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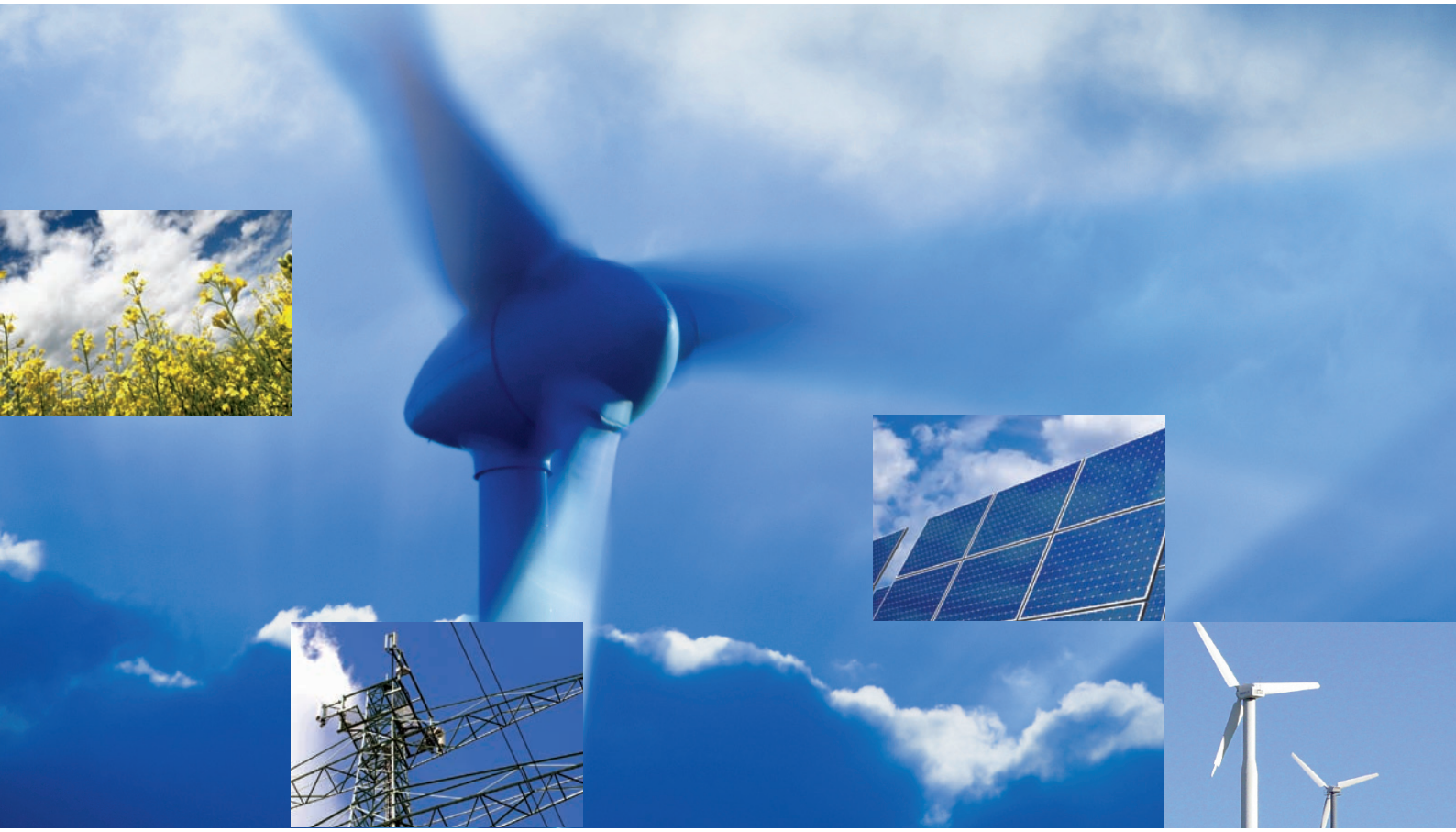

Energy-policy Framework Conditions for Electricity Markets and Renewable Energies

16 Country Analyses

Eschborn, November 2009

Energy-policy Framework Papers,
Section »Energy and Transport«

gtz TERNA Wind Energy Programme

On behalf of
Federal Ministry
for Economic Cooperation
and Development

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New Edition of the TERNA Country Survey

Since the first edition of the TERNA country survey appeared in 1999, there has been a distinct heightening of public and political awareness of the consequences of climate change and of energy provision as a key factor in sustainable development.

In Germany and other industrialised countries, a political tailwind, effective promotion mechanisms and rising energy prices have created the conditions for a dynamic market in which renewable forms of energy are exhibiting high growth rates within the energy mix. In 2008, renewable energy resisted the credit crunch more successfully than many other sectors for much of the year and new investment reached $120 billion, up 16 percent over 2007. However, by the end of the year, the impact of the crisis was beginning to show.

Economic development in many emerging countries has triggered rapidly rising demand for energy and competition on the international oil market. Against the background of the volatile cost of fossil fuels, supply risks and damage to the environment, the significance of renewable energy as a means of generating electricity is growing – also in developing and emerging countries. According to information released by the Renewable Energy Policy Network for the 21st Century (REN21), by early 2009, policy targets existed in at least 73 countries and at least 64 countries had policies to promote renewable power generation. Feed-in tariffs were adopted at the national level in at least five countries in 2008/early 2009, including Kenya, the Philippines and South Africa.

During 2008 the existing wind power capacity grew by 29 percent to reach 121 GW. The US and European market acted as the driving force for the wind energy industry and provide still an indispensable background of experience. However, growth in the industry is also increasingly apparent in developing and emerging countries: China doubled its wind power capacity for the fifth year in a row, ending 2008 at 12 GW, and breaching China's 2010 development target of 10 GW two years earlier. It is the successes in countries such as China, India and Egypt which encourage commitment beyond the borders of industrialised nations. In those countries there is a growing proportion of local content in the systems and equipment they produce – and not only for supply to their own domestic markets.

A number of other countries though, too, are erecting their first wind farms, thereby establishing the basis for gaining experience to be utilised in future markets. To help interested players gain access to the new markets, this survey provides detailed descriptions of the framework conditions for electricity markets and renewable energy in 16 developing and emerging countries.

This latest country survey and the previous editions are available on our homepage: www.gtz.de/wind. The publication is also available on CD-ROM. For information on how to obtain this, again, go to the homepage. Our grateful thanks go to a large number of GTZ staff members and other experts in the field for their help in putting this information together.

Eschborn, November 2009

THE COUNTRIES		
Latin America	Africa/Middle East	Asia
Argentina	Egypt	Indonesia
Brazil	Morocco	Pakistan
Caribbean States	Namibia	Viet Nam
Chile	Senegal	
Mexico	South Africa	
Panama	Tunisia	
Peru		

Legal Information

1.

The data used in this study is based on both publicly accessible sources of information (publications, specialist articles, internet sites, conference papers etc.) and non-public papers (for example internal expert reports from promoting institutions), as well as personal interviews with experts (for example officials at energy ministries in the investigated countries and project staff at promoting institutions). Although all information has been checked as far as possible, errors cannot be ruled out. Neither the GTZ nor the authors can therefore provide any guarantee of the accuracy of the data included in this study; no liability can be accepted for any loss or damage resulting from use of the data included in the study.

2.

The TERNA Wind Energy Programme

There is great potential for generating electricity from renewable energy sources in many developing and emerging countries. Obstacles to the exploitation of such sources include a lack of knowledge of framework conditions in the energy industry and insufficient transparency with regard to the prior experience and interests of national actors.

The purpose of the TERNA (Technical Expertise for Renewable Energy Application) wind energy programme, implemented by GTZ on behalf of the Federal German Ministry for Economic Cooperation and Development (BMZ), is to assist partners in developing and emerging countries in planning and developing wind power projects. Since 1988 the TERNA programme has pursued the goals of laying the foundations for sound investment decisions while at the same time enabling partners to assess wind energy potentials, plan wind energy projects and improve energy-policy frameworks for renewable forms of energy.

The TERNA wind energy programme's partners are institutions in developing and emerging countries that are interested in commercial exploitation of wind power. These include, for example, ministries or government institutions which have the mandate to develop BOT/BOO projects, state-owned or private energy supply companies (utilities) and private enterprises (independent power producers).

TERNA offers its partners expertise and experience. In order to initiate wind power projects, favourable sites must be identified and their wind energy potential ascertained. To do this, wind measurements are normally taken over a period of at least twelve months and wind reports are drawn up. If promising wind potentials are found, the next step is to conduct project studies investigating the technical design and economic feasibility. TERNA also provides advice to partners on matters of finance, thus closing the gap between potential investors and funding sources from national and international donors. If required, CDM baseline studies can be prepared. In order to ensure as much transfer of know-how as possible, efforts are made to ensure cooperation between international and local experts, for example when preparing the studies. In successful cases, TERNA initiates investment-ready wind farm projects by this method. TERNA itself is not involved in financing.

In addition to the activities that are tied to specific locations, TERNA advises its partners on how to establish suitable framework conditions for the promotion of renewable energy sources. Up until 2009, TERNA has been active in over ten countries around the world. Further information on GTZ's TERNA wind energy programme is available at www.gtz.de/wind or directly from:

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List of Abbreviations

ADEERA	Asociación de Distribuidores de Energía Eléctrica de la República de Argentina [Association of electricity distributors of the Republic of Argentina]
AGEERA	Asociación de Generadores de Energía Eléctrica de la República de Argentina [Association of electricity generators of the Republico f Argentina]
AGUEERA	Asociación de Grandes Usuarios de Energía Eléctrica de las República de Argentina [Association of large electricity users of the Republic of Argentina]
AR $	Argentine Dollar
ATEERA	Asociación de Transportistas de Energía Eléctrica de la República de Argentina [Association of electricity transporters of the Republic of Argentina]
CAF	Corporación Andina de Fomento [Andean Development Corporation]
CAMMESA	Compañía Administradora del Mercado Eléctrico Mayorista SA [Administrating company of the wholesale electricity market]
CDM	Clean Development Mechanism
CFEE	Federal Council of Electric Energy
DNA	Designated National Authority
ENARSA	Energía Argentina SA
ENRE	Ente Nacional Regulador de la Energía [National Regulatory Entity of Energy]
EUR	Euro
FAC	Fondo Argentino de Carbono [Argentinean Carbon Fund]
GDP	Gross Domestic Product
GENREN	Generación Renovable [Renewable Generation]
GHG	Green House Gas
IADB	Interamerican Development Bank
IAU	International Astronomical Union
Ktoe	Kilotonne of oil equivalent
kV	Kilovolt
GWh	Giga watt per hour
MEM	Mercado Eléctrico Mayorista [Wholesale Electricity Market]
MEMSP	Mercado Eléctrico Mayorista Sistema Patagónico [Wholesale Electricity Market Patagonic System]
MW	Megawatt
NGO	Non-governmental Organisation
PAEPRA	Programa de Abastecimiento Eléctrico a la Población Rural Dispersa de Argentina [Program for electricity supply for rural Spreads population in Argentina]
PERMER	Proyecto de Energías Renovables en el Mercado Rural [Project for renewable energies within the rural market]
PJ	Peta Joule
PRONURE	Programa Nacional de Uso Racional y Eficiente de la Energía [National Program for Rational and Efficient Use of Energy]
PV	Photovoltaic
SA	Sociedad Anónima [Anonymous Society]
SADI	Sistema Argentino de Interconexión [Argentinean Interconnection System]
SIP	Sistema Interconectado Patagónico [Patagonic Interconnection System]
TWh	Terawatt per hour
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCC	United Nations Framework Convention on Climate Change
USD	United States Dollars
WTE	Waste to Energy

1.1 Introduction

FIGURE 1:
MAP OF ARGENTINA

Data source: CGIAR 2009

Argentina is located in the South of South America and borders Bolivia, Brazil, Chile, Paraguay and Uruguay with a coasts meeting the South Atlantic Ocean.

The Argentine territory has a diversity of landscapes that range from arctic regions in the South to forested jungle regions in the North and the rugged mountain regions (Andes) along the 4 000 km border to Chile.

Argentina's political system is a federal democratic republic, in which the President of the Nation (currently Cristina Fernandez de Kirchner, elected in December 2007) holds the position of head of state and head of government. Argentina, being one of the world's wealthiest nations in the first half of the 20th century, went through decades of constant economic decline, cumulating in national bankruptcy in 2001. Since then, economic recovery has made good progress (annual GDP growth rates around 7 %), but the country is still facing structural economic problems such as high public debt, inflation risk, weak fiscal basis, high dependency on international prices for raw materials and lack of investment in the domestic infrastructure and several economic sectors such as the oil and gas industry.[1]

The industrial sector currently accounts for 31 % of the nation's GDP. Major production comprises iron and steel, cement, diverse automobile parts and equipment for agricultural purposes. 11 % of the national GDP is generated by export of energy and fuels to Brazil and Chile. After the economic crisis, the oil and gas industry has been suffering from lack of investment, with some recovery in recent years. Biofuels are gaining importance, but still to limited extent. The Agriculture sector (8 % of nation's GDP) accounts for one third of the total employment. Exports of agricultural products such as soya, wheat, corn, meat and others represent 54 % of total export revenues. Main countries receiving these products

TABLE 1:
STATISTIC INFORMATION OF ARGENTINA

Area	Population	GDP (2008)*	GDP/Capita (2008)	Import (2008)	Export (2008)
2 780 400 km²	41 Millions	221 970 Billion R	5 585 R	39 035 Million R	47 994 Million R

* Position 31 of countries listed by GDP (nominal)
Sources: Instituto nacional y de estadísticas de Argentina; Fondo Monetario Internacional

[1] Econométrica S.A. Economic Research and Forecast. Informe Económico Especial. »La Triple Tenaza Energética«. (2007)

TABLE 2:
HISTORICAL DEVELOPMENT OF ARGENTINE GDP FROM 2000 TO 2008

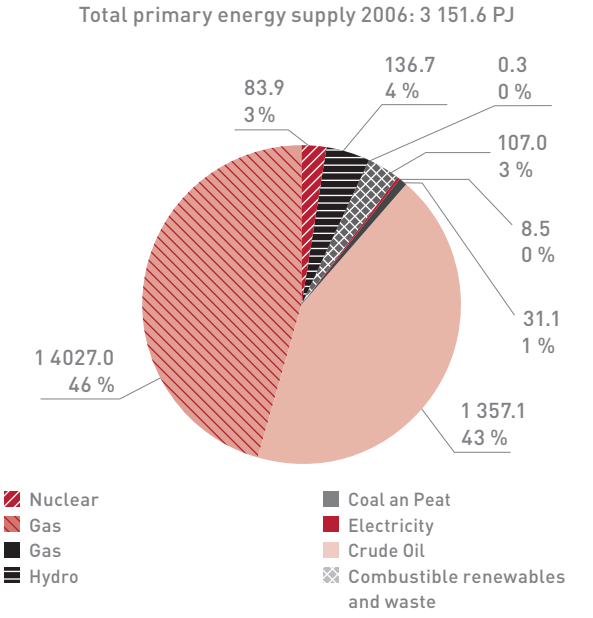
Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
GDP (U.S.$; current prices) in billions	284 204	268 697	97 732	127 571	151 958	181 549	212 710	260 402	326 474
GDP (R; current prices) in billions	307 713	300 019	103 354	112 775	122 163	145 928	169 409	190 005	221 970

Source: International Monetary Fund

are Brazil, Chile, China and USA. The majority of the products imported are related to the following sectors: vehicles, electric appliances and fuels (in particular oil and natural gas).

Most imports come from Brazil, China, EU and USA. Argentina is member of the Mercosur[2] since 1991. Mercosur represents the main economic partner of the Argentinean economy. Countries involved in this organisation receive 23 % of exportations of the country and provided 16 % of importations to Argentina. Presence of Argentina and Brazil within the Mercosur framework has strengthened economic relation between the two countries which have signed bilateral agreements to ease economic relations and transactions.

FIGURE 2:
TOTAL PRIMARY ENERGY SUPPLY IN ARGENTINA, 2006



Source: IEA 2008

1.2 Energy Market

Overview of the energy market

Since 2001, energy supply in Argentina has faced some structural problems, however in the long term, energy supply has shown a constant increase (with main contribution of oil and natural gas).

Data for 2007 is available from the national regulatory body (ENRE) and uses slightly different categories than IEA from which data can be seen in figure 2. According to ENRE, Argentina's primary energy amounted in 2007 to 1 771 PJ natural gas, 1 264 PJ oil, 147 PJ hydro, 91 PJ nuclear, 48 PJ wood, 42 PJ bagasse, 16 PJ coal and 25 PJ other.

Due to the economic crisis and a lack of capital investments (regulated energy prices did not reflect market prices), the gas production decreased and the transmission and distribution network led to capacity constraints. In 2004 the frequent supply interruptions led to serious gas shortages and power cuts in the industrial and residential sector. The central government issued several plans of actions such as the Programme for Rational Use of Gas and the Programme for Rational Use of Electricity to bear down the energy crisis. The final energy consumption in Argentina amounted to 52 966 ktoe[3]

[2] MERCOSUR (Mercado Común del Sur): regional trade agreement among Argentina, Brazil, Paraguay, Uruguay, Bolivia, Chile, Colombia, Ecuador and Peru.

[3] Equal to 2 333 PJ or 647 866 GWh

TABLE 3:
FINAL ENERGY CONSUMPTION IN ARGENTINA 2007 (KTOE)

Total Final Energy Consumption*						
Sector	Industry	Transport	Residential	Public/commercial	Agriculture	non energetic
PJ	772	521	501	160	131	249
%	33	22	21	7	6	11
Total	3 404					

* Provisional data for 2007
Source: Secretaría de Energía

in 2007. The table above illustrates illustrates the energy consumption according to different sectors in the country. In 2007, the central government launched a national plan to save energy as a solution to cope with the increase of demand which is still not still not completely covered by the current energy supply. However, energy demand still increased by 4.9 % in 2008. Argentina is currently facing serious energy shortages that are forcing the government to take measures[4] to slow down the consumption rate. The nation has also diminished gas deliveries to Chile as well as increased oil imports from Bolivia and started importing oil from Venezuela to replace natural gas as a source for energy generation.

The Electricity Grid

The power supply system comprises two interconnected grids: SADI which operates in north and central Argentina, used by the generation companies Mercado Eléctrico Mayorista (MEM; Wholesale Electricity Market); and Sistema Interconectado Patagónico (SIP) in Patagonia, which handles electricity generated by the members of the Mercado Eléctrico Mayorista Sistema Patagónico (MEMSP). Both grids are managed by by the Compañía Administradora del Mercado Mayorista Eléctrico Sociedad Anónima (CAMMESA) a private company[5] responsible for the administration of the wholesale electricity market (see also chapter on liberalisation).

The national demand is concentrated in three main areas: Areas of Gran Buenos Aires, Litoral and the province of Buenos Aires.[6] These areas represent 65 % of the national

FIGURE 3:
MAP OF ELECTRICITY GRID IN ARGENTINA

Data source: CGIAR 2004

electricity demand. In these areas generation capacity is remarkably lower compared to their consumption (energy generated in these areas represent 43 % of the total consumption). In the rest of the country, the installed capacity is larger than the respective electricity demand

[4] Measures such as the PRONUREE (Programa Nacional de Uso Racional y Eficiente de la Energía)

[5] 80 % of shares in the company belong to the different stakeholders involved in the Wholesale Electricity Market while 20 % of the shares are under the control of the national government

[6] The area of Gran Buenos Aires is used to define the megacity composed by the Autonomous city of Buenos Aires and the urban conurbation located in the province of Buenos Aires that comprises 24 »departments« that surround the city of Buenos Aires. The area Litoral of Argentina limits with Uruguay, Brazil and Paraguay and comprises the cities of Corrientes and Rosario.

TABLE 4:
INSTALLED CAPACITY BY ENERGY SOURCE ARGENTINA 2000 – 2007

MW	2000	2001	2002	2003	2004	2005	2006	2007
Thermal	11 382	13 075	13 407	13 555	13 530	13 962	13 439	13 669
Hydropower	10 834	10 834	10 931	10 931	11 003	11 164	11 164	11 216
Nuclear	1 005	1 005	1 005	1 005	1 005	1 005	1 005	1 005
Total	23 221	24 914	25 343	25 491	25 538	26 131	25 608	25 890

Source: Ente Nacional Regulador de la Electricidad. Informe Anual 2007

resulting in energy exporting areas that define electricity fluxes of principal lines to the province of Buenos Aires.
Regarding the integration of renewable energy capacity, grid conditions for wind power projects in the provinces of Buenos Aires, Comahue and Patagonia are favourable. Their transmission grid will be adequate to support the installation of various small and medium size wind parks without any additional investments in infrastructure.
In April 2008, the 500 kV line between the Patagonian cities of Puerto Madryn and Pico Truncado was inaugurated. This is a 550 km connection which will facilitate and promote the development of wind power in the region of Southern Patagonia. However, the new capacity enabled by this connection represents only a small percentage of the total wind energy potential in Patagonia. The region is connected to the national grid via a 500 kV connection line between the cities of Puerto Madryn and Choele-Choel (project finalized in April 2008). New expansion of the grid capacity is expected as a new bid process has been opened in July 2009 to construct a 500 kV line to link the regions of Pico Truncado and Río Gallegos.

Installed Capacity

At the end of 2007, the power generating capacity installed in Argentina was producing a total output of 25 890 MW (representing an increase of 1 % compared to the previous year). Of this, thermal power stations (fuelled by natural gas, fuel oil and coal) accounted for 13 669 MW (52.79 %). The installed nuclear capacity was 1 005 MW (3.89 %) while hydropower accounted for 11 216 MW (43.32 %). The electricity demand within the country is increasing (over 6 % annually) and therefore the national government is commissioning the construction of large energy generation projects (particularly regarding hydro power). It has been estimated that about 1 000 MW of new generation capacity are needed per year to ensure energy supply. An important number of projects will be financed through public funding (coming from the national government or public international entities such as multilateral banks) while private initiatives are still limited.
The installed capacity connected to both MEM and MEMSP, has changed as follows in recent years:
The contribution of renewable energies other than hydropower is very small compared to the total energy production (less than 0.1 %). It is likely that the scenario will change in the coming years due to a shortage of natural gas supply, as a consequence of bottlenecks in exploration and exploitation as well as on gasoducts.
Gas extraction rate diminished for the first time in 2005.[7] The overall supply is likely to be affected, as it has not yet been achieved to conclude gas agreements with Bolivia or build new regional gasoducts.
In the short term (up to 2010) a range of investments will be made by the national government to ensure energy supply within the whole country. These investments include the erection of new hydro power plants (named La Barrancosa, Condir Cliff, Punta Negra, Portezuelo del Viento, Los Blancos, Chihuido I and II). Projects to be developed comprises the construction of 2 020 km of new electricity grid lines. These capacity expansions will also include the finalisation of the nuclear plant of Atucha II and the construction of two CHP plants[8] (adding 840 MW additional power capacity). The government will increase

[7] This fact explains reduction of capacity installed in 2006 and 2007
[8] By a consortium of Argentine companies and the Spanish company Isolux (involving 569 million euros and total capacity of 840 MW)

TABLE 5:
GROSS ELECTRICITY GENERATION BY ENERGY SOURCE IN GWH; ARGENTINA 2000 – 2008

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Thermal	43 248	36 510	32 642	39 466	49 399	51 351	53 928	61 012	66 877
Hydropower	33 760	41 507	41 090	38 717	35 133	39 213	42 987	37 290	36 882
Nuclear	6 541	5 393	7 025	7 313	6 374	7 153	6 721	6 849	6 541
Imports	1 011	1 450	2 210	1 234	1 441	1 222	559	3 459	1 774
Total	83 750	86 007	81 334	86 442	93 286	98 160	104 627	108 482	112 382

Source: CAMMESA

TABLE 6:
POWER CONSUMPTION ACCORDING TO USER GROUP; 2001 – 2007 (TWH, %)

Sector		2003	2004	2005	2006	2007
Households	TWh	107	115	118	124	139
	%	18	19	20	20	23
Commerce	TWh	37	39	39	42	45
	%	18	19	19	21	22
Industry	TWh	149	123	128	186	214
	%	19	15	16	23	27
Others	TWh	201	245	253	259	250
	%	17	20	21	21	21
Total (TWh)		495	523	538	610	648

Source: Secretaria de Energía

efforts on gas and oil exploration throughout the country via two programmes named »Petróleo Plus« and »Gas Plus«.[9]

Electricity generation

In 2007 the total electricity produced amounted to 108 482 GWh. Electricity generation was split between hydro power[10] (34 % total generation) and thermal power[11] (60 % of total generation) . Nuclear power amounted to 6 % of the total energy generation within the country.

This year showed a remarkable increase in the electricity imports (208 % increase compared to the previous year)[12] due to the restrictions set up by the government related to electricity and gas supply and a steady increase of the nation's energy consumption in previous years. Energy exports were reduced by 73 % (compared to the previous year). Table 6 presents the distribution of energy and consumers. It can be stated that main energy consuming sectors are households and industry, followed by commercial and other uses.

Renewable energies

As a result of the energy policy developed on the previous decades by the central government and the work performed by the old public companies[13] (privatised in the 90's), hydro energy plays an important role in the current energy generation mix in Argentina.

Argentina possesses multiple resources for generating energy from hydro and wind power but also from solar, biomass and geothermal sources. As stated previously, the current contribution of renewable energy sources other than hydro in the energy generation mix in Argentina is very scarce and mainly framed within government programmes for supplying energy in remote areas to end-

[9] More information can be retrieved at the website of the Secretary of Energy (www.energia3.mecon.gov.ar)

[10] Electricity generation via hydro power decreased 12 % compared to the previous year due to less water resources available at the lakes that are used as reservoirs for the hydro plants.

[11] Electricity generation increased 14 % this year to compensate the decrease on electricity generated via hydro.

[12] Energy imported by Argentina this year sum up total amount of 3 458 GWh (equivalent to 3 % of total net generation of the country).

[13] Such as Agua y Energía Eléctria and Hidronor

users who have no access to the electric grid. Renewable energies other than hydro still do not contribute to the interconnected electricity supply system as the current main purpose is to provide electricity to rural areas, where 30 % of the households still remain without access to electricity.

In the solar thermal sector no major plans have been implemented to promote this technology. The use of solar thermal applications is economically unattractive due to high installation costs and low prices for natural gas. In rural areas firewood and other biomass products cover the domestic hot water demand. Biomass use contributes to almost 5.5 % of the final energy consumption and contributes mainly to the industrial, agricultural and forestry sector. Firewood and bagasse are used for the production of charcoal. Projects of biomass-fired energy generation have not yet been implemented in the country despite favourable conditions.

The increasing energy in the last years combined with the lack of national capacity to self-generate this energy represents a major barrier to the development of the renewable energy sector as other sources of energy (such as hydro power) and energy importation (i.e. natural gas) are considered as the short-term solutions to the current energy crisis.

Nevertheless, the Secretary of Energy has estimated that 2 500 MW new renewable capacity will be installed in Argentina by 2016 to fulfil the required goals set out by law 26 190/06, which aims to cover 8 % of national electricity consumption through renewable energies. The Secretary has also foreseen that an additional 1 000 MW should be installed by 2025 with wind energy representing half of this amount.

Electricity prices

The price of electricity is based on two components; one component reflects prices at which energy and electricity are acquired from the wholesale electricity market by companies including transmission costs.[14] The other component reflects costs regarding services offered by the distribution company (which include costs for development and investment in the grid, operation, maintenance, commercialization of electricity and profitability of the invested capital). The price of the electricity has increased steadily in recent years. While the average price in MEM was 13.2 €/MWh in 2004 it has increased to 30.02 €/MWh in 2009. An explanation of this tendency is the lack of availability of hydroelectric power and partial substitution of natural gas with other fuels, in response to a situation of domestic energy demand exceeding the national gas production rate.

Liberalisation

Up to 1989, Argentina's electricity sector was characterized by state or state-owned electricity companies. The main state-owned utilities were Ayee (created in 1957), Hidronor (created in 1957), and Segba (created in 1962). Additionally, another 19 provincial companies (mainly distributors) and various electricity cooperatives were also present on the market. But in 1992 Argentina privatized its electricity sector as a result of poor management practices and insufficient investments in the electrical system.[15] The integrated state companies were unbundled and privatized with regards to generation, transmission and distribution by the Electricity Act of 1992. While generation became competitive, the transmission and distribution sector were established on basis of private monopolies. In June 1995 more than 25 state-owned power companies were privatized.

Nowadays, the generation sector is based on a least-cost bidding arrangement that resulted in price caps on the new created wholesale market in order to stabilize the prices. These price caps are finally set by ENRE – the independent sector regulator. The electricity can be sold either by bilateral contracts, seasonal purchasing contracts or short-term contracts. More than half of the electricity is traded on a short-term basis.

Electricity transmission and distribution is regulated at national and regional level with CAMMESA as the main player in the regulation of the wholesale market. The main responsibilities of this entity comprise of operation and dispatch of generation and price calculation in the spot-

[14] These prices are established by the Secretary of Energy and adjusted on a three months basis.

[15] Lokey 2009

market, real-time operation of the electricity system and administration of the commercial transactions in the electricity market. Power generation companies are not allowed to purchase majority shares in transmission companies. In general, all electricity generators have free and equal access to the grid. Nevertheless, transmission companies charge a toll/tariff for their transmission services.

Rural Electrification

Some regions have considered different approaches to solve the problem of energy supply in rural areas. In some provinces solutions have come through the use of power units (such as the cases of Juyjuy, Río Negro and Neuquén), mini hydro (in the provinces of Misiones, Salta and Neuquén), solar PV systems (in the provinces Juyjuy, Catamarca, Santa Fe, La Rioja, Neuquén and Río Negro), wind turbines (in the provinces of Chubut, Neuquén and San Juan) as well as extension of the provincial electricity grids (principally in the province of Neuquén).

According to the last Population and Dwellings Census performed by the National Institute of Census and Statistics[16], 5 % of Argentina's overall population is without access to electricity. However, in rural areas about 30 % of the population has no access to electricity. Consequently, the national and provincial governments have set up special programmes for the electrification of rural areas. Since inadequate transmission factors often preclude a connection to the public power grid, there is strong interest in stand alone solutions which includes renewable energies for remote areas. The two programmes that are relevant for the promotion of rural electrification are the PAEPRA and the PERMER.[17]

PAEPRA

In Argentina there are currently between two and three million inhabitants located in rural areas who have no access to electricity. Similar conditions affect approximately 6 000 buildings related to public services in these areas (schools, medical centres, police stations, etc).

Aimed at providing off-grid technical solutions to supply energy to these areas, in 1995 the Secretary of Energy launched the PAEPRA Programme (Programa de Abastecimiento Eléctrico de la Población Rural). The programme grants subsidies to private concessionaires who guarantee via competitive tendering to provide electricity to rural areas for the lowest amount of subsidies, even if off-grid options have to be implemented.

The first two provinces in which the rural electricity market was established in accordance with the PAEPRA Programme were Juluy and Salta in the north-western part of the country. Most electrification is effected on the basis of isolated networks or off-grid approaches relying on fossil fuels and/or renewable sources of energy.

PERMER

In 1999, the Programme PAEPRA was expanded to include as a new component a programme geared specifically towards the use of renewable sources for rural electrification purposes (Proyecto de Energías Renovables en Mercados Rurales – PERMER). The project aims to broaden the private-sector market for alternative power supply systems and to make the supply of power in rural regions sustainable. PERMER is intended to concentrate on scattered settlements, houses and facilities.

At the beginning of the project it was planned to provide electricity to 1.8 million people in 314 000 households and 6 000 institutions and facilities such as schools, medical centres and police stations. By September 2006, however, only 2 235 households and 556 public institutions received electricity thanks either to expansion of the public grid or to isolated, off grid solutions.[18] At present, 3 440 photovoltaic systems have been installed on private buildings and 690 on public buildings in the provinces of Catamarca, Río Negro, Jujuy, Santiago del Estero, Salta and Tucumán.

[16] INDEC (Instituto Nacional de Estadísticas y Censos). More information available at: http://www.indec.gov.ar/

[17] More information on PAEPRA and PERMER is available at: http://energia.mecon.gov.ar/permer/permer.html

[18] Regarding the present status of the PERMER project, please refer to energia.mecon.gov.ar/permer/Estado.html; Status: September, 2008.

1.3 Market Actors

Secretaría de Energía [Secretary for Energy]

Created under the umbrella of the Ministry of Federal Planning, Public Investment and Services, the Secretary of Energy is responsible for ensuring energy security and access to energy. Responsibilities of this entity are elaboration, formulation and execution of national policies regarding energy in coordination with regional governments. Furthermore, it is responsible for studying and analyzing the behaviour of the energy markets, developing strategic planning regarding electricity and fuels as well as controlling and supervising rational use of energy in the country. The Secretary comprises the Sub-secretary of Fuels, Sub-secretary of Electricity, the General Direction of Cooperation and Finance Assistance, the General Direction of Energy Policy Planning and Coordination.

Ente Nacional Regulador de la Energía Eléctrica (ENRE) [National Electricity Regulatory Body]

This entity was created in 1993 in response to the liberalisation of the electricity market (framework of law no 24 065 on 16 January 1992 – »Electricity Act«) and is an independent organization within the Secretary of Energy that holds the responsibility of applying the regulatory framework set up by law no 26 046 by 1991. ENRE conciliates in cases of conflicts between utilities, ensures that federal laws and regulations are implemented and watches over the conclusion of concession contracts. ENRE also sets the standards for power distribution, the maximum electricity prices as well as the transmission and distribution charges, and supervises both the generating companies and CAMMESA.

CAMMESA (Compañía Administradora del Mercado Mayorista Eléctrico)

This entity was established as a private, non-commercial company responsible for the administration of the country's electricity whole sale market not covered by bilateral agreements. The power producers' association (AGEERA), the power users' association (AGUEERA)[19], the power distributors' association (ADEERA), the association of high-voltage transmission network operators (ATEERA) and the Secretary of Energy each hold a 20 % interest in CAMMESA. CAMMESA's main tasks are the operation and dispatch of generation and price calculation in the spot market, real-time operation of the electricity system and the administration of the commercial transactions in the electricity market.

Consejo Federal de la Energía Eléctrica [Federal Council of Electric Energy CFEE]

The Federal Council of Electric Energy (CFEE) is an entity created in 1960 which administrates funds (e. g. named National Fund for Electric Power[20] and Fund for the Investment Needed to Increase the Supply of Electricity in the Wholesale Market) provided by the government These funds specifically aim at electricity operations. The CFEE is also an adviser to the national and provincial governments in issues related to the power industry, public and private energy services, priorities in the execution of new projects and studies, concessions and authorizations, and electricity tariffs and prices. It is also an adviser for legislative modifications in the power industry. The Council is composed of an Executive Committee and Regional Committee in the provinces of Córdoba, Catamarca, Misiones, Río Negro and Buenos Aires.

ENARSA (Energía Argentina SA)

ENARSA is a public company created by government in 2004 related to the areas of exploration, exploitation, distillation and wholesale of oil and by-products. The company also sells electricity and natural gas. Its foundation was influenced by the political necessity of the government to establish a regulatory state-owned company in an almost privatised oil market (after the largest oil company in the country YPF was privatised in 1990, becoming part of the group Repsol). In addition to securing the government's influence on the oligopoly of the oil and gas markets, the company was geared to ensure

[19] Major consumers are those who purchase at least 2 000 MWh/a.

[20] This main Fund provides economic support to these other funds: Subsidiary Fund for Regional Tariff Compensation to Final Users (FCT); Fund for the Electric Development of the Interior (FEDEI); Fiduciary Fund for Federal Electricity Transmission (FFTEF) and Wind Energy Fund.

the availability of basic supplies. According to its statutes, the state is supposed to hold 53 % and the provinces 12 %. The remaining 35 % were sold to private investors via the stock market. At present, ENARSA is also expanding activities into the renewable energy sector and has been appointed by the Ministry of Federal Planning, Public Investment and Services to be the auctioneer for 1 000 MW generated by renewable energy sources under the umbrella of the GENREN Programme. The company is also participating actively in the development of projects regarding production of hydrogen and wind projects through its subsidiary company »Vientos de la Patagonia I« currently constructing a wind park in the province of Chubut.

Asociación Argentina de Energías Renovables y Ambiente [Argentinean Association for Renewable Energies and Environment]

This entity was created in 1974 and arose from the UNESCO-IAU school and CHEGH for young astronomers and Latin-American scientists within the area of solar physics, in the Solar Observatory of Cosmic Physics. At present, it has approximately 300 members from public institutions, universities, laboratories, environmental NGO's and the private sector. The organisation is active in the promotion of renewable energies within the country through organisation of events[21] and publications[22] and also acts as advisor for state bureaus as well as national and international organisations.

Asociación Argentina de Energía Eólica [Argentinean Wind Energy Association]

This organisation gathers different entities and companies related to the promotion and development of wind energy in the country. In collaboration with institutional partners active in the wind energy promotion and the private sector this entity is an active centre of service-provision aiming at the promotion and development of the wind sector in Argentina. Activities range from consultancy to evaluation of resources and development and realization of wind projects.

Centro Regional de Energía Eólica [Regional Centre for Wind Energy]

The centre was created in 1985 through a partnership among the province of Chubut, the National University of Patagonia and the Secretary of Energy and is composed of six people which are experts in the areas of wind planning, wind evaluation resource, and social impact of wind technology. The centre works on the following areas: wind project management, technical-economical-financial aspects of the wind technology, organization of authorisations application, operation and maintenance, wind park design, design and development of rural electrification programmes and capacity building in wind energy.

Cámara Argentina de Generadores Eólicos [Argentinean Chamber of Wind Power Generators]

Created in 1999 this entity comprises entrepreneurs and professionals from wind resources prospection, applied research, development and implementation, administration and operation of wind energy systems. Goals of this entity are the promotion of instruments to ease and develop the use of wind resources within the country as well as to gather institutions and people involved in the wind energy sector such as project developers, wind turbine manufacturers and suppliers as well as service companies in the field of wind energy projects. At present this entity represents, with the Argentinean Wind Energy Association, an active association in the promotion of wind energy within the country.

Private actors

By the end of 2007, a total of 48 power-generation companies, 14 auto-producers, 3 co-generators, 76 distribution companies and 2 248 major consumers were involved in the two interconnected grids. In the generating sector, three companies have the biggest market share: Endesa Costanera, Central Puerto and Yacyretá. Of the distribution companies, the two largest, EDENOR and EDESUR, delivered about 40 % of all electricity consumed in 2007. A concession for power transmission via

[21] Last event took place on 2006
[22] In addition to studies and reports, the organization publishes two journals related renewable energies and environment

high-voltage lines was awarded to Trasener SA in 1990 for contract duration of 95 years. The low voltage grids are operated by six supra-regional enterprises. In addition to the power producers integrated within the SADI and SIP grids there are also a number of local utilities linked to the interconnected network that do not participate in the coordination of the electricity distribution process. There are also independent power producers who either feed in the isolated grids or produce for their own consumption.

1.4 Political Framework Conditions for Energy

PRONUREE and other national energy strategies

In December 2007, the Government launched the National Programme for the Rational and Efficient Use of Energy[23] which is under the responsibility of the Secretary for Energy. This programme aims at increasing energy efficiency within the energy consuming sectors through energy improvement measures, educational programmes on energy efficiency, enhanced regulations to expand cogeneration activities; labelling of equipment and appliances that use energy; improvements to the energy efficiency regulations; and broader utilization of the Clean Development Mechanism (CDM) to support the development of energy efficiency projects. The objective of the programme is to reduce electricity consumption by 6 %.

Other relevant official strategies regarding energy framework conditions are defined within the programmes Energy Plus and Gas Plus. The first programme was launched in 2006 by the Secretary for Energy. It intended to increase the nation's generation capacity in order to meet the increased electricity demand. Within this programme, CAMMESA requires all large users (above 300 kV) to contract the difference between their current demand and that in the year 2005 in a deregulated market (Energy Plus Market) where the energy sold is produced from new generation plants. In doing so, this programme guarantees a supply for end consumers and encourages increasing efficiency in energy generation of this sector (using cogeneration technology for electricity production). On the other hand, it aims to encourage the industrial sector to invest in energy generation projects to self supply electricity. The Gas Plus market was launched by the Government in 2008 to encourage private investments in natural gas exploration and production via the application of a special price (for the new gas commercialised in the domestic market).[24]

Regarding transmission, the Federal Plan for Electricity Transport in 500 kV is under implementation by the Fiduciary Fund for the Federal Electricity Transport to develop main electricity connection lines among the generation zones within the country. The complementary Federal Plan for Electricity Transport II (launched in 2003 and updated in 2006) is coordinating activities on the grid development to address constrains faced by regional transmission networks in the period up to 2010.

The legal framework for electricity generation is regulated under Law No 24 065 (»Electricity Act«) and the implementation regulation (Decree 1398/92 of August 1992). It restructured and reorganised the electricity sector, and represented the key for the privatisation of virtually all commercial activities carried out formerly by federally owned enterprises. It set up the basis for the Regulatory Entity and other institutional authorities in the sector, as well as the administration of the wholesale electricity market, pricing in the spot market, tariff-setting in regulated areas and evaluation of assets to be privatised. Within this law there is no reference to promotion and deployment of renewable energy within the country.

Electricity production using renewable energy sources was incorporated within the national regulatory framework via law 25 019 from 1998 and the law 26 190 from 2007 (which will be described on the following chapter).

[23] PRONUREE; Decree 140/2007. More information available at: http://www.energy-strategies.org/focusfiles/D_140-07_PNUREE_Argentina.pdf

[24] Price of the gas is not regulated via current regulation »Agreement with Natural Gas Producers 2007 – 2011« but based on costs and reasonable profit.

1.5 Framework Conditions for Renewable Energies

Legal Conditions and Support Schemes for Renewable Energies

The most important legal instruments for the promotion of renewable energy within the country are law no. 25 019 from 1998 and law no. 26 190 from 2007.[25] The 1998 law, known as the »National Wind and Solar Energy Rules«, declared wind and solar generation of national interest and introduced a top up feed in tariff mechanism to set up additional payment per generated kWh, which in 1998 meant a 40 % premium over market price. It also granted certain tax exemptions for a period of 15 years from the law's promulgation. Due to the economic crisis and related barriers, the 1998 law remained without measurable impact.

Law 26 190 declares electricity generation through renewable energies of »national interest«. The law defines a feed in tariff scheme to pay 2.67 Euro per MWh[26] produced with renewable technologies. The tariff is guaranteed by the »Renewable Energies Fiduciary Fund«[27] that will be created specifically for that purpose and managed by the Federal Council of Electricity. The goal of this law is to cover 8 % of national electricity consumption using renewable energy sources by the year 2016 which is equivalent to 2 500 MW of renewable energy capacity. There are other incentive mechanisms foreseen by the law which are: exemption of the VAT in activities regarding buying, manufacture, construction or importation of capital goods and equipment for infrastructure; accelerated amortization of revenues generated by production of renewable energy.

Based on the goals established in the law on 26 190 from 2007, in May 2009 the National Government via the Ministry of Federal Planning, Public Investment and Services launched the programme GENREN (Generación Renovable) which recovers an old »Plan de Energías Renovables« for Argentina. This programme (which is still under development) will serve as a framework to set up a regulation aiming at the promotion of renewable energies in the country using fiscal schemes, exemptions and incentives for all investments related either to the production of energy from renewable sources or renewable generation equipment. The national government has appointed the national energy company ENARSA as entity to run a bidding process. In this regard ENARSA is offering capacities to be contracted with private parties. This bidding process is in line with Argentina's goal to generate at least 8 percent of renewable electricity by the year 2016. The process should enable private investors to erect 1 000 MW of renewable energy capacity via purchase contracts for a period of 15 years. The government foresees that the private sector will invest 1 769 million € to implement all projects comprised within this program which will focus on the following areas: wind energy (500 MW), biofuels (150 MW), WTE [28](120 MW), biomass (100 MW), mini hydro (60 MW), geothermal (30 MW), solar energy (20 MW) and biogas (20 MW). This scheme combined with the feed in tariff proposed by the law will be a milestone to accelerate the deployment of the renewable energy in Argentina.

The biofuel sector, particularly related to the production of biodiesel and bioethanol, has shown a remarkable increase in Argentina. However, it can be stated there are insufficient measures in place in order to support the development of this sector. The law no 26 093 (Biofuels Law) which mandates that gasoline and diesel should be mixed with 5 % biofuel as from January 2010 lacks the necessary support and complementary schemes to achieve the respective target. So far, the government has only specified parameters such as price or criteria to select projects for ethanol production, but not for biodiesel.

Law no. 26 123 from the National Programme for Hydrogen, issued on 2006 to foster and regulate developments and investments in hydrogen production, is still waiting to be implemented and thus remains ineffective to promote this source.

The province of Santa Cruz has issued a provincial law (Ley Provincial 2 796) which specifies tax relief and subsidies for renewable energy plants during the first 10 opera-

[25] Law 26 190 was finally implemented on 2009 through Decree 562/2009
[26] Tariff for solar PV is 1.60 Euro per MWh
[27] Fondo Ficudidario de Energías Renovables
[28] Waste to Energy

tion years. Tax exemptions vary between 50 % and 100 % depending on the percentage of components locally produced[29]. The subsidy follows the same pattern and ranges from 0.01 AR $ (0.0018 €) to 0.03 AR $ (0.0054 €) per kWh. This subsidy works as an addition to the feed in tariff mechanism promoted within the national law no 26 190.
Successful promotion and deployment of renewable energy plants in the country largely depends on the existence of support mechanisms and schemes to ease integration of this sources in the national energy generation mix provide investors with mitigation tools for long term risks as well as easing access to financing schemes to overcome higher costs related to this type of technology. The regulatory support framework for renewable energy sources in Argentina currently relies only on law no 26 190 as the old Renewable Energy Plan of Argentina became obsolete. The finalisation and efficient application of the GENREN program which will ensure 1 000 MW of additional new renewable energy capacity in the country represents the first step to reactivate the renewable energy industry in the country, which stopped activities after an initial phase in 2002 due to the economic crisis in Argentina.

Clean Development Mechanism

Argentina ratified the Kyoto Protocol in 2001. The Clean Development Mechanism Office OAMDL (Oficina Argentina de Cambio Climático) reports to the Secretary for the Environment and Sustainable Development and serves as the country's Designated National Authority (DNA). Decree no. 1 070 of September 2005 established a national fund (Fondo Argentino del Carbono – FAC) aiming at the development and implementation of CDM projects. Tasks of this organisation comprise a wide range of activities such as:

- Technical assistance to project developers interested in the evaluation of the mitigation potential of their projects (involving pre-feasibility and feasibility studies, due diligences, etc.) as well as the possibility of being considered as a candidate for the CDM process.
- Identification of potential projects and areas for GHG emission mitigation (via sector studies, national communications, mitigation strategies, etc).
- Capacity building regarding Climate Change mitigation strategies (involving development of communication tools, campaigns and events).

Until September 2009, twenty six projects have been approved by the DNA to be registered as CDM projects under the UNFCCC scheme. From these, fifteen have already been registered as CDM projects by the UNFCCC. From the total amount of projects presented to the UNFCCC only seven were related to electricity production via renewable energy sources (presented in table 7) and only one refers to wind energy. It can be stated that the largest amount of projects registered under the CDM scheme are comprised within the waste handling and disposal sector (seven projects fall under this category) particularly in the area of landfill gas recovery and abatement of methane.

There is currently no major impact of the CDM scheme on the development and deployment of renewable energy projects within the country as investment conditions as well as regulatory framework still need to be developed from the central government in order to create favourable market and regulatory conditions to gear renewable energy sources to play an important role within the energy mix of the country.[30] The application of the CDM scheme should work as catalysing factor to increase the use of renewable energy sources. However, the use of the CDM scheme should be developed in parallel to the renewable energy market.
Biomass and biogas resources are currently not being exploited in the country; however, there is great potential in bio-energy resources in Argentina. Particular potential (for GHG emissions reduction) has been identified[31] for the use of biodiesel in the transport and agriculture sector as well as the use of biomass for energy generation. If developed, both types of projects are more likely to become suitable for CDM registration. In the case of solar energy, this solution is considered solely for isolated settlements

[29] Since 1st January 2007 tax relief is 100 % of all part manufactured locally.

[30] It has to be considered that an effective application of the GENREN Program within the country might change the current conditions regarding renewable energies deployment facilitating these sources to play a more important role in the energy generation mix of the country.

[31] For more information see: Klimaschutz in Argentinien und Brasilien. Marktpotenziale und Ratgeber für CDM Projekte. Cámara Argentino Alemana.

TABLE 7:
REGISTERED AND PLANNED RENEWABLE ENERGY-CDM-PROJECTS IN ARGENTINA

Project	Place	Type	Savings foreseen (t CO2 eq)	MW	Status	Date of national approval	Date of registration
Antonio Moran Wind Power Plant in Patagonia Region	Comodoro Rivadavia – Province of Chubut	Renewable energy projects	185.483	10.56	Registered	19-07-05	29-12-05
Bio-energy in Geeral Deheza – Electricity generation based on peanut hull and sunflower husk	General Deheza – Province of Córdoba	Renewable energy project	585.760.9	10	Registered	11-10-06	09-04-07
Complejo Industrial La Plata – Recovery and use of flaring residue gases project	Ensenada – Province of Buenos Aires	Energy industries (renewable and non renewable resources) Manufacturing industries	1.977.056	n.a.	Not yet registered	31-01-07	
Pindó Biomass Energy Generation from Forest Biomass	City of Puerto Esperanza-Department of Iguazú – Province of Misiones	Renewable energy project	491.197	4	Not yet registered	18-03-08	
6 MW electricity generation plant using biomass originated from the poultry industry	District of Lobos – Province of Buenos Aires	Renewable energy project	1.102.793	6	Not yet registered	24-06-09	
Biogas recovery and thermal energy production in CITRUSVIL plant (plant for citric products manufacture)	Cevil Pozo – Province of Tuscumán	Energy industries (renewable and non renewable resources)	338.993	9.20	Not yet registered	19-03-09	
Anaerobic digestion and energy generation at Semino Starch Plant Project	Caracañá City - San Lorenzo Department – Province of Santa Fe	Energy industries (renewable and non renewable resources) Waste handling and disposal	203.073	10.05	Not yet registered	19-03-09	

Source: Oficina Argentina del Mecanismo para un Desarrollo Limpio 2009

where connection to the grid is either difficult or too expensive. Activities concerning larger solar PV projects under the CDM scheme are still very limited due to the small potential.

International donor activities

The Japan International Cooperation Agency (JICA)

The JICA is an entity created by the Japanese government and responsible of the execution of technical cooperation programs in developing countries. Since 2007, this entity is collaborating with the Secretariat of Environment and Sustainable Development of the Nation in the identification and development of CDM projects within the country, particularly in the forestry sector. They are currently carrying out the project »Enforcement of technologies for the application of CDM in the forestation and reforestation (CDM F/R) in Argentina«.

Carbon Finance-Assist Program

The Carbon Finance-Assist Program (CF-Assist) was an initiative created by the World Bank in 2005. The goal of this project is to assist developing countries and transition economies in the development and implementation of CDM projects. Argentina became part of this program in 2006 through the signature of an agreement between the World Bank and the Argentinean Secretary for Environment and Sustainable Development. A work plan is currently being executed between the two entities emphasizing the following work areas:

- Design of strategies for the Argentinean Carbon Fund
- Development of a project portfolio for the Argentinean Carbon Fund
- Technical assistance for CDM projects
- capacity building
- Participation of Argentina in the Carbon Expo 2006 – 2007

Inter-American Development Bank

In 2006, Argentina received funding from the Inter-American Development Bank valued at 580 million dollars loan for the realization of the »Norte Grande Electricity Transmission Program«. The project focuses on the construction of an electricity extra high transmission line (500 kV) to connect the Northeast (NOA) and Northwest (NEA) regions of the country, and electrical transmission of high and medium voltage networks (smaller than 500 kV) for the complementary regional transmission networks of both regions.

Andean Development Corporation

The Corporación Andina de Fomento (CAF) is a multilateral financial institution created to provide banking services to both public and private clients (particularly for the Andean Region). In 2006, this institution financed two projects in Argentina: the electricity interconnection Comahue-Cuyo and the electricity interconnection Rincón Santa Maria-Rodriguez. In the same year, 210 million US $ were given to modernize the country's hydro infrastructure. In June 2007, the CAF approved a 45 million US $ loan for the Buenos Aires province to partly finance expansion of electricity transport capacity in the northern part of the province.

1.6 Market Potential for Wind Energy

Wind energy potential

The wind energy sector represents the most promising alternative for renewable energy production in the country. The central government has already initiated the first steps to evaluate, analyze and use the large wind potential in the country. According to the last report[32] elaborated by the Cámara Argentina de Energías Renovables on the status of the wind industry in Argentina, 70 % of Argentina's territory is suitable for wind energy utilization with an annual average wind speed of 6 m/s (measured at 50 meter height). Best sites are located in the southern part of the country, particularly in the middle and southern Patagonia where average wind speeds reach values of 9 m/s and 12 m/s respectively (http://argentinaeolica.org.ar/portal/images/stories/Eolica%20en%20Argentina.pdf). One of the main problems detected for the development of wind farms is the fact that generation points are far away from densely populated areas and industrial centres, and thus grid problems arise (grid connections, grid capacity, high costs for transmission lines, large energy losses etc.). Wind maps are currently also available for two provinces in the southern part of the country (Chubut and La Pampa). The compilation of a comprehensive wind atlas for the entire country constitutes an essential component of the national wind energy plan. Aiming at improving the planning of wind power projects, the Regional Centre for Wind Energy (CREE) in Chubut province was called upon in 2005 to compile the atlas which was finished in 2006. The atlas can be accessed via their homepage (eee.eeolica.com.ar). Argentina's government estimates that 300 MW of wind energy capacity can be implemented by 2012.

[32] »Estado de la Industria Eólica en Argentina« (2009). Cámara Argentina de Energías Renovables.

Framework conditions for wind energy in Argentina

The precarious economic situation in 2001 – 2002 seriously compromised the development of the wind energy industry in the country and paralysed a lot of studies and projects. To reactivate the sector, the government has established an integral plan to develop the wind industry (National Wind Energy Strategic Plan, PENEE) at national level aiming not only at an increase of installed capacity but also to reactivate the wind industry within the nation (being an economic niche almost unexplored up to that moment by national investment).

The PENEE contains the official development programme of wind parks and shall lead to the construction of at least 300 MW of wind energy projects. Initial actions of this development involve the creation of the wind atlas and the project Vientos de la Patagonia 1 and 2. Both wind farms are financed by the government with additional funding from the provinces where they are located. The wind farm Vientos de la Patagonia 1 is 80 % property of ENARSA and 20 % of the Chubut province and is structured in two phases. Phase 1, already in construction and foreseen to be finished by 2009, aims at the installation and certification of two prototype turbines from local manufacturers, one from the company IMPSA Wind and the other from NRG Patagonia. Phase 2 considers the installation of a 60 MW wind farm in Chubut using the certified turbines in Phase 1. Wind farm Vientos de Patagonia 233 with a capacity of 20 MW is located in the province of Santa Cruz. Studies regarding prospection and analysis of the wind resources are currently being carried out.

Wind energy legislation

- National Law Nº 26 190: as stated before, this law grants economical support to energy generated through renewable sources. In the case of wind energy, it specifies some small subsidies (0.26 €cent/kWh for wind) and tax benefits (such as the accelerated amortization or exemption of VAT payment) for the wind projects.
- Provincial Law of Chubut (Ley Provincial no 4 389): this regulation specifies additional subsidies and tax benefits and also establishes the percentage[34] of wind turbine components that must be manufactured or assembled within the province. The subsidies amount to 0.089 €cent/kWh, on top of the national subsidy.
- Provincial Law of Buenos Aires (Ley Provincial no 12 603) specifies additional subsidies for wind energy. The subsidies amount to 0.089 €cent / kWh, on top of national subsidy.
- Provincial Law of Santa Cruz (Ley Provincial no 2 796): as stated in the previous chapter this regulation provides for tax exemptions (50 – 100 % depending on local content) and small subsidies (0.18 – 0.54 €cent, also depending on local content) for renewable energy projects.

Current Use of Wind Energy and Project Pipeline

The current installed wind energy capacity amounts to 30 MW with projects mainly developed within the period from 1994 to 2002[35] and set up by electric cooperatives.[36] The last wind equipment installed in the country has been a 2 MW turbine for the company Barrick in its mine located in the province of San Juan. The following table presents a short description of existing wind projects in the country.

After a few years of inactivity due to the economic crisis, the wind energy development is gathering momentum which is reflected by a remarkable project pipeline. Apart from Vientos de Patagonia described above, the following projects are planned:

The Arauco Wind Farm is a project located in the province of La Rioja and developed by the company IMPSA. The project foresees the installation of 12 wind turbines (each with 2.1 MW capacity) reaching a total capacity of 25.2 MW and performed in two stages, finishing by May 2010. In an extended phase, the installation of 90 MW are being considered. The Malaspina project is developed by the company Central Eólica de Malaspina SA. This project will be based on 40 wind turbines (Ves-

[33] Capacity of the wind farm is 20 MW.

[34] January 1st 2007 the percentage equals to 100 %.

[35] The economic crisis in the period 2001 – 2002 slowed down investments in wind energy. As the Argentinean economy is slowly recovering, market conditions start to foster again this kind of investments.

[36] Electric cooperatives are defined as organisations of investors who gather in cooperatives in order to increase size and economic capability to be able to participate in large projects and to create an effective lobby group to defend their interests.

TABLE 8:
INSTALLED WIND FARMS IN ARGENTINA

Site	Starting date	Installed Capacity (MW)	Owner
Claromecó	December 98	0.8	Cooperative Claromecó
Darragueira	September 97	0.8	Cooperative Darragueira
M. Buratovich	October 97	1.2	Cooperative M. Buratovich
Punta Alta	February 95	0.4	Cooperative Punta Alta
Punta Alta	December 98	1.8	Cooperative Punta Alta
Tandil	May 95	0.8	Cretal Cooperative Ltd. Cooperative Tandil
C. Rivadavia	January 94	0.5	Pecorsa
C. Rivadavia	September 97	6.0	Soc. Coop. Comodoro Rivadavia
C. Rivadavia	October 01	10.6	Soc. Coop. Comodoro Rivadavia
R. Tilly	March 96	0.4	Coagua
Gral. Acha	November 02	1.8	Cosega
Cutral Có	October 94	0.4	Copelco
Pico Truncado	March 01	2.4	Municipality Pico Truncado
Veladero	August 08	2.0	Barrick
TOTAL		**29.8**	

Source: Cámara Argentina de Energías Renovables 2009

tas V-80 with a rated capacity 2 MW each) located in the Pampa Malaspina, approximately 130 km north of the city of Comodoro Rivaldiva in Chubut. It is foreseen that the park will be operating by 2010/2011.

The Vientos del Secano project is going to be developed by the company ABO Wind and will be located in the proximities of the municipality of Ing. Buratovich (territory of Villarino). The wind park will have a total capacity of 50 MW and construction will begin by the end of 2010. It is foreseen to start running by 2011.

Another project planned is the construction of the wind park Diadema in the proximities of the city of Comodoro Rivadavia with a total capacity of 6.3 MW (comprising 7 turbines ENERCON E-44 with 900 kW capacity each) and an average generation rate of 22 GWh per year. In addition to the wind farm, the construction of a hydrogen plant is being considered. It is planned that the project will initiate operations by 2010 although some sources mention that the project is currently on halt.

Active local companies

On the Argentinean wind market, there are currently three local turbine manufacturers:

The company IMPSA owns a production facility which produces wind turbines (≥ 1.5 MW). The plant is located in Mendoza and allows the company to build 75 wind turbines including blades per year. The company has developed different types of turbines (1 MW, 1.5 MW and 2.1 MW) for different types of wind characteristics. IMPSA is currently working on the development of turbines with a rated power of more than 4 MW. IMPSA Wind is the largest wind technology developer in Brazil with 13 wind farms adding up to a total capacity of 317 MW distributed on the north east and south of the country. In Argentina, the company is actively participating in projects located in the provinces of Buenos Aires, Chubut, Córdoba, Neuquén, San Luís and Santa Cruz. In the Patagonic region IMPSA has installed one turbine (1.5 MW) and intends to install a wind farm (90 MW) in the province of La Rioja (enough to supply 45 % of the provincial electricity demand).

The company NRG Patagonia commercializes the model NRG 1500 with a capacity of 1.5 MW. This technology has been specifically designed and classified in Germany to operate in strong wind locations, such as in some areas of Patagonia, commonly defined as IEC Type I+ or Type »S«. Using a reinforced structure of the turbine Type 1+, NRG Patagonia has developed a Type II with a 77 m diameter rotor and a Type I with a 70 m rotor. At present NRG Patagonia is in its final stage to develop the first unit that should be installed and certified for the development of project Vientos de Patagonia I.

The company INVAP develops mostly large and medium size turbines. INVAP is very advanced in the development of a 1.5 MW turbine (EOLIS 15) for strong class winds (Class 1). The developed turbine will be particularly useful for the centre and south regions in Patagonia and the Atlantic coast in the province of Buenos Aires. INVAP has also planned the development of a 2 MW turbine suitable for Class 2 winds (less intense than the ones existing in Patagonia).

1.7 Contact Addresses

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National Electricity Regulatory Body
Ente Nacional Regulador de la Electricidad (ENRE)
Avda. Madero 1020 – Piso 10º
Buenos Aires (C1106ACX)
Tel.: + 54 (11) 4510-4600
www.enre.gov.ar

Energía Argentina SA (ENARSA)
Av. Libertador 1068 – Piso 2º
Buenos Aires (C1112ABN)
Tel. / Fax: +54 (11) 4801-9325
www.enarsa.com.ar

Association of Electric Energy Distributors
Asociación de Distribuidores de Energía Eléctrica de la República Argentina (ADEERA)
Tacuarí 163- Piso 8º
Buenos Aires (1071AAC)
Tel. / Fax: +54 (11) 4331-0900
E-mail: adeera@adeera.org.ar
www.adeera.org.ar

Association of Power Producers
Asociación de Generadores de Energía Eléctrica de la República Argentina (AGEERA)
Av. Callao – 1604 piso 4º
Buenos Aires (C1024AAP)
Tel./Fax: +54 (11) 4807-3310
www.ageera.com.ar

Argentine Association for Renewable Energies and Environment
Asociación Argentina de Energías Renovables y Ambiente (ASADES)
President: Ing. Alfredo Esteves
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La Plata (1900) (Prov. Buenos Aires)
E-mail: www.asades.org.ar

Argentinean Chamber of Renewable Energies
Cámara Argentina de Energías Renovables
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E-mail: info@cader.org.ar
www.argentinarenovables.org

Ministerio de Planificación Federal, Inversión Pública y Servicios / Secretaría de Energía
Ministry of Federal Planning, Public Investment and Services / Secretary of Energy
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E-mail: energia@minplan.gov.ar
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Secretary of Environment and Sustainable Development
Secretaría Ambiente y Desarrollo Sustentable.
San Martín 451
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Federal Electrical Energy Council
Consejo Federal de Energía Eléctrica (CFEE)
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Argentine Wind Energy Association
Asociación Argentina de Energía Eólica (AAEE)
President: Prof. Erico Spinadel
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Argentine Association of Wind Power Generators
Cámara Argentina de Generadores Eólicos
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Esmeralda 356_P9 Of.29
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www.cadege.org.ar

Japan International Cooperation Agency
Agencia de Cooperación Internacional de Japón
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German-Argentine Chambers of Industry and Commerce
Cámara de Industria y Comercio Argentino-Alemana
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Andean Promotion Corporation (Argentine Bureau)
Corporación Andina de Fomento (Oficina en Argentina)
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Argentine Bureau of Clean Development Mechanism
Oficina Argentina del Mecanismo de Desarrollo Limpio Secretary for the Environment and Sustainable Development
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1.8 Information Sources

Asociación Argentina de Energía Eólica www.argentinaeolica.org.ar

Asociación Argentina de Energías Renovables y Ambiente (ASADES) www.asades.org.ar

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