



**FP7 Collaborative Project
CLARIS LPB
Deliverables**



FP7 Collaborative Project

CLARIS LPB

**A Europe-South America Network for Climate Change Assessment and
Impact Studies in La Plata Basin**

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Summary

The present study focuses on collecting, consolidating and analysing historical information on hydropower park and energy demand in La Plata Basin -LPB-. It also includes a survey on historical data and future scenarios.

The historical data of installed electricity power generation and generated energy by the five countries, as well as energy demand per capita for each country, for the period 1980-2008, are provided by the Regional Energy Integration Commission – CIER–. The historical electricity demand at basin level is estimated considering the energy demand per capita in each country and the population in the basin for 2000. The percentage for each country's electricity demand for 2000 (at LPB) is defined and used to estimate the historical series of the basin (1980-2008). Besides, the hydropower generation for LPB is calculated using the national percentage for each year (1995-2008). All the calculations for LPB are done successfully and as a reference estimation, the electricity demand in 2008 is 350.160 MWh with a 73% coming from hydropower generation.

The total hydropower potential in La Plata Basin, estimated from different sources of information, is 107.000 MW, where 63% corresponds to the Parana sub-basin, 10% to Paraguay sub-basin and 27% to Uruguay sub-basin. The installed hydropower park existing in the five countries is 67.583 for 2008 (CIER, 2009). The list of existing dams and the projected ones for the LPB are also presented.

Regarding to future scenarios, the electricity demand at basin level (2010-2040) is estimated considering the extrapolation of national values and the percentage of inhabitant in the basin (same procedure applied for 1980-2008). The value of the future electricity demand for La Plata Basin in 2040 is 961.200 MWh. Besides, the future hydropower production at basin level is extrapolated to 440.000 MWh for 2040 (about 82% of the feasible hydropower production) but the trend of this extrapolation has a large uncertainty mainly because it is complicated to predict the fast evolution of the renewable energy source (RES) for the coming decades.

These consolidated data of hydropower production and demand presented in the present report will be an input for further analysis related to adaptation strategies considering possible hydrological scenarios, within the framework of the CLARIS LPB Regional Hydroclimate Project.

1. Introduction

The La Plata Basin -extending over 3.1 million km²- includes the south of Brazil, the south-east of Bolivia, a large part of Uruguay, the whole Paraguay and an extensive portion of the central and northern part of Argentina. The three main river systems comprising the La Plata Basin are Paraguay, Parana and Uruguay Rivers. The Parana and Uruguay Rivers together form the La Plata River, draining to the south-west Atlantic Ocean, with an average outflow of 25,000 m³/s. It is an area of concentrated population, exceeding 100,000,000 people, living in 57 cities, each one with more than 100,000 inhabitants—including the four capital cities: Buenos Aires, Brasilia, Asunción, and Montevideo—and generating more than 70% of the GDP of the countries mentioned above.

The present report is made within the framework of the CLARIS LPB Regional Hydro climate Project. This Regional Project aims at predicting the regional climate change impacts on La Plata Basin (LPB) and designing adaptation strategies for land-use, agriculture, rural development, hydropower production, river transportation, water resources and ecological systems in wetlands.

The study focuses on collecting, consolidating and analysing historical information on hydroelectric production and demand of La Plata Basin. It also includes a survey on future scenarios. These data will be an input for further analysis related to adaptation strategies considering possible hydrological scenarios and their consequences.

2. Historical data of installed electric power capacity and electricity generation

2.1 Data of electricity at national level

Information at national level is provided by the Regional Energy Integration Commission –CIER-, an international organization created in 1964 which involved the five countries of La Plata Basin. Historical data from CIER [2] is summarized in Tables 1 to 4.

The evolution of electricity services (installed power generation, energy generated and energy demand per capita) between 1980 and 2008, for the five countries is presented in Table 1. The installed power generation for the five countries increased from 40.063 MW in 1980 to 146.428 in 2008. The energy demand was 170.288 GWh in 1980 and 651.431GWh in 2008. In relation with energy demand per capita, Argentina had the highest value (1.280 kWh/inh in 1980 and 3.225 kWh/inh in 2008); the lowest value in 1980 was in Paraguay (221 kWh/inh) while Bolivia had the lowest value in 2008 (622 kWh/inh).

In Table 2, values of available installed hydro-power and generated hydroenergy are detailed for each country of the Basin, considering years 1995, 2000, 2005 and 2008.

The data show the importance of hydropower at country level, particularly for Brazil and Paraguay.

In order to give an idea of the installed electric power capacity and the important position of the hydropower, Table 3 shows values per country, for 2008. As complementary data, the available information related to energy exchange between countries is included in Table 4.

Table 1: National values of electricity installed power generation (MW), generated energy (MWh) and energy demand per capita (kWh/inhabitant) for the period 1980-2008

	1980	1985	1990	1995	2000	2005	2008
ARGENTINA							
MW	10.079	13.476	14.966	18.511	26.357	28.292	30.841
GWh	35.875	38.870	45.303	62.809	88.965	106.523	121.978
KWh/ inhabitant	1.280	1.360	1.459	1.882	2.438	2.871	3.225
BOLIVIA							
MW	392	470	525	709	1.325	1.379	1.503
GWh	1.253	1.429	1.901	2.792	3.884	4.908	6.238
KWh/ inhabitant	228	222	284	378	468	521	622
BRAZIL							
MW	28.524	40.515	49.603	55.497	67.713	92.865	102.771
GWh	129.181	178.247	211.328	261.060	323.936	405.100	459.840
KWh/ inhabitant	1.076	1.336	1.554	1.886	2.142	2.402	2.598
PARAGUAY							
MW	273	1.324	6.178	6.933	8.166	8.116	8.816
GWh	700	3.999	27.158	41.607	53.210	51.047	55.362
KWh/ inhabitant	221	374	641	890	1.044	1.212	1.414
URUGUAY							
MW	795	1.881	1.909	2.108	2.115	2.030	2.497
GWh	3.279	6.517	7.244	6.252	7.365	7.566	8.013
KWh/ inhabitant	1.145	1.317	1.521	1.934	2.386	2.518	2.686
TOTAL (five countries)							
MW	40.063	57.666	73.181	83.758	105.676	132.682	146.428
GWh	170.288	229.062	292.934	374.520	477.360	575.144	651.431

MW: Installed power generation

GWh: Generated energy

kWh/inhabitant: Energy demand per capita

Source: *Síntesis Informativa Energética de los Países de la CIER. Comisión de Integración Energética Regional*, 2009. <http://www.cier.org.uy/> [2]

Table 2: National values of hydroelectricity (installed power generation –MW- and generated energy – MWh-) for 1995, 2000, 2005 and 2008, with percentage of the total values

	1995		2000		2005		2008	
ARGENTINA								
MW	8.211	44%	9.581	36%	9.906	35%	9.945	32%
GWh	26.911	43%	28.761	32%	33.966	32%	31.402	26%
BOLIVIA								
MW	277	39%	376	28%	461	33%	476	32%
GWh	1.230	44%	1.925	50%	1.964	40%	2.281	37%
BRAZIL								
MW	50.681	91%	59.853	88%	71.060	77%	77.508	75%
GWh	250.480	96%	298.563	92%	340.500	84%	400.929	87%
PARAGUAY								
MW	6.895	99%	8.116	100%	8.110	100%	8.810	100%
GWh	41.604	100%	51.047	100%	51.046	100%	55.361	100%
URUGUAY								
MW	1.519	72%	1.534	73%	1.538	76%	1.538	62%
GWh	5.875	94%	6.870	93%	6.610	87%	4.501	56%

MW: Hydroenergy - Installed power generation

GWh: Hydroenergy - Generated energy

Source: *Síntesis Informativa Energética de los Países de la CIER. Comisión de Integración Energética Regional, 2009.* <http://www.cier.org.uy/> [2]

Table 3: National values of installed power generation (MW) and generated energy (MWh) for 2008

	Therm. Vap. Conv	Turbo Gas Open Cycle	Turbo Gas Comb. Cycle	Disel and other sources	Nuclear	Hydro	Auto producers	TOTAL
ARGENTINA								
MW	4.466	4.046	7.027	725	1.018	9.945	3.614	30.841
GWh	19.143	9.569	40.378	605	7.330	31.402	13.551	121.978
BOLIVIA								
MW		1.027			-	476	-	1.503
GWh		3.957			-	2.281	-	6.238
BRAZIL								
MW	4.911	11.780	6.565	2.007	77.508	-	102.771	
GWh	8.840	23.872	12.148	14.051	400.929	-	459.840	
PARAGUAY								
MW	-	-	-	6	-	8.810	-	8.816
GWh	-	-	-	1	-	55.361	-	55.362
URUGUAY								
MW	255	532	-	10	-	1.538	162	2.497
GWh	1.206	2.157	-	12	-	4.501	137	8.013

Source: CIER (2009) *Síntesis Informativa Energética de los Países de la CIER.* [2]

Table 4: Energy exchange (GWh) between countries of La Plata Basin for 2008

		Exporter			
		Argentina	Brazil	Paraguay	Uruguay
Importer	Argentina		1.277	6.891	8
	Brazil	1		39.582	14
	Paraguay	-	-		-
	Uruguay	834	129	-	

Source: CIER (2009) *Síntesis Informativa Energética de los Países de la CIER*. [2]

A study was carried out by CEPAL “Renewable Energy Sources in Latin America and Caribbean. Situation and Policy Proposal, 2004” [1], giving consolidated information on total energy supply, at country level for Argentina, Bolivia, Brazil, Paraguay and Uruguay considering data from OLADE (*Organización Latinoamericana de Energía*) among others. Although the information is not required for the present study, it is nevertheless included in this report, for the purposes of bringing a framework matrix of each country situation. Data corresponding to year 2002, are presented in Annex I.

According to the above mentioned study, the percentage of hydro-energy considering the total energy supply -at national level- is 6,8% for Argentina, 17,0% for Bolivia, 14,8% for Brazil, 71,8% for Paraguay and 36,8% for Uruguay.

2.2 Electricity demand in La Plata Basin

The historical electricity data of La Plata Basin –LPB– estimated in this report, was calculated considering data for each country from CIER as the main source of information.

The estimation of the proportion of electricity corresponding to the area of La Plata Basin –LPB–, was calculated as follows:

- The number of inhabitants living in the basin during 2000 is presented in WWAP (2007) [13]. The total population amounts to 100,852,919. The distribution of total population by country is presented in Table 5, which also shows the composition of the population by gender. In particular the data for 2000 are: Argentina 26,274,861 inh , Bolivia 1,718,908 inh, Brazil 65,455,629 inh, Paraguay 5,163,598 inh and Uruguay 3,043,969 inh.
- National values of energy demand per capita (kWh/inhabitant) corresponding to the period 1980-2008 is presented by CIER (2009) [2] and described in Table 1 of the present report.

In particular the data for 2000 (Table 1) are: Argentina 2.438 kWh/ inh, Bolivia 468 kWh/ inh, Brazil 2.142 kWh/ inh, Paraguay 1.044 kWh/ inh and Uruguay 2.386 kWh/ inh.

- With the presented data for 2000 (population of the basin per country and energy demand per capita per country), it is possible to estimate the energy demand for the hole La Plata Basin –LPB–. This results in an estimated electricity demand for the basin, for 2000 of 265.541 GWh distributed as follow:
 - Argentina 64.058 GWh
 - Bolivia 804 GWh
 - Brazil 140.206 GWh
 - Paraguay 53.210 GWh
 - Uruguay 7.263 GWh

The estimated electricity demand for the basin represents the following percentage of the total country value:

- LPB-Argentina consumes a 72% of the total Argentinean electricity demand
 - LPB-Bolivia consumes a 21% of the total Bolivian electricity demand
 - LPB-Brazil consumes a 43% of the total Brazilian electricity demand
 - LPB- Paraguay consumes a 100% of the total Paraguayan electricity demand
 - LPB-Uruguay consumes a 99% of the total Uruguayan electricity demand.
- Based on the obtained percentage of the basin demand related to the total demand per each country for 2000 (Argentina 72%, Bolivia 21%, Brazil 43%, Paraguay 100% and Uruguay 99%), an extrapolation to the rest of the historical series can be done. The subsequent results are presented in Table 6 and Figure 1.
 - Considering the historical data of energy demand in the basin, the hydroelectricity consumed in the basin is calculated taking into consideration the proportion of hydro-production in each country per year (Table 2). The new results at basin level are presented in Table 6 and Figure 2.

Table 5: La Plata Basin. Total population in the early 2000s

Countries	Total Population*	Male	Female
Argentina**	26,274,861	12,772,061	13,502,800
Bolivia***	1,718,908	848,085	866,823
Brazil****	65,455,629	31,813,496	33,642,133
Paraguay	5,163,598	2,603,242	2,559,956
Uruguay*****	3,043,969	1,472,848	1,571,121

Note: * Last registered data: Argentina & Bolivia, 2001; Brazil, 2000; Paraguay, 2002; Uruguay, 2004.

** Provinces and departments included in the basin.

*** Departments and provinces included in the basin.

**** States and municipalities included in the basin.

***** Departments included in the basin.

Table sources: INDEC, 2001[5]; INE, 2001[6]; IBGE, 2000 [4]; DGEEC, 2002 [3].

Source : WWAP (2007) [13]

Table 6: Electricity demand in La Plata Basin –LPB– (total and hydroelectricity)

	1980	1985	1990	1995	2000	2005	2008
ARGENTINA							
GWh - Total in LPB (72% of country value)	25.830	27.986	32.618	45.222	64.055	76.697	87.824
% of hydro				43	32	32	26
GWh – Hydroelectricity in LPB				19.446	20.498	24.543	22.834
BOLIVIA							
GWh - Total in LPB (21% of country value)	263	300	399	586	816	1.031	1.310
% of hydro				44	50	40	37
GWh – Hydroelectricity in LPB				258	408	412	485
BRAZIL							
GWh - Total in LPB (43% of country value)	55.548	76.646	90.871	112.256	139.292	174.193	197.731
% of hydro				96	92	84	87
GWh – Hydroelectricity in LPB				107.766	128.149	146.322	172.026
PARAGUAY							
GWh - Total in LPB (100% of country value)	700	3.999	27.158	41.607	53.210	51.047	55.362
% of hydro				100	100	100	100
GWh – Hydroelectricity in LPB				41.607	53.210	51.047	55.362
URUGUAY							
GWh - Total in LPB (99% of country value)	3.246	6.452	7.172	6.189	7.291	7.490	7.933
% of hydro				94	93	87	56
GWh – Hydroelectricity in LPB				5.818	6.781	6.517	4.442
TOTAL							
GWh - Total in LPB	85.587	115.384	158.218	205.861	264.664	310.458	350.160
GWh – Hydroelectricity in LPB				174.894	209.045	228.841	255.150
% of hydro				85	79	74	73

Figure 1: Electricity Demand in La Plata Basin (per country)

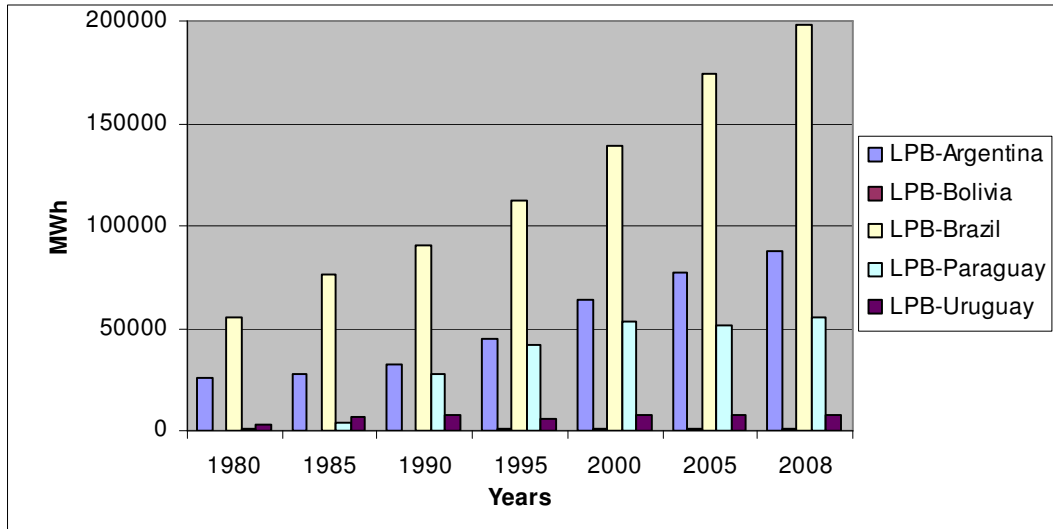
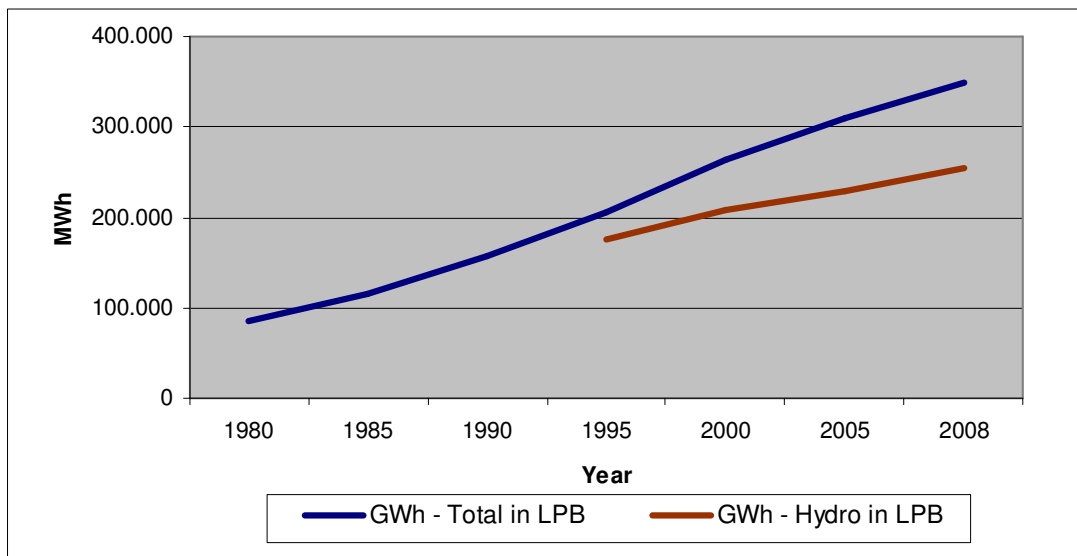


Figure 2: Electricity demand in La Plata Basin (total and hydropower values)



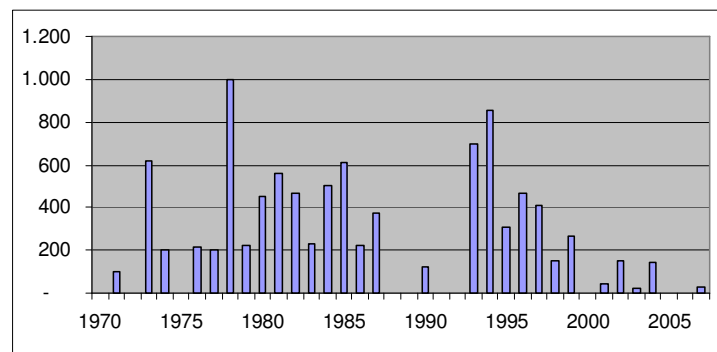
3. Hydropower park in La Plata Basin

3.1. *Hydropower park available data*

Considering the situation in each country, Argentina began to make use of the electric power coming from the rivers in La Plata Basin in 1979, together with Uruguay at Salto Grande. The most significant development was in 1994, together with Paraguay when the bi-national Yacyretá dam started its operation.

The evolution of installed hydroelectricity for Argentina, at national level, incorporated from 1970 is presented in Figure 3.

Figure 3: Argentina hydroelectric power incorporated to the national park (MW)



Source: *Secretaría de Energía de Argentina*

Although Bolivia lacks dams in the basin, it is estimated that virtually all of the rivers' potential could eventually be exploited since this country is able not only to design hydraulic power stations, but also to build a large part of the necessary equipment (there exist three water turbine factories) and to start the operation of the hydraulic power stations at a price which would be sensibly more competitive than photovoltaic systems. According to a project inventory carried out in the mid-1990s by the *Secretaría Nacional de Energía*, it is possible to have installed capacities of 7 MW in microstations distributed in over one hundred projects allowing supply to nearly 20,000 families (CEPAL, 2004) [1].

The information from the *Comité Nacional de Despacho de Carga (CNDC)* of Bolivia (2010), presented in Table 7, shows that the hydroelectric potential estimated at national level is 39,870 MW and the corresponding value to La Plata Basin is 5,370 MW.

Table 7: Hydroelectric data in Bolivia (MW)

Sub-basin /Basin /Country	Gross	Potential	Inventoried	Operating
Amazonas	235.500	34.210	7.540	290
La Plata	81.200	5.370	3.160	23
Altiplano	17.400	290	-	-
TOTAL Bolivia	334.100	39.870	10.700	313
TOTAL Bolivia (2003)	334.100	39.870	13.685	428

Source: *Comité Nacional de Despacho de Carga (CNDC) Bolivia, 2010*

For Brazil [12], hydroelectricity plays a key role in the country's socio-economic success. Brazil belongs to the group of countries where the production of electricity is massively generated from hydroelectric plants. The 75% of installed power in the country is hydroenergy and generated – in 2005– 93% of the electricity required in the National Interconnected System (*Sistema Interconectado Nacional - SIN*). It should also be noted that only about 30% of the national hydroelectric potential is exploited. The hydroelectric potential of Brazil is estimated on 251 GW. Of this total, 43% is located in the North. Hydroelectric potential in Brazil, per sub-basin is presented in Table 8.

Table 8: Hydroelectric Potential in Brazil (MW)

Sub-Basin / Basin / Country	Existing (<i>aproveitado</i>)	Inventoried (<i>inventario</i>)	Feasible in the near future (<i>estimado</i>)	Total	% of total hydroelectric potential of Brazil
Paraná Sub-basin (LPB Brazil)	41.696	10.742	5.363	57.801	23,0
Uruguay Sub-basin (LPB Brazil)	5.182	6.482	1.152	12.816	5,1
Paraguay-Sub-basin (LPB Brazil)	499	846	1.757	3.102	1,2
Total LPB-Brazil	47.377	18.070	8.272	73.719	28,3
TOTAL Brazil	77.777 30,9 %	126.164 50,2 %	47.549 18,9%	251.490 100%	

Notes: 1) includes potential of existing plants in December 2005 and the plants in construction or concession granted, 2) inventory in this table indicates the minimum level of study 3) values consider only 50% of bi-nationals plants; 4) Figures do not include the potential of small hydropower plants.

Source: *Ministério de Minas e Energia (2007). Table 5-18 from Report "Matriz Energética 2030"[12]*

In Uruguay, the estimated potential for hydropower is 1.815 MW (CEPAL, 2004[1]), where 1,546 MW has been already installed. Half of the 1,890 MW in Salto Grande dam corresponds to Uruguay River, and 601 MW corresponds to 3 stations on the Negro River.

The consolidated information of potential hydropower at national and basin level, is presented in Table 9. In this table, the hydroenergy installed at national level for 2008 is also presented as reference data. Data of the potential hydropower in LPB, for Argentina, Paraguay and Uruguay is taken from the study made in 1985 by OAS [8].

Nowadays, the estimated feasible hydropower potential in La Plata Basin is 107.000 MW. Considering that the installed hydropower in 2008 was 67.583MW, about 39.576 MW is still possible to develop, representing 37% of the total estimated feasible potential.

Table 9: Hydropower Park Data (MW).

	Installed Hydropower 2008 National Level (2)	Estimated Potential Hydropower (MW)				
		National Level	La Plata Basin –LPB–			
			Total LPB	Parana Sub-basin	Paraguay Sub-basin	Uruguay Sub-basin
Argentina	8.211	N/a	15.836 (4)	10.563 (4)	1325 (4)	3.948 (4)
Bolivia	277	39.870 (3)	5.370 (3)	-	5.370	-
Brazil	50.681	251.490 (5)	73.719 (5)	57.801 (5)	3.102 (5)	12.816 (5)
Paraguay	6.895	N/a	10.428 (4)	-	-	10.428
Uruguay	1.519	1.815 (1)	1.806 (4)	-	-	1.806
TOTAL	67.583	N/a	107.159	68.364 63%	9.797 10%	28.998 27%

Source:

(1) CEPAL (2004). *Fuentes renovables de energía en América Latina y el Caribe. Situación y propuestas de políticas* [1].

(2) CIER (2009). *Síntesis Informativa Energética de los Países de la CIER* [2]

(3) CNDC (Comité Nacional de Despacho de Carga), *Bolivia, 2010*

(4) OAS-OEA (1985) *Infraestructura y Potencial Energético en la Cuenca del Plata* [8]

(5) *Ministerio de Minas e Energía – Brazil (2007) Matriz Energética Nacional 2030* [12]

3.2. Characteristics of existing dams

There are over 100 hydroelectric plants operating in La Plata Basin, most of which can be found in the Brazilian sector. Three of the large reservoirs in the basin are binational: Yacyretá (Argentina-Paraguay), Itaipú (Brazil-Paraguay), and Salto Grande (Argentina-Uruguay). (WWAP, 2007 [13])

Table 10 shows a description of the dams existing in the basin, by country. In general, the largest number of dams in the basin is located on the Paraná River and its tributaries.

Table 10a: La Plata Basin. Hydropower and Large Dams
Binational – Argentina – Paraguay – Uruguay (from WWAP, 2007)

Country and project name Dam name (hydro plant in brackets if different)	River Name	Dam height (m)	Year dam completed	Installed hydropowers (MW)
BINATIONAL				
Itaipú (Paraguay - Brazil)	Paraná	196	1982	12.600
Salto Grande (Argentina - Uruguay)	Uruguay	47	1979	1.890
Yacyretá (Argentina - Paraguay)	Paraná	43	1994	1.800
ARGENTINA				
Urugua-í	Urugua-í	90	1991	120
PARAGUAY				
Acaray	Acaray	41	1972	256
URUGUAY				
Constitución	Negro	66	1982	333
Gabriel Terra/ Rincón del Bonete	Negro	51	1948	160
Rincón de Baygorria	Negro	45	1960	108

Source: WWAP (2007) [13]

Table 10b: La Plata Basin. Hydropower and Large Dams
Brazil (from Mine et al., 2009)

Num	Plant	Basin	Pot (MW)	Num	Plant	Basin	Pot (MW)
1	Camargos	Grande	46	35	Capim Branco II	Paranaíba	210
2	Itutinga	Grande	232	36	Corumbá IV	Paranaíba	127
3	Funil Grande	Grande	180	37	Corumbá III	Paranaíba	93,6
4	Furnas	Grande	1312	38	Corumbá I	Paranaíba	375
5	M. de Moraes	Grande	478	39	Itumbiara	Paranaíba	2280
6	Estreito	Grande	1104	40	Cach. Dourada	Paranaíba	658
7	Jaguara	Grande	424	41	São Simão	Paranaíba	1710
8	Igarapava	Grande	210	42	Caçu	Paranaíba	65,1
9	Volta Grande	Grande	380	43	Barra dos Coqueiros	Paranaíba	90
10	Porto Colombia	Grande	328	44	A. A. Laydner	Paranapanema	97,8
11	Caconde	Grande	80,4	45	Pirajú	Paranapanema	80
12	E. da Cunha	Grande	108,8	46	Chavantes	Paranapanema	414
13	A. S. Oliveira	Grande	32	47	Ourinhos	Paranapanema	44,1
14	Marimondo	Grande	1488	48	L. N. Garcés	Paranapanema	72
15	A. Vermelha	Grande	1396,2	49	Canoas II	Paranapanema	69,9
16	Santa Clara	Iguacu	120	50	Canoas I	Paranapanema	82,5
17	Fundão	Iguacu	120	51	Capibara	Paranapanema	640
18	Foz do Areia	Iguacu	1676	52	Taquaruçu	Paranapanema	554
19	Segredo	Iguacu	1260	53	Rosana	Paranapanema	372
20	Salto Santiago	Iguacu	1420	54	Barra Bonita	Tietê	140
21	Salto Osório	Iguacu	1078	55	A. S. Lima	Tietê	144

Num	Plant	Basin	Pot (MW)	Num	Plant	Basin	Pot (MW)
22	Salto Caxias	Iguacu	1240	56	Ibitinga	Tietê	131,4
23	Ilha Solteira	Paraná	3444	57	Promissão	Tietê	264
24	Jupia	Paraná	1551,2	58	Nova Avanhandava	Tietê	347,4
25	Porto Primavera	Paraná	1540	59	Três Irmãos	Tietê	807,5
26	Itaipu	Paraná	14000	60	Henry Borden	Tietê	888
27	Salto Rio Verdino	Paraná	93	61	Barra Grande	Uruguai	690
28	Salto	Paraná	108	62	Campos Novos	Uruguai	879,9
29	Espora	Paraná	32,1	63	Machadinho	Uruguai	1140
30	Serra do Facão	Paranaíba	212,6	64	Itá	Uruguai	1450
31	Emborcação	Paranaíba	1192	65	Passo Fundo	Uruguai	226
32	Nova Ponte	Paranaíba	510	66	Monjolinho	Uruguai	67
33	Miranda	Paranaíba	408	67	Quebra-Queixo	Uruguai	120
34	Capim Branco I	Paranaíba	240	68	Foz do Chapecó	Uruguai	855,2

Source: Mine et al. (2009) [11]

3.3. Dams in project

The existing dams in project are presented by country in Table 11.

Table 11: La Plata River Basin. Dams projected by country in 2002

Project Name	River Name	Dam Height (m)	Hydro Capacity u/c or planned (MW)
BINATIONAL			
Garabi (Argentina - Brazil)	Uruguay	81	1.500
Corpus Christi (Argentina - Paraguay)	Paraná	40	2.880
Añacuá (Argentina - Paraguay)	Paraná branch	n/a	250
Arrazayal (Argentina – Bolivia)	Bermejo	120	93
Cambarí (Argentina - Bolivia)	Grande de Tarija	110	102
Las Pavas (Argentina - Bolivia)	Bermejo	110	88
ARGENTINA			
Chapetón (Paraná Medio)	Paraná	15	3.000
BRAZIL (*)(**)			
São Joao	Chopim	51	60
Itumirim	Corrente	n/a	50
Salto Santiago 2	Iguaçu	65	710
Pai Querê	Pelotas	158	292
Note: n/a not available u/c under construction (*) WWAP, 2007: Many other planned hydroelectric projects in Brazil are to be granted concessions by ANEEL. A further 2,734 MW was planned to begin before the end of 2002, and 6,390 MW in 2003. Source: UNEP, 2004 (**) The list of dams in Brazil are the ones included in WWAP 2007 and not existing in the list of Mine et al. 2009.			

Source: WWAP (2007) [13] and Mine et al (2009) [11]

4. Scenarios of future hydropower park and electricity demand

4.1 *Electricity demand and hydropower development plan at national level*

Argentina has a National Strategic Plan with a future tendency demand by 2025. The values -obtained from a graphic presented by the *Secretaría de Energía*- are presented in Table 12. The original information is included in Annex II.

Table 12: Argentina – Estimated national values for Electricity Demand (GWh) by 2025 in GWh

	2010	2015	2020	2025
GWh (total)	145.000	175.000	195.000	216.400
% of hydro (from total demand)	35%	35%	38%	40%

Source: *Secretaría de Energía de Argentina*

The *Comité Nacional de Despacho de Carga (CNDC)* of Bolivia provided the estimation for the future electricity demand and power installation, at national level. Data are presented in Table 13.

Table 13: Bolivia – Estimated national values for Installed Power generation (MW) and Electricity Demand (GWh) by 2040 in GWh

	2010	2015	2020	2025	2030	2035	2040
MW	1.014	1.338	1.712	2.19	2.802	3.585	4.586
GWh	5.819	7.747	9.902	12.658	16.180	20.682	26.438

MW: Installed Power Generation

GWh: Electricity Demand

Source: *Comité Nacional de Despacho de Carga (CNDC) Bolivia, 2010.*

Brazil has a detailed estimation of the matrix for electricity scenarios until 2030, developed by the *Ministerio de Minas e Energía*. Data is presented in Table 14.

Table 14: Brazil – Estimated national values for electricity demand and hydro-production

	2010	2020	2030
Total Demand of Electricity (GWh)	486.200	706.600	1.030.100
Hydro-production (GWh)	395.000	585.700	817.600
% of Hydro-production	81	83	79

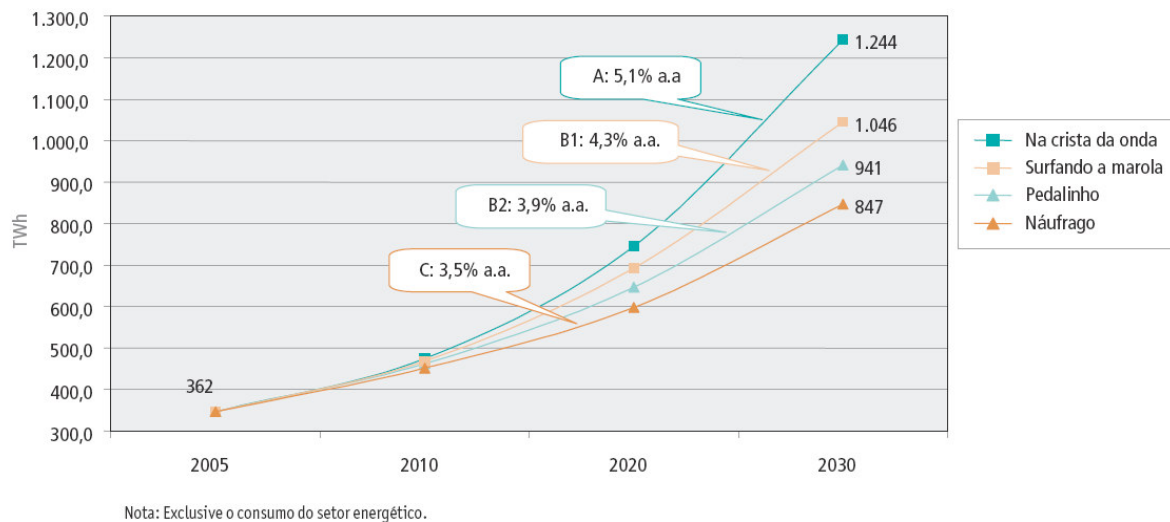
Source: *Ministério de Minas e Energia (2007).*

Table 6.9 from Report *Matriz Energética 2030*. [12]

Brazil has also information related with the evolution of the percentage of hydroenergy into the national matrix. By 2016, hydroelectricity can decrease until 69% or 56% depending on the forecast scenarios.

The *Ministério de Minas e Energia- Empresa de Pesquisas Energéticas* has also developed different scenarios of total demand of electricity, considering variations of economical parameters. Figure 4 includes the scenarios of total electricity demand. Parameters considered in each scenario are detailed in Annex III.

Figure 4: Brazilian scenarios of total electricity demand (GWh)



Source: *Ministério de Minas e Energia- Empresa de Pesquisas Energéticas (Figure32 in the source document)*

Respecting to Paraguay and Uruguay, no data studies with future scenarios were located and therefore the values included in the present report are estimated using historical data.

The consolidated information is presented in Table 15 and Figure 5. The extrapolated estimation from available information is shown in italics in Table 15 and as dotted line in Figure 5.

Table 15: Future Electricity Demand at National level

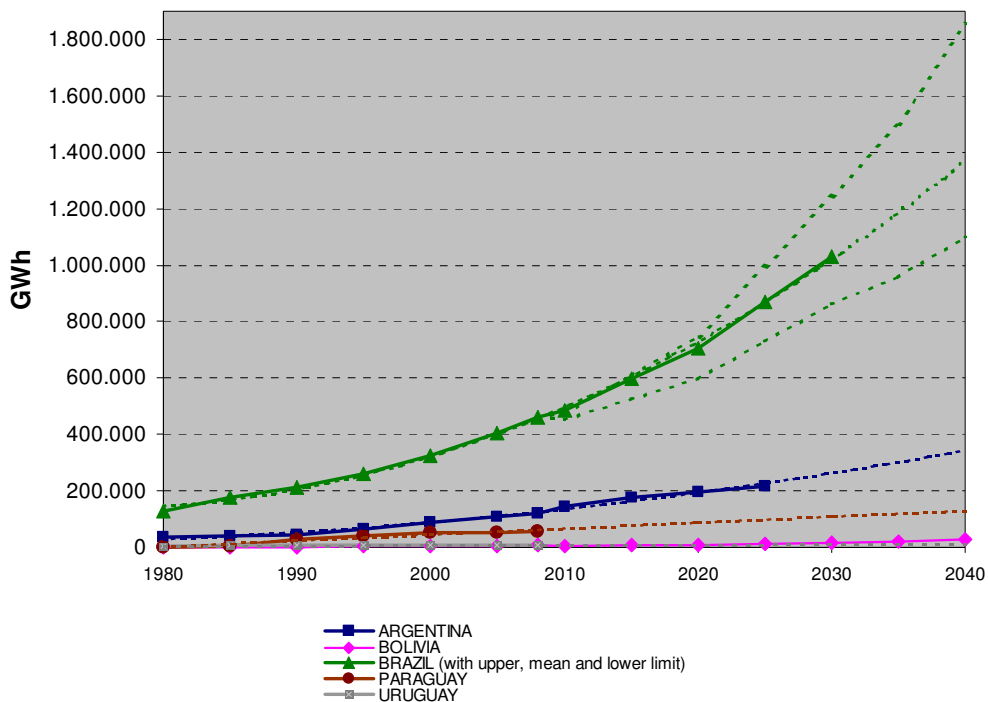
		2010	2015	2020	2025	2030	2040	2040
ARGENTINA								
GWh – National level (1)		145.000	175.000	195.000	216.400	<i>247.340</i>	<i>285.890</i>	<i>327.220</i>
BOLIVIA								
GWh – National level (2)		5.819	7.747	9.902	12.658	16.180	20.682	26.438
BRAZIL								
GWh National level	Upper (3b)	475.000	<i>610.500</i>	746.000	<i>995.000</i>	1.244.000	<i>1.500.000</i>	<i>1.850.000</i>
	Mean (3a)	486.200	<i>596.400</i>	706.600	<i>868.350</i>	1.030.100	<i>1.164.810</i>	<i>1.346.100</i>
	Lower (3b)	452.000	<i>525.000</i>	598.000	<i>737.500</i>	877.000	<i>960.000</i>	<i>1.100.000</i>

PARAGUAY							
GWh – National level (4)	65.930	76.530	87.110	97.660	108.190	118.690	129.160
URUGUAY							
GWh – National level (4)	8.490	9.110	9.720	10.340	10.950	11.570	12.190

Source:

- (1) Secretaría de Energía de Argentina (period 2010-2025) and *extrapolated values (period 2030-2040)*
- (2) Comité Nacional de Despacho de Carga (CNDC) Bolivia, 2010 (period 2010-2040).
- (3) (3a) Ministério de Minas e Energia, 2007 -Table 6.9 from Report *Matriz Energética 2030-* (period 2010-2030) and *extrapolated values (period 2035-2040)* [12]
(3b) Ministério de Minas e Energia- Empresa de Pesquisas Energéticas (Figure32 in the source document) - Upper and lower limit.
- (4) *Estimated data* from regression analysis considering historical data for the period 1980-2008 (Table 2 of the present report)

Figure 5: Historical and Future Electricity demand at national level (GWh)



Source:

1980-2008 Data from CIER (2009) / 2010-2040 see detail in Table 15

4.2 Estimation at basin level

The future demand of electricity at basin level was estimated using the same calculation method applied for the period 1980-2008 (paragraph 2.2), based on the percentage of consumption of the inhabitant living in the basin during 2000. Consolidated results are presented in Table 16 and Figure 6 (blue line).

Table 16: Estimated Future Electricity Demand in La Plata Basin –LPB–

		2010	2015	2020	2025	2030	2040	2040
ARGENTINA								
GWh - Total in LPB (72% of country value)		104.400	126.000	140.400	155.808	178.085	205.841	235.598
BOLIVIA								
GWh - Total in LPB (21% of country value)		1.222	1.627	2.079	2.658	3.398	4.343	5.552
BRAZIL								
GWh - Total in LPB (43% of country value)	Upper	204.250	262.515	320.780	427.850	534.920	645.000	795.500
	Mean	209.066	256.452	303.838	373.391	442.943	500.868	578.823
	Lower	194.360	225.750	257.140	317.125	377.110	412.800	473.000
PARAGUAY								
GWh - Total in LPB (100% of country value)		65.930	76.530	87.110	97.660	108.190	118.690	129.160
URUGUAY								
GWh - Total in LPB (99% of country value)		8.405	9.019	9.623	10.237	10.841	11.454	12.068
TOTAL								
GWh – Total in LPB	Upper	386.217	477.706	562.012	696.238	837.463	987.363	1.179.918
	Mean	389.023	469.628	543.050	639.753	743.456	841.197	961.201
	Lower	376.327	440.941	498.372	585.513	679.653	755.163	857.418

The projected dams in the basin are presented in Table 11 and this future hydropower production will be included into the National Interconnected System (*SIN – Sistema Interconectado Nacional*).

The future hydropower production at basin level is estimated by extrapolating the past information of hydropower demand (1995-2008) reported in Figure 2. The results of the logarithmic fit are presented in Figure 5 (red dot). This trend has a large uncertainty mainly because it is complicated to predict the fast evolution of the renewable energy source (RES) for the coming decades.

An additional analysis was completed, in order to estimate the feasible hydropower production for LPB based on the total estimated potential hydropower (presented in Table 9) and the relation between the energy generated and the installed power generation (presented in Table 2). Results are reported in Table 17. It is interesting to notice that the hydropower production for 2040 (440.000 MWh in Figure 6) is about 82% of the feasible hydropower production estimated in Table 17 (527.878 MWh).

Figure 6: Electricity Demand and Hydropower Production in La Plata Basin (GWh) 1980-2040

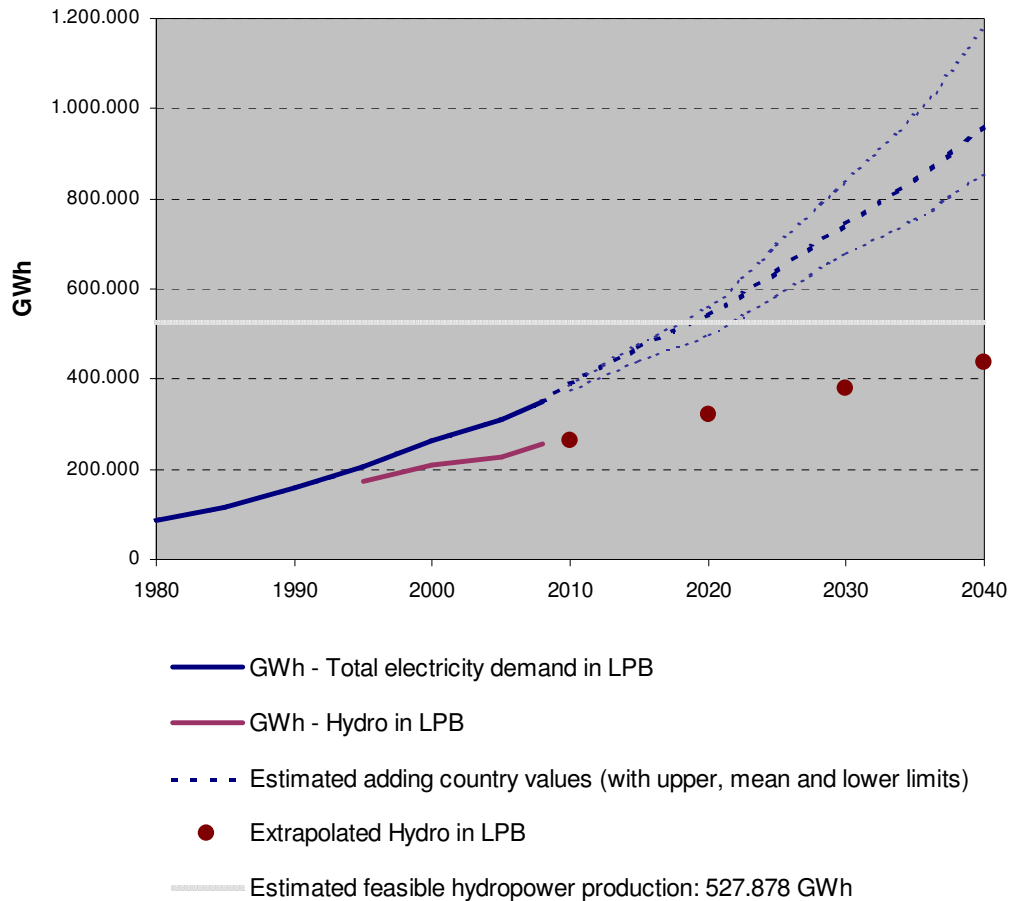


Table 17: Estimated Future Feasible Hydropower Production in La Plata Basin (GWh)

	Estimated Potential Hydropower Total at Basin Level <i>Data from Table 9</i> (MW)	Relation Energy generated / Installed power generation <i>Data from Table 2 (2008)</i> (GWh/MW)	Estimated Feasible Hydropower Production (GWh)
	(a)	(b)	(a) * (b)
Argentina	15.836	3,1	50.003
Bolivia	5.370	4,8	25.733
Brazil	73.719	5,2	381.329
Paraguay	10.428	6,3	65.528
Uruguay	1.806	2,9	5.285
TOTAL	107.159		527.878

5. Conclusions

At national level, the Regional Energy Integration Commission –CIER– gives reliable historical data of installed electricity power generation and generated energy by the five countries, as well as energy demand per capita for the period 1980-2008. Based on this data, estimation for LPB was done, giving consolidated information such as values of electricity demand at basin level. In 2008 the electricity demand was 350.160 MWh, in which 255.000 MWh, about the 73%, is coming from hydropower.

Regarding to future scenarios, the electricity demand for La Plata Basin by 2040 is estimated in about 960.000 MWh based on national extrapolations data and percentage of inhabitant in the basin. Moreover, the future hydropower production at basin level is estimated in 440.000 MWh by 2040, it means 46% of the total demand. Anyway, the trend of this extrapolation has a large uncertainty mainly because it is complicated to predict the fast evolution of the renewable energy source (RES) for the coming decades.

The total hydropower potential in LPB, estimated from different sources of information, is 107.000 MW, where 63% corresponds to the Parana sub-basin, 10% to Paraguay sub-basin and 27% to Uruguay sub-basin. Based on this data, the feasible hydropower production of LPB is estimated in 528.000 MWh, concluding that the estimated hydropower production by 2040 (440.000 MWh) will be about 82% of this feasible value and will supply about 46% of the electricity demand.

It is important not to consider the basin as a close system and analyse the situation within the framework of the National Interconnected Systems (SIN). The SINs are responsible for receiving/providing the electricity generation/demand at national level and for the import/export balance in the region. Therefore issues of energy production/demand of LPB are immersed into the national SINs policies.

Bibliography

- [1] CEPAL (Comisión Económica para América Latina y el Caribe). 2004. *Fuentes renovables de energía en América Latina y el Caribe. Situación y propuestas de políticas*. UNITED NATIONS, GTZ.
- [2] CIER (Comisión de Integración Energética Regional). 2009. *Síntesis Informativa Energética de los Países de la CIER*. <http://www.cier.org.uy/>
- [3] DGEEC (Dirección General de Estadística, Encuestas y Censos de la República del Paraguay). 2002. *Censo Nacional de Población y Vivienda. Año 2002*. Asunción, DGEEC.
- [4] IBGE (Instituto Brasileiro de Geografia e Estatística). 2005 b. *Síntese de Indicadores Sociais 2004*. Rio de Janeiro, Instituto Brasileiro de Geografia e Estatística.
- [5] INDEC (Instituto Nacional de Estadística y Censos). 2001. *Censo Nacional de Población y Vivienda 2001*. Buenos Aires, Instituto Nacional de Estadística y Censos.
- [6] INE (Instituto Nacional de Estadística de la República de Bolivia). 2001. *Censo Nacional de Población 2001*. La Paz, Instituto Nacional de Estadística.
- [7] INE (Instituto Nacional de Estadísticas de la República Oriental del Uruguay). 1996. *Censo Nacional de Población 1996*. Montevideo, Instituto Nacional de Estadísticas.
- [8] OEA/OAS (1985) *Infraestructura y Potencial Energético en la Cuenca del Plata*. Secretaría General de la Organización de los estados Americanos Washington. D.C.1985.
<http://www.oas.org/dsd/publications/unit/oea16s/begin.htm#Contents>
- [9] SECRETARÍA DE ENERGÍA DE LA REPÚBLICA ARGENTINA. 2004. *Plan Argentina*. <http://energia.mecon.gov.ar/inversiones/planargentina.htm>. *Balance Energético* <http://energia3.mecon.gov.ar/contenidos/verpagina.php?idpagina=2973>
- [10] UNEP, 2004. *Patagonian Shelf, GIWA Regional assessment 38*. University of Kalmar, Kalmar, Sweden.
- [11] Mine M. R. M., Fill H. D., Kaciski E., Bessa M. R., Fernández C.V S, Santos I., Cunha L. M., 2009. Water Resources in La Plata Basin in the context of Climate Change: Impact of the climate changes in hydropower. Report 01, Curitiba: UFPR. Brazil.
- [12] MINISTERIO DE MINAS E ENERGÍA – BRASIL. 2007. *Matriz Energética Nacional 2030*. Secretaría de Planejamento e desenvolvimento energético. Empresa de Pesquisa Energética.
http://www.mme.gov.br/spe/galerias/arquivos/Publicacoes/matriz_energetica_nacional_2030/MatrizEnergeticaNacional2030.pdf
- [13] WWAP (WORLD WATER ASSESSMENT PROGRAMME) 2007. La Plata Basin Case Study. http://www.unesco.org/water/wwap/case_studies/index.shtml



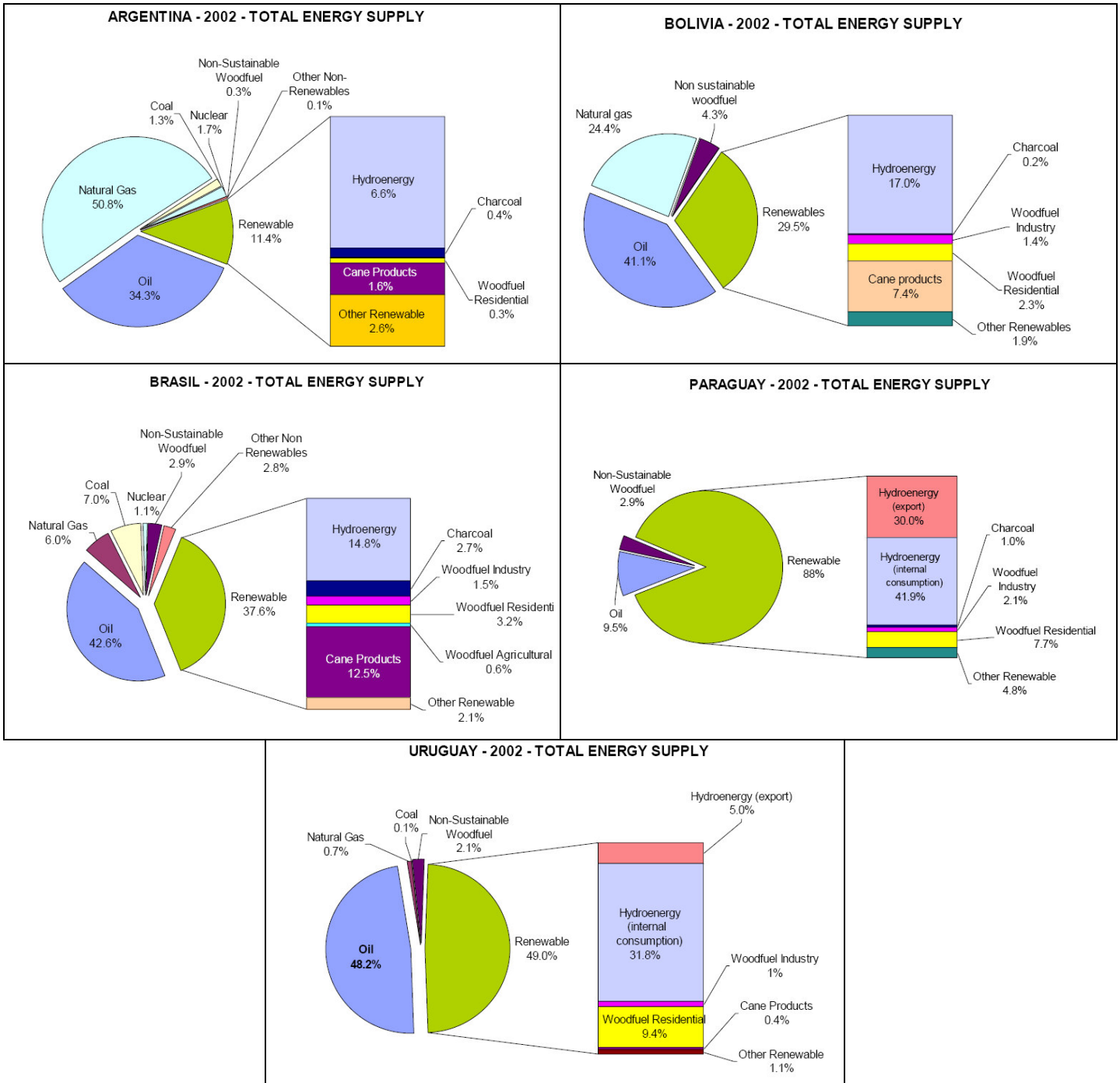
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ANNEXES

ANNEX I

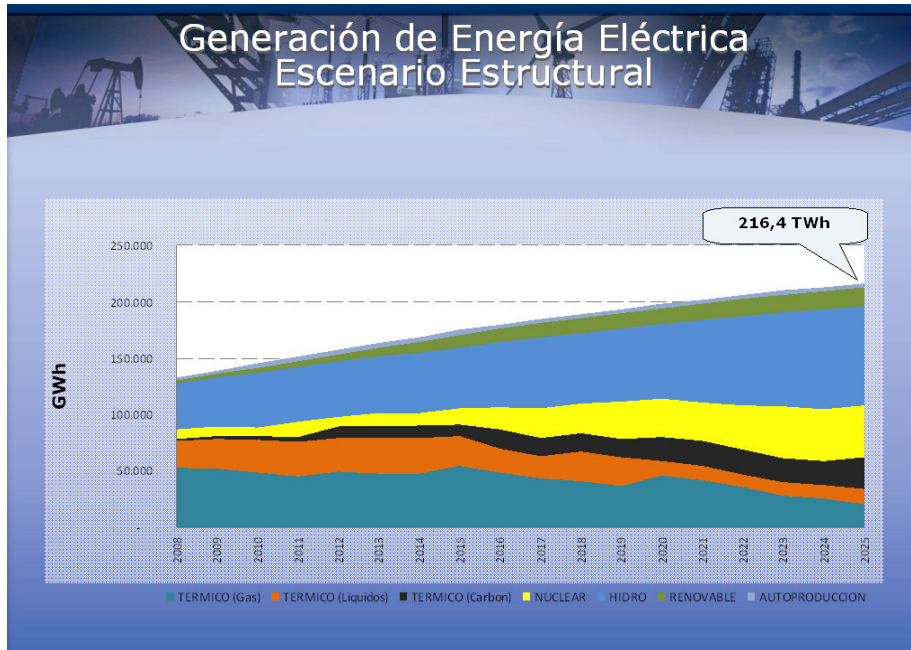
Total Energy Supply -divided by sources- in 2002 for the individual countries of La Plata Basin (Argentina, Bolivia, Brazil, Paraguay and Uruguay).



Source: Renewable Energy Sources in Latin America and Caribbean. Situation and Policy Proposal. CEPAL (2004).

ANNEX II

Structural Scenario for future electricity generation - Argentina



Source: Secretaría de Energía de Argentina. Presentación “La Expansión como medio de garantizar la seguridad del suministro” en el III Seminario Internacional de Legislación del Sector Eléctrico. España, 2008.

ANNEX III

Indicators considered for estimation of scenarios for Brazilian total electricity demand

Economic and energy indicators for Scenario “Na Crista da Onda”
Tabela 52 - Indicadores econômicos e de energia - Na Crista da Onda - Brasil, 2005/2030

Discriminação/Ano	2005	2010	2020	2030	Média no período
PIB [R\$ bilhões de 2005]	1.939	2.415	3.837	6.712	-
Varição média no período (% a.a.)	-	4,5	4,7	5,8	5,1
População [milhões de habitantes]	185	198	220	239	-
Varição média no período (% a.a.)	-	1,3	1,1	0,8	1,0
PIB per capita [R\$ de 2005/hab]	10.452	12.195	17.434	28.136	-
Varição média no período (% a.a.)	-	3,1	3,6	4,9	4,0
Consumo final de energia ⁽¹⁾ [mil tep]	165.044	207.334	309.268	474.014	-
Varição média no período (% a.a.)	-	4,7	4,1	4,4	4,3
Consumo final de energia per capita ⁽¹⁾ [tep/hab]	0,890	1,047	1,405	1,987	-
Varição média no período (% a.a.)	-	3,3	3,0	3,5	3,3
Intensidade energética do PIB [tep/mil R\$ de 2005]	0,085	0,086	0,081	0,071	-0,7
Intensidade energética do PIB [tep/mil US\$ de 2005]	0,207	0,209	0,196	0,172	-0,7
Elasticidade-renda do consumo de energia	-	1,04	0,86	0,76	0,85

Nota: 1 - Exclusive o consumo do setor energético

Economic and energy indicators for Scenario “Surfando a Marola”
Tabela 53 - Indicadores econômicos e de energia - Surfando a Marola - Brasil, 2005/2030

Discriminação/Ano	2005	2010	2020	2030	Média no período
PIB [R\$ bilhões de 2005]	1.938	2.357	3.406	5.290	-
Varição média no período (% a.a.)	-	4,0	3,8	4,5	4,1
População [milhões de habitantes]	185	198	220	239	-
Varição média no período (% a.a.)	-	1,3	1,1	0,8	1,0
PIB per capita [R\$ de 2005/hab]	10.452	11.092	15.476	22.175	-
Varição média no período (% a.a.)	-	2,6	2,7	3,7	3,1
Consumo final de energia ⁽¹⁾ [mil tep]	165.044	206.328	290.642	408.860	-
Varição média no período (% a.a.)	-	4,6	3,5	3,5	3,7
Consumo final de energia per capita ⁽¹⁾ [tep/hab]	0,890	3,2	1,321	1,714	-
Varição média no período (% a.a.)	-	3,6	2,4	2,6	2,7
Intensidade energética do PIB [tep/mil R\$ de 2005]	0,085	0,088	0,085	0,077	-0,4
Intensidade energética do PIB [tep/mil US\$ de 2005]	0,207	0,213	0,208	0,188	-0,4
Elasticidade-renda do consumo de energia	-	1,15	0,93	0,77	0,90

Nota: 1 - Exclusive o consumo do setor energético

Source: Ministério de Minas e Energia- Empresa de Pesquisas Energéticas

ANNEX III (cont.)

Indicators considered for estimation of scenarios of Brazilian total electricity demand

Economic and energy indicators for Scenario “Pedalinho”

Tabela 54 - Indicadores econômicos e de energia - Pedalinho - Brasil, 2005/2030

Discriminação/Ano	2005	2010	2020	2030	Média no período
PIB [R\$ bilhões de 2005]	1.939	2.357	3.018	4.256	-
Varição média no período (% a.a.)	-	4,0	2,5	3,5	3,2
População [milhões de habitantes]	185	198	220	239	-
Varição média no período (% a.a.)	-	1,3	1,1	0,8	1,0
PIB per capita [R\$ de 2005/hab]	10.452	11.902	13.713	17.841	-
Varição média no período (% a.a.)	-	2,6	1,4	2,7	2,2
Consumo final de energia ⁽¹⁾ [mil tep]	165.044	206.328	267.925	356.285	-
Varição média no período (% a.a.)	-	4,6	2,6	2,9	3,1
Consumo final de energia per capita ⁽¹⁾ [tep/hab]	0,890	1,042	1,217	1,494	-
Varição média no período (% a.a.)	-	3,2	1,6	2,1	2,1
Intensidade energética do PIB [tep/mil R\$ de 2005]	0,085	0,088	0,089	0,084	-0,1
Intensidade energética do PIB [tep/mil US\$ de 2005]	0,207	0,213	0,216	0,204	-0,1
Elasticidade-renda do consumo de energia	-	1,15	1,06	0,83	0,98

Nota: 1 - Exclusive o consumo do setor energético

Economic and energy indicators for Scenario “Naufrago”

Tabela 55 - Indicadores econômicos e de energia - Naufrago - Brasil, 2005/2030

Discriminação/Ano	2005	2010	2020	2030	Média no período
PIB [R\$ bilhões de 2005]	1.938	2.246	2.607	3.337	-
Varição média no período (% a.a.)	-	3,0	1,5	2,5	2,2
População [milhões de habitantes]	185	198	220	239	-
Varição média no período (% a.a.)	-	1,3	1,1	0,8	1,0
PIB per capita [R\$ de 2005/hab]	10.452	11.341	11.845	13.988	-
Varição média no período (% a.a.)	-	1,6	0,4	1,7	1,2
Consumo final de energia ⁽¹⁾ [mil tep]	165.044	200.013	243.649	309.283	-
Varição média no período (% a.a.)	-	3,9	2,0	2,4	2,5
Consumo final de energia per capita ⁽¹⁾ [tep/hab]	0,890	1,010	1,107	1,296	-
Varição média no período (% a.a.)	-	2,6	0,9	1,6	1,5
Intensidade energética do PIB [tep/mil R\$ de 2005]	0,085	0,089	0,093	0,093	0,3
Intensidade energética do PIB [tep/mil US\$ de 2005]	0,207	0,217	0,227	0,226	0,3
Elasticidade-renda do consumo de energia	-	1,31	1,33	0,97	1,16

Nota: 1 - Exclusive o consumo do setor energético

Source: Ministério de Minas e Energia- Empresa de Pesquisas Energéticas

ANNEX IV

Fixed equations used for extrapolations

Figure 5 Future Electricity Demand of the counties	Argentina		$y = 55,53x^2 - 218019,78x + 213993919,16$
	Brazil	Upper limit	$y = 3E-33e0,0438x$
		Mean limit	$y = 289,95x^2 - 1145288,23x + 1131078168,67$
		Lower limit	$y = 174,49x^2 - 685504x + 7E+08$
	Paraguay		$y = 4268124,56\ln(x) - 32396956,59$
	Uruguay		$y = 123,23x - 239202$
Figure 6 Future Hydro Electricity Demand of LPB			$y = 1E+07\ln(x) - 9E+07$

ANNEX V

Contacted institutions / persons

Institution	Contacted person
Secretaría de Energía de Argentina	Juan Meira. Director Nacional de Prospectiva. jmeira@minplan.gov.ar
Comité Nacional de Despacho de Carga (CNDC) de Bolivia	Arturo Iporre Presidente del CNDC aiporre@cndc.bo Carlos Javier Gordillo Rosas. Jefe División de Planificación del SIN cgordillo@cndc.bo
ITAIPU Binacional – Brazil	Sidney Carlos da Silva - Diretoria de Coordenação sidney@itaipu.gov.br
Asociación Paraguaya de Recursos Hídricos ITAIPU Binacional – Paraguay	Francisco Pedro Domaniczky fpd@itaipu.gov.py presidencia@aprh.org.py
Ministerio de Industria , Energía y Minería de Uruguay	Olga Otegui. Dirección Nacional de Energía y Tecnología Nuclear olga.otegui@dne.miem.gub.uy
Comisión de Integración Eléctrica Regional – Organismo de Integración del Sector Energético de América Latina (CIER) http://www.cier.org.uy/	Comité Argentino de la Comisión de Integración Energética Regional (CACIER) cacier@cacier.com.ar
Organización Latinoamericana de Energía http://www.olade.org/	Tomás Montesino – Coordinador de Electricidad tomas.montesinos@olade.org