SUSTAINABLE
ENERGY FOR ALL

Rapid Assessment Gap Analysis
Uruguay

Uruguay

Rapid Assessment and Gap Analysis

Sustainable Enery for All

IDB

Index

Objectives of the study

Executive summary

Section 1: Introduction

1.1 Socio-economic context

1.2 Energy situation

1.2.1 Supply

1.2.2 Demand

1.2.3 Sustainable energy and development

Section 2: Current situation with respect to the goals of SE4ALL

2.1 Access to energy vis–à–vis the goal of SE4ALL

2.2 Energy efficiency vis–à–vis the goal of SE4ALL

2.3 Renewable energy vis–à–vis the goal of SE4ALL

Section 3: Challenges and opportunities to reach the goals of SE4ALL

3.1 Political and institutional framework

3.2 Gaps and barriers

3.3 Conclusions and recommendations

Sources and bibliography

Study objectives

The purpose of this study is to provide a rapid analysis of the Uruguayan situation and perspectives related to the following aspects of its energy market:

- The energy situation in the country in the context of its economic and social development and the eradication of poverty
- The positioning of the country in terms of fulfilling the goals of SE4ALL
- The main challenges and opportunities within the framework of the SE4ALL goals

Executive summary

Uruguay has a growing energy demand that is taking place in the framework of strong economic growth, increased employment, and poverty reduction.

The energy supply is more than 50% composed of oil and its derivatives, which generates costs and risks that are very relevant. These are supplemented with renewable energy, biomass, and hydroelectricity.

The level of access to modern energy services is very high with near universal values. However, there are very significant problems associated with irregular energy consumption among the most vulnerable populations, especially in the metropolitan area. This situation creates security risks and highly inefficient consumption.

The country has established specific policies and rules for the development of energy efficiency. While it is true that there have been important advances, it is necessary to seek solutions for public and freight transport by incorporating means of lower specific consumption, such as rivers and trains, or by substituting fuels with lower cost and better environmental performance alternatives. At the same time, efforts should be increased to reduce economic, regulatory, and cultural barriers to the incorporation of energy efficiency.

Historically, renewable energy in Uruguay has played an important role in the energy mix, especially in the electricity mix, with shows the strong presence of hydroelectricity. Hydroelectricity is so developed that new large scale projects are not feasible. The incorporation of renewable energy into the mix will be led by wind power, co-generation with biomass associated with forest projects, solar energy, and, on a smaller scale, biofuels.

Energy policy is conceptually aligned with the objectives established in the initiative of the Secretary General of the United Nations, *Sustainable Energy for All.*

However, there are significant difficulties involved in meeting these goals by 2030 that are associated with the risks and challenges for the effective implementation of projects. The financing and fiscal sustainability of plans like the development of human resources and new capacities will be key.

SE4ALL Goal by 2030	*Current situation*
Universalization of access to modern	Access to modern energy is at 99.1% and

energy services	is predicted to reach the goal before 2030. The main problem associated with irregular energy consumption is that it is concentrated in metropolitan areas and affects more socially vulnerable families. This represents important security risks and highly inefficient consumption.
To double the rate of energy efficiency	Policies and specific regulations have been established to develop energy efficiency. There are important advances, but there is space to develop substantial improvements. It requires a greater and more specific effort to decrease the economic, regulatory, and cultural barriers to the incorporation of energy efficiency. A significant change is necessary in public transport and loads and in the thermal conditioning of construction, as well as a decrease in burning low efficiency firewood for heating.
To double the participation of renewable energy in the energy mix	The participation of renewable energy in the energy mix was 44% in 2011 and in the electricity mix it was 54%. Authorities estimate 54% for the energy mix for 2015 and 93% for electricity. Given the starting point with high participation in renewables, it will not be possible to double participation by 2030. It is estimated that these percentages will stabilize in the long term approximately in 2015.

Section 1: Introduction

1.1 Socioeconomic context

The Eastern Republic of Uruguay is 176,215 km2 and has a population of 3,286,314 according to the 2011 Population Census. 94.66% of the population lives in urban areas and 5.34% in rural areas.

Of the population over 12-years-old – 2,696,329 people – 1,474,437 are employed and 1,221,892 are unemployed or inactive (retired or other causes).[1] The country has low population growth estimated at 0.19%[2] and a GDP per capita of USD 14,263 in 2011. The 2011 GDP in current values was USD 46,710 million.

The total State earnings represent 31.71% of the 2011 GDP, and the expenditure of the State was 32.50%. The estimated GDP by sector in 2012 is distributed 9.4% in the primary sector, 21.7% in industry, and 68.9% in services. The main primary products are: soy, rice, meat, fish, wood, and pulp.

The main industrial products are: food, oil derivatives, textiles, automobiles, chemicals, and drinks. According to the HDI (Human Development Index) created by the United Nations Development Program (UNDP), Uruguay is 48 out of 187 countries with an index of 0.783. The HDI of Latin America and the Caribbean as a region is 0.731, which means that Uruguay is situated above the regional average.

As is shown in the following table, there is a clear trend of improvement over the past 30 years consistent with the indicators that make up the index.

[1] National Statistics Institute – Census 2011

[2] Results of the 2011 Population Census: population, growth, and structure by sex and age – National Institute of Statistics

Human Development Index Trends - Uruguay

Year	Life expectancy years	Expected education years	Average education years	Per capita income	HDI
1980	70.2	12.1	6.3	7.520	0,658
1985	71.5	12.2	6.9	5.765	0,660
1990	72.5	12.9	7.2	7.041	0,686
1995	73.6	13.1	7.4	8.421	0,705
2000	74.7	14.1	8.0	9.589	0,736
2005	75.8	15.2	7.9	9.400	0,748
2010	76.8	15.5	8.5	12.656	0,780
2011	77.0	15.5	8.5	13.242	0,783

Source: Report on Human Development (UNDP 2011)

Poverty was reduced from 30.5% in 2007 to 13.7% in 2011, and extreme poverty fell from 3.2% to 0.5% during the same period.

The Gini Index fell from 0.449 in 2007 to 0.401 in 2011.[3]

Despite the fact that Uruguay continues to be a more equal society, this level of the Coefficient of Gini locates it in the range of "high inequality."

Poverty and Extreme Poverty (as a % of the population) in Montevideo and the rest of the country

	Total		Montevideo		Rest of the country (1)		Rest of the country (2)		Rural	
	Poverty	Extreme poverty	Poverty	Extreme poverty	Poverty	Extreme poverty	Poverty	Extreme poverty	Poverty	Extreme poverty
2007	30,5	3,2	31,3	2,8	30,4	3,6	38,9	3,5	17,9	2,7
2008	22,4	2,0 2	5,1	2,0	20,6	1,8	29,9	3,0	9,7	1,7
2009	20,9	1,6	24,0	1,8	19,0	1,4	25,4	2,1	9,6	1,3
2010	18,6	1,1	21,6	1,3	16,4	1,1	23,8	1,1	6,2	0,9
2011	13,7	0,5	16,7	0,6	12,1	0,5	16,2	0,4	6,0	0,4

(1) urban areas with more than 5,000 inhabitants
(2) urban areas with less than 5,000 inhabitants

Source: Poverty estimate by incomemethod, 2011, INE

Poverty and extreme poverty have been greatly reduced under the impulse of significant GDP growth and other social policies that have been implemented. However, there are high levels of structural poverty with strong components of cultural marginalization. It is necessary to create conditions so that the achievements made will be consolidated over time.

1.2 Energy situation

[3] Poverty estimate by the income metod in 2011 – National Institute of Statistics

The energy mix in Uruguay has been dominated by biomass (firewood) on the supply side and hydroelectricity as a native resource, and oil and its derivatives, which are entirely imported. Historically, imported energy has been above 50%, often reaching values above 60%.

Final energy consumption has evolved from approximately 1,700 ktoe (thousands of tons of oil equivalent) in 1965 to more than 3,500 ktoe in 2011. It didn't experience very significant growth between 1965 and 1990, but it experienced significant growth with a strong setback from the financial crisis in 2002.

Final energy consumption was historically concentrated in three sectors: residential, industrial, and transport. Since 2008, industrial consumption has doubled, making it the most demanding sector given that the consumption of biomass in industry is associated with pulp.

Something particular to the energy mix in Uruguay is the significant level of electricity interconnection with Argentina. The power of the Interconnection is more than 2,000 MW, a value much superior to the maximum power peak of 1,745 MW that occurred in 2011.[4]

The institutional framework of the sector establishes that the Ministry of Industry, Energy, and Mines defines Energy Policy via its special unit, the National Board of Energy.

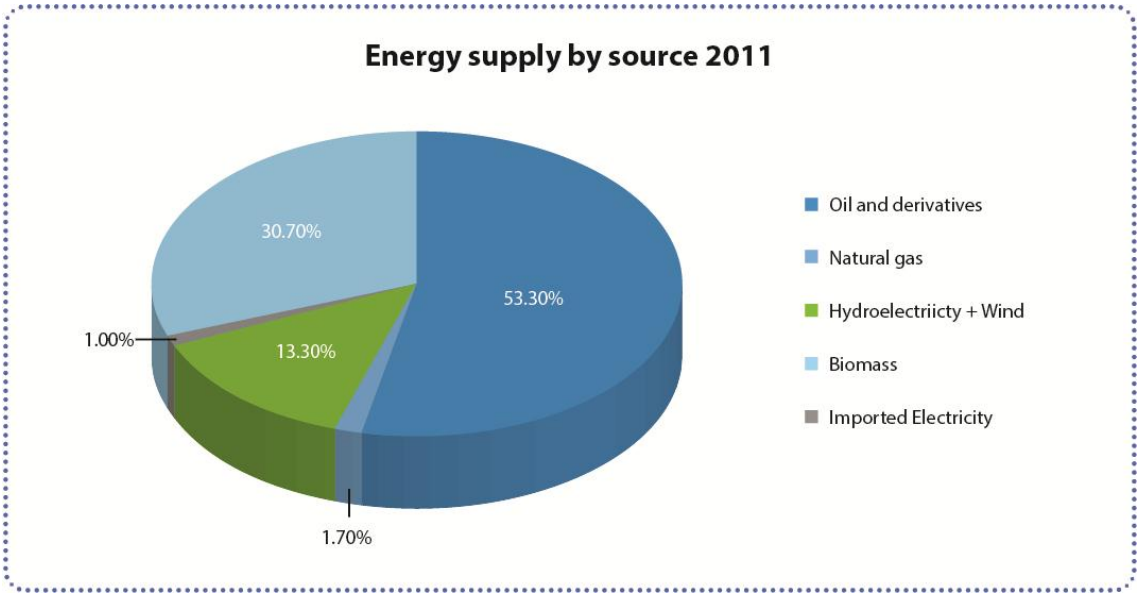
The sector has a predominant presence in the state through two business units, the ANCAP (National Administration of Alcohol Fuel and Portland) and the UTE (National Administration of Electricity Plants and Transmission). The first has a monopoly on the import of crude oil, refining, and derivative products. It also participates in the biofuel development business and the distribution of liquid fuels and liquefied petroleum gas. The UTE is now the only carrier, distributor, and marketer of electricity in the territory. While it is starting to increase private generation, the state has a hegemonic presence through the UTE plants and Uruguay's share of the binational hydroelectric Salto Grande.

The public utilities regulatory unit, the URSEA, has supervisory powers over the energy and water sectors in defining its rules of action, safety, quality, and price.

In the electricity subsector, the ADME (Electricity Market Administration) administers the wholesale electricity market through the operation of the National Load Dispatch and the enforcement of freely negotiated contracts between generators, distributors, and large consumers.

1.2.1 Supply

[4] UTE in numbers



Energy supply has a relevant influence on oil and its derivatives with 53.3% of the total. This value is historically affected, like the quantity of imported electricity, by the high variation in hydroelectric energy.

In 2011, hydroelectric power fell 557 ktoe from a value of 723 ktoe in 2010, a 23% decrease.

Hydro and wind sources reached 13.3%, a value well below their 17.6% 2010 participation. Electricity of wind origin, although it has a little influence, has grown significantly and, in 2010, it contributed 6.0 ktoe and in 2011 reached 9.6 ktoe – a growth of 60%.

The second most important source is biomass (firewood, biomass residues, and others) with 30.7%. This source has high participation and has been very stable in the last 5 years. It is associated with industry and the production of wood pulp. Of the total 2011 supply, 40% corresponds to firewood, 57.6% to biomass residues, and 2.4% to other primary sources.[5]

The remaining sources have a lesser participation in the matrix.

Natural gas participates with 1.7% and is below the values of the 2003-2008 period. The scarce development of this source has been strongly impacted by supply restrictions from Argentina and by the imposition of export taxes that have made the product not competitive.

Imported electricity was 41.0 ktoe and represented 1% of the supply. This value is the lowest in the last 10 years. The participation of imported electricity depends on water contributions to electricity generation and also on the growing commercial difficulties of achieving a fluid energy exchange via the interconnection with Argentina.

If we analyze the composition of the average supply over longer time periods (where the effects of hydrological volatility are reduced), we can see a decrease in hydraulic energy and oil and its derivatives and an increase in biomass.

[5] National Energy Board

Supply by Average Source

	1990 - 2011	2000-2011	2007 - 2011
Imported electricity	1,8%	2,9%	1,8%
Hydro/wind electricity	19,5%	18,3%	14,6%
Natural gas	1,1%	1,9%	1,9%
Oil and Derivatives	56,8%	55,2%	54,4%
Biomass	20,8%	21,6%	27,3%

We will describe the installed capacity for electricity generation.

Historically, the supply of electricity capacity was composed of energy produced by Hydroelectric Plants and Thermal Generation Plants, vapor and gas, consuming fuel oil and gas oil. All the plants, with the exception of the binational Salto Grande dam, are property of the National Government and were property of the UTE.

Electricity generation plants - installed capacity - 2011

Plants	MW	
Gabriel Terra		152
Baygorria		108
Palmar		333
Salto Grande		945
Total hydro generation		**1.538**
Batlle 3 y 4	Steam turbines	50
Batlle 5	Steam turbines	80
Batlle 6	Steam turbines	125
AA	Gas turbines	20
Backup Thermal Plant	Gas turbines	212
Punta del Tigre	Gas turbines	300
Batlle Motores	Reciprocating motors	80
Distributed equipment	Diesel generators	5
Total Thermal Generation		**872**
Sierra de Caracoles		20
Nuevo manantial		13
Kentilux		10
Total wind generation		**43**
UPM		46
Fenirol		10
Bioener		12
Weyerhauser		12
Liderdat		5
Galofer		14
Alur		10
Total Biomass Generation		**109**
Las Rosas	Biogas	1
Total Installed Capacity		**2.563**
Maximum annual capacity		**1.745**

Source: UTE in 2011 data and own elaboration

Currently the UTE has a dominant presence on the market, although private producers are beginning to have significant installed capacity. In particular, generation based on biomass residues is being developed with the forest industry and other industrial activities (rice and sugarcane).

Wind generation has experienced slower development, and there were only 43 MW installed by the end of 2011. However, the outlook for growth was significant given the contracts signed by the UTE with independent producers and the development of parks.

If they meet the goals established by authorities, by the end of 2015 wind energy will have a major role in the total electricity supply.

According to the 2011 National Energy Balance, the inputs for generation were composed of the following: hydroelectricity with 43% (in 2010 the participation was 65%); gas oil with 24%; fuel oil with 20%; biomass 9%; wind with 2%, and natural gas with 1%.

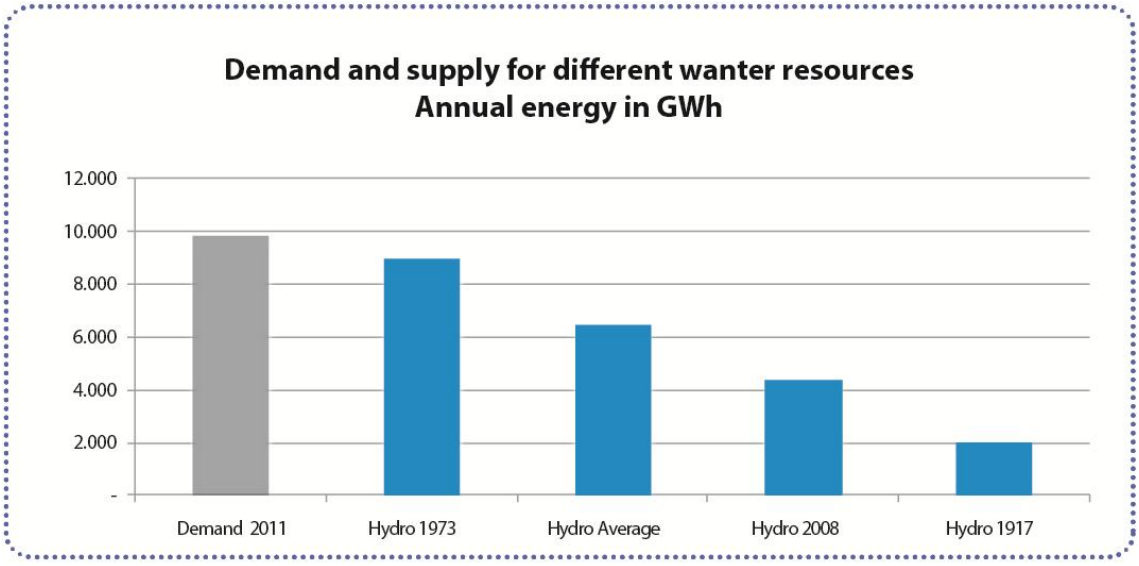
Consumption from oil derivatives for electricity generation moved from 256.6 ktoe to 637.3 ktoe between 2010 and 2011 respectively, a growth of 140%.

In its energy offerings Uruguay presents three important vulnerabilities that are related: a high dependence on oil and its derivatives, the huge variability of hydropower supply, and the lack of a power backup.

The high presence of petroleum in the mix with values that are above 50% has an impact on the variability of energy costs, on security, on the logistical costs of storage, and on the very important role they play in the total imports of the country.

The variability of the hydropower supply has a direct relationship to the previous statement given the characteristics of installed capacity and the decrease in production due to low rainfall. It has to be covered either with imports or with generation based on petroleum derivatives.

The impact of this variability can be seen in hydropower, and in the conditions of maximum hydraulic output, which can practically supply the entire demand. However, at its lowest point it scarcely produces enough energy to cover a fifth of the output.[6]



Source: UTE

The risks associated with water volatility coupled with the growth in demand that has occurred in recent years make it essential to quickly add continuous energy to the system.

[6] CEPAL – The development and the provision of infrastructure services: the electricity experience in Uruguay between 1990 - 2010

This need increases if analyzed in the context of the significant deterioration of the conditions governing imports from Argentina, which involves both issues of price and availability.

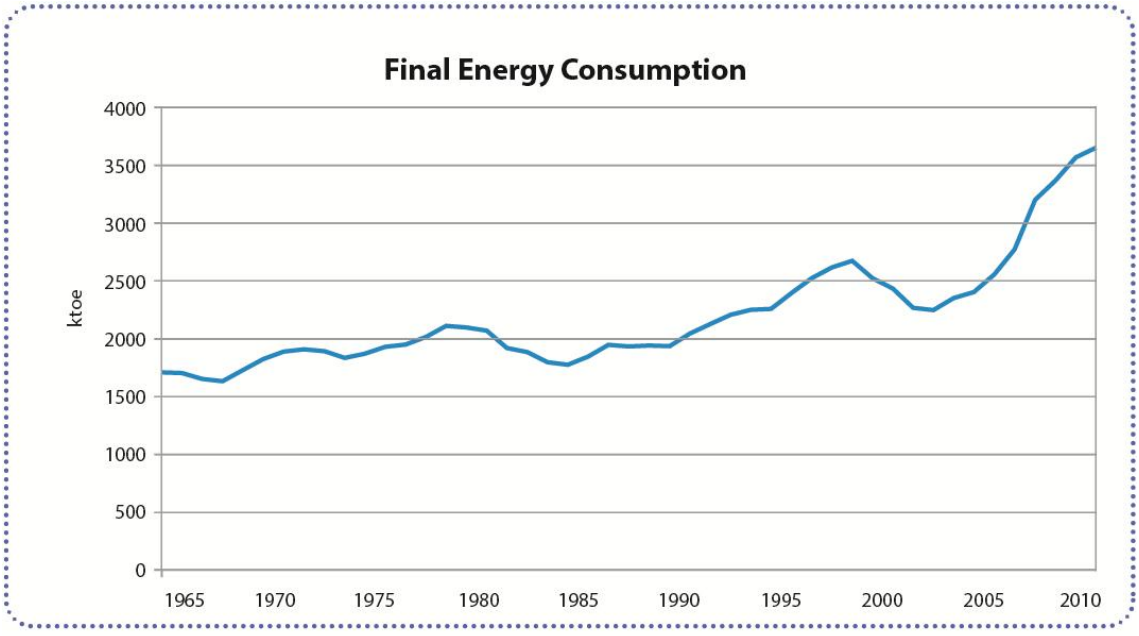
The solution designed involves the construction of a regasification plant and a system incorporating a 500 MW combined cycle plant. The corresponding international calls are currently in progress.

1.2.2 Demand

The growth in energy demand was very weak between 1965 and 2011, with a cumulative annual rate of around 1.6%.

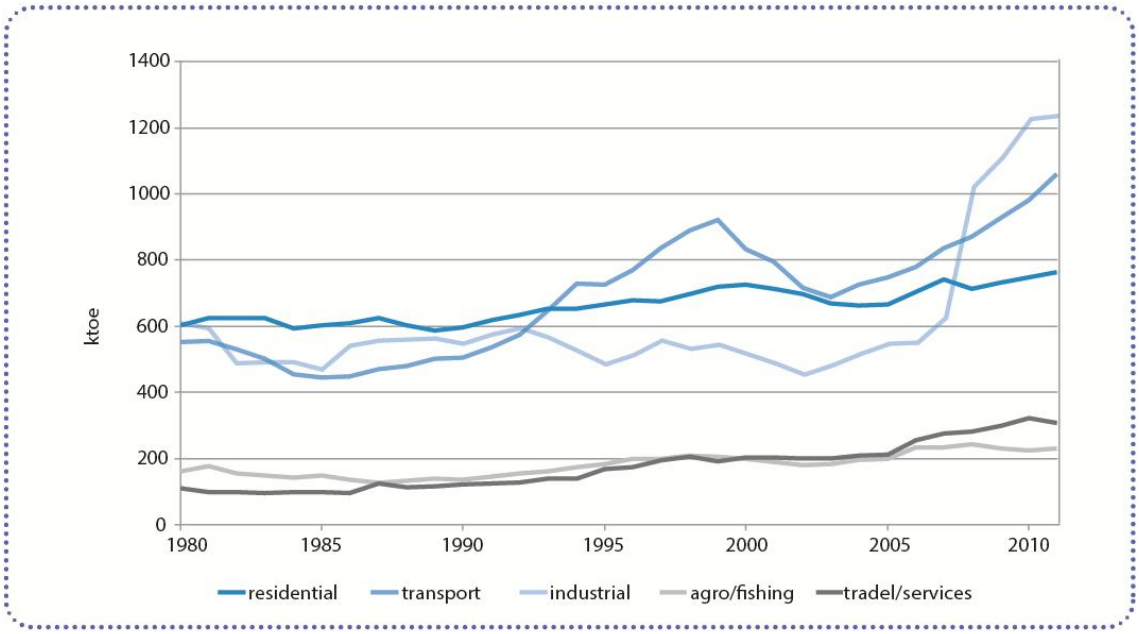
Some periods can be distinguished with particular characteristics. For example, the period 1965-1999 is characterized by low growth rates (1.3% cumulative annual) and relative stability. The period from 1999-2003 showed a significant reduction in consumption of almost 16% in 4 years due to the financial economic crisis that affected Uruguay.

Between 2003 and 2011, there has been significant growth in energy demand at a rate of 6.25% per year cumulative. This growth is driven by very strong GDP growth in historical terms, with growth at close to 6% on average during the same period.



Source: Energy balance 2011 - DNE

While final energy consumption is growing in all sectors, the most significant increases are occurring in the industrial sector (with a high impact from the pulp industry) and the transport sector. Starting in 2008, the growth of the industrial sector displaced the transport sector as the highest energy consumer in Uruguay.

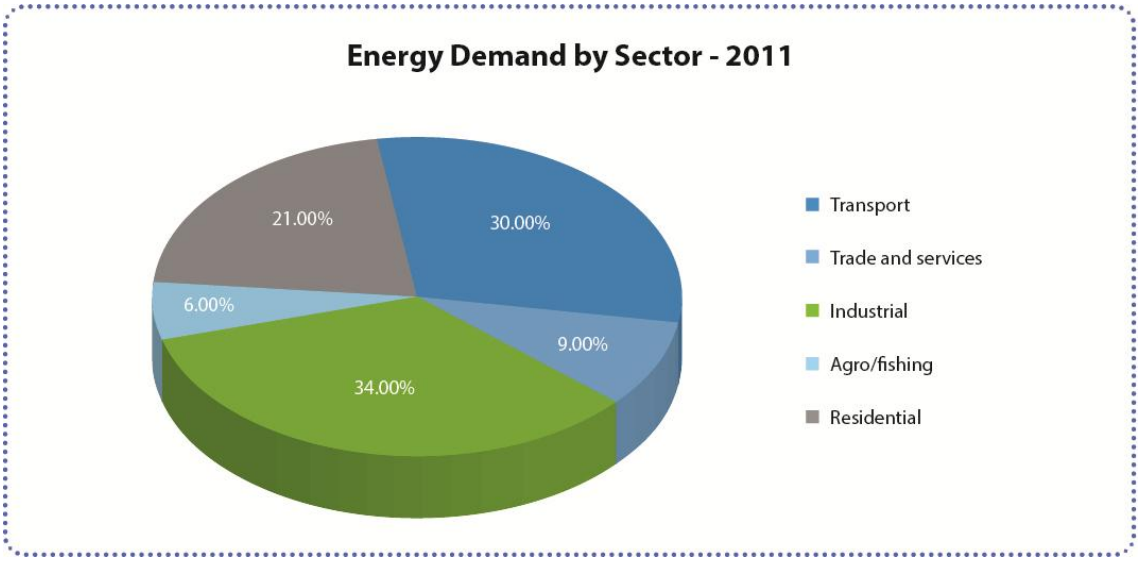


Source: Energy balance 2011 - DNE

It is important to note residential sector behavior. Despite strong GDP growth and household income during the period, growth rates have remained very low.

Residential consumption peaked in 2000 at 724.5 ktoe, after declining in 2004. From there, it began to grow again, reaching just slightly above the 2007 values that were given before the 2002 economic crisis.

Energy consumption in 2011 was 763.4 ktoe. The behavior of the demand from the residential sector was tied to savings plans that drove the UTE, a policy of energy prices that, in general, tried to reflect the true costs of delivery service and the beginning of operation of the energy efficiency plan.



Source: Energy Balance 2011 - DNE

Of the total energy demand in the residential sector, 41% is covered by primary sources, and 59% by secondary sources. The main primary source is firewood and the secondary ones are electricity and liquefied petroleum gas.

The transport sector is fully supplied by secondary sources: naphtha and gas oil, and a very minor portion of biofuels.

The industrial sector is a major consumer of biomass as a primary source, and electricity and fuel oil as the main secondary sources.

In the agriculture/ fishing sector, there is a strong predominance of secondary energy and particularly oil gas. However, in recent years, there has been an increasing share of electricity. The primary source for the sector, with a minority stake, is firewood.

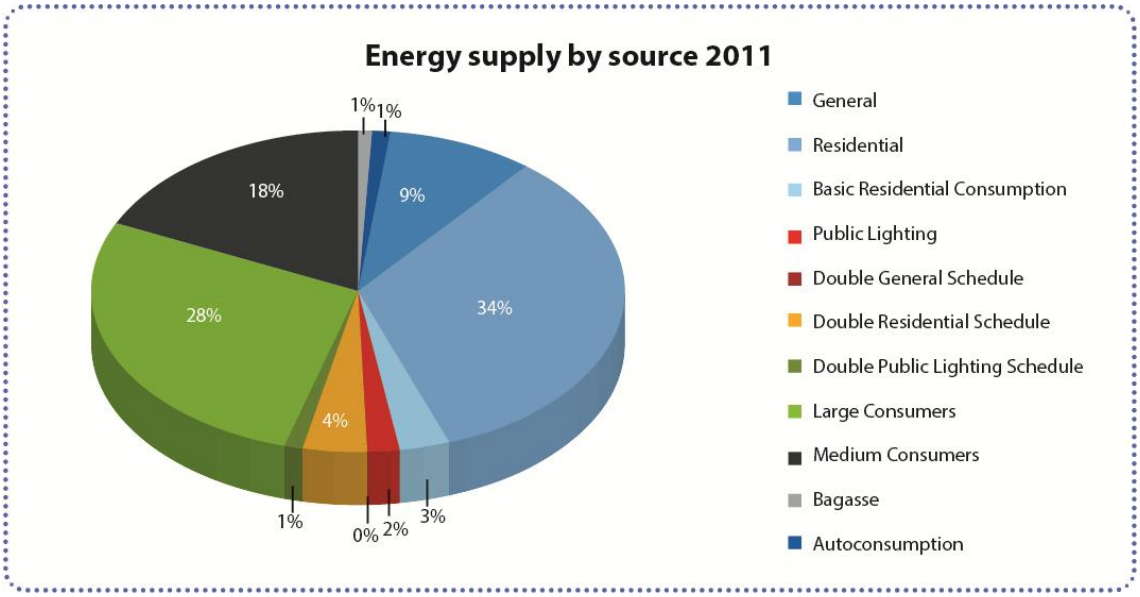
In the commercial and service sectors, there is a strong predominance of electricity, followed by gas oil and fuel oil. Other sources used by the sector are firewood, propane, and liquefied petroleum gas.

Electricity demand, after the fall associated with the crisis of 2001 and 2002, had a cumulative annual growth of around 3.7% between 2003 and 2011. This growth has been significantly lower than the GDP and the whole energy demand during the same period.

Electricity sold to the internal market - GWh

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
General	887	803	713	644	661	677	668	727	661	660	689	724
Residential	2.846	2.831	2.711	2.494	2.479	2.526	2.539	2.700	2.645	2.728	2.647	2.723
Basic Residential Consumption	-	-	-	-	-	-	-	-	-	-	163	208
Public Lighting	192	203	217	217	223	223	216	222	138	138	142	138
Double General Schedule	48	44	37	31	29	26	25	25	23	22	22	21
Double Residential Schedule	47	60	85	115	145	167	181	216	206	231	281	327
Double Public Lighting Schedule	-	-	-	-	-	-	-	-	84	92	99	105
Large Consumers	1.562	1.586	1.524	1.598	1.801	1.890	1.949	2.059	2.116	2.113	2.194	2.221
Medium Consumers	754	814	785	788	861	903	927	1.034	1.116	1.205	1.304	1.408
Bagasse	43	28	23	29	44	50	51	39	62	46	58	69
Autoconsumption	55	62	56	62	61	55	58	54	63	67	54	74
Total	**6.434**	**6.431**	**6.151**	**5.978**	**6.304**	**6.517**	**6.614**	**7.076**	**7.114**	**7.302**	**7.653**	**8.018**

Electricity sales in 2011 for different rate categories are presented in the following graph. The consumption is concentrated in the residential sector, large consumers, and medium consumers.



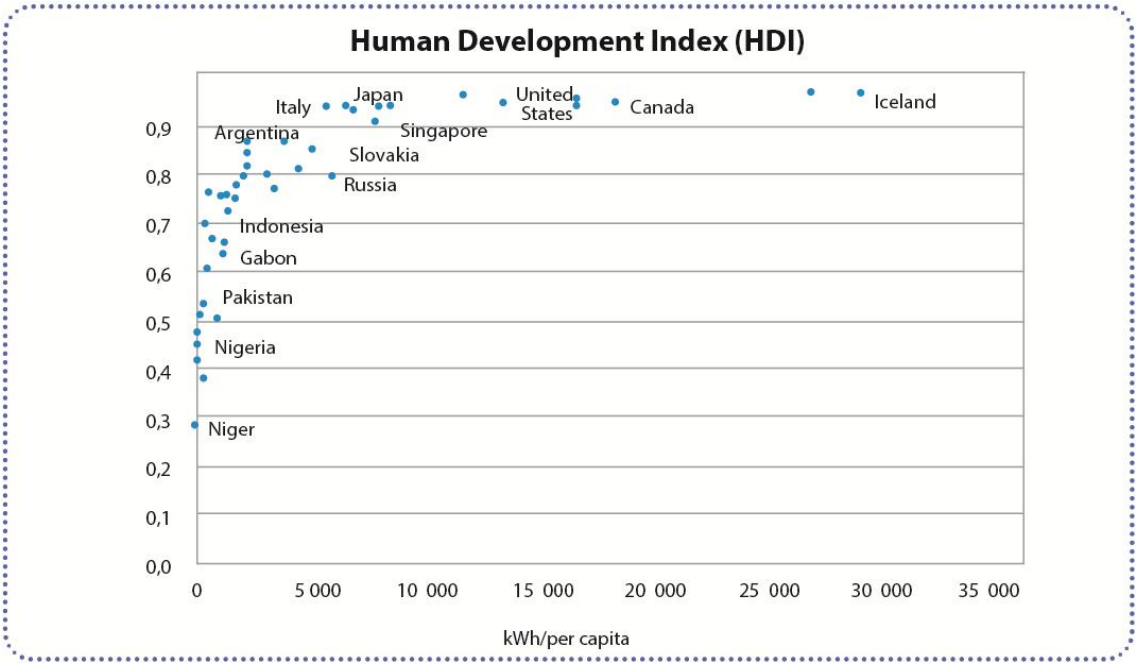
Source: 2011 Energy Balance - DNE

1.2.3 Energy and Sustainable Development

Energy is essential for sustainable development and poverty reduction. Globally, it affects all aspects related to human development: housing, access to clean water, agricultural production, health, education, and solving some gender issues.

The high correlation between the level of energy consumption and the GDP is well known, but there is also a positive correlation between the HDI and energy consumption.

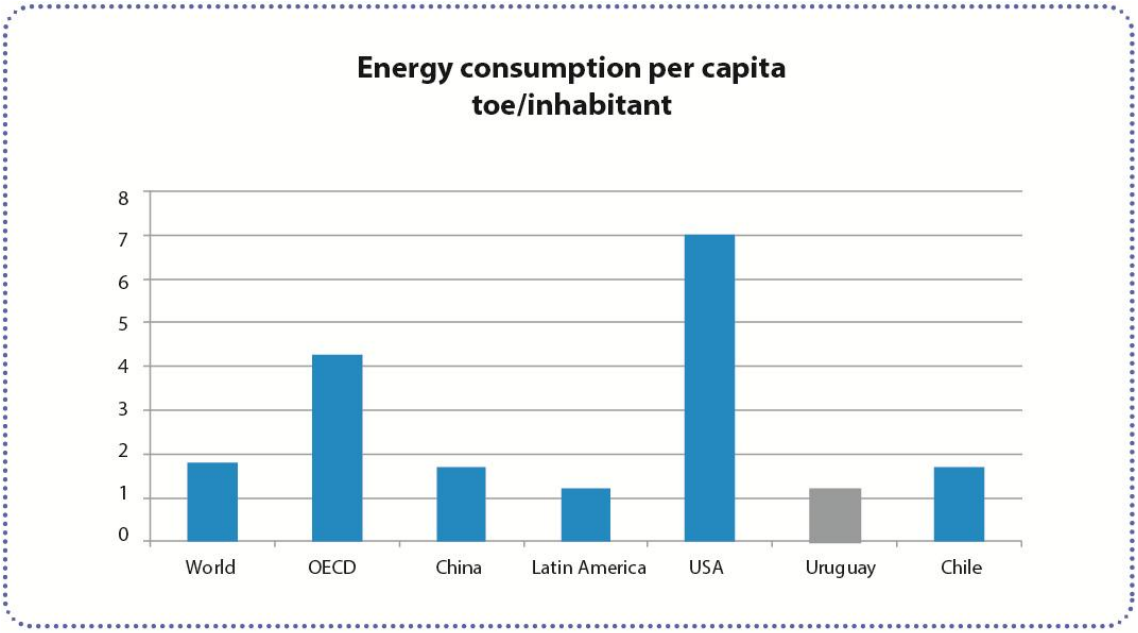
Achieving adequate levels of development requires that society exceed certain minimum thresholds of energy consumption.



Index of human development and electricity consumption per capita (UNDP 2005).

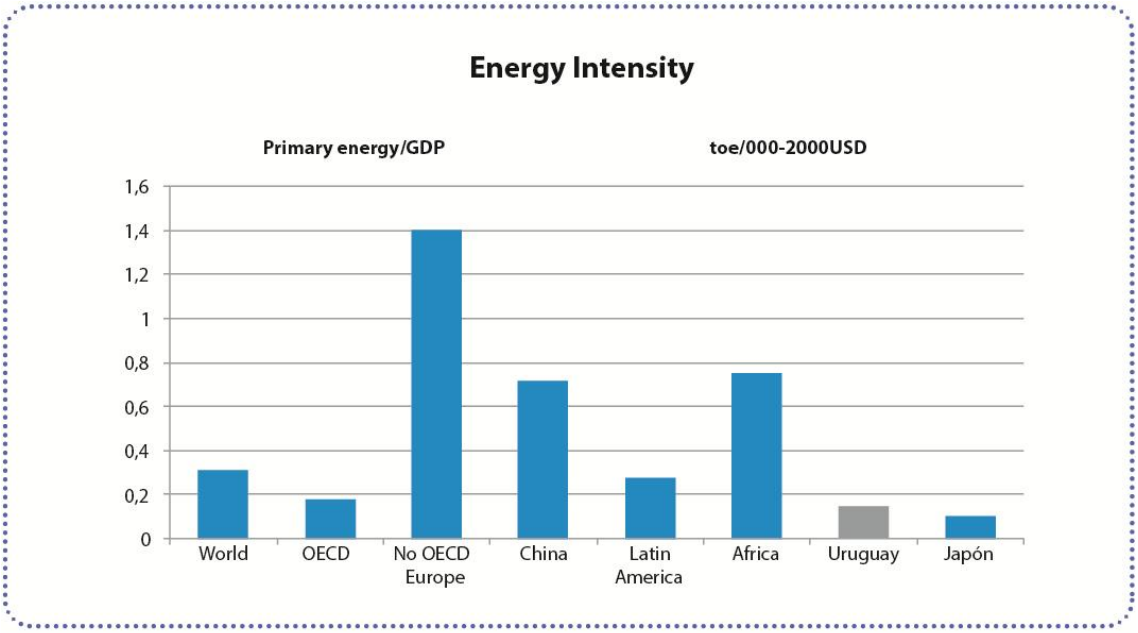
Per capita consumption of electricity in Uruguay in 2011 reached the 2,671 kWh, a value that lies somewhat below the world average and above the values of Latin America and the Caribbean.

In terms of global energy consumption per capita, measured as total primary energy supply divided by the number of people, Uruguay has values well below that of developed countries, but similar to the range of other Latin America countries.



Source: Key World Energy Statistics 2011 - IEA

At the same time, the country shows very good performance in terms of the amount of energy consumed per unit of the GDP (energy intensity)



Source: Key World Energy Statistics 2011 - IEA

Uruguay has historically had low energy intensity values. This performance can be attributed to multiple factors. Only in the last few years have the results of the Energy Efficiency Program become visible.

The important relative weight of the service sector in Uruguay (low-energy) relative to industry is crucial for this result. Beginning in 2007 with the installation of the pulp mill UPM - Botnia has grown both in terms of industry participation and energy intensity in the sector. Also, in recent years a decrease in energy intensity in the transport sector (historically the highest consumption sector) has been verified. It is due to the strong renewal of the vehicle fleet. [7]

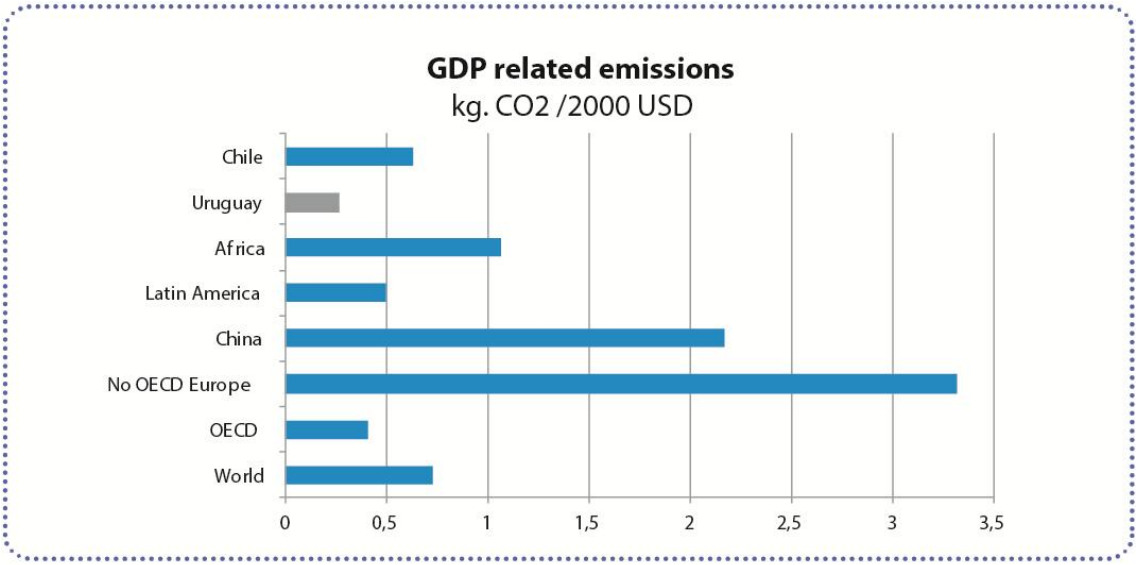
It is expected that the changes in the production mix of the country, with the addition of large-sized industrial processes, will generate an increase in energy intensity.

Furthermore, when analyzing the need for changes in the energy mix, especially in the electricity field, emphasis is put on primary generation source, its availability, conversion efficiency, equipment use, etc.., and usually less emphasis is put on the proper development of networks and transmission and distribution infrastructure.

Uruguay has good network development, covering the whole territory but, in the coming years, a major challenge will be adapting its network to a new scenario.

This new scenario includes changes to the quality requirements of consumers regardless of their geographical location, power requirements of new industrial facilities, the retrofitting of locations associated with new infrastructure (deep-water port, rail, distributed generation) and the impact of possible large-scale investment (large-scale mining, new pulp mill project).

As for environmental protection, Uruguay is a country with low net carbon emissions relative to the GDP.



Source: Key World Energy Statistics 2011 – IEA

However, according to the National Study of the Economics of Climate Change, conducted by ECLAC and the Presidency of the Republic, emissions of greenhouse gases, except the reductions from forestry in 2002, reached a total 28.5 million tons of carbon dioxide equivalent.

[7] A detailed analysis of these points can be found in: Institutional Efficiency of National Energy Efficiency Programs. The cases of Brazil, Chile, Mexico, and Uruguay – Beno Ruchansky, Odón de Buen, Gilberto Januzzi, and Andrés Romero – CEPAL – May 2011.

This represents about 8.7 tons of CO2 equivalent per capita, one of the highest numbers of Latin America and similar to countries like France and Japan.

80% of total emissions were produced by the agricultural sector, mainly due to methane emissions from livestock and emissions from the energy and industrial sectors, which totaled nearly six million tons of CO2 equivalent.

Categories	1990	1994	1998	2000	2002
Energy	3.641	3.970	5.436	5.179	4.107
Industrial Processes	230	279	518	392	253
Agriculture	21.424	22.897	23.276	21.092	22.694
Changes in land use and forestry	(3.047)	(6.336)	(7.270)	(14.210)	(23.477)
Waste	1.155	1.288	1.332	1.426	1.406
Total	**23.403**	**22.098**	**23.292**	**13.879**	**4.983**

Source: National Study of the Economy of Climate Change - Oct 2010 - Cepal. President of the Republic.

Discounting the removals produced especially by planting forests, net emissions of greenhouse gases were almost 5 million tons.

It is important to highlight that during the study period (1990 - 2002) an exponential increase in forest planting occurred.

According to information from the IEA (International Energy Agency) in *Key World Energy Statistics 2011*, net emissions of greenhouse gases in Uruguay were 7.7 million tons.

The energy sector, particularly electricity, has an important influence on emissions. According to a document prepared by UTE, the Emission Factor for the Uruguayan electricity system in 2008 was 0.713 tCO2/ MWh according to the Simple Adjusted Operating Margin method and 0.320 tCO2/ MWh according to the Average Operating Margin.

According to the same document, the CO2 emission factor for power generation is as follows:

Generator	Fuel	tCO_2/MWh
Punta del Tigre	gasoil	0,677
CTR	gasoil	0,862
Maldonado	gaoil	1,129
Central Batlle U6	fueloil	0.867
Central Batlle U5	fueloil	0,836
Central Batlle FB	fueloil	1,118
Grupo Diesel	gasoil	0,879
Branaá	natural gas	0,428

Source: UTE

An important aspect of the Uruguayan electricity system is its significant degree of interconnection with neighboring countries, particularly Argentina, with a capacity of 2,000 MW. It has a 70 MW connection with Brazil and is in the process of building a new Frequency Conversion with a capacity of 500 MW.

In addition to the issues related to the security of supply and cost reduction potential, international interconnections allow a reduction in the emission of greenhouse gases, and better use of renewable energy, primarily hydroelectric power.

Particularly in Latin America, where there are untapped renewable resources, the benefits of electricity interconnections can be very important.

From an analysis of the twelve interconnection projects considered by the CIER Project 15, it appears that the net operating benefit of doing the same would exceed USD 1,500 million per year while a significant environmental benefit, with emissions savings of over 4 million tons of CO2, would be obtained. These projects selected for study total more than 10,000 miles of new high voltage lines, about 6,500 MW of new capacity, and investment costs of approximately USD 5,000 million.

Section 2: Current situation in relation to SE4ALL goals

Energy Policy that guides the action of the authorities, to the extent that it can be implemented, is consistent with the goals set by the United Nations for the year 2030.

At this point, the progress that Uruguay has had so far for each of the goals as well as the difficulties, shortcomings, and challenges that the country has had, have been made explicit.

In Uruguay the main difficulties are not associated with the development of policies or with achieving significant levels of political and social consensus on them.

The main risks and challenges are associated with achieving the adequate and efficient implementation of solutions, and achieving levels of robustness that allow the country to stay the course even in situations of low economic growth. In particular, it will be necessary to finance an ambitious investment plan and to have the necessary human resources to carry out the plan.

2.1 Access to energy vis à vis the goal of SE4ALL

Access to modern energy services allows social and economic development, providing opportunities for improved living conditions and a path to prosperity.

The development of sustainable energy sources is an opportunity. However, 1.3 million people (one in five worldwide) lack electricity to light their homes or to do business.

Uruguay is very close to achieving universal electricity access through its network, which reaches 98.7% of occupied homes. If another type of electrification system is added for the home, the value reaches 99.1%.

According to the 2010 Total Power Coverage Index made by the Electric Coverage report in Latin America and the Caribbean, Uruguay ranks first among the 27 countries surveyed.

Lack of access to some type of lighting service is concentrated in the rural sector.

Houses occupied - electricity lighting service

	Montevideo	Resto del País	Total
UTE or general network	444.452	645.076	1.089.528
Wind charged battery	77	503	580
Solar charged battery	15	2.575	2.590
Own generator	20	831	851
Other electric	69	856	655
None	791	8.463	9.254
Total	**445.424**	**658.034**	**1.103.458**

Source: National Statistics Institute (INE) - Census 2011.

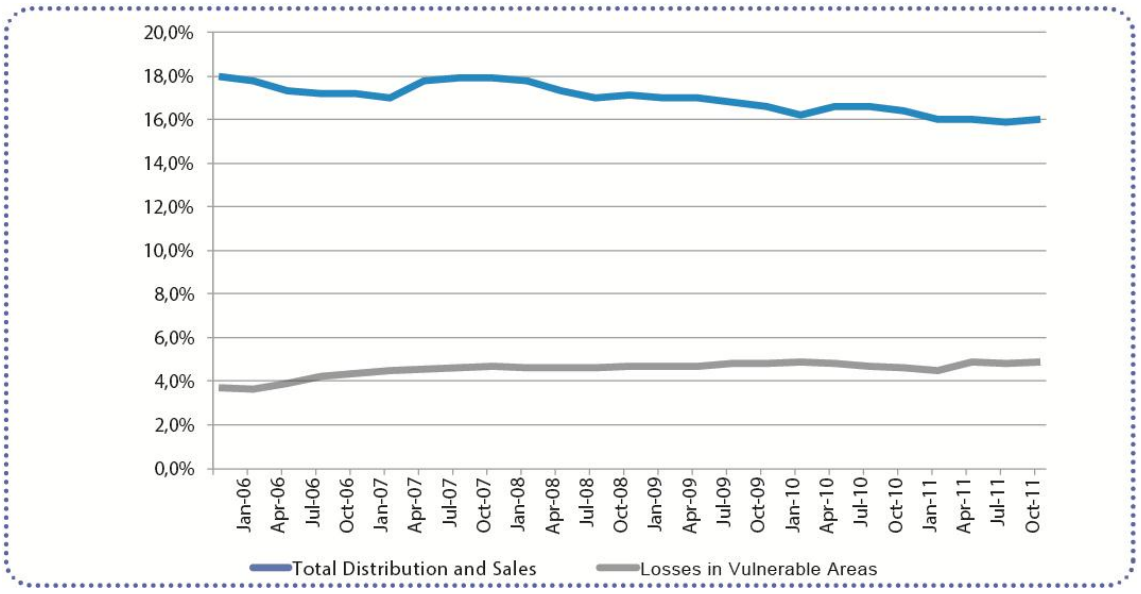
Historically the UTE has developed several rural electrification plans seeking to achieve universal service.

In recent years, it was decided that that areas with a density of one customer for every 2 km could access plans for rural electrification (recently this limit has been extended to a density of one customer every 3 km)

The problems associated with getting electricity to the last non-electrified areas with low population density are the high investment required and the very high maintenance costs. This makes it necessary and desirable to combine network expansion with mixed solutions involving distributed generation with the participation of non-conventional renewable, wind, and solar

Uruguay's electricity access problems are concentrated in the irregular use of energy. Non-technical losses of electricity have very high values. This creates problems for security, social inclusion, and energy efficiency.

The following graph shows the evolution of total energy losses (technical and non-technical) in the distribution and marketing of electricity.



Total losses have evolved slowly downward, from 18.1% in August 2007 to a value of 15.9% in December 2011.

Marketing and distribution losses peaked in 2004 at 20.2%, mainly as a result of the 2002 economic crisis, and values were around 13.5% in 2000.

In the same period, the energy losses associated with the areas of social vulnerability grew slightly and stabilized at around 5% (4.8% at December 2011)

This situation is even more complex in urban areas and particularly in Montevideo, where the total losses of distribution and marketing in December 2011 were at 19.4%, and those associated with vulnerable socioeconomic areas reached 8.9%.

Despite the actions the UTE has developed over the last 15 years, including systematic work in underserved areas, the situation that is concentrated in 300 districts of the metropolitan area could not be reversed.

Solutions have also been incorporated into rates as is seen in the 2010 creation of the Residential Consumer Staples rate. It subsidized prices and, by the end of 2011, included over 160,000 homes out of a total of 1,329,633 active services. [8]

While the agreement between the UTE and the Ministry of Social Development has begun to advance a comprehensive energy solution through the substitution of electricity consumption by LPG, delivering equipment and education in energy efficiency, the results are still very limited.

Energy and health problems associated with cooking are low in Uruguay, unlike what happens in other Latin American countries. 97% of households use at least one source of modern energy for cooking.

Energy used for cooking

Number of homes

	Urban	Rural	Total
Electricity	59.361	1.054	60.415
Natural Gas	36.439	147	36.586
Liquefied Petroleum Gas	957.443	43.695	1.001.138
Kerosene	2.105	101	2.206
Firewood or Coal	11.243	12.692	23.935
Other	277	25	302
None, no cookstove	8.353	321	8.674
Total	**1.075.221**	**58.035**	**1.133.256**

Source: National Statistics Institute (INE) - Census 2011.

High electricity coverage is coupled with the significant development of access to Liquefied Petroleum Gas Products, which has a large capillary network throughout the country. This allows for limited use of firewood for cooking.

Even in rural areas, the use of LPG exceeds the use of wood. The use of natural gas, because of supply constraints, is low and is concentrated in Montevideo.

[8] UTE in 2011 figures.

In home heating, there is a major change, and you can see the strong predominance of wood, even in urban areas.

Energy used for heating

Number of homes

	Urban	Rural	Total
Electricity	228.339	4.167	232.506
Firewood	374.142	44.872	419.014
Liquefied Petroleum Gas	280.248	3.791	284.039
Kerosene	16.478	293	16.771
Natural Gas	16.422	30	16.452
Gas Oil	2.771	10	2.781
Fuel Oil	8.210	1	8.211
Other	1.988	74	2.062
Ninguna	146.623	4.797	151.420
Total	**1.075.221**	**58.035**	**1.133.256**

Source: National Statistics Institute (INE) - Census 2011.

While it may not be a problem regarding coverage and health issues, it does generate energy inefficiency associated with the burning mechanisms used. This problem is associated with structural and cultural issues.

Additionally, based on studies that are being developed in the metropolitan area, the CO2 emissions produced by the burning of biomass are very important.

The main challenge in the energy system regarding issues of coverage and access involves resolving non-technical energy losses, particularly with irregular electricity consumption in poor neighborhoods. This creates serious security problems and highly inefficient power consumption. It is also necessary to solve problems related to the distribution of LPG in small containers to ensure adequate access, price, quality, and security to the most vulnerable population.

This is concentrated in urban centers and is more severe in Montevideo and metropolitan area.

A sustainable solution in the long term requires an approach that largely exceeds energy sector responsibility, requiring joint actions related to the problem of social exclusion.

From the standpoint of access, irregular connections generate risks to people's safety, especially when it comes to housing for the poor.

On the other hand, from the point of view of energy efficiency, the use of irregular supplies is usually done with very low efficiency equipment and with consumption that doubles the average consumption of Uruguayan households with a regular connection.[9]

Solving this problem requires a consistent approach from multiple disciplines.

[9] Energy access and poverty reduction to reach the Millennium Development Objectives in Latin America and the Caribbean CEPAL Jorge Molinari, 2009

The situation of irregularity covers housing issues, land use, access to water, sanitation, and electricity; and has an impact on access to education and health services.

Attempts at a solution involving only the energy sector have had little impact, despite the regularization efforts made by the UTE through direct management solutions like network design and the development of special pricing solutions for the most vulnerable.

It is important to highlight that this problem is not specific to Uruguay and has to do with the increasing "urbanization" of poverty in Latin America.

Following Roberto Kozulj work,[10]

• In Latin America and the Caribbean, urban poverty, although lower than rural poverty in relative terms, is quantitatively and qualitatively a greater problem.

• This fact, along with demographic projections, requires the urgent need for comprehensive strategies for poverty alleviation in urban and rural areas simultaneously.

• The total number of poor in Latin America and the Caribbean (LAC) was estimated in late 2007 at about 200 million people.

• Of these, just over two-thirds lived in urban areas. The number of poor represented about 72 million, 50% of them living in urban areas.

Solving the problem requires the increased effort of society to attack the problem holistically. This implies creating a clear definition, measurement, and determination of a financing scheme and the explicit subsidies necessary to resolve the problem.

Land regularization and access to housing is necessary to provide access to safe and cost effective modern energy sources.

In addition to the involvement of authorities and energy companies, a clear commitment on the part of urban authorities and those responsible for social policies is required.

Progress in reducing the problem requires the implementation of a clear system of measurement and monitoring regarding the performance of the implemented solutions.

2.2 Energy Efficiency vis à vis SE4ALL goals

Energy efficiency allows us to obtain more from existing resources, increasing the productivity of world resources, creating new economic growth, and reducing energy costs for all citizens.

Investing in energy efficiency creates jobs, fosters economic growth, and improves energy security for countries without fossil fuels. [11]

Uruguay has established a specific legal framework for energy efficiency. It has been formalized through a series of laws, decrees, and resolutions that position energy efficiency as part of state policy and allow for the promotion of entrepreneurship.

[10] Contribution of energy services to the Millennium Development Objectives and the mitigation of poverty in Latin America, Roberto Kozulj – CEPAL, UNDP, and others
[11] *Sustainable Energy for All initiative*

These include:

- Law 18,587: Efficient Energy Use
- Decree 408/ 08: Public Lighting
- Decree 311/ 06: Summer Schedule
- Decree 527/ 08 and 152/ 010: Energy Efficiency in the Public Sector
- Decree 306/ 09: Energy efficiency labeling
- Decree 354/ 09: Promotion of investments in energy efficiency
- Resolution 2928/ 09: Municipal regulation of thermal insulation

In addition to introducing a new regulatory framework, the Energy Efficiency Project Management Unit has established institutions for the development and monitoring of energy efficiency activities.

During the Uruguay Energy Efficiency Project, the activities were funded by a grant from the GEF (Global Environment Fund), which provided money for the implementation of the project via a World Bank grant to the State. The Ministry of Industry, Energy, and Mining and the UTE provided the remaining funds to implement the project as local counterpart.

According to the Energy Efficiency Act, the activities will be funded by the Trust for Uruguayan Energy Efficiency (FEE). The trust manages the funds raised from taxes levied on energy (electricity and fuel) and the installation of new power generation from fossil fuels.

The Energy Efficiency Services Unit (USEE) executes the part used by the UTE.

As part of its objectives, the project incorporates the market development of Energy Service Companies and contributes to strengthening them, creating the necessary conditions for the implementation of projects under the scheme of Performance Contracts between the ESCO's and energy consumers.

The main objectives of the Uruguayan Energy Efficiency Program of are aimed at increasing competition, encouraging private sector participation, diversifying sources of energy, protecting the environment and technology, supporting programs that promote efficient energy use, and facilitating access to modern energy for rural households.

The program “Lights for All” delivered over 1.5 million lamps labeled efficiency “A” to residential customers by July 2010. This implies a level of penetration of efficient lighting in 14% of lighting in urban residences in the country.

In September 2009, decrees came into effect that required energy efficiency labeling for electrical and gas equipment. Upon completion of the transitional periods specified in individual decrees, the labeling became a mandatory prerequisite for marketing in Uruguay.

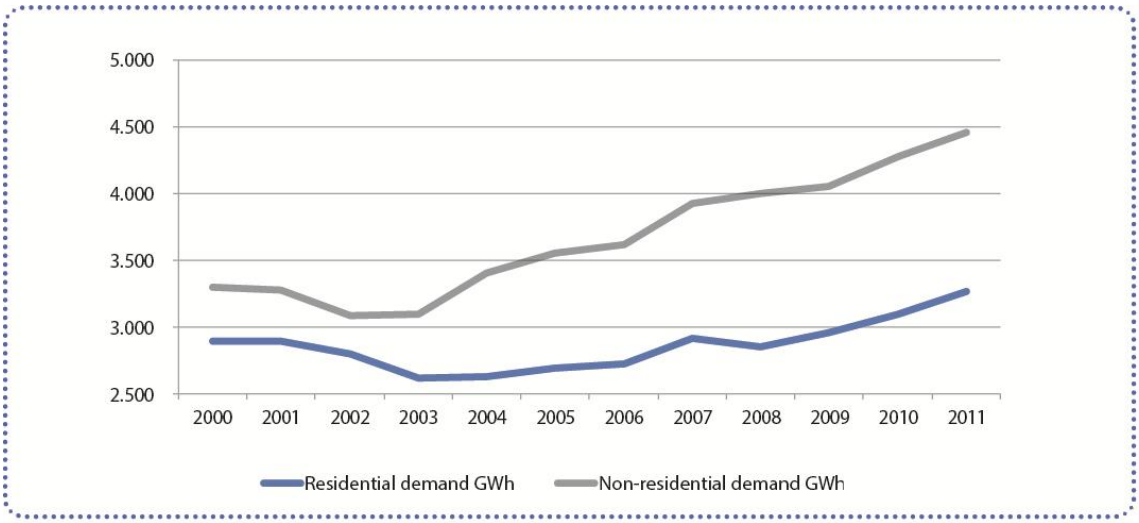
One of the main objectives of energy efficiency policy is to position the state as an example of the imperative to move consistently in achieving cultural change objectives. Specific savings goals and plans have been designed for public offices, lighting, and thermal conditioning.

For many years, the electricity sector has been developing programs for demand management, seeking to reduce peak consumption hours.

Between 2000 and 2011, the quantity of residential electricity services and small industries and businesses that used double time rates rose from approximately 5,000 clients to 40,000. The energy supplied at these rates rose from 95 GWh in 2000 to 453 GWh in 2011.

For many years, the UTE has had a tariff structure for consumption segments with rising energy prices. This has a positive impact from the point of view of energy efficiency, improves price signals, and supports cultural change.

Progress in the management of demand coupled with the important work carried out by elementary schools and the diverse electricity savings plans implemented in the last decade have allowed very limited growth in residential demand even with high a GDP and per capita income growth.



Source: UTE

Use of residential electricity demand indicates that the most important activity is heating water, with a total of 37%, followed by food conservation with approximately 20%, appliances with 17%, and lighting with 15%.[12]

The absence of a solid and competitive supply of natural gas has led electricity to play an important role in heating water. Despite seeking to improve the energy efficiency of equipment, there are still a high number of low efficiency instant electric heaters, particularly among economically vulnerable members of the population.

Within this framework, a plan to introduce solar thermal energy to replace residential consumption was created. This plan includes certification for equipment and installers and a fixed monthly discount for a yearly electricity rate. It has also given consumers a line of financing via the Mortgage Bank of Uruguay.

Via these incentives, the Solar Plan seeks to take on the main barriers - the incorporation of technology and the high initial investment.

An official public campaign is also being developed that will address cultural and information barriers that affect the development of the program.

There are also incentives to incorporate solar energy into the commercial, industrial, and service sectors.

As a promotion mechanism, there are several fiscal instruments and regulations in Law No. 16.906 "Promotion of Investment":

- ✓ Decree Nº 02/ 007: Companies that invest in solar equipment (considered an investment in Cleaner Production) may be exempt from a percentage of the investment to be deducted from the IRAE in 5 years.

[12] UTE

- ✓ Decree 354/ 009: For national solar manufacturing equipment and the conversion of solar energy into electricity. Exemptions in paying the IRAE for 12 years (6 years with 90% exemption, 3 years with 60% and 3 years with 40%).

The expected global results of the Project are:

- US$ 22.7 million in energy efficiency investments
- More than US$ 6.2 million to finance projects via the EE Trust
- To have at least 10 energy service companies (ESCOs) in operation
- To have at least 250 certified organizations practicing energy efficiency
- An energy savings for the period of 559 ktoe
- To avoid the emission of 1.4 million tons of CO_2

In Uruguay, important barriers have been identified to the incorporation of energy efficiency. These include economic, regulatory, cultural, and technological issues, as well as access to education.[13]

To maintain a price structure that reflects the costs of provision to different demand segments, it is essential to generate incentives so that energy efficiency projects can advance.

According to a report made by CAF for the XXI Ibero-American Summit,[14] Uruguay has a disparate situation in terms of electricity rates. On the one hand, the average rates in the residential sector are the highest in Latin America and, on the other, the average rates in the industrial sector are within the average values.

Industrial tax rates have historically been below the effective cost of supply, a situation that began to reverse slowly starting in 2003.[15]

The average prices of electricity in Uruguay for different rates without taxes have had the following evolution:

[13] Energy Efficiency – Engineer Alfonso Blanco – A methodological application for the development of electricity in Uruguay – May 2011

[14] Infrastructure in the comprehensive development of Latin America – strategic diagnosis and proposal for a priority agenda.

[15] CEPAL – The development and provision of infrastructure services: the electricity experience in Uruguay between 1990 – 2010.

Average prices of sale in cents on the dollar per kWh

Tariff category	2006	2009	2010	2011
General	14,25	18,41	21,69	23,40
Residential	13,09	18,77	22,40	24,41
Basic Residential Consumption			13,64	15,51
Public Lighting	13,22	19,22	23,01	25,15
Double General Schedule	12,78	18,99	22,90	24,74
Double Residential Schedule	9,37	14,16	16,70	18,42
Double Public Lighting Schedule	9,89	14,52	17,52	19,26
Large Consumers	5,79	9,18	10,91	11,89
Medium Consumers	9,75	14,21	16,89	18,28
Bagasse	7,96	13,10	16,27	16,20
Weighted average	10,39	14,95	17,58	19,12
Type of change	24,06	22,53	20,05	19,30

Source: UTE in figures

More action should be taken geared at having adequate price signals in different rate categories, the availability of access to financing in the long term, and improving the level of information available in different demand segments.

The main problems and challenges of energy efficiency policies implemented in Uruguay are in the transport sector, in home heating, and in construction and industry.

- Transport sector

As was mentioned in 1.2.2, demand in the transport sector in 2011 represented 30% of energy demand. Until 2008 the UPM pulp plant opened, it was the energy sector with the greatest participation.

Boosting energy efficiency in transport has been especially relevant to its growth in recent years because its total consumption is based on oil derivatives and because the sector has significant improvement potential.

Measures for the promotion and development of energy efficiency in the sector are still in the initial stages and are of low incidence. It is necessary to establish specific financing mechanisms.

In particular, it should advance in:

Seeking alternatives to fuel like CNG (compressed natural gas), especially in public transport, which can be done by obtaining a secure and reliable supply. CNG has better performance and less impact on emissions and would help diversify imported energy offerings. The next call for bids to construct and operate a regasification plant in Uruguay could allow the country to obtain a secure supply for this purpose. However, the development of this alternative requires a significant investment in infrastructure (supply stations, etc.) and an analysis of the impact on the refining process and the logistics associated with liquid fuels.

To plan changes relevant to freight, especially incorporating specific ways to consume less fuel. This requires the development of water and rail transport and an effort by management to optimize logistics. While Energy Policy does address these issues, the advance made up until now is practically nil. It should be noted that progress in this

regard, in addition to very significantly improving the energy efficiency of the sector, enables the country to improve the longevity of road infrastructure.

To make progress in improving passenger transport, to create incentives to increase the use of public transport and consequently to reduce the use of private vehicles. So far, little progress has been made, especially progress aimed at improving the price of access to urban public transport via Escrow ticket subsidies and other instruments. Moreover, aspects related to the quality and reliability of service that create a real incentive to use public transport have not progressed at the required speed. There are projects associated with the reactivation of rail, the installation of an above ground metro, and the incorporation of trolley buses, but they have not made progress. Although it is very slow, we are working on improving efficiency through the possible use of buses working in coordination with smaller buses.

To improve the development of infrastructure and urban design via the massive incorporation of bike lanes and the use of the bicycle as a mode of transport to be used in combination with public transport.

- To decrease the use of firewood for heating

According to the 2011 Census, more than 400,00 homes in Uruguay, approximately 37% of the total, use firewood as a source for home heating.

The problem with efficiency isn't associated with the use of firewood as a fuel but rather with the burning of very low efficiency wood. There are several cultural and regulatory aspects of construction associated with this problem.

Additionally, burning firewood produces a significant level of greenhouse gas emissions that are especially concentrated in metropolitan areas.

The introduction of efficient wood burning equipment, the establishment of thermal conditioning and heating, and the definition of actions that can promote cultural change should contribute to a significant improvement in the situation.

- Thermal conditioning of buildings

The delay that Uruguay has experienced in terms of incorporating Energy Efficiency in the construction and thermal conditional of buildings in comparison to more developed countries is noteworthy.

Decisions to buy homes are heavily impacted by this initial investment, and in the country there is little information about the total cost of property over its lifetime. Given the cultural pattern of the market, construction companies seek to minimize the investment and not take on the costs of a solution with a greater value over the long term.

It is necessary to improve human resources with expertise in energy efficiency by incorporating the issue with greater relevance in the study plans of related university degrees. It is necessary to reach a critical mass of knowledge that, together with the definition of adequate incentives, allows the required rapid social change.

It is important to highlight that the Efficient Energy Use Law considers the creation of rules and minimum requirements for energy efficiency for new buildings.

- Energy use of wastes

Uruguay needs to implement mechanisms that permit the use of waste from homes to generate energy. It is necessary to develop one or more projects that take advantage of energy potential, improve municipal management and, at the same time, improve environmental conditions.

- Cogeneration for industrial projects

The potential of new projects associated with the pulp industry, like the incorporation of a solid natural gas supply, would allow an increase in industry cogeneration projects.

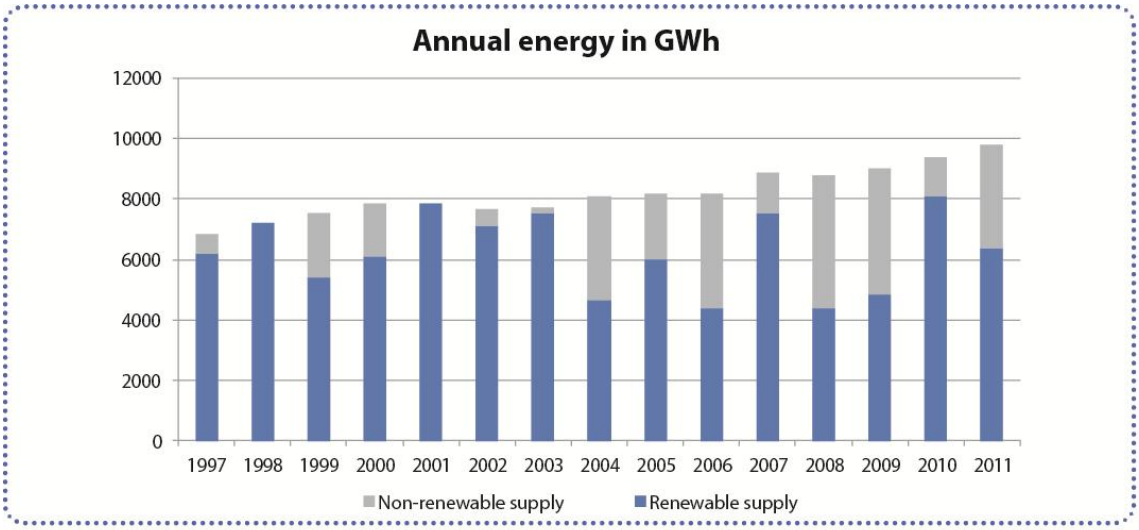
2.3 Renewable Energy vis à vis the SE4ALL goal

The energy generated from renewable resources (wind, water, sun, biomass, and geothermal) is endless and clean. Renewable energy currently makes up 15% of the energy mix worldwide.

Renewable energy creates jobs, promotes economic growth, and improves energy security.[16]

Uruguay has a long tradition of using renewable energy, mainly hydroelectric energy.

If we evaluate the supply of electricity demand over the last 14 years, from 1997 to 2011, 76% of the supply was generated by renewable energy.



Source: UTE in figures

The level of participation of hydropower, aside from its variability, has been in decline due to the growth in demand, as Uruguay has developed all of its large-scale hydroelectric potential.

The possibility of continuing to maintain a strong renewable component in the total supply will depend from here on out on an increase in wind capacity and biomass residues generation that can be installed in the system.

Uruguay has significant wind potential with high plant factors and a network capable of absorbing the initial technology development.

[16] *Sustainable energy for all initiative*

Uruguay has comparative advantages to develop wind energy compared to other countries: low density of the electricity market for the territorial unit, large hydroelectric development, thermal units that start and stop quickly, international interconnections, territory with winds from standardized classes and the potential to install pumps and accumulator plants.[17]

To this date and through various competitive processes, UTE has awarded contracts for the purchase of wind energy to private generators for a total of 850 MW at competitive prices on the international market. Some of these projects are in operation, and others are in the process of signing contracts with UTE.

This is a relevant value if we compare it with the total electricity capacity at the end of 2011, 2563 MW.

Wind development in Uruguay does not have any subsidies.

Wind power projects awarded

Project	Power MW
Nuevo manantial	13
Kentilux	18
Venti Innovent	50
Palmatir	50
Fingano	50
Aguas Leguas	100
Ensol	90
Eólica Minas	42
Polesine	50
Estrellada	50
Molinos de Rosa	50
Astidey	50
Noukar	50
R del Sur	50
Vientos de Pastorale	50
Tulifox	50
Vengano	50
Total	**863**

Source: UTE in figures

As has been mentioned, of the total supply, oil and its derivatives are the predominant source with values above 50%.

[17] Wind Energy: an overview of electricity generation from wind resources on a global level. Engineer Oscar Ferreño – A methodological application for the development of electricity in Uruguay– Catholic University of Uruguay – Mayo 2011

The introduction of non-conventional renewables into the system has its limits. In particular, the proper and safe function of the system requires that the maximum limit of wind energy that can be absorbed be continuously determined.

The level of this upward boundary is provided by the filtering capacity that achieves the power and storage of hydroelectricity, wind diversification that is achieved at parks and the contribution that it can provide to interconnections.

To be able to count on relevant power interconnections and clear operating rules will allow the achievement of greater values of growth in wind energy in Uruguay. The possibility of having backup for short-term variations and of having a secondary market where surplus can be managed is essential to the adequate management of variability risks.

Generation based on biomass residues has initiated the development of non-traditional renewable energy.

The projects that have been developed total 109 MW and are fundamentally co-generation projects. These projects will continue to grow with the development of the forest industry and wood pulp.

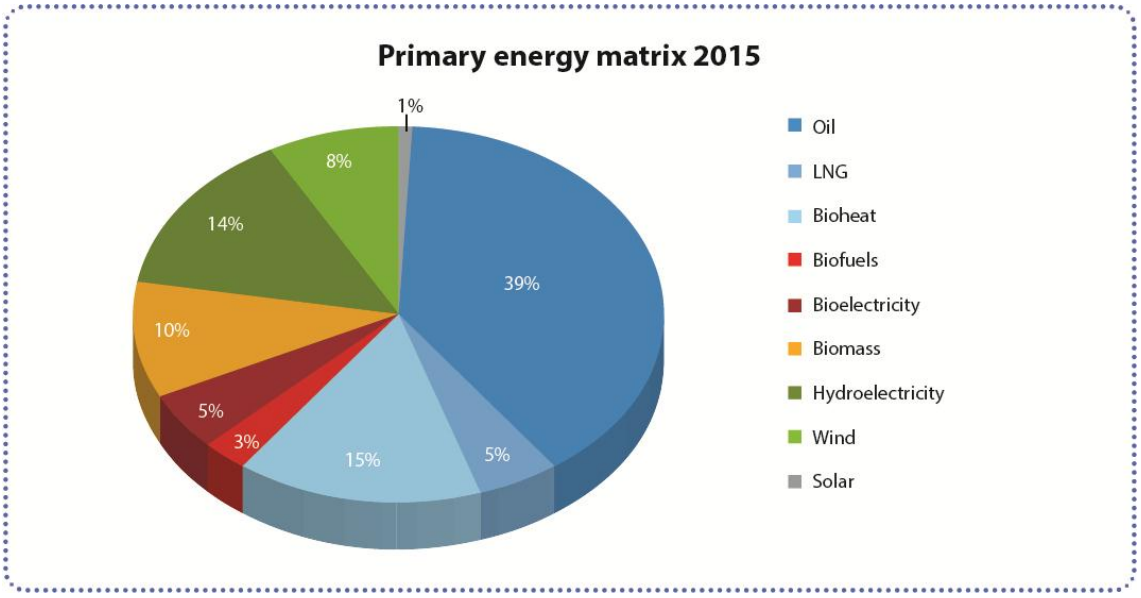
Projects that don't have an associated productive process and don't have fuel insured have faced difficulties. Important barriers to the development of new ventures include alternative uses of wood, new productive processes that generate fewer residues, and the distance to the places where the plants are installed.

To make advancements in energy plants requires a detailed analysis of many important factors and, in particular, a rigorous evaluation of alternative uses of land.

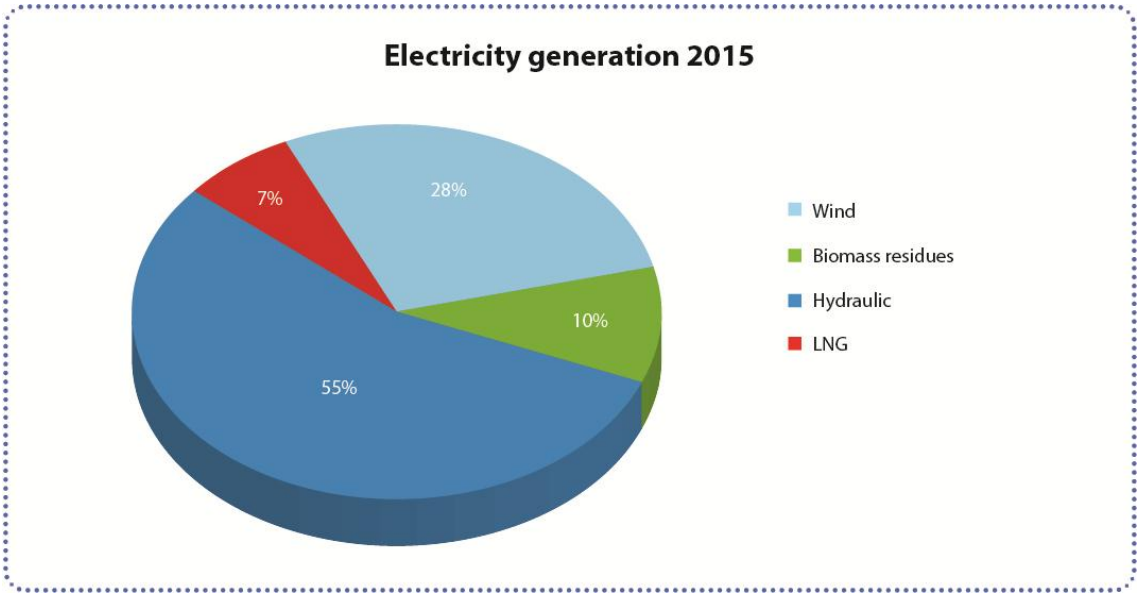
The ANCAP has begun the production of biofuels via its subsidiary ALUR. By approving 2007 biofuels law No 18195, the country set the goal of mixing biodiesel in gasoil by 2% by 2008 and 5% by 2012, as well as 5% alcohol fuel to gasoline by 2014.

According to the planning carried out, authorities[18] predict that the energy mix of primary energy for 2015 will be more than 50% renewables and will have the following composition:

[18] Presentation at the Innovation Forum of the Americas – Dr. Ramón Méndez – National Energy Director – November 2011



At the same time, electricity generation in 2015 will be composed of more than 90% renewable sources, and its composition is expected to be the following:



The comparison between the situation at the end of 2011 and that expected for 2015 shows that the primary energy mix would be 44% renewable energy in 2011 and 56% in 2015.

In terms of the electricity mix, the renewable component in 2011 was 54% and the expected value predicted by authorities for 2015 was 93%.[19]

It was not possible to obtain quantitative estimates about the expected mix for 2020 and 2030, but it can be estimated that, if they meet the established plan, the participation of renewables in the total energy mix will stabilize around 55% in 2020 and above 90% in the electricity mix.

[19] 2011 National Energy Balance and Presentation of Energy Policy 2030, Dr. Ramón Méndez, November 2011

As was mentioned, the national energy plan is very ambitious in terms of incorporating renewable energy, particularly in terms of electricity supply.

The depletion of hydroelectric resources on a relevant scale makes it necessary to concentrate efforts on non-conventional renewable energy (particularly wind, biomass residues, and solar energy).

Given that historically Uruguay's energy mix has had an elevated component of renewable energy, it would not be possible for the country to comply with the goal of doubling the participation of renewable energy sources as has been established by the Sustainable Energy for All initiative. To reach the goal would imply that the entire mix had a renewable component above 80%.

The challenges in implementing policies are mainly related to decreasing entry barriers for incorporating new technology, minimizing the risks of implementation and financing for projects in the long term, and maintaining consistent policies in the long term to avoid the changes associated with circumstantial situations.

- To decrease the barriers to entry

One of the most significant barriers to incorporating non-conventional renewable energy on a relevant scale is the electricity system having the level of strength and reliability that allows the adequate development of the country.

Given the characteristics of hydrological variability in the system and the low level of reliability that is provided by the interconnection with Argentina, it is necessary to incorporate reliable power and also increase the levels of opening by diversifying providers via a valuable interconnection with Brazil.

The potential of incorporating non-conventional renewable energy with significant levels of variability will definitely depend on the levels of backup power for the system and the complementarity of sources that cold be achieved between hydropower (storage in reservoirs) and wind and the capacity to exchange surplus energy with neighboring countries.

Uruguay is approaching the objective based on the construction of a Regasification Plant and a Combined Cycle Plant that will give the country a reliable natural gas supply.

Aside from achieving the objective of providing the system with the necessary required power, having a reliable natural gas supply will allow it to diversify primary energy sources that currently have a relevant impact on oil and its derivatives and to significantly improve the thermal generation emissions profile that today is made up of oil derivatives.

Adequate levels of thermal backup will allow the country to reach the required levels of reliability in order to incorporate planned wind energy.

On the other hand, the plan to incorporate non-conventional renewable energy, a characteristic that is necessarily distributed in the territory, requires the significant and timely development of transport and distribution infrastructure, as well as the adaptation of a system with greater levels of variability and shorter time intervals.

Firm power and the development of networks are essential elements to ensure that the plan to incorporate renewable energy reaches intended levels.

Also, the interconnection with Brazil is in full operation, and it will allow a healthy diversification of energy providers, a market that can organize renewable surplus to generate and count on important energy sources that also cover the variability of local sources. The contractual negotiation of trade faces major challenges in the current regional context, but it will allow a significant increase in the incorporation of higher levels of renewables in the mix in the future.

Another relevant barrier to entry is related to the significant volume of investment required of Uruguay that is related to infrastructure, particularly in the energy sector.

- To minimize the risks of implementing and financing projects

Uruguay's strategy for renewable energy is ambitions, and it has a clear long-term plan. Obviously it will have to face the risks of implementing and financing a large number of investments.

In only the first five years, it is estimated that total investment in energy infrastructure is more than 6,000 million USD, which represents approximately 14% of the GDP.

The current situation is very favorable for the development and financing of projects: low interest rates on an international level, low risk in Uruguay, a controlled fiscal situation, continuous improvement in the relationship debt/ GDP, and high availability of equipment on the national market. However, it is an ambitious plan and, in the long term, it should generate alternatives and diversification that will allow the plan to continue even when difficult situations present themselves. In this sense, it is necessary to seek a diversified financing portfolio for projects, to seek agreements for implementing them with equipment providers and developers, and to establish long-term incentives.

As has been mentioned, Uruguay has a strong State presence in the sector via the UTE and the ANCAP. However, it is not in a position to carry on with all the necessary investments with fiscal resources or without impacting the financial levels of the State despite the improvement of key indicators in recent years.

Thus, the adequate fulfillment of the planned goals in the long-term requires a balance between private and public participation in the development of new energy infrastructure. It requires, beyond the circumstantial advantages that may exist, the creation of rules and incentives that allow the country to continue attracting foreign direct investment in the sector even in adverse situations.

It is necessary to diversify providers, developers, financers, and to generate balance and coverage for the negative phase of the cycle. It is clear that all diversification policies have costs, but these should be analyzed in light of the risks that they minimize and in the timeframe that they have been planned.

- To maintain consistent policies in the long-term

Similar to above, the policies planned will require adjustments at different points in time. This adaptation should be carried out while avoiding sudden changes in the current situation. The changes should be made within the framework of an evaluation of the long-term strength of the adopted solution.

This framework of actions is especially important if the existence of fossil fuels, oil, and gas are confirmed in Uruguay. Having its own resources could generate difficulties for maintaining domestic energy prices in line with comparable international ones. This

could generate disincentives to energy efficiency and to maintaining an adequately diversified mix with a low emissions level.

The decisions made by energy policy have an impact in the long-term, mobilize important resources, and develop in uncertain economic, social, and political conditions.

For this reason, it is important to work now on an analysis of different alternative scenarios and study how policies could be adjusted to fit each one. The impact of possible changes should be analyzed in light of the society's conceptual objectives regarding meeting its energy needs within a timeframe defined.

Section 3: Challenges and opportunities to reaching the goals of SE4ALL

3.1 Political and Institutional Framework

In August 2008, the Executive Branch approved the Energy Policy.[20] The last Analysis of the Situation and Revision of the Lines of Action are from December 2009.

Building off of the government-elect's initiative in November 2009, in February 2010 it established the Multiparty Energy Commission.

As a result of the work of this Commission, the four political parties with parliamentary representation agreed on the core and strategic aspects of energy policy.

The Policy represents a detailed plan of strategies and goals that authorities established with three timeframes in mind: 2015, 2020, and 2030.

The established objective of Energy Policy is:

"the satisfaction of all national energy necessities at a cost that is adequate for all social sectors and that contributes to the competitiveness of the country and promotes healthy energy consumption habits, seeking energy independence for the country in a framework of regional integration with sustainable politics from both the economic and environmental viewpoint, using energy policy as an instrument to develop productive capacity and to promote social integration."

The Policy has four strategic areas:

- Institutional
- Supply
- Demand
- Social

Institutional Area

General Objective:

The Executive (PE) will design and conduct energy policy, coordinating the various actors. State companies (that should be modern, efficient, and dynamic) are the main instruments for applying these policies. Private actors participate according to conditions defined by the PE, thereby contributing to the productive development of the country. Based on guidelines defined by the PE, the Regulatory Unit supervises aspects of consumer security, quality, and defense. The regulatory framework of the

[20] Government energy policy is explained in the Energy Policy 2015-2030 document, which is available on the National Energy Board website.

energy sector and of each subsector should be clear, transparent, and stable, and should provide guarantees to all actors (consumers, public and private companies, etc.)

Some Specific Objectives:

- Public energy companies are modern, efficient, and dynamic leaders with independent business management that operate in an energy policy framework designed by the PE.

- Private actors participate in the energy sector according to the guidelines determined by the PE and try to avoid the existence of dominant actors in each subsector.

- The Regulatory Unit for Water and Energy Services (URSEA) regulates issues like security, quality, and consumer protection according to the policies and specific guidelines defined by the PE. It will oversee, with political and technical independence, compliance with these regulations.

- To provide assurance to all stakeholders, it is necessary to have full, clear, transparent, and stable regulations for both the global energy sector and for each subsector. This framework should be adapted to the objectives of energy policies and should be an instrument for its execution and auditing.

Energy Supply Focus

The overall objective and most relevant specific objectives for the purposes of this study.

Overall objectives:

Diversification of the energy mix both in terms of sources and providers, trying to reduce costs, to decrease dependence on oil and to promote the participation of native energy resources, in particular renewables. This process will enhance the technology transfer and the development of national capacity and will try to minimize the environmental impact of the sector.

Specific objectives:

- For the foundation of the system, it is necessary to regularly improve infrastructure and logistics to make the energy system stronger.

- It should ensure mechanisms of energy integration, in particular in countries in the region, like the signing of exchange contracts for stable energy, firm energy, and the spot market.

- Given that the country has abundant renewable energy sources and that it can generate energy at market costs, the introduction of forms of energy that don't need a subsidy should be promoted – medium and large wind, biomass, thermal solar, the use of certain residues, and micro-hydropower.

- The country should have a timeframe for incorporating energy for the short, medium, and long-term. It should identify the goal for each source that needs to be incorporated and the form of investment for each.

- There should be an agreed upon timeframe for extending electricity transmission and distribution networks to support the growth of demand and the incorporation of distributed generation while keeping in mind different sources and ways of financing investments.

- To ensure the vertical integration of the ANCAP via the search for oil and gas in national territory and to evaluate the potential for joint oil exploration in other countries via established businesses from a commercial, technological, and political point of view.

- To promote the national development of biofuels.

- To seek ways to improve the participation of natural gas in the Uruguayan mix at a competitive price.

- To explore the national territory in search of non-renewable energy.

- To encourage energy generation in the home like the heating of water with solar energy, micro-wind generation, the use of biomass, firewood, etc.

Focus on Energy Demand

Overall Objectives:

To promote Energy Efficiency in all sectors of national activity (industry, construction, transport, agriculture, homes, etc.) and for all energy uses (lighting, appliances, vehicles, etc.) via the improved use of energy resources without having to decrease production levels, comfort, and care levels for daily needs. To promote a cultural change related to the consumption habits via formal and informal education systems.

Specific objectives:

- The State, via diverse organizations and public polices, should make itself a pragmatic example of the rational energy use.

- Information to promote the comparative advantages of efficient energy use via the formal education system and diverse forms of cultural diffusion.

- The country should have the regulation and tax structure to adequately promote Energy Efficiency, in particular in construction insulation, lighting, vehicles, and other energy consuming equipment, etc.

- The country should have adequate financing mechanisms to promote technology and process modifications both at the industrial and residential level, which will improve energy efficiency.

- Given that the transport sector has historically been the main consumer of energy in the country, it is necessary to integrate energy into state transport policies and to promote changes in the modes, medium, and sources that increase energy efficiency in the sector.

Social Focus

General Objective:

To promote adequate access to energy in terms of security and cost for all social sectors, using energy policy as a powerful instrument to promote social integration and improve the quality of our democracy.

Specific objectives:

- It is necessary to satisfy the energy needs of sectors with a sparse population and to test different social intervention alternatives like an energy basket that allows energy access in secure conditions (avoiding dangerous connections that cause accidents) at an accessible cost for the weakest sectors, to promote the

responsible use of energy and avoid unwanted burdens for the rest of society. These initiatives should be included in the global social policies of the State and should be carried out in an interdisciplinary and multi-institutional manner.

- Universal access to energy reach all inhabitants of the country by using diverse energy sources and technologies with solutions adapted to the necessities of the geographic context and of each home.

- It should ensure access to appropriate information (comparison of sources, equipment, costs, long and short-term projections, etc.) for all citizens.

Goals to be reached

Based on the Strategic Guidelines for Energy Policy, goals for the short, medium, and long-term were defined.

Goals 2015 (short term):

- The participation of native renewable sources has reached 50% of the mix of primary total energy. In particular:
  - ✓ The participation of non-traditional renewable sources (wind, biomass residues, and micro-hydropower) make up 15% of electricity generation.
  - ✓ At least 30% of agro-industrial and urban residues in the country are used to generate diverse forms of energy, thus transforming an environmental liability into an energy asset.

- In comparison with normal tendencies, consumption of oil in transport has decreased by 15% via the promotion of new methods, mediums, technologies, and sources.

- Expand universal access to achieve 100% electrification in the country via a combination of mechanisms and sources.

- The culture of Energy Efficiency has permeated all of society.

- The country has national companies producing energy supplies and developing efficient energy processes.

Goals 2020 (medium term):

- To reach an optimum level in relation to the use of renewable energy, in particular wind energy, biomass, thermal solar, and biofuels.

- To reach a balance in relation to the use of energy residues to generate energy.

- The use of natural gas in the global energy matrix has reached a level of stability and sustainability.

- La Teja refinery has finished its modernization process; in particular, it is capable of processing heavy crudes.

- Achieving the vertical integration of the ANCAP.

- Has completed the exploration of the national territory in search of energy.

- The country has developed pilot project plans for the use of new energy sources and/ or technology in development.

- The consumption of energy in the country has decreased 20% in relation to the baseline scenario via a combination of actions that promote Energy Efficiency.

- Adequate energy access has been achieved for all sectors of society.

- The country has leading companies on a regional level that produce energy supplies and develop processes that promote Energy Efficiency.

Goals 2030 (long term):

- The Uruguayan energy model is the worldwide model; in particular, the energy intensity of the country is one of the best in the world.

- The country has saved at least USD 10,000 million since 2010 due to the substitution of sources and the promotion of Energy Efficiency compared to the baseline scenario.

- The country has leading companies on a regional level that produce energy supplies and develop processes that promote Energy Efficiency.

- The country is a leader in the use of certain sources and in the development of particular technologies and energy processes.

- Regional energy integration has been achieved; in particular, there are functioning bi and tri-national projects.

Some Lines of Action for Energy Policy

- Adapt the regulatory framework of the energy sector to reflect the Strategic Energy Policy Guidelines. Strengthen the regulatory framework of each subsector, in particular:

    - ✓ To revive the law regulating the energy sector to adapt it to the reality of the country and current policies.
    - ✓ To develop rules for distributing liquid fuels to create a regulatory framework for the natural gas subsector.

- To centralize international energy connections in the Executive and, in particular, with governments in the region, integrating energy policy in the foreign ministry and seeking solid and stable international commitments.
- To promote the expansion of infrastructure necessary to strengthen the energy sector: pipelines, storage capacities, harbors, buoys, among others.
- Add 300 MW of electricity generation from wind power and 200 MW of biomass through private investment, which should be operational by 2015.
- Complete ongoing studies of alternative power generation for the medium and long term: coal, energy crops and, in particular, to do it after working with the party committee studying the viability of the nuclear option.
- Define a tentative schedule for the incorporation of electricity generation for the short, medium, and long-term, including goals for each of the sources.
- Define a tentative schedule for extending the capabilities of the electricity transmission and distribution sector, taking into account the needs of distributed generation and the demand for new electro-intensive productive enterprises.
- Complete the new interconnection with Brazil, between San Carlos and President Medici.
- Continue strengthening vertical integration via the ANCAP:

- ✓ Joint investment to continue exploration of the maritime platform in Uruguay in search of oil and gas.
- ✓ Association with oil companies for the exploitation of fields abroad via strong business from an economic, technological, and political point of view.

- To continue updating the capacities of the ANCAP refinery culminating in the installation of a desulfurization plant, to begin the process of installing a deep conversion module and a co-generation plant.
- To complete the necessary studies and make definitions that allow an increase in natural gas participation in the energy mix at a reasonable price: a regasification plant and/ or a new gas pipeline through joint investment.
- To continue promoting public and private investment to expand the national production of biofuels.
- Under the law "Promotion of Solar Thermal Energy" to promote instruments that will further its introduction in the country by citizens and companies, especially industrial companies.
- To complete the design of mechanisms that promote energy generation for residential use from renewable energy.
- To design mechanisms that promote the industrial use of solid or liquid residues with a high biological content (in drums, refrigerators and other agro-industrials) for the generation of biogas to be used in the industrial processes.
- To resolve, along with municipalities, mechanisms to effectively transform municipal residues into energy.
- To promote joint investment to continue searching for other energy sources in the national territory: coal, shale, shale gas, and uranium. To promote pilot enterprises for possible use.

Under the Energy Efficiency law:

- To finish labeling appliances and to promote replacement plans.
- To finish the process of modifying rules to promote EE.
- To monitor recently created financial instruments and lines of financing and to promote any adjustments.
- To design EE plans for each state agency.
- To continue promoting diffusion campaigns both inside and outside the formal education system.
- To introduce an energy focus in the integrated vision of cargo and passenger transport with an emphasis on energy efficiency by promoting rail and river transport, passenger transport, and other means of urban mobility thus promoting the rejuvenation of truck and bus fleets, culminating in a review of taxes and regulations to promote electric and hybrid vehicles, among others.
- To further the work of energy and technology to properly plan for the introduction of new energy alternatives in the long-term.
- To maintain the Power Sector Fund, a financial research instrument, at an academic and business level of development and innovation.
- Improve the link between the education sector and energy issues.
- To revise all energy rates, led by the PE. These should reflect the actual costs of each company, but the overall pricing policy should be an instrument of energy policy and should serve social and productive policies. In the case of resolving cross subsidies, these should be clearly defined and articulated.
- Working with state agencies in charge of social policy to continue developing tools to ensure adequate access to energy for the poorest sectors, so as to ensure access to safe energy and to promote social integration. In particular, completing the pilot test of neighborhood solutions by introducing a basic energy basket, such as electricity, supergas, firewood,

and simple technology for harnessing renewable energy, among others, seeking solutions adapted to the needs of each context.

- To promote universal energy access across the country through accessible and tailored solutions to each socio-economic and geographical context: water heating via solar panels, energy-efficient use of wood, biogas from agricultural wastes and farmers, etc.

- To design appropriate instruments to achieve 100% electrification of the country through the combination of the traditional laying of networks and systems using off-grid generation by hybrid systems essentially based on renewable energy (wind, solar photovoltaic, diesel, or biofuels). We will analyze the integration of these initiatives with other state policies such as land use and the environment, seeking synergies for sustainable development at the local level by promoting, among other objectives, reaching the rural level of decent living conditions.

As part of the implementation of the government plan, which has been detailed in the preceding pages, improvements are needed in other institutional areas.

Besides the opportunities associated with improvement directly related to the three goals established by the Sustainable Energy for All program, there are three aspects that need attention in the Uruguayan energy market to achieve the ambitious goals that they have set:

Energy policy should be reviewed periodically to produce a new consensus. It is necessary to incorporate an analysis of the changes that are produced in the context. Since the approval of Energy Policy, there have been important changes, among others: the Fukushima nuclear accident and its consequences, new discoveries of shale gas (USA, Russia, Argentina, etc.), have increased the possibilities of having hydrocarbon in Uruguay.

- To have the necessary human resources to make the important investments in infrastructure that the country requires and particularly those related to the energy sector. The introduction of new generation technologies, the development of smart grids and a more distributed supply will require a sensible increase in the quantity of human resources, particularly among the different branches of engineering.

- The need to make a consistent effort to invest in the development and automation of transmission and distribution networks; like the equipment associated with connection and measurement points. Distributed generation, the improved efficiency associated with better management of the network, the potential of interacting with clients to obtain substantial improvements in energy efficiency, and the possible development of electric transport will make a reliable high-performance network essential.

- To define a new regulatory network in the energy sector, particularly in the electricity sector. Currently, Uruguay has a regulatory framework defined by a multiple supply scheme and demand on the wholesale electricity market that is not adapted to the current reality.

According to the conclusions of a paper by Mr. Mario Vignolo, [21] "the conceptual scheme that inspired regulatory reforms of the electricity sector in the late nineties and the new millennium is not part of the current energy policy in Uruguay. The country

[21] Una aplicación metodológica para el desarrollo eléctrico del Uruguay – Universidad Católica –

has not implemented an electricity market with various producers, consumers, and traders, acting freely to buy and sell energy through contracts and to resolve differences on the spot market.

The various decrees made after 2005 and the policy developed to incorporate greater generation in the energy matrix are not aligned with the principles of the 1997 and 2002 regulatory frameworks. In practice, this tends to create a model similar to the single buyer model in which UTE sells power from new generators.

In this situation, following the principle that clear and stable rules of the game are needed to create appropriate investment conditions, it would be convenient to change the regulatory framework to match this new reality.

3.2 Gaps and barriers

The planning established by the Uruguayan 2030 Energy Policy is conceptually aligned with the goals set by the initiative of the Secretary General of the UN Sustainable Energy for All initiative. However, there are significant barriers to achieving them:

- Social aspects and demographics associated with irregular energy consumption, in particular electricity.
- The absence of a strategic plan for the introduction of greater efficiency levels in public and freight transport.
- The necessity to improve regulation, information, and financing that will allow significant improvements in thermal conditioning, illumination, and the thermal equipment used in construction.
- Cultural aspects associated with the high use of firewood for heating homes with low efficiency burning systems.
- Some weakness in price signals, primarily in the industrial sector, which can affect business decision making in line with higher energy efficiency levels.
- Risks related to promoting a strong private sector in addition to the system of non-conventional renewable energy in order to maintain adequate levels of investment in adverse fiscal conditions.
- Potential difficulties in access to diverse financing sources whose duration is compatible with energy projects.
- Deficiencies related to information and measurement mechanisms for monitoring the different goals that have been set, and in particular to monitoring the SE4ALL goals

3.3 Conclusions and recommendations

Uruguay has had significant development in the energy market and has achieved the highest levels of coverage in Latin America both related to electricity supply and to the arrival of liquid fuels and liquefied petroleum gas to all points in the country. The electricity market has almost entirely developed its hydroelectric potential, which has allowed it to count on a renewable energy electricity supply above 70% during the last 14 years.[22]

[22] Own elaboration based on UTE information.

Infrastructure development has been conditioned by historical low economic growth, a situation that has been reversed since 2003, and that creates the need to expand the supply to sustain economic growth in recent years.

Uruguay can achieve the goal of universalizing modern energy services in an even shorter timeframe than the one established by the initiative. The weak points are associated with the security of the provision, particularly for the irregular use of energy by populations in socially vulnerable conditions and the high costs of electrifying the final stretch of low-density areas.

The goal of doubling the rate of improvement in energy efficiency is very difficult to quantify. However, it is possible to achieve significant improvements in energy efficiency by 2030. While it is true that Uruguay has low energy intensity values, changing the productive structure imposes significant challenges.

The goal of doubling the share of renewables in the energy mix cannot be reached in Uruguay because it has a very high starting point due to the high share of hydropower and biomass energy sources. However, Uruguay has an ambitious plan to incorporate wind energy and waste generation from biomass. The main challenges are associated with effective funding, completing projects, and long-term maintenance including ensuring high renewable energy components, even in bad times.

The challenges and risks to achieve the established goals are summarized in the project implementation strategy include finding the necessary funding to carry out some of the cultural change initiatives.

The main challenges in the sector are associated with supply and reducing the heavy dependence on oil; to improve the management of risks associated with the high variability of the hydropower supply and carry out an ambitious plan of investment in generation and networks that would ensure the strength of the system in a scenario of increasing demand (especially to address the shortfall of firm power).

In the coming years, four lines of action must be completed to reach the objectives: complete electrical interconnection with Brazil. To develop trade agreements to the fullest, to incorporate natural gas into the energy mix with adequate prices and security levels for the supply (regasification plant), to install a firm power plant with competitive generation costs (Combined Cycle Natural Gas) and to develop a plan for incorporating non-conventional renewable energy (wind, biomass residue, cogeneration, and solar).

Uruguay has good quality and abundant wind resources. Its varied territorial conditions and electricity market are favorable to the development of wind energy. However, it is necessary to determine the safety and competitive edge of its growth; and to define rules that can be sustainable in the long term.

In parallel, the country should continue to invest in the development of transmission and distribution networks, as well as the introduction of equipment for the management, communication, and measurement that make it compatible with the new challenges of energy efficiency and distributed generation.

The main recommendations for achieving the overall Energy Policy objectives in relation to the goals of the Sustainable Energy for All initiative are:

To design strategies and policies to help resolve non-technical energy losses, especially in metropolitan areas. They must be comprehensive and interdisciplinary because they surpass the responsibilities of the energy sector. Housing policies, land use, health, and education are essential to achieve a sustainable solution in the long run.

- To design strategies and policies to help resolve non-technical energy losses, especially in the metropolitan area. They must be comprehensive and interdisciplinary because they surpass the responsibilities of the energy sector.

Housing policies, land use, health, and education are essential to achieve a sustainable solution in the long run.

- To detail actions to continue lowering the barriers for incorporating energy efficiency, particularly having to do with price signals, long-term financing, and cultural aspects and access to information
- To advance in the search for solutions for public transport and freight by seeking alternatives to fuel like CNG (compressed natural gas) by obtaining a competitive firm and reliable supply. Important changes are required in freight transport to incorporate specific mediums of lower consumption like water and rail transport.
- To achieve an adequate balance between the projects and investments to be developed for the public and private sector, taking into account the ambitious investment plan about long-term fiscal balance.
- To minimize the implementation risks of renewable energy projects by ensuring the continuity of policies in the long-term and consolidating rules that allow adequate financing for projects.
- To increase the quantity of qualified human resources in the sector, especially the different engineering branches.
- To seek better access to diversified financing sources for both large projects and for small-scale development and studies that improve capacity.
- To improve the rules of Corporate Governance and the management capacity that allows the companies, institutions, and organizations involved in Energy Policy to reach greater levels of efficiency.

Sources and bibliography

Calculation of the CO_2 emission factor of the Uruguayan Electricity System 2008 – Estimate for the PDD –
Cabal, Claudia; Fontana, Fernando; García Pini, Enrique; Kramer, Ricardo
UTE, Management of Investment Planning and the Environment
2009

Electricity Coverage in Latin America and the Caribbean
OLADE and the IDB
2012

Contribution of energy services to the Millennium Development Objectives and the mitigation of poverty in Latin America and the Caribbean
Roberto Kozulj
Santiago, Chile, CEPAL – UNDP – Madrid Club
2009

The development and provision of infrastructure services: the electricity experience in Uruguay from 1990 – 2009
Dubrovsky, Hilda; Ruchansky, Beno
Santiago, Chile, CEPAL – Division of Natural Resources and Infrastructure
2010

Institutional efficiency of national energy efficiency programs: the case of Brazil, Chile, Mexico, and Uruguay

De Buen, Odón; Januzzi, Gilberto; Romero, Andrés; Ruchansky, Beno
Santiago, Chile, CEPAL – Division of Natural Resources and Infrastructure
2011

Estimate of poverty by income 2011
National Institute of Statistics
2012

National Study of the Economy of Climate Change – Uruguay
Montevideo, CEPAL – President of the Republic
2010

Latin American Infrastructure and Comprehensive Development. Strategic Report and Proposals for Agenda Priorities. Electricity.
Antmann, Julia; Arnau, Alejandro; Sanz, Ramón; Skerk, Carlos
Andean Development Corporation (CAF) – XXI Ibero-American Summit Paraguay
2011

New Opportunities for Electricity Interconnection in Latin America
Project CIER 15
Regional Electricity Interconnection Commission (CIER) and the Andean Development Corporation (CAF)
2012

Key World Energy Statistics
International Energy Agency (IEA)
2011

Energy Policy Uruguay 2030
Dr. Ramón Méndez – National Energy Director
Forum on Innovation in the Americas (FIA),
2011

Results of the 2011 Population Census: population, growth, and structure by sex and age
National Statistics Institute
2011

International Access Seminar on energy and poverty reduction to reach the Millennium Development Objectives in Latin America and the Caribbean
CEPAL
An analysis of the Uruguayan energy sector,
Molinari, Jorge
2009

Application of methodology for Uruguayan electricity development. Electricity function and a multidimensional analysis.
Braga, Omar; Perroni, Alejandro; Tierno, Andrés; Zeballos, Raúl.
Montevideo, Catholic University of Uruguay.
2011

Uruguayan Energy Balance 2011 - National Energy Board - www.dne.gub.uy

2011 Census -National Statistics Institute www.ine.gub.uy/ censos2011/ index.html

Uruguayan Energy Policy 2030 - National Energy Board - www.dne.gub.uy

Sustainable Energy for All - United Nations - www.sustainableenergyforall.org

World Bank – data.worldbank.org

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