



# Energy Industry in Uruguay



## General State of the Economy

Uruguay, or the Eastern Republic of Uruguay, is one of the most economically developed countries in Latin America, located in the southeast of the southern continent between Argentina, Brazil and the Atlantic Ocean.

Uruguay has a small territory, the size of which is less than almost all South American countries except Suriname and Guyana. In terms of the size Uruguay is 89<sup>th</sup> in the world, and according to the population density the country is 207<sup>th</sup> [1,2]. The total length of the country's coastline is 660 km [3].



Sources:

1. GDP (purchasing power parity), 2020 est. / The World Factbook/Library/Central Intelligence Agency \*228
  2. GDP - per capita (PPP), 2020 / The World Factbook/Library/Central Intelligence Agency \*229
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  4. Charges for the use of intellectual property, receipts (BoP, current US\$), 2020 / International Monetary Fund, Balance of Payments Statistics Yearbook, and data files. / License: CC BY-4.0 \*88
  5. The Global Competitiveness Index 2019 / Rankings / Reports / World Economic Forum \*141
  6. High-technology exports (current US\$) 2019-2020 / United Nations, Comtrade database through the WITS platform / License: CCBY-4.0 / Data \*134
  7. 2021 Index of Economic Freedom / International Economies / The Heritage Foundation \*178
  8. Reserves of foreign exchange and gold, 2017 est. / The World Factbook / Library / Central Intelligence Agency \*195
  9. Annual average GDP growth in %, for the last 10 years (2011-2020) / World Bank national accounts data, and OECD National Accounts data files / License: CC BY-4.0 \*206
  10. Public debt (% of GDP), 2017 est. / The World Factbook / Library / Central Intelligence Agency(from smallest to largest) \*210
- \* Total number of countries participating in ranking

Figure 1. Economic indices of Uruguay

According to 2022 data, the country is home to 3 407 213 people [3]. More than half of Uruguay's population is concentrated in the capital (Montevideo) and its

surroundings; most Uruguayans are Hispanic. The administrative map of Uruguay is divided into 19 departments.

Uruguay has a stable economy, focused mainly on the export of agricultural products. Half of the indices reflected in the comparative diagram (Fig. 1) are located in the upper part (ie. over 50% of the best countries in the world included in the rating). However, for a number of indicators, such as the inflation rate and the high-technology exports, etc. Uruguay shows negative results. According to [3] GDP purchasing power parity in Uruguay reached \$75.06 trillion in 2020, with a steady GDP growth observed over the past decade, except for the last year [3,4]. GDP purchasing power parity per capita decreased from \$23 000 in 2018 to \$21 600 in 2020 [3,5].

Uruguay ranks 54<sup>th</sup> in the Global Competitiveness Report 2019, up 22 positions from the previous ranking, thanks

to a significant increase in the share of renewable energy. In the list of countries according to the index of economic freedom in 2021, Uruguay takes 44<sup>th</sup> place, and is included in the group of countries with moderately free economies, ahead of, for example, Peru. In terms of reserves of foreign exchange and gold Uruguay is 66<sup>th</sup> in the world.

According to the indicator for the average GDP growth in percentage over the last 10 years, in 2020 the country was 138<sup>th</sup> out of 206 countries. In terms of public debt, calculated as a percentage of the country's GDP, Uruguay was ranked 110<sup>th</sup> out of 210 countries considered in 2017.

For more information on Uruguay's economy click [here](#).

## Energy resources

Conventional resources in Uruguay are virtually non-existent. Nevertheless, we can note the presence of minor deposits of shale gas and oil shale with 4,6 Tcf and 0.6 billion barrels, respectively, which are many times

less than the same resources for the leaders of the continent – Brazil and Argentina [6].

The level of solar radiation is not very high (4.6-4.9 kWh/m<sup>2</sup>/day) and scattered over most of the country. In the north, this figure reaches more than 4.9 kWh/m<sup>2</sup>/day [7]. In most parts of Uruguay the average annual wind speed is 5.0-7.0 m/sec, and along the coastline it can reach over 7.0 m/sec [8].

**Table 1. Renewable energy resources of Uruguay**

Resource/ explanations	Solar Potential (GHI)*	Wind Potential (50 m)*	Hydro energy Potential**	Bio Potential (agricultural area)	Bio Potential (forest area)	Municipal Solid Waste
<b>Value</b>	4.6 - 4.9	5.0 - 7.0	10	80.4	11.6	1.01
<b>Unit</b>	kWh/m <sup>2</sup> /day	m/s	GWh/year	% of land area	% of land area	Kg/per capita/day
<b>Year</b>	2018	2018	2009	2020	2020	2016
<b>Source</b>	[7]	[8]	[11]	[9]	[10]	[12]

\*for most of the territory of the country

\*\*technically exploitable hydro power potential

More than 80% of Uruguay is covered by agricultural land, and about 11.6% is occupied by forests, this number has increased two-fold in the last 25 years due to a reduction in arable land [9,10].

It should be emphasized that this is a significant biological resource for energy production. The natural landscape of the country consists of plains and lowlands. Theoretically exploitable hydropower potential is 10 GWh/year, which compared to other South American countries seems small, but is considerable for Uruguay, given the country's size and population density [11]. This energy review of Uruguay would not be complete without mentioning municipal waste, which in many countries, has become a significant source of energy.

The MSW generation rate in Uruguay is the lowest in Latin America –1.01 kg per person per day [12].

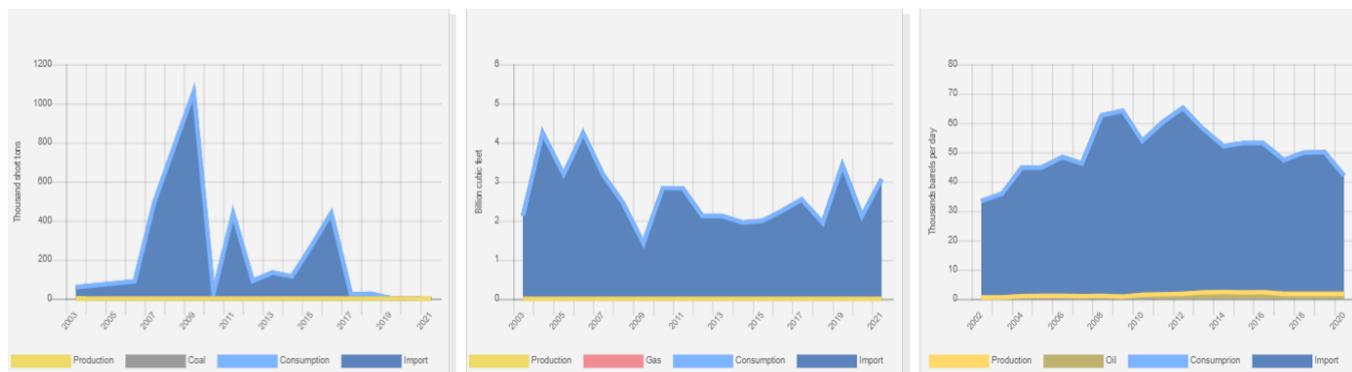
For more information about energy resources in Uruguay click [here](#).

## Energy Balance

Uruguay is a net importer of traditional fossil fuel resources. Oil consumption has risen significantly starting in the early 2000s, (Figure 2) reaching its peak of about 65 000 barrels day in 2012, before falling to 42 000 barrels a day in 2020 [13]. In 2018, according to [3] Uruguay imported about 41 500 barrels of oil per day. Natural gas consumption in the country has started to decline

after 2006, reaching one of its lowest levels at 1.94 Bcf in 2018 before going back up and reaching 3.1 Bcf in 2021. In 2019, Uruguay imported 96.87 million m<sup>3</sup> of natural gas.

Coal is almost never used in the production of electric power and the imports of this resource are small, its consumption has been decreasing over the past 8 years and in 2019 reached 1.6 thousand short tons (Figure 2).

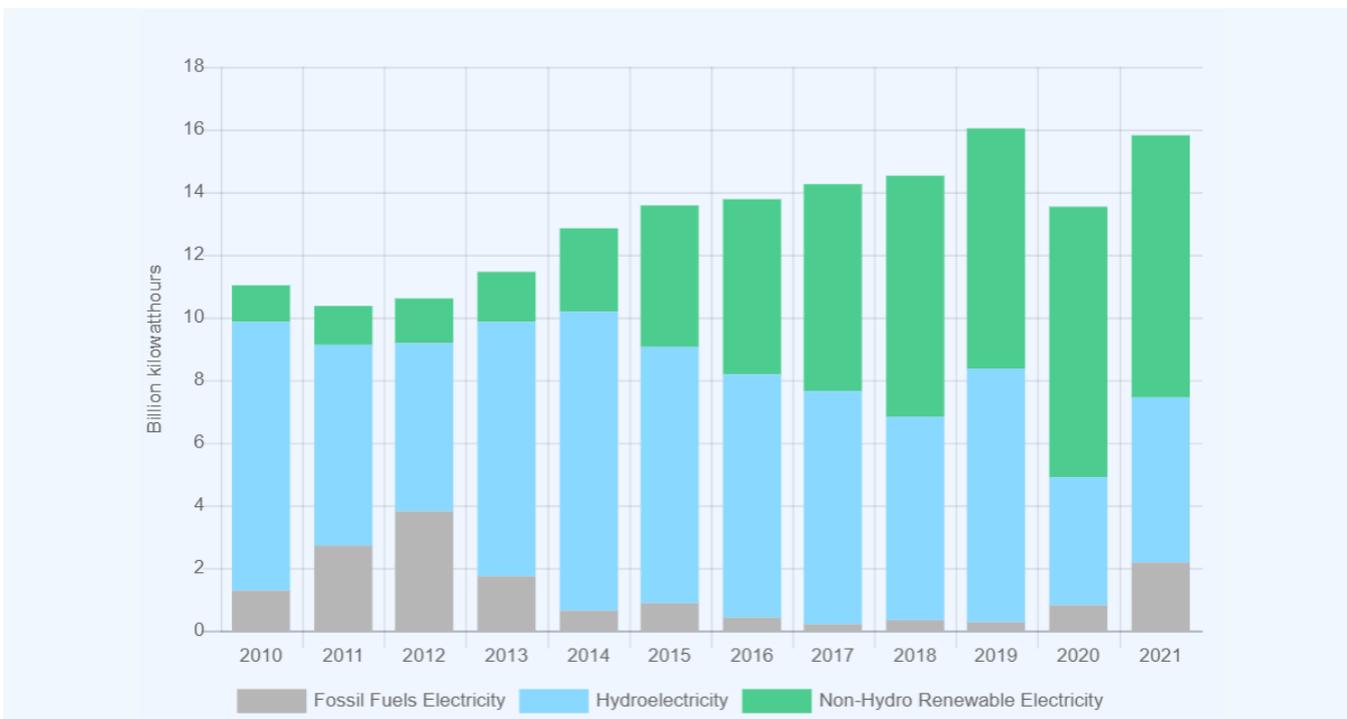


Source: U.S. Energy Information Administration (Dec 2022) / <https://www.eia.gov/>

Figure 2. The production and consumption of fossil fuels in Uruguay (coal-left, gas-in the center, oil-right)

Historically, Uruguay has a high share of hydropower in electricity production (Figure 3). In 2021, Uruguay produced about 15.82 GWh of electricity, of which 33.3% by hydroelectric plants, 13.8% by

thermal power plants on fossil fuels, and 52.9% by other renewable energy sources[14].

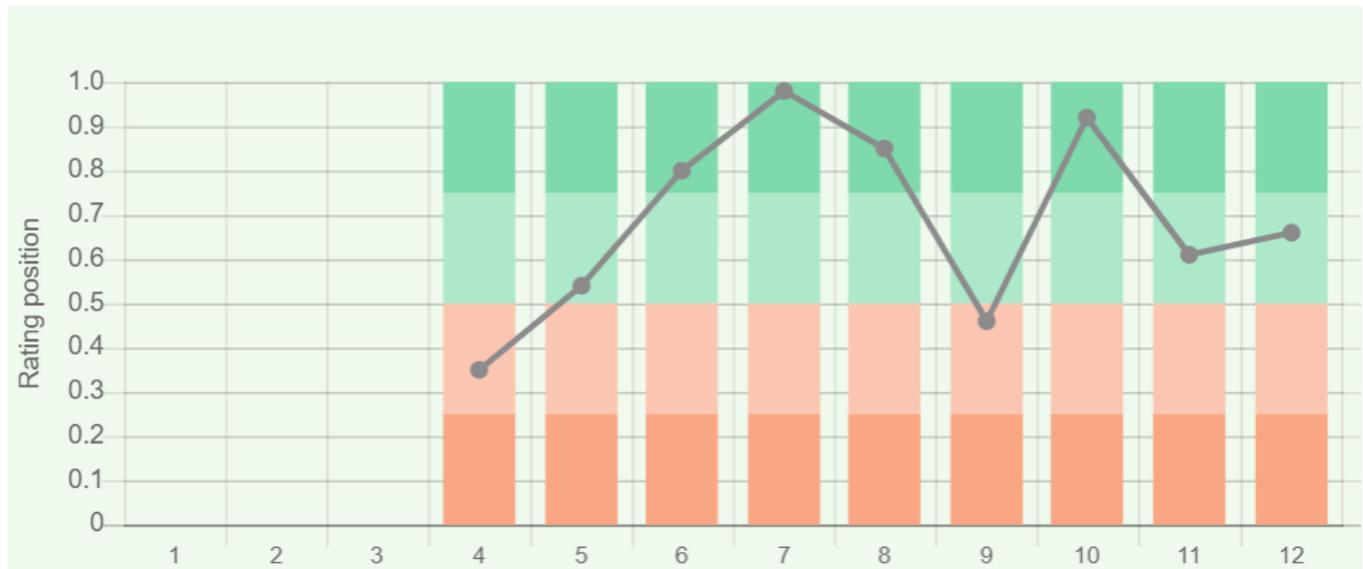


Sources: U.S. Energy Information Administration (Dec 2022) / <https://www.eia.gov/>

Figure 3. Electricity production in Uruguay

In 2020, the export of electricity increased from Uruguay reached 1 148 kWh. At the same time there is clearly an increasing trend of the share of renewable energy in electricity production,

which amounted to more than 52% in 2021 (Fig.5). Uruguay's position in the comparative diagram of energy index is shown in Fig. 4 .



Sources:

1. Crude oil proved reserves, 2021 / International Energy Statistic/Geography / U.S. Energy Information Administration (Nov 2021)\*98
2. Natural gas proved reserves 2021 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) \*99
3. Total recoverable coal reserves 2019 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) \*81
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5. Combination production-consumption for Natural gas 2019 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) \*123
6. Combination production-consumption for Coal 2019 / International Energy Statistic / Geography / U.S. Energy Information Administration (Nov 2021) \*128
7. Electricity – from other renewable sources (% of total installed capacity), 2017 est. / The World Factbook / Library / Central Intelligence Agency \*170
8. GDP per unit of energy use (PPP per unit of oil equivalent), 2020 \*66
- Primary energy consumption - BP Statistical Review of World Energy 2021/BP/GDP (purchasing power parity) - The World Factbook/Library/Central Intelligence Agency
9. Energy use (primary energy use of oil equivalent per capita) 2020 \*127
- Primary energy consumption – BP Statistical Review of World Energy 2021; Population - United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, custom data acquired via website. Retrieved 15 November 2021\*66
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11. Electric power consumption (kWh per capita), 2016 \*217
- Electricity Consumption - The World Factbook / Library / Central Intelligence Agency; Population - United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, custom data acquired via website. Retrieved 15 November 2021
12. Combination of electricity production-consumption (kWh)/The World Factbook/Library/Central Intelligence Agency \*216

Figure 4. Energy indices of Uruguay

Uruguay's indices based on reserves of fossil fuels and export opportunities, are absent. However, other indices look more convincing.

The share of renewable energy in electricity production in Uruguay is predominant, according to the Ministerio de Industria, Energia y Minería del Uruguay, and in 2017 the country was 4<sup>th</sup> out of 170 countries selected for consideration.

In the Global Energy Architecture Performance Index 2017, which is based first on the level economic growth, environmental safety, and energy independence of the country, including access to energy, Uruguay gained 15 ranking positions over the previous year, and is 10<sup>th</sup> in the world.

The country is in the top half of the ranked list of countries for such indicators as GDP per unit of energy use in

2020 - 10<sup>th</sup> out of 66 countries considered, while energy consumption per capita is much lower - 68<sup>th</sup> out of 127 countries. In terms of electricity consumption per capita, the country is 85<sup>th</sup> in the world, however, for the indicator of combination of electricity production-consumption, Uruguay is 73<sup>rd</sup> in the ranked list of 216 countries.

More information on the energy balance of Uruguay can be found [here](#).

## Energy Infrastructure

Map of territorial distribution of the largest infrastruc-

ture projects of the fossil fuel sector in Uruguay is shown in Figure 5.

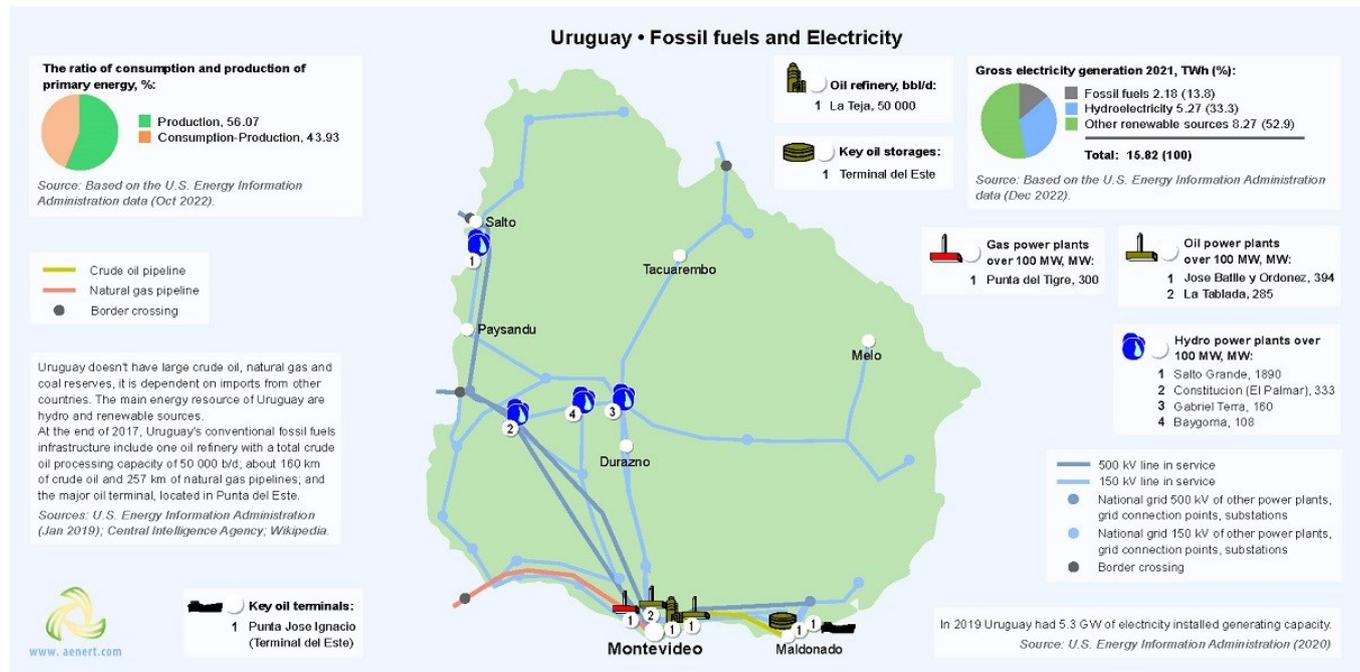


Figure 5. Basic infrastructural facilities of the fossil fuel sector in Uruguay: fossil fuels and electricity

As mentioned above, Uruguay has no substantial conventional fossil fuel reserves. The basis of power generation in represented by hydropower and renewable resources, the share of which in 2021 exceeded 86%. Basic infrastructural facilities of the oil sector are concentrated in the south, near the capital. To date, the country has one refinery with a capacity of 50 thousand barrels/day – Ancap – La Teja Oil Refinery [15]. It should be noted that it is has been operating since 1937. Also in close proximity is a oil power plant, Jose Batlle y Ordonez with a capacity of 394 MW [16].

The only existing to date gas power plant is Punta del Tigre-A, with an installed capacity of 300 MW [16]. Alongside with it - Combined Cycle gas power plant, Punta del Tigre-B, which was supposed to put into operation in 2017, but because of a number of law suits it the comissioning got delayed [17].

A 160-kilometer pipeline ensures the delivery of crude oil from the oil storage and oil terminal in Maldonado to the processing plant [2]. Gas pipeline Cruz del Sur, stretching over 200 km and with a capacity of about 1.8 billion m<sup>3</sup> per year, supplies gas to Uruguay from Argentina [18].

The total installed capacity of hydroelectric power plants in Uruguay is more than 1.5 GW [14]. The largest hydroelectric plant is the Salto Grande Hydroelectric Power Plant with an installed capacity of 1 890 MWe [19].

Unlike the fossil fuel infrastructure, the objects of renewable energy are relatively evenly distributed throughout the country (Figure 6). Over the last 3 years there has been a burgeoning of new capacity in wind and solar energy [14].

The total installed capacity of renewable energy in Uruguay in 2021 amounted to 3.74 GW [20]. The leading position is hydropower (41.1%), followed by wind energy with 1.51 GW of installed capacity (40.5%), bioenergy (11.5%) and solar energy (6.9%) [20]. The country has 11 large wind farms, each producing more than 50 MW. The largest of these, Pampa UTE, has a capacity of 141.6 MW and entered the market in 2016 [21].

Bioenergy for the period 2010-2015 also made a breakthrough by exceeding the level of 400 MW of installed capacity [20]. It must be stressed that Uruguay is among the top ten world leaders in the share of biofuels in electricity production [22]. The Uruguayan bioenergy industry is quite diverse. The company, ALUR, successfully uses modern technology for bioethanol and biodiesel production. Two plants for the production of biodiesel (Paso de la Arena, Capurro) and a bioethanol production plant (Paysandu) have an installed capacity of 18, 62, 70 million litres per year, respectively [23]. .

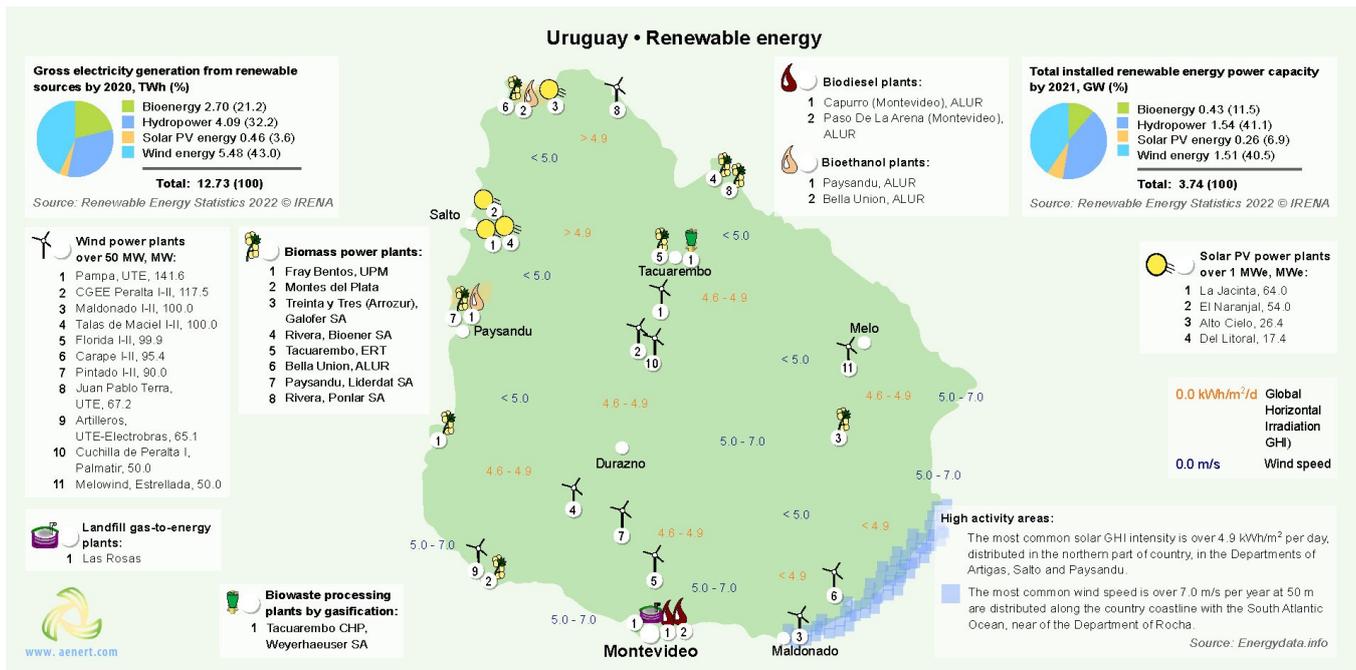


Figure 6. Energy infrastructure of Uruguay: Renewable Energy

The company, Las Rosas, which produces landfill gas from the municipal waste of Maldonado, has an installed capacity of 1 000 m<sup>3</sup> / h of biogas and 1.2 MW of electricity production [24]. Uruguay is also among the top ten countries when it comes to the production of synthetic gas from waste. This revolutionary technology of gasification from wood waste is used by the enterprise, Tacuarembó CHP Unit, commissioned in 2010, with a capacity of 500 000 Nm<sup>3</sup> / d of synthetic gas (Figure 6). Special attention should be paid to solar energy, which installed capacity amounted to about 240 MW in 2015, against the 5 MW in 2014 [14]. Two photovoltaic stations in Uruguay (La Jacinta - 65 MWp, Alto Cielo - 26 MWp) enter the list of the top twenty largest Latin American stations [25].

## Education and Innovation

The set of indices reflecting the position of Uruguay among other countries in the field of education and innovation can be seen in Figure 7.

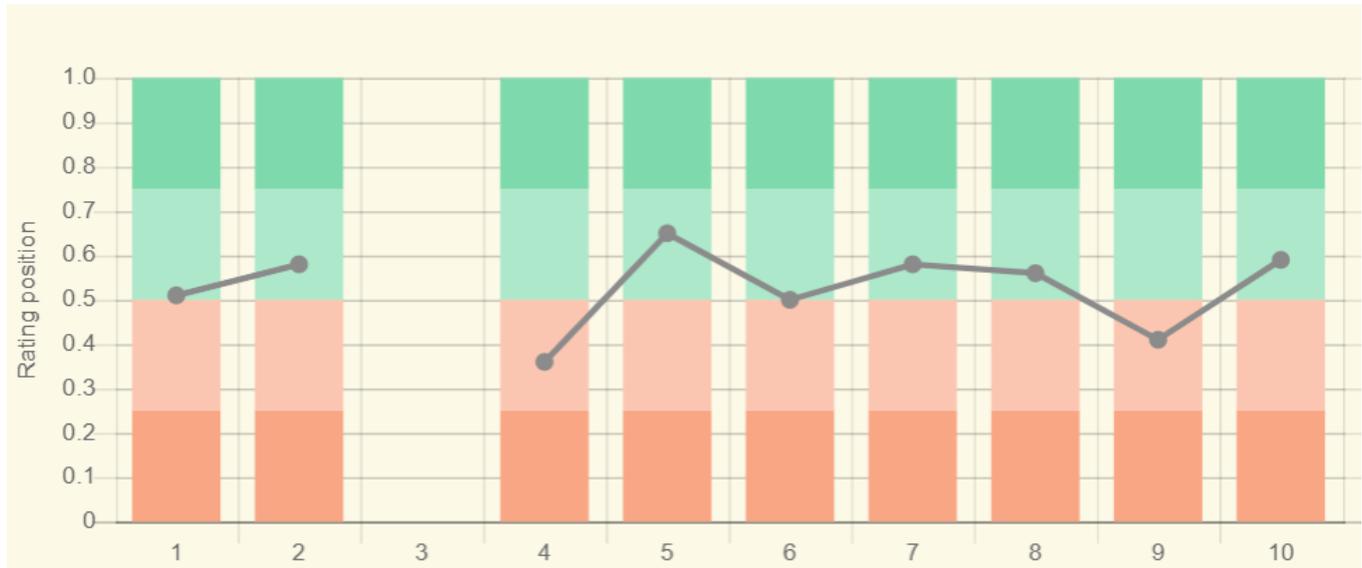
Figure 7 shows the indices that have an indirect effect on the energy sector, but in many respects predetermine its future. In 2018, according to the Global Innovation Index, Uruguay was ranked 65<sup>th</sup> out of the 132 member countries, ahead of Colombia, but behind Mexico. According to

Uruguay has adopted the National Energy Policy 2005-2030, which is being implemented reasonably successfully as of 2015. The threshold of 15% of electricity produced by wind, biomass and small hydropower has been surpassed. Another aspect of the energy policy is the processing of 30% of municipal solid waste and agricultural waste.

For more information about the energy infrastructure of Uruguay click [here](#).

the number of patents granted to the residents of Uruguay, both inside the country and abroad, the country ranks 77<sup>th</sup> in the world.

Although renewable energy in the country advances, patenting in this sector and other areas has not received active development.



Sources:

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  2. Patent Grants 2011-2020, resident & abroad / Statistical country profiles / World Intellectual Property Organization \*185
  3. Patents in Force 2020 / Statistical country profiles / World Intellectual Property Organization \*109
  4. QS World University Rankings 2022 \*97
  5. SCImago Country Rankings (1996-2020) / Country rankings / SCImago, (n.d.). SIR-SCImago Journal & Country Rank [Portal]. Retrieved 17 Nov 2021 \*240
  6. Internet users in 2018 / The World Factbook / Central Intelligence Agency \*229
  7. Internet users in 2018 (% Population) / The World Factbook / Central Intelligence Agency \*229
  8. Government expenditure on education, total (% of GDP), 2019 / United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics. License: CCBY-4.0 / Data as of September 2021\*177
  9. Research and development expenditure (% of GDP), 2018 / UNESCO Institute for Statistics. License: CCBY-4.0 / Data \*119
  10. Scientific and technical journal articles, 2018 / National Science Foundation, Science and Engineering Indicators. License: CCBY-4.0 / Data \*197
- \* Total number of countries participating in ranking

Figure 7. The indices of education and innovation in Uruguay

Uruguay demonstrates medium indices, characterizing the level of education in the country: the country is 62<sup>nd</sup> in the QS World University Ranking, and according to the level of public spending on education and research, expressed in % of GDP, Uruguay lags far behind the world leaders—78<sup>th</sup> place and 70<sup>th</sup> place, respectively. Nevertheless, Scimago Journal and Country Rank indicate that activity in the field of scientific and research publications is high. Universidad de la República (UdelaR) offers training programmes in various engineering specialties, including Electrical Engineering, Chemical Enginee-

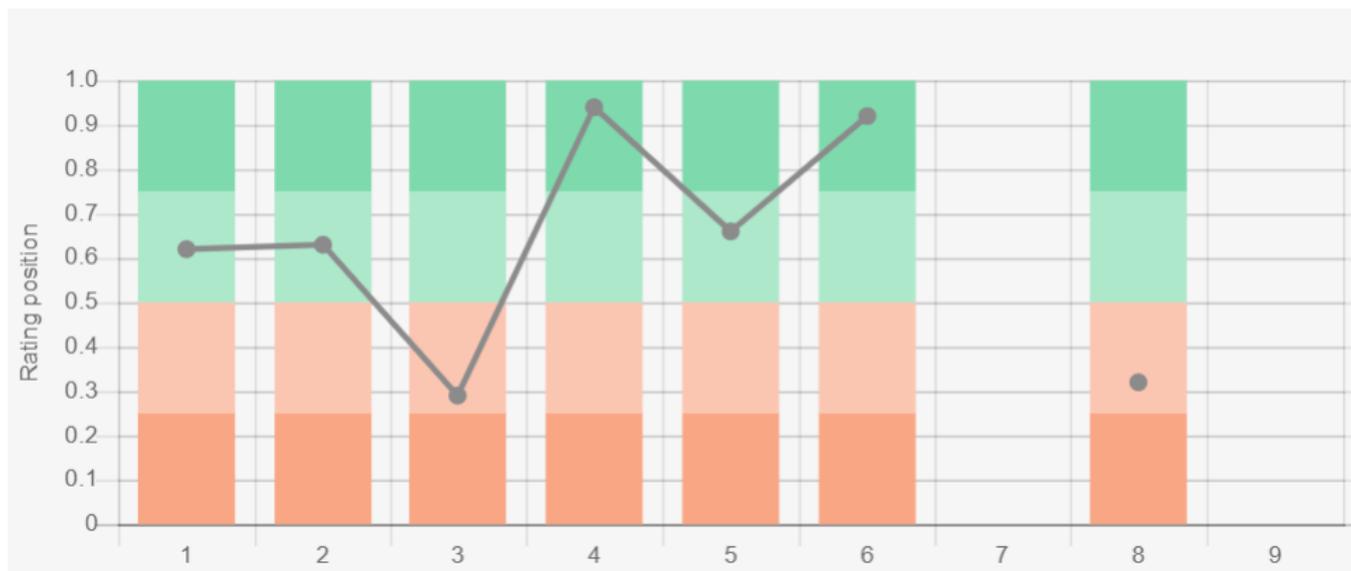
ring, and Industrial Engineering. The university conducts research in the field of biotechnology, concentrated solar power, and wind energy.

Additional information about education in the country can be obtained [here](#), and the list of research institutes in the country [here](#).

## Ecology and Environment Protection

A diagram of environmental indices is shown in Figure 8. To some extent the indices represented in the diagram reflect the ecological situation in Uruguay. First of all, Uruguay demonstrates relatively low level of CO<sub>2</sub> emissions in general, and per capita, and medium level of methane emissions. These figures may be re-

duced in the future due to the rapid growth of the share of renewable resources in the production of electricity; since the introduction of the single largest photovoltaic plant, La Jacinta, which provides electricity for about 2 million households, CO<sub>2</sub> emissions have been reduced by 6 million tonnes [28].



Sources:

1. CO2 total emission by countries 2020 / European Commission / Joint Research Centre (JRC) / Emission Database for Global Atmospheric Research (EDGAR)\*208
  2. CO2 per capita emission 2020/European Commission/Joint Research Centre (JRC) / Emission Database for Global Atmospheric Research (EDGAR) \*208
  3. Forest area 2020 (% of land area) / The Global Forest Resources Assessment 2020 / Food and Agriculture Organization of the United Nations \*234
  4. Forest area change 2010-2020 (1000 ha/year) / The Global Forest Resources Assessment 2020 / Food and Agriculture Organization of the United Nations \*234
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- \* Total number of countries participating in ranking

Figure 8. Environmental indices of Uruguay

There is also a positive trend in forest conservation and annual freshwater withdrawals. In this respect a high ranking place in the Environmental Performance Index in 2020, where the country is 61st out of 180 countries is quite significant, because this index focuses primarily on

the assessment of the environmental performance of national governments.

For more information on the energy complex of Uruguay see the attached link library by clicking [here](#).

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*The sources of charts and curves are specified under the images.*