoline	69,218.99
Diesel	74,104.68
Bunker	77,298.41
AVG	82,388.97
Jet fuel	71,366.41
LPG	63,038.37
Kerosene	71,946.62
Gas oil	75,378.00
Petroleum coke	92,708.00
IFO 380	77,367.00
Charcoal	112,000.00

Source: Reports on GHG of the IMN (2014) and Eggleston et al. (2006).