

Methodology

Overview

This comprehensive Energy Database is a tool to help governments, businesses, academics, and citizens understand the energy landscape in Latin America and the Caribbean. The Database, compiled by the Inter-American Development Bank (IDB) Energy Division, contains two distinct products: Energy Flow and Institutional Frameworks. The first is a quantitative time-series that transforms the International Energy Agency (IEA) *World Energy Statistics and Balances*¹ into suitable data to create different visualizations. The second is a qualitative dataset that explains the regulatory framework and market organization of selected countries. Together, this Energy Database provides the necessary context for the IDB, our member countries, and the global community to understand the energy sector landscape of individual countries, and how they compare to each other. It is envisioned as a tool to help decision making, project design, and with that, a more sustainable energy future.

Countries Denoted with a *

The IEA does not publish the required data to feed the infographics for the following group of IDB member countries: Bahamas, Barbados, Belize, Guyana, and Suriname. To ensure that they were included in this database, a team under the leadership of Ramon Espinasa compiled this information from the sources listed below. This is Phase I of a work in progress. The data will be improved when possible and updated as further information becomes available.

BAHAMAS

The matrix was constructed with data from the Energy Information Administration (EIA), Organization of American States (OAS), the International Renewable Energy Agency (IRENA) and the Bahamas Environment, Science and Technology Commission (BEST).

BARBADOS

The matrix was constructed using data from the United Nations Energy Balances.

BELIZE

The matrix was constructed using data from OLADE; Tillett, Locke and Mencias, "Towards Energy Efficiency, Sustainability and Resilience for Belize in the 21st Century" (report prepared for the Government of Belize); Belize Electricity Limited; and the Central Bank of Belize.

GUYANA

The matrix was constructed using data from the United Nations Energy Balances.

SURINAME

The matrix was constructed using data from the United Nations Energy Balances.

Regional Data

In order to provide our users with regional context on the energy flow in Latin America and the Caribbean (LAC), the database includes LAC as a simple grouping of the energy balances for the following IDB borrowing member countries that are included in the IEA published data: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador,

¹ IEA World Energy Statistics and Balances, is an annual publication of the Organization for Economic Co-operation and Development (OECD)

Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad & Tobago, Uruguay, and Venezuela.

Energy Flows

At this stage², this dataset comprises eight visualizations:

1. Energy Matrix
2. Energy Production Comparison
3. Energy Comparison
4. Energy Sources and Flows over Time
5. Electricity Generation and Losses by Source
6. Final Consumption by Sector over Time
7. Final Consumption by Sector and Source.
8. Electricity Matrix

Although each visualization is designed to provide a different insight into a specific country's energy segment, overall, the information shows the availability of resources, current patterns of supply and demand, and changes over time.

As mentioned earlier, the primary source of information is the IEA *World Energy Statistics and Balances*. This publication is recognized for its uniformity and reliability, both necessary elements for meaningful comparative analyses. The dataset contains information on the majority of countries in Latin American and the Caribbean³ including supply, transformation, and consumption of primary energy sources⁴ such as coal, oil, gas, biofuels and waste, nuclear energy, and geothermal energy. It also provides data on secondary energy sources⁵ such as products derived from crude oil and electricity, including sources of electricity generation. The IEA balances also include information about the consumption of each energy source by sector; namely residential, transportation, commercial, and industrial.

The original source of data is reported in thousands of tons of oil equivalent per year (ktoe). In order to make this information useful to the widest of audiences, the IDB Energy Division transformed the data into thousands of barrels of oil equivalent per day, (kboe/day)⁶ which is the unit of measurement used by crude oil—the largest and most traded global source of energy. Given that individuals who work in electricity are used to gigawatt/hour as a measurement unit, the electricity matrix visualization offers the user a choice between seeing the data in either thousands of barrels of oil equivalent per day or in gigawatt hour per year.

Data can be normalized by GDP (measured at purchasing power parity in 2011 U.S. dollars) or by population, using information from the World Bank. Normalized data is presented in barrels of oil

² This project is ongoing and variations of existing visualizations as well as additions to the set are expected throughout 2014 and beyond.

³ All figures are obtained from the IEA, which relies on country and regional energy reporting agencies. For Latin American and Caribbean countries, the bulk of the information obtained from national agencies is submitted to the Latin America Energy Organization (OLADE) via an on-going reporting mechanism.

⁴ Primary energy is used to designate an energy source that is extracted from a stock of natural resources or captured from a flow of resources and that has not undergone any transformation or conversion other than separation and cleaning.









⁵ Secondary energy refers to any energy that is obtained from a primary energy source employing a transformation or conversion process. Oil products and electricity are secondary energy sources because their production requires refining or electric generators.

⁶ Conversion table can be accessed at <http://www.iea.org/stats/unit.asp>

equivalent (boe) per 10,000 dollars of GDP and by boe per person.

Definitions of all energy sources, whether primary or secondary, are common among all visualizations.

Energy Flows Content ⁷

-  **BIOFUELS AND WASTE** are comprised of solid biofuels, liquid biofuels, biogases, industrial waste, and municipal waste. Note that for biomass commodities, only the amounts specifically used for energy purposes (a small part of the total) are included in the energy statistics. Therefore, the non-energy use of biomass is not taken into consideration and quantities are null by definition. Data under this heading is often based on small sample surveys or other incomplete information.
-  **COAL** includes all coal, both primary (including hard coal and lignite) and derived fuels (including patent fuel, coke oven coke, gas coke, BKB, gas works gas, coke oven gas, blast furnace gas, and oxygen steel furnace gas)⁸.
-  **CRUDE OIL** comprises crude oil, natural gas liquids, refinery feedstocks, and additives, as well as other hydrocarbons (including emulsified oils, synthetic crude oil, mineral oils extracted from bituminous minerals such as oil shale, bituminous sand, etc., and oils from coal liquefaction).
-  **ELECTRICITY** shows final consumption and trade in electricity (which is accounted at the same heat value as electricity in final consumption; i.e. 1 GWh = 0.000086 Mtoe).
-  **HYDRO** shows the energy content of the electricity produced by hydro power plants. Hydro output excludes output from pumped storage plants.
-  **NATURAL GAS** comprises gases occurring in underground deposits, whether liquefied or gaseous, consisting mainly of methane. It includes both "non-associated" gas originating from fields producing only hydrocarbons in gaseous form, and "associated" gas produced in association with crude oil, as well as methane recovered from coal mines (colliery gas) or from coal seams (coal seam gas). Production represents dry marketable production within national boundaries, including offshore production and is measured after purification and extraction of NGL and sulphur. It includes gas consumed by gas processing plants and gas transported by pipelines. Re-injected, vented, or flared gas is excluded.
-  **NUCLEAR** shows the primary heat equivalent of the electricity produced by a nuclear power plant with an average thermal efficiency of 33 percent.
-  **OIL PRODUCTS** comprise refinery gas, ethane, LPG, aviation gasoline, motor gasoline, jet fuels, kerosene, gas/diesel oil, fuel oil, naphtha, white spirit, lubricants, bitumen, paraffin waxes, petroleum coke, and other oil products. Oil products are any oil-based products which can be obtained by distillation and are normally used outside the refining industry. Finished products classified as refinery feedstocks are the exception.

⁷ All energy sources are defined using the IEA definitions.

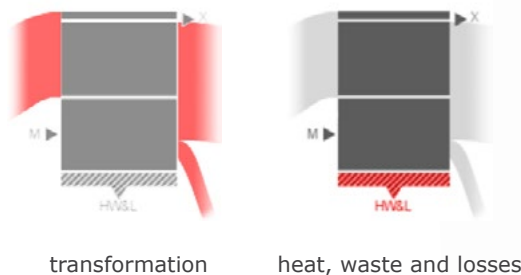
⁸ Starting with 2011 edition (IEA), gas works gas is included with coal. In prior years, gas works gas was included with natural gas.





PRODUCTION is the production of primary energy, i.e. hard coal, lignite, peat, crude oil, NGL, natural gas, combustible renewables and waste, nuclear, hydro, geothermal, and solar and the heat from heat pumps that is extracted from the ambient environment. Production is calculated after the removal of impurities (e.g. sulphur from natural gas).

IMPORTS AND EXPORTS comprise amounts that have crossed national territorial boundaries, regardless of whether or not customs clearance has taken place. Imports and exports of coal comprise the amount of fuel obtained from or supplied to other countries, whether or not there is an economic or customs union between the countries involved. Coal in transit is not included. For electricity, amounts are considered as imported or exported when they have crossed the national territorial boundaries of the country. If electricity is "wheeled" or transited through a country, the amount is shown as both an import and an export.


HEAT, WASTE, AND LOSSES is defined as energy dissipated due to heat and waste during the process of electricity generation, technical losses in transmission and distribution, losses in the refining process if any, and in the transport of coal. Crude oil losses represent the volume of crude oil reported by petroleum refineries as being lost in their operations. These losses are due to spills, contamination, fires, etc., as opposed to refining processing losses.


TRANSFORMATION refers to the process by which primary energy sources are transformed by different methods into secondary energy sources.



-  **TOTAL ENERGY CONSUMPTION** is made up of production plus imports, minus exports, minus international marine bunkers plus/minus stock changes. It is also called Total primary energy supply or Gross inland energy consumption and represents the quantity of all energy necessary to satisfy inland consumption.
-  **INDUSTRIAL SECTOR** consists of all facilities and equipment used for producing, processing, or assembling goods. Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products which includes generators that produce electricity and/or useful thermal output primarily to support industrial activities.
-  **RESIDENTIAL SECTOR** consists of private households. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a variety of other appliances.
-  **TRANSPORTATION SECTOR** consists of all vehicles whose primary purpose is transporting people and/or goods from one physical location to another. Included are automobiles; trucks;

buses; motorcycles; trains, subways, and other rail vehicles; aircraft; and ships, barges, and other waterborne vehicles. Vehicles whose primary purpose is not transportation (such as construction cranes and bulldozers, farming vehicles, and warehouse tractors and forklifts) are classified in the sector of their primary use.

 **COMMERCIAL SECTOR** refers to consumption of energy by repair and installation of machinery, water collection, treatment and supply, sewerage, waste collection, waste management services, wholesale and retail trade and repair of motor vehicles and motorcycles, Warehousing for transportation, Postal, Accommodation and Food, information and communications, Finance and insurance, real estate, professional, scientific and technical activities, administrative and support activities, public administration, education, human health and social work, arts, entertainment and recreation, other service activities, and extraterritorial organizations.

 **OTHER** refers to consumption of energy by agriculture/forestry, fishing, non-energy and other non-specified sectors, such as the military.

OWN USE refers to the energy used in energy producing industries for heating, lighting, and operation of equipment used in the extraction process, for traction, and for distribution.

LATIN AMERICA AND THE CARIBBEAN BY REGION The database classifies IDB member countries in different regions, distinct from the Bank's operational departments. The regions are: Central America, including Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama; Mexico; Andean, with Bolivia, Colombia, Ecuador, Peru and Venezuela; the Southern Cone, where we have Argentina, Brazil, Chile, Paraguay, and Uruguay; and the Caribbean, with Bahamas, Barbados, Guyana, Dominican Republic, Haiti, Jamaica, Suriname, and Trinidad & Tobago.

Units

Most of the data is presented in thousand barrels of oil equivalent per day (abbreviated as kBOE/day), where a BOE is defined as a unit of energy contained in one barrel of crude oil, which is measured in other units of energy as 5.8×10^6 BTU or 6.118×10^9 Joules. Electricity consumption data is presented in Gigawatt-hour.

Time series

The information is presented for both one year and four year time periods. The data averaged over four year periods provides a look at long-term trends and allows users to see the difference between extreme energy changes that might occur in a particular year and the overall energy trajectory in a country during a longer time period. These four-year periods are: 1971 to 1974, 1984 to 1987, 1999 to 2002, and 2005 to 2008. The period 1971-1974 represents the average of data from the four earliest available years. The second and third periods, 1984 to 1987 and 1999 to 2002 were chosen to coincide with periods of important changes in the crude oil price regime. The period between 2005 and 2008 represents the most recent data available for a four-year period at the time the project began.

Institutional Overview

The institutional information was collected using the most recent⁹ sources of information available from the respective countries. In order to define market participation, the IDB relied on multiple sources including reports from public organizations related to the sector, audited financial statements, and/or reports from international agencies. See the information below for specific explanation on the visualization content.

NATURAL GAS for all market segments, with the exception of Consumption, the information contains the portion of the country's natural gas produced, treated or processed, transported, distributed and sold to final consumers, imported, and exported by a particular company in the country. The information for Consumption represents the portion of the country's natural gas consumed by each economic sector.

CRUDE for Exploration and Production, Imports and Exports, the information contains the portion of the country's crude oil that is produced, imported, or exported by a particular company.

OIL DERIVATIVES (EXCLUDING LPG) for all market segments with the exception of Exploration and Production and Consumption, the information contains the portion of the country's oil derivatives refined, transported, distributed and sold, imported, and exported by a particular company. The information for Consumption represents the portion of the country's oil derivatives consumed by each economic sector.

LPG for all market segments with the exception of Exploration and Production and Consumption, the information contains the portion of the country's LPG refined, transported, distributed and sold, imported, and exported by a particular company. The information for Consumption represents the portion of the country's LPG consumed by each economic sector.

PUBLIC PLAYERS are defined as companies that participate in the energy market in which the largest shareholder is the state or a state institution, or in which the state or a state institution maintains managerial control.

PRIVATE PLAYERS are defined as companies that participate in the energy market in which the largest shareholders are private companies or in which private agents maintain managerial control.

GOVERNMENT AGENCIES are institutions, organizations, or agencies that form part of the state and participate in the energy market to regulate and/or supervise sector development.

On specific explanation on the visualization content:

ELECTRICITY for all market segments, with the exception of Dispatch Coordinator and Consumption, the information contains the portion of the country's total capacity, transmission lines length, electricity commercialized at the wholesale level, and total connections, by a particular company. The information for Consumption represents the portion of the country's electricity consumed by each economic sector.

⁹ As of December 31, 2013

Timeline

The timeline was constructed via a historic review of the Official Gazettes (main legal publication) of each country. In general, the process began by identifying the main current laws in force in each country. Later, the history of reforms that influenced or modified each of the laws was constructed. In the process, relevant historic regulations that had an impact on the energy sector were identified. All laws and regulations (original source) presented as part of each country timeline were extracted directly from official government institutions, regulatory agencies and official gazettes.

Private participation in the market

The graph on private participation in the market was created to respond to the following questions: Is there private participation in any specific activity in the value chain of energy products? It is considered private participation in some activities if: (i) there is effectively a private participant in the activity; or (ii) if some activity that is part of the value chain of a product that does not exist in the country, it responds to the question based on the most current legislation.

Linked Data

The Energy Database is published in both human and machine readable formats. The machine readable portion leverages Linked Data - which is the international data exchange format for publication of data on the World Wide Web. Linked Data is intended for access by both humans and machines. Linked Data uses the RDF family of standards for data interchange and query. The benefit of using the international data exchange standard RDF (Resource Description Framework) is that it may be readily parsed by other computer programs without access to proprietary libraries. Creating and publishing data following Linked Data principles helps search engines and humans to find access and re-use data. Once information is found, computer programs can re-use data without the need for custom scripts to manipulate the content¹⁰.

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¹⁰ This publications is an international peer reviewed glossary published by the W3C (published in June 2013).