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Electricity Reform in Argentina: Lessons for Developing Countries

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Abstract

Argentina was one of the first countries in the world to implement a comprehensive reform of its electricity sector in the recent period. Among developing countries only Chile has had a comparably comprehensive and successful reform. This paper traces the history of the Argentine reform, which began in 1992, and assesses its progress and its lessons. We conclude that the reform was very successful prior to the collapse of the Argentine peso in early 2002. We suggest lessons for the generation, transmission and distribution sectors, as well as the economic regulation of electricity and the general institutional environment favourable to reform. We note that the achievements of the sector are now threatened by the delays in tackling the financial consequences of the peso devaluation.

Keywords: Argentina, electricity, restructuring, regulation, privatisation.

JEL classification: L33, L51, L98.

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Electricity Reform in Argentina Lessons for Developing Countries

1. Background

Argentina is one of the world's leading countries in terms of comprehensive electricity sector reform. The sector was substantially restructured in 1992 as part of the reorganisation and privatisation programme of the first term of the government of President Menem. This reform saw the break-up of the three vertically integrated state-owned companies into 27 separate generating units, 7 transmission companies and several distribution companies. These were then privatised. This reform took place only 2 years after the landmark reorganisation of the UK's electricity sector. Together with its next door neighbour, Chile, Argentina was long thought of as having been host to the most comprehensive and generally successful electricity reform among developing countries.

The experience of the electricity sector in Argentina cannot be separated from that of the rest of the economy. Argentina has had a turbulent economic and political history. In 1900 Argentina had the second highest income per capita of any country. Its wealth was based on its large and fertile agricultural land area capable of producing high value added exports, in particular beef cattle. However the country struggled to convert its initial advantages into successful industrial development and was troubled by a substantial underclass and associated poor distribution of income. The election of a populist government led by General Peron in 1946 was followed by a military government in 1955, which continued with only brief interludes of democracy until 1983. This sorry history was marked by class conflict between rich landowners, the middle classes and the underclass. By 1983 Argentina had been reduced to a developing country with large international debts and high unemployment.

Following a sharp deterioration in the country's fortunes during the 1980s, Carlos Menem was elected president in 1989. Menem was a populist from the Peronist party and initially espoused an agenda of radical social reform. However realising that Argentina's hyperinflation was driven by large fiscal deficits, the Menem government began a massive privatisation programme which eventually privatised 154 state companies in energy (including gas supply and electricity) telecommunications, railways, banking and other sectors.² The privatisations raised \$19.4bn, including \$14bn of cash and \$13.7bn of nominal debt repurchased – this sum represents around 13% of GDP in 2002. 80% of the revenue was raised between 1990 and 1993. The privatisations also substantially reduced the losses on state owned companies, which had been 3% of GDP in 1989.³ The scale and speed of the privatisation was staggering. Even the UK, thought to be the world leader in mass privatisations, the total sum raised was only around 10% of 2002 GDP and it took around 12 years to raise 80% of the total value.⁴

² See Galiani et al. (2003), Section 2, for details of the privatisation programme.

³ See Ennis and Pinto (2002, p.71).

⁴ If we date the UK privatisation programme from October 1979 to July 1996, the total value raised was £61,973m, 80% of this was not raised until March 1991 (see Pollitt, 1999, p.37).

The privatisation of the electricity sector was one of the most significant privatisations and was masterminded by the Minister of Energy, Carlos Bastos. Bastos was one of the leading reformers within the government. The privatisation programme occurred against the important macroeconomic background of the creation of one to one convertibility between the Argentine Peso and the US dollar in 1991. This provided assurance for foreign investors who enthusiastically bought shares in the newly privatised companies and began to invest heavily in upgrading the capital stock of their companies.

The privatisation programme successfully reduced the government debt in the early 1990s and associated interest payments.⁵ Government debt fell from \$78.9bn in 1990 to \$69.6bn in 1993 and associated interest payments as a percentage of GDP stayed low in the first years of the 1990s before rising sharply as the privatisation revenue stream slowed. Public support for commercial activity fell from 11.7% of public expenditure in 1991 to 5.4% in 2000, of this fall more than half was due to reduced support for the electricity and gas sectors.⁶ The stock market was stimulated with 38.5% of all dividends paid between 1992-1999 coming from privatised companies. However in the second Menem term government expenditure began to increase rapidly and the fiscal deficit began to worsen. This put pressure on the parity between the dollar and the peso. Menem left office in 1999.

The macro-economy continued to deteriorate and in early 2002 the government was forced to abandon peso parity with the dollar and let the currency float freely. The Peso collapsed to less than 30% of its former value and Argentina defaulted on its overseas debts. This economic crisis which was accompanied by bank runs and a massive surge in unemployment provoked a political crisis. The elected President Fernando de la Rúa was forced to resign in December 2001 to eventually be replaced by the interim administration of Eduardo Duhalde in January 2002. His administration lasted until fresh elections in May 2003 when Nestor Kirchner succeeded to the presidency. The economy began a recovery as its exports benefited from the effect of the massive devaluation but the economic and political situation remains fragile in mid 2004. In particular the country has defaulted on its sovereign debt and investors currently rate Argentina as one of the worst prospects for electricity investment of any large developing country.⁷

The period since the crisis of February 2002 has had a marked effect on the privatised sectors. Most privatised companies were under foreign control at the start of the crisis and had prices that were officially pegged to the US dollar. This was the contractual underpinning of the large investments which overseas companies have made in Argentina since 1990. In the electricity sector total investment was \$12.5bn, of which 60% is represented by post-privatisation investments (much of it coming from overseas investors).⁸ Regulated residential tariffs were frozen in peso terms in February 2002 leaving most companies shouldering heavy financial losses once loans have been repaid

⁵ See Ennis and Pinto (2002, pp.71-79).

⁶ See Ennis and Pinto (2002, p.78).

⁷ Survey reported in Lamech and Saeed (2003).

⁸ CAISE (2002, p.4).

in dollars. The World Bank has been involved in negotiations with the government about allowing the prices to rise in order to allow some recovery of initial investments and to ensure that future investment is not prejudiced. This process has not led to a resolution of the contractual disputes between the private companies and the government and the political cost of substantial price rises for utilities remains high. Since the beginning of 2004 strong demand for electricity stimulated by rapid economic growth and low relative energy prices, has led to electricity supply shortages and emergency measures to reduce demand and increase domestic supply.

Argentina is an enigma among developing countries. In spite of a well-educated workforce, abundant natural resources and strong cultural links to both Europe and the US it is characterised by political instability and periodic macroeconomic crises of a substantial magnitude. The political system finds it very difficult to manage the state budget responsibly and to stabilise the macro environment. Within this context, making credible commitments not to arbitrarily regulate the electricity sector and to honour concession contracts is very difficult. The instability of the Argentine institutional environment since 1973, when President Peron (elected for a third time) died in office, is in marked contrast to its neighbour Chile.⁹

Argentina is an important case study of electricity reform because it shares many of the features of developing countries' electricity systems. Like Brazil and India it is a federal state and the provinces retain a large degree of autonomy over the regulation of local utilities including the power to privatise local distribution utilities and to set residential prices. The population is significant at 38.4m and it has some ability to exploit economies of scale. The GDP per head was US \$2700 in 2002 (at market exchange rates), this figure being barely unchanged from that in 1992 following a 15% fall in GDP between 2000 and 2002.¹⁰ However there has been a significant economic recovery in 2003 and into 2004 with annualised GDP growth of around 8% in 2003 and around 10% at the beginning of 2004.¹¹ Electricity consumption per head is relatively low but grew rapidly between 1992 and 2002 (3.3% p.a.). The electricity system has significant hydro capacity (just under 40% of the total in 2002)¹². Argentina shares the political and macroeconomic instability of many other developing countries but is perhaps unusual in its capacity for designing and running sophisticated economic institutions such as those required by a deregulated electricity market.

2. Argentina's Electricity Reform

The privatisation of the electricity sector was one of the most comprehensive of the Menem period. Starting from an industry which was wholly state and provincially owned,

⁹ See Murillo (2001) and Heller and McCubbins (1996) for comparisons of the political background to reform in Chile and Argentina.

¹⁰ Source: World Bank, 'Argentina at a glance', at http://www.worldbank.org/data/countrydata/aag/arg_aag.pdf

¹¹ See www.indec.gov.ar

¹² Source: CAMMESA website.

more than 80% of the generation, all of the transmission and 60% of the distribution sector was transferred into private ownership. Remaining public ownership was limited to the state owned nuclear power generating company and two hydro-electric plants (with foreign ownership) in the generation sector and some provincially owned distribution companies. There was also come co-operative ownership. A basic sketch of the Argentine electricity system can be gained from Figures 1 to 4 and Table 1 in the appendices. The comprehensive nature of the electricity reform in Argentina reflected the neo-liberal nature of the incoming government and the poor performance of the sector prior to privatisation. Severe blackouts had occurred in the summers of 1988 and 1989, thermal generation plant suffered from poor availability (over 50% in 1991) and distribution system losses (up to 22% in 1991) were high (partly due to theft).¹³

Half of the population live in the Greater Buenos Aires area (the so called Gran Buenos Aires). This area accounts for nearly half of GDP and of electricity demand. The national transmission system is focussed on supplying power to this region. It was the state owned companies in this region that were at the forefront of the privatisation. A first attempt to address the problems of the sector was the adoption of the Federal Electricity Pact (Pacto Federal Electrico) in November 1989, but by early 1991 nothing much had changed. Therefore a new electricity industry was designed in 1990-91 by the Ministry of Energy, supported by the World Bank. It came into being with a new Electricity Law (24,065) in April 1992 and was carried out over 1992-93.¹⁴ This law together with Decree 634/91 of April 1991 constituted the legal framework for the transformation of the sector and provided for: the break-up and sale of the existing state owned companies; the creation of a wholesale energy market; the creation of a sector specific regulator; and the definition of the powers of the Secretary of Energy in the new system. It also established a Federal Energy Council to advise the Secretary of Energy and the Congress and administer the National Fund of Electricity, which is used for regional subsidies.

Law 24,605 characterized electricity transmission and distribution as public services to be provided under monopolistic conditions and thus prescribed regulatory oversight of prices and quality to guard against the abuse of market power and monopolistic exploitation. The law further required “open access” for transmission and distribution facilities—third parties are to afforded non-discriminatory access to the grid. Distributors were placed under a public utility obligation to supply all the energy demanded within their concession areas. Generation on the other hand was deemed to be a structurally competitive activity. Still the law required all generators to receive a uniform rate (taking into account the system’s short-marginal cost and the cost of non-supplied energy) at each delivery site determined by the National Load Dispatch (Legisa 1999).

The largest state owned company Servicios Electricos del Gran Buenos Aires (SEGBA) was broken into 5 generation firms and 3 distribution companies.¹⁵ The distribution companies created were Edenor S.A., Edesur S.A. and Edelap S.A. The first two were the largest and represented more than 1/3 of all electricity customers in the country and their

¹³ See CAISE (2002, pp.19-20).

¹⁴ See Delfino and Casarin (2003) for details of the break-up of the state owned electricity companies.

¹⁵ See Delfino and Casarin (2003).

privatisation in September 1992 raised 1/3 of the total privatisation proceeds from the sector. The second largest firm Agua y Energia Electrica (AyE) operated 16 generation plants, transmission lines and provincial distribution companies. Its privatisation began in early 1993 as its power stations were separated and sold off. Hidronor, which operated hydro power plants in the Comahue region was privatised in mid 1993. This was accompanied by the granting of concessions to operate one national transmission grid (Transener) and five regional grids. In 2001 there were more than 40 generation companies operating in Argentina and 30 distribution utilities and most were privately owned and operated.

The Argentine electricity privatisations raised \$3.1bn for the central government and associated privatisations by the provinces raised a further \$2.1bn. The privatisation drew heavily on the experience of privatisation in Chile and the UK, then seen as the pioneers of electricity reform of state owned electricity companies in the post-World War II period. Thus the design of the market for wholesale power was based on the Chilean market which had a cost based bidding system for scheduling power plants and an independent system operator (ISO) responsible for dispatch. There were also echoes of the Chilean system of seasonal average prices being passed through to regulated customers. The large scale break up of the generation sector and the separation of generation, transmission and distribution reflected the UK experience from 1990. The UK had separated transmission and generation and continued the separation between distribution and generation. It was also experiencing problems of having an overly concentrated generation market which the Argentine system was at pains to avoid. The Argentine model of regulation with the creation of an independent national electricity regulator, ENRE, drew on the UK model by investing responsibility for price setting in a specialist independent agency with responsibility only for the electricity sector.

The break up of the ownership of the generation sector was accompanied by the creation of a Wholesale Electricity Market (MEM). This market covers most of the country (and 93% of electricity demand) apart from the far south, which has its own non-interconnected market (MEMSP). The MEMSP supplies 6% of total electricity demand with the remaining 1% of power demand supplied by small isolated systems. The MEM is managed by a corporation: CAMMESA.¹⁶ Its functions are to carry out efficient dispatch (via the Dispatch Management Agency – Organismo Encargado del Dispatcho), co-ordinate centralised operation and the manage the MEM generally. CAMMESA is a not-for profit joint stock company owned by the Association of power generators (AGEERA), the Association of large users (AGUERRA), the distributors' association, the association of high voltage transmission companies (ATERRA) and the Secretariat of Energy (the responsible government ministry). Each shareholder has 20% of the company. CAMMESA has a board of 10 members to which each association appoints 2 members. The Secretary of Energy (the chief minister of the Secretariat of Energy) is another member and the final member is appointed with the assent of three of the associations subject to the veto of the Secretary of Energy. Its decisions are made by majority voting but must include the Secretary of Energy. In the event of a tie the

¹⁶ See Rodriguez-Pardina (2004) for details of the governance of CAMMESA.

Secretary of Energy's vote counts as double and in the event of a disagreement the Secretary of Energy decides.

The actual power market, which CAMMESA manages, involves a cost based energy price determination system.¹⁷ Every 6 months (July and December) thermal and nuclear generators submit bids for the price at which they are willing to supply energy in every hour for next six month period (November to April and May to October). Bids cannot exceed 115% of the actual fuel costs incurred by generators in their fuel purchases. They can be adjusted within the six month pricing period if fuel prices fluctuate by more than a certain percentage. All generating plants are also required to declare availability. Hydro generators must declare the value of water in their reservoirs. Using demand forecasts for each day CAMMESA determines the marginal plant for each hour of operation during a given day (there is no demand side bidding as such). Local prices can develop where there are transmission constraints. Generators receive the spot price plus a nodal factor and a capacity charge if they are running during the period 6am to 11pm¹⁸. This fee was fixed at \$10 USD per MWh in 1994 and is added to the energy cost of the marginal turbine on the system¹⁹. Optimal dispatch also takes account of start up costs in the system. Fuel costs are subject to verification by CAMMESA, for gas plants the reference price is that provided by the national gas company, ENER GAS, for oil the reference price is the New York price and coal prices only affect one plant. There were initially four emergency tariffs (\$120, \$170, \$240 and \$1500 per MWh) which can be set at times of shortage.

In 1991 generation was initially in the hands of four major companies with a combined market share of 77.3% with the largest company (SEGBA) having a market share of 23.3%.²⁰ By 2002 there were more companies in the market and the share of the largest four largest private companies was 40.5%, with the largest private firm having a market share of 12.3%. The energy market was liberalised for customers with demands greater than 5MW, this has been successively reduced to 30KW. These customers are free to contract directly with generators and can participate directly in the generation market. As a result of this liberalisation the number of participants in the MEM was 2527 in December 2002 that included 38 generating companies and 2308 large energy users. At this time national installed capacity was equal to 23.6 GW. The liberalised market accounts for around 50% of national electricity demand.

Electricity transmission charges are paid by generators and suppliers and there is non-discriminatory right of access to all transmission lines.²¹ For existing lines these are based on regulated tariffs (regulated third party access). Transmission lines are operated under 95 year concessions subject to management contracts which are renewed every 15 years.

¹⁷ See Ferreira (2002) for details of the operation of the wholesale power market.

¹⁸ The "Market" node is located at the System Load Centre (the Ezeiza 500 kV node in the Greater Buenos Aires/Litoral Area). In each of the other nodes on the grid the energy price takes into account the cost of taking the energy to or from the Market node.

¹⁹ This capacity charge was calculated as the sum of a base price (\$5 USD per MWh) and a reliability price determined by the Secretariat of Energy (in May 1994 it was set at \$5 USD per MWh).

²⁰ Market data on the MEM and the MEMSP has been supplied by ENRE.

²¹ See Vignolo (2000) and Gomez-Ibanez and Rodriguez-Pardina (2001a,b).

Transmission charges were to be reviewed every 5 years by ENRE. Transener hold the national transmission concession and faced their first five year renewal in 1998, of which more detail later.²² The basis of the regulation was to be incentive based regulation of the required revenue of the transmission company such the regulated revenue would be fixed in real US dollars and subject to an annual efficiency adjustment.²³ This approach was borrowed from the UK and indeed Transener was part owned by the UK's National Grid Company from 1993 to early 2004.

However Argentina followed a new approach to large transmission expansions: the so called 'Public Contest' mechanism.²⁴ Transmission expansion was to be determined by negotiated third party access. However, the methodology used to determine the "beneficiaries" of a new transmission line and what are the percentage levels of the benefits of the various beneficiaries seems to be based on energy usage, rather than on economic or market benefits-- once new lines were built payment was to be on the basis of energy usage, those whose power went down the line would have to pay for it, independently of how the line affected their overall financial position. Since this methodology sets the payments that the "beneficiaries" are required to make towards the costs of constructing a new line, predictably significant problems arose from the unwillingness of some parties to any more for new facilities than they expect to gain from the facilities in economic benefit. Equally or more significant, is the danger that a proposed new line is actually not a worthwhile investment, or not the best choice of an investment, or not a well-timed investment. There is also the allied danger that a desirable project would be missed, because those to whom the project might bring the most benefit would be unable to pay accordingly for an assured portion of its services. It seems that some of these problems arose in the context of the issues surrounding the delayed decision to construct a "Fourth Line" which was to bring additional power to Buenos Aires from the south which we discuss further below.

Transener was not responsible for system planning merely for operation and maintenance of existing lines. Proposals for new lines could be made and subjected to a vote of all the effected users. If 30% of the users affected by the new line voted against the line then it would not go ahead. This procedure was particularly important when considering major transmission lines linking the hydro and gas plants in the south to the load centre in Buenos Aires.. Lines approved under this mechanism would be subject to competitive tendering. CAMMESA also administered a fund, which collected the transmission congestion rents accruing on congested lines (the difference between the prices received by constrained generators and the prices paid by constrained custo mers). Contracts for specific capacity expansions would be issued when the individual constrained lines had collected enough rents to pay for a capacity expansion.

²² For a discussion of the regulation of Transener see Gomez-Ibanez and Rodriguez-Pardina (2001b).

²³ The efficiency adjustment cannot exceed 1% per annum or cumulatively 5% throughout the review period.

²⁴ For discussions of the transmission expansion regime in Argentina see Abdala and Chambouleyron (1999), Gomez-Ibanez and Rodriguez-Pardina (2001c), Gomez-Ibanez and Rodriguez-Pardina (2003) and Littlechild and Skerk (2004a, b).

Electricity distribution in the Greater Buenos Aires area is regulated under concession contracts. These asset concession contracts are for 99 years, with prices subject to review every 5 years, at which time the distribution tariffs for regulated customers were to be reset following assessment by ENRE under the principles of incentive regulation. Under the concession contracts electricity distributors were responsible for bill collection and were given strong incentives to reduce energy losses. These were initially very high due to a combination of technical inefficiency and theft. Third party access charges to the distribution network are not regulated and are subject to negotiated third party access. For regulated customers (which include all residential customers, small commercial and small industrial customers) the regulated electricity tariff can be adjusted every three months. The basis of this adjustment was the seasonal energy price, which is set every 6 months.²⁵

The seasonal prices are based on estimates of prices calculated by CAMMESA; these can be altered after 3 months by the Secretary of Energy if there are significant differences between the actual prices and estimated prices within the period. The energy price faced by each distribution company is determined according to nodal factors. The capacity price faced by distributors is based on the a fixed monthly payment based on the actual power contracted by the distributors during the capacity charging period and the total forecast payments during the 6 month period which the generators are due to receive for capacity. Final prices for regulated customers were a combination of the seasonal energy and capacity charge and transmission and distribution value added charges. Distribution charges could be reset every 5 years at the request of the companies but no request came in 1997 and so the next opportunity for a price review was to be in 2002. No review has yet been conducted following the macroeconomic crisis. Other provinces have their own system of regulation of distribution but their distributors pay for energy for regulated customers using the same seasonal price formula and most have based the regulation of final tariffs on the principles set out in the 1992 Electricity Law. By 2000 around 25% of provincial electricity distribution was privatised (e.g. in Cordoba and Mendoza).²⁶

The regulatory agency, ENRE, was made responsible²⁷ for: protecting users rights; promoting competition in production and encouragement of long term supply; promotion of open access in transmission and distribution; regulation of transmission and distribution tariffs; promotion of efficiency and encouraging investment. In contrast to the situation in Chile where the activities of the regulatory agencies were sharply prescribed ENRE was tasked with producing a large number of regulations to do with: security and safety and quality standards and the basis for tariffs and the awarding of concessions.²⁸ ENRE was therefore to be left to develop appropriate methodologies to set the regulated distribution tariffs and the regulated transmission tariffs. In transmission they did this in the 1998 price control for Transener and were working on the methodology of assessment for the distribution companies price review. Between 1992 and 2001 ENRE issued no less than 131 resolutions concerning the regulation of the

²⁵ See Vignolo (2000, pp.11-12).

²⁶ See Vignolo (2000, p.15).

²⁷ Law 24,065, Article 2, on Electricity Law Objectives for ENRE.

²⁸ Law 24,065, Article 56, on Functions and Capabilities of ENRE.

electricity sector.²⁹ In 2003 ENRE seemed well resourced with 158 staff, of which 87 were professional staff (15 were economists).

The governance of the electricity sector in Argentina established in 1992 maintained a large role for the Secretary of Energy.³⁰ He heads the board of CAMMESA and he appoints 3 of ENRE's 5 directors. He monitors the two remaining state owned hydroelectric plants (Yacyreta and Salto Grande) and the state owned nuclear power company (Nucleo Electrica). He also sits on the Federal Electricity Power Council (CFEE) which has responsibility for the management of the National Energy Fund. ENRE has responsibility for dispute resolution in the sector but in the event of disputes with ENRE the Secretary of Energy arbitrates. The provinces via the Federal Electricity Power Council appoint ENRE's two remaining directors. The Secretariat of Energy has majority ownership of the National Transmission Dispatch agency (DNDC) for which CAMMESA has the management.

The initial privatisations attracted a large amount of foreign interest with many of the firms passing into foreign ownership soon after the initial offering. An estimated 30 foreign companies have investments in the Argentine electricity sector.³¹ The generation market has seen significant amounts of new entry by foreign utilities and investment by incumbent utilities. AES of US, Endesa of Spain and Total Fina Elf of Europe are major players in the generation sector. Transener was taken over by a consortium lead by the British company, National Grid. In distribution Edesur was taken over initially by Enersis of Chile and then Endesa of Spain, Edelap by AES and Edenor by EdF of France. Ultimate parent firms do control both distribution and generation companies but usually with less than 100% shares in both companies.

The initial generation market had low a concentration ratio. The market shares of the leading firms have increased since 1992 but the market remains less concentrated than most European and North American markets. The Herfindahl Hirshman Index of concentration (HHI) was 708 in 2002 in terms of energy sold to the wholesale market by business unit (though the HHI was 1589 when cross-share holding is accounted for).³² In transmission there was a long running attempt to gain approval for a fourth major transmission line from the Comahue region in the south to Buenos Aires.³³ This line was initially proposed in February 1995 with a capacity of 1000 MW at a cost of \$200m USD. The beneficiaries would have been seven generators in the Comahue region supplying Greater Buenos Aires who frequently faced transmission constraints. However more than 30% of the pool of beneficiaries voted against the proposal even though a social benefit analysis would have indicated that it was clearly in the national interest. Eventually a negotiated agreement was reached which involved a much cheaper upgrade of the existing lines and a new plan approved in September 1996. The new capacity

²⁹ See Rodriguez-Pardina (2004).

³⁰ See Rodriguez-Pardina (2004).

³¹ See CAISE (2002, p.8).

³² Source: ENRE. ENRE also find that the economic group HHI increases from 1446 in 2000 to 1589 in 2002.

³³ See Abdala and Chambouleyron (1999).

became available in 1998. The problems of the veto system thrown up by the fourth line negotiation lead to a radical proposal for a system of transmission capacity rights.³⁴ This was approved by the then Secretary of Energy just before the end of the Menem government but was never enacted.

There have been two major attempts at revising the 1992 Electricity Act in 1999 (Resolution 545 of 1999) and in 2001 (Decree 804 of 2001).³⁵ Both of these were subsequently overturned and were not put into place. We will make some reference to their proposals in what follows. The major event affecting the sector has undoubtedly been the macro-economic crisis (and the government reaction to it). Regulated electricity tariffs, as we have seen, were pegged to the US dollar. In the February 2002 when the peso was allowed to follow freely all prices within the sector were delinked to the US currency and fixed in nominal pesos. This has effected the capacity payment in the power market, which is the one specified price in the market. The fuel prices from which energy prices are calculated have been affected by pesification in the gas market, where the price of gas from ENER GAS has been fixed in pesos. This has limited the impact of pesification on the peso energy price. Regulated transmission and distribution charges have been converted to pesos. The impact of this on the electricity sector, as in most privatised sectors, has been profound. Most electricity companies are showing large losses on their original (US dollar based) capital investments, leading to the collapse of new investment and significant non-payment risks. These arise from the increase in bad debt among final electricity customers and the fact that spot prices for generated electricity are not being fully passed through to regulated customers running down the reserve funds of CAMMESA and requiring the government to loan CAMMESA money.³⁶

Currently (mid 2004) the concession contracts and final prices are being renegotiated by the government but there is no sign of a deal. This inability to reach an agreement to raise prices to economic levels has had serious consequences which were easy to predict, especially when combined with lower than normal hydroelectric availability. Low electricity prices have led to a rapid growth in electricity demand. Underlying demand growth is running at 8.7% p.a. and July 2004 total was 6% above the pre-crisis monthly peak (December 2000).³⁷ Since the beginning of the year capacity shortages have led to cuts in supply to industrial consumers. In April there was a serious power loss in the Buenos Aires area which led to the network operating at lower than normal voltage. In March the government unilaterally cut gas supplies to Chile by 15%³⁸ in order to raise the

³⁴ See Gomez-Ibanez and Rodriguez-Pardina (2001c).

³⁵ See Rodriguez-Pardina (2002).

³⁶ The government had loaned CAMMESA around \$250m by July 2004 in order to compensate generators for the difference between what distributors are paying in respect of regulated customers and spot prices (See 'Argentina Grants Electric Grid Operator New ARS300M Loan', *Dow Jones International News*, 2 August 2004).

³⁷ Source: CAMMESA website.

³⁸ This action violated the 1995 Energy Integration Treaty between the two countries. This treaty states that supplies can only be cut in proportion to the energy shortage within Argentina. This would have

amount of gas available for consumption in domestic power plants and exports of electricity to neighbouring countries have been restricted. Such actions have not addressed the fundamental problems facing the sector since the crisis but have served to worsen international relations in the region.³⁹ Economists now estimate that Argentina's growth rate will be up to 2% lower as a result of the shortage of electricity.⁴⁰

The government has announced a package of measures aimed at addressing the energy crisis.⁴¹ This included a timetable to raise the industrial price of electricity to the competitive level within 18 months (prices have already begun to rise) and an incentive scheme for domestic users of electricity. The incentive scheme will see the marginal price of electricity rise by 50% for units in excess of 95% of the previous year's consumption. These measures form part of the 'Integral Energy Plan', published in May 2004, which includes price rises for domestic natural gas and plans for a state energy company to facilitate investments in fuel production and transportation infrastructure. There are also suggestions that the state may invest in new hydroelectric and nuclear facilities.

The magnitude of the macro-economic shock makes it difficult to believe that the majority of the problems experienced by the sector since February 2002 could have easily been avoided. However the inaction of the government does seem to have prolonged the financial stress of the electricity sector and led to operational problems which could have been avoided. Our review of the lessons from the Argentine electricity reform will mainly focus on the lessons of the period 1992 to 2001.

3. The Performance of the Argentine Electricity Sector since 1992

In this section we report some indicators of performance of the sector over the reform period. The areas, which we look at, are those that relate most directly to the social welfare effects of the reform and those indicators that are most important in a developing country context. Detailed information can be found in the information appendices. There are some papers, which attempt to measure the overall welfare effects of the Argentine

implied a 5% cut in gas supplies (See 'What sort of neighbour is this?', *The Economist*, 15th May 2004, p.34).

³⁹ Restricted Argentine gas supplies have led Chile switch to expensive fuel oil for electricity generation and have put pressure on its transmission network as changing plant availability have reconfigured power flows across its power grid. Argentina has agreed to import more gas from Bolivia. However the Bolivians have an old border dispute with Chile which has led them to stipulate that none of the extra imports be used to increase the flow of gas to Chile. (See *The Economist*, 15th May 2004, op.cit.)

⁴⁰ See Adam Thomson, 'Argentina's lights grow dim as energy crisis hits home', *Financial Times*, 5th April 2004, p.7.

⁴¹ The crisis applies to the gas sector as well, where low gas prices have encouraged switching of cars from gasoline to natural gas. Up to 30,000 cars a month are being converted to use gas. This has exacerbated the shortage of gas for electricity generation (See 'The laws of economic bite back', *The Economist*, 24th April 2004, p.35). For details of the 'Integral Energy Plan' see

privatisation program (including electricity). These studies do find significant overall welfare benefits from privatisation.⁴²

3.1 Investment

Between the beginning of 1992 and the end of 2002 the installed capacity in the main MEM system expanded from 13,267 MW to 22,831 MW (4.9% p.a.). The capacity of the MEMSP system was only 778 MW at the end of 2002. The reserve margin was 46% at the peak in 2002 (highest demand divided by available capacity). The expansion of generation capacity was achieved by privately owned operators and while keeping prices low. The number of units delivered increased by 45800 GWh to 72106 GWh from 1992 to 2002 (4.6%). The total investment was around \$7.5bn in fixed assets between 1992 and 2002.⁴³

In transmission the route length of transmission lines in the main MEM system expanded from 16,958 km to 22,140 km (2.7% p.a.) between 1992 and 2002.⁴⁴ In distribution the total number of electricity customers was 9.835m in 2001. Of these the number in the two largest SEGBA successor companies was 4.34m in 2002, this was an increase of 11% from 1993. This includes the effects an ambitious plan to connect 650,000 shanty town households to the electricity network between 1994 and 1998 via collective meters that achieved its objectives over the period.

By the standards of other developing countries this is a very good investment record.

3.2 Prices

Currently electricity prices in Argentina are the lowest in Latin America and extremely low by world standards.⁴⁵ In May 2002 residential tariffs were just 2.5 US cents per kWh for a residential consumer compared with 9.8 cents a kWh in the US, while industrial tariffs were a mere 1.3 cents per kWh (against 5.9 cents in the US). This reflects the effect of pesification on the sector. Prior to the crisis the comparable prices were 8.9 cents and 4.8 cents per kWh. These prices reflected the significant amount of hydro in the Argentine generation mix (33% of total capacity) and the efficiency improvements seen in the generation sector since 1992.

Figures 5 to 8 show the evolution of tariffs in the Greater Buenos Aires Area compared with those under SEGBA.⁴⁶ It is clear that the pricing mechanism eliminated the large fluctuations in the real value of tariffs seen in the 1980s. It also led to a fall in the average real tariff from 9.1 cents per kWh to 6.4 cents per kWh (29%). Figure 6 shows that this fall is almost entirely explained by the fall in the cost of wholesale power in the

⁴² See for example: Delfino and Cesarin (2003), Chisari et al. (1999) and Benitez et al. (2003). The latter two papers also show that effective regulation which transfers benefits to consumers reasonably quickly will significantly raise the benefits from privatisation.

⁴³ Source: CAISE (2002, p.4).

⁴⁴ CAMMESA Annual Report 2002, p.74.

⁴⁵ See CAISE (2002, p.15) for evidence on the impact of crisis on relative tariffs.

⁴⁶ Figures are taken from Devoto and Cardozo (2002).

MEM, where as Figure 7.1 shows the nominal US dollar price of energy fell 70% pre-crisis. Figure 7.2 also shows the government's political problem: the real peso price of electricity is almost constant comparing before and after the crisis. This implies that raising the price of electricity to reflect international prices of gas and to recover rates of return on investment will necessitate sharp relative price rises for electricity. While industrial customers benefited disproportionately from the falls in the wholesale price pre-crisis Figure 8 shows that the average captive customer saw their price decline from 9.1 cents to 7.8 cents per kWh (14%). Though among captive customers the smallest residential (making up around 38% of total customers) customers on Tariff T1-R1 saw their prices rise by 25%.

3.3 Financial Performance

The low price of electricity and high rates of investment in the sector prior to 2002 were accompanied by strong financial performance by the companies involved. Financial performance in the SEGBA had been very poor prior to its reorganisation. After privatisation the average post-tax rates of return on shareholders' funds in generation were 4.6% in 2000⁴⁷, though they appear to have been higher in previous years. And in transmission Transener's post tax rate of return on equity was 6.8% in 2000.⁴⁸ Among the distribution companies rates of return on equity were rather higher: Edenor and Edesur earned post tax rate of returns on equity of 10.9% and 9.5% in 2000⁴⁹. These rates of return are respectable by international standards but look low given the country risk associated with Argentina. In Transener's price control review of 1998 the country risk premium was estimated to be 4.89%p.a. in real terms.⁵⁰ It seems clear that investors were not getting this return in generation before the crisis. One can therefore question whether financial performance was satisfactory in this period and whether investors original investment levels were rational given subsequent returns.

The macro-economic crisis has caused returns to fall in 2002. Electricity prices fixed in pesos, while most debts were denominated in US dollars⁵¹. This resulted in widespread defaulting on debt payments and significant losses of shareholder value. Transener had a loss of 121% on shareholders equity.⁵² This reflected a sharp decline in income as a result of the crisis and exchange rate losses on debts. Distribution companies also posted big losses.⁵³ Edenor had a 30% loss on start of year shareholders' equity in 2002 and Edesur had financial losses amounting to 13% of start of year shareholders' equity.⁵⁴ Generation

⁴⁷ Net income divided by Net Worth for a sample of four generation companies (Central Puerto, Central Termoelectrica Buenos Aires, Central Costanera and Central Termica Guemes). Data taken from accounts and summary financial statements available at www.cnv.gov.ar.

⁴⁸ Net income divided by Shareholders' Equity (see Transener Annual Report 2001, p.3).

⁴⁹ Net income divided by Shareholders' Equity (see Edenor Financial Statement 2003, English Translation, p.44 and Edesur Annual Report 2003, p.39).

⁵⁰ See Gomez-Ibanez and Rodriguez-Pardina (2001b, p.13).

⁵¹ External debts of the electricity sector were \$4.3bn at the end of 2001 (CAISE, 2002, p.21).

⁵² Transener Annual Report and Financial Statements 2002, p.69.

⁵³ Estache (2004) discusses the theoretical effects of pesification combined with a tariff freeze on distribution company profits.

⁵⁴ Edenor Annual Report and Financial Statement 2002, p.2.

companies announced significant losses for 2002.⁵⁵ Foreign currency investors saw the foreign currency value of their remaining shareholder funds decline by at least two thirds. The UK's National Grid sold its stake in Transener for less than 10% of its pre-crisis investment value in March 2004.⁵⁶ Electricity firms pointed out that at current price levels new investment was not profitable and supply shortages were likely in the near term if low prices continued (CAISE, 2002).

3.4 Efficiency Improvements

The falls in prices and moderate rates of return reflect large efficiency improvements in the industry. Employment in SEGBA and its successor companies fell, from 21,535 in 1987/90 to 7,945 in 1997, a fall of 63%.⁵⁷ This overall improvement reflects a large decrease in generation plant unavailability from over 50% to around 20% in just 5 years as well as labour efficiency improvements in both generation and distribution.⁵⁸

Figure 9 shows the sharp improvement in generation plant availability. Figure 10 shows that labour productivity in Endesa Argentina (the second largest generator in 2002) improved from 13 to 35 GWh generated per employee between 1995 and 2000. Figure 11 shows sales per employee in the two largest distribution companies improved from less than 2 GWh in 1993 per employee to 5.7 GWh per employee in 2001. These numbers compare very favourably with experience in the UK where labour productivity improved by less over a longer period.⁵⁹

3.5 Shanty Town Electrification

A notable initial success in Argentina has been the regularisation of connections and payment for the large numbers of shanty town dwellers in the Greater Buenos Aires area.⁶⁰ Beginning in 1994 the central government embarked on an ambitious plan to put in regular metered electricity connections to shanty town areas. The three incumbent electricity companies were given capital subsidies to connect the poor customers and did so at a very rapid rate. By end of 1998 650,000 new customers had been added under this

⁵⁵ Total Fina Elf report a 431m Euros loss in Argentina in 2002 (Total Fina 2002 Form 20-F), Endesa Argentina a \$454m loss in 2002 (Endesa Annual Report 2002, p.72-3).

⁵⁶ 'LATIN AMERICA: National Grid to exit Argentina's Transener with sale to local fund', *Platts Global Power Report*, 25 March 2004.

⁵⁷ See Ennis and Pinto (2002, p.50).

⁵⁸ Benitez et al. (2003, p.4) report electricity generation and distribution efficiency gains from date of transfer until 1999: the reduction in the share of intermediate purchases as a share of gross value added fell by 17.2%, while in distribution the figure fell by 5.5%. In terms of labour productivity, GWh per employee rises by 17.4% for generators and by 31.5% for distribution companies over the period from transfer date to 1999.

⁵⁹ Newbery and Pollitt (1997) find that for the CEBG (responsible for generation and transmission of electricity in England and Wales labour productivity increased from 4.7 GWh generated per employee to 10.4 GWh generated per employee over the period 1985-86 to 1995-96. Domah and Pollitt (2001) found that in the distribution and supply businesses of the 12 regional electricity companies in England and Wales labour productivity increased from 2.5 GWh sales per employee in 1985-86 to 5.5 GWh sales per employee in 1997-98.

⁶⁰ See Bouile et al. (2002).

scheme. The percentage of the poorest income decile households in Greater Buenos Aires area with electricity had risen to 99% in 1996/97 from 65% in 1985/86.⁶¹ This had a positive impact on the social welfare of these households as they often wanted electricity for heating and for pumping water. Non-payment was reduced as payments were regularised and as local governments began to pay for the very poorest customers usually via municipal meters which recorded aggregate consumption for up to 1000 households.

3.6 Quality of Supply

Quality of supply has improved overall within the Argentine electricity sector since 1992. Technical and non-technical losses have fallen sharply. The reduction in losses is shown in Figure 12. For the utilities in the Greater Buenos Aires area the number of hours of supply lost per year was 21 in 1988, 16.8 in 1993/94 and dropped to 5 in 2000/01.⁶² This reflects significant improvement in metering and bill collection to reduce non-technical losses (i.e. theft). However it is worth noting that the recent macroeconomic crisis has been accompanied by a small upturn in the measured losses, possibly due to a combination of increased theft, under-investment and fundamental supply shortage.

Power outages in the transmission system have fallen since privatisation. In the Transener transmission system the rate of own failures per year was 1.48 in July 1994 and was 0.57 in 2002 well below the limit of 2.50 set in the concession contract.⁶³

3.7 Major Problems

The Argentine electricity system has operated successfully at the national level for the 12 years since the restructuring of the state owned system. This is in spite of the recent macro-economic crisis, which has disrupted the basis of the payment arrangements within the sector. The most serious problem the system has actually had was the infamous Edesur incident in 1999.⁶⁴ This was a serious power blackout in the city of Buenos Aires, which was handled badly by the private company involved and did much to damage the local reputation of privatisation. The incident shares some similarities with the Auckland Crisis of February 1998 when the centre of Auckland was without power for three weeks.

During the early morning of February 15 there was a fire in a new substation as it was being energised. This resulted in 156,540 customers being without power. By that night 60,000 customers were still without power. It was not until February 24 that the last customer was reconnected. The situation was poorly handled by Edesur, who continually promised that the problem would be solved imminently. The blackout occurred during some of the hottest days of the summer and led to street protests. Edesur compounded the bad impression left by the incident by their subsequent initial reluctance to fully indemnify losses. Eventually a fine of \$51m dollars was imposed on the company by the

⁶¹ See Ennis and Pinto (2002, p.30).

⁶² See CAISE (2002, p.17).

⁶³ See Transener Annual Report 2002, p.21.

⁶⁴ For a full description and analysis of the incident, see Ullberg (2002).

regulator because of the seriousness of the blackout and the total cost after compensation payouts reached around \$80m.

Since then there have been other serious incidents but these have not attracted the same level of fine as the Edesur incident.⁶⁵ There have also been suggestions that recent power outages caused by shortage of capacity have been caused by strategic under-investment by electricity companies in generation, transmission and distribution. There seems little evidence of strategic under-investment but plenty of evidence that prices are much too low to justify any additional investment in capacity to increase quantity or quality of supply.

4. Detailed Lessons from the Reforms of the Argentine Electricity Sector

We discuss the reforms in detail looking at the issues under five headings: generation, transmission, distribution and retailing, practice of regulation and general institutional framework. In our view the picture that emerges is one a system which has worked well and significant benefits since its inception. In 1992, the design of the electricity market drew on best practice design experience at the time. In the 2003 the system continues to function well in spite of an enormous macro-economic shock. We examine the Argentine experience in the light of best practice as it currently stands. To summarise these under each of our five headings:

- A. Generation markets work best when characterised by a lack of integration with monopoly transmission and distribution networks, low degrees of concentration in the price setting segment of the market and when generators freely contract with customers.
- B. Transmission systems need appropriate regulation of incumbents to ensure both fair prices and an adequate rate of return on investment. In a relatively well developed transmission network there needs to be some institution charged with proposing and overseeing system wide planning to ensure timely building of new transmission links.
- C. Distribution companies need to be regulated to ensure that distribution charges both incentivise efficiency and are fair. Third party access charge regulation is essential to ensure efficient financial bypass of the distribution network by customers free to choose supplier. Supply competition is itself feasible for all industrial and commercial customers and has been successfully implemented for residential customers in some countries.
- D. Economic regulation of the electricity sector is best practised by a single independent regulatory agency with minimal ministerial control. Statutory duties to ensure adequate planning of future demands in the sector can be effectively delegated to this body. Output based regulation using appropriate quasi-market mechanisms can deal with issues of quality of supply, network extension and consumer cross-subsidy which are the areas most subject to political interference.
- E. The general institutional environment in which the electricity sector is placed must be stable and foster long-term investment based on protection from arbitrary changes in

⁶⁵ See for example 'Government could fine Edesur for power cuts', *Business News Americas*, 3 February 2004.

government policy. Legislation regarding the electricity sector should be credible and sustainable. However there should be the capacity for the regulation regarding the system to respond to new information. The ability of the regulator and the Independent System Operator (ISO) to do this requires clear and quick dispute resolution/review mechanisms especially in the case of disputes between companies and the regulatory agency. Given the technical nature of many of the issues this should involve specialist arbitration panels perhaps under the authority of the general Competition Agency.

4.1 The Generation Sector

The Argentine electricity system illustrates the potential for larger developing countries to operate competitive power markets. Argentina's power market has successfully delivered low prices and reasonable rates of return for investors prior to the macro-economic crisis. There have been no problems of the strategic exploitation of market power due to both the cost based bidding system and the degree of competition in the market which has meant that generators have in general not even bid up energy prices to the maximum price allowed for their technology.⁶⁶ There has been significant new entry and so far the market share of the largest four firms has remained lower than in 1991. The system of independent system of operation and dispatch has worked well and supported the market.

The vertical separation of electricity generation from both transmission and distribution created a vigorous competitive market for industrial customers. Argentina learnt well the negative lessons from Chile about the need to separate electricity generation from both transmission and distribution. In Chile the continued integration of Endesa generation and transmission combined with negotiated third party access created hold up problems for other generators. This has not been a problem in Argentina where generation and transmission are legally separate. Similarly in Chile integration of Endesa generation and Chilectra distribution has made it difficult for other generators to compete for large customers embedded within the Chilectra distribution network. In Argentina these hold-up problems did not exist and there have been no incentives for distribution companies to prevent efficient financial bypass of their network. The result has been a very competitive market for free customers, where a significant percentage have left their local distribution company in the Greater Buenos Aires area.

Price based bidding could have worked in Argentina whereas the actual cost bidding system was flawed. There is little evidence of market power being exercised in the generation market, this may have been because of the way the capacity payment was paid. Generators did not get capacity payments for availability, as theory would suggest. Instead they received capacity payments when they were actually running during the non-valley hours. This gave generators an incentive to underbid on their energy cost in order

⁶⁶ Ferreira (2002) finds that firms are not exploiting any market power within the Chilean market at the end of 2000. The prices which prevail in the market are equal to those which a social planner would choose if she were determining which plants were dispatched.

to ensure that they got to run their generating plants. This may have led to plants running out of merit order and could easily have been corrected by given capacity payments for availability. An alternative approach would have been closer auditing of energy costs.

The Argentine energy market was very competitive unlike that in Chile, where simulations suggest that price based bidding would have led to much higher prices.⁶⁷ It is clear that a price based bidding system could have worked under the competitive situation of the Argentine market. Price based bidding systems, in theory, provide better signals for long term investment as dispatch is on the basis of the scarcity value of electricity rather than on the basis of current costs. Such a system would have reduced the transaction costs and scope for cost based gaming in the current system. The gains from switching to this system would initially have been small but might have provided less scope for government interference. It is interesting to note that the proposed reform in 1999 (Resolution 545) did include a provision for day ahead price based bidding in the energy market⁶⁸; the 2001 reform also included a provision for a move to price based bidding.⁶⁹

The long term contract market was negatively affected by the seasonal price that distribution companies paid for power. Distribution companies could only pass through the seasonal price of electricity, which was an expectation of the spot price. This left little scope for a meaningful long-term contract market between generators and distributors. Distributors would never wish to pay a price higher than the seasonal market and on average generators would only be interested in long term contracting if they could get a price greater than the average spot price. In the situation when the spot price was falling, as it was for most of the 1990s, distributors would be happy to purchase power spot. The absence of long term contracts is worrying in that long term contracting and price signals reduce the future supply shortages by providing signals of future scarcity. A lack of long term contracting in the Californian electricity market was one of the key reasons for the financial problems experienced by electricity distribution companies during the 2000-01 power crisis.⁷⁰ The unwillingness of distributors to sign long term contracts in the context of a developing country with high and variable demand growth can expose the sector to unnecessary power shortage risks.

Recent increases in concentration in generation and mergers between distribution and generation are worrying. The initial structure of the Argentine market in terms of horizontal and vertical disintegration was extremely favourable to the operation of a successful liberalised market. Recently concentration has been allowed to increase in the generation market, partly because of the need to improve the financial viability of generating companies in the macro-economic crisis via merger. For example, AES has been selling generation assets to Total Fina, the largest generator. Edelap, the smallest of the distribution companies in Greater Buenos Aires, is part of the AES group.

⁶⁷ See Arellano (2003).

⁶⁸ For the text of this resolution see <http://infoleg.mecon.gov.ar/>

⁶⁹ For the text of this decree see <http://infoleg.mecon.gov.ar/>

⁷⁰ See Sweeney (2002).

There is a lot of cross shareholding across generation and distribution. EdF now has share holdings in Edenor and in some hydro power plants and Endesa of Spain has shareholdings in Edesur and Endesa Argentina (in generation). Such mergers have been motivated partly by the macro-economic crisis, which has reduced the price of electricity assets for foreign owned companies and allowed them to acquire assets cheaply. It has also been motivated by incentives to improve quality of supply on distribution companies who can reduce the penalties for failures in the transmission system by investing in nearby generation. Such changes in market structure will hamper the operation of both the market for wholesale power, increasing the potential for market power and lessening the benefits of a move to price based bidding. It will also reduce the effectiveness of competition for free customers embedded within distribution networks.

Recent changes in the nature of the bidding and payment rules of the power market have been arbitrary and unnecessary. The crisis has led a number of attempts by the Secretary of State to reduce the payments crisis problems within the electricity sector by interfering with the way the market price is determined. Such moves have had incentive properties and threaten the orderly nature of trading observed in the market since 1992.

One example of an arbitrary change was to remove fuel oil plants from the calculation of the system marginal price. Thus the merit order was determined as normal but only the most expensive fuel oil plants on the system receive the true system marginal prices, other plants received the lower price which would have prevailed in the absence of the fuel oil plants being required. This change had the effect of reducing the amount of money required to pay the generators within the context of fixed regulated prices. These sorts of interventions do not change the overall revenue going in to the sector but change the distribution of that revenue between generators and distributors.

4.2 The Transmission Sector

The system of regulated third party access charges for existing transmission lines did successfully ensure the revenue adequacy of the transmission operator. In contrast to Chile there were no problems of non-payment for particular existing lines in Argentina. Transener received enough revenue during the pre-crisis period to meet its concession obligations and to improve the quality of its service. There was no problem of poor incentives to maintain certain sections of the network which were not being properly remunerated.⁷¹

The system of competitive tendering for new lines was successful. As in Chile, where a similar system exists, Argentina obliged all new public transmission investments above \$2m to be competitively tendered. This implied that the incumbent transmission companies did not have a monopoly on new lines in their areas. Between 1992 and 1997 there were four competitive tenders for nearly 2000 km of new lines. The first three attracted new entrants, the final one was won by Transener. Littlechild and Skerk (2004a)

⁷¹ See Gomez-Ibanez and Rodriguez-Pardina (2001b).

note that these tendering processes seem to have been competitive and have led to significantly reduced construction costs.

The Argentine system implemented an untried model of transmission expansion, which proved controversial. The ‘Public Contest’ mechanism of transmission system expansion was accused of being biased against investment in transmission. This was because if new lines were built every one who used the line would have to pay for it independently of how it affected their net revenues. If 30% of users objected on the basis of this charging mechanism then it would not go ahead. If the line was built under a direct contract between a transmission company and beneficiaries of the line there were other potential problems (this was the ‘Contract between Parties’ method). In this case as new line access rights would belong to those who paid for the line, it might be worthwhile to free-ride on the initial investment of others. This is because new users of the line might be able to pay just marginal usage costs.

The building of the fourth line from the Comahue to Buenos Aires illustrates the controversial nature of the ‘Public Contest’ mechanism for building new lines.⁷² Seven generators were due to benefit from the line in terms of energy benefits. However two of the generators were closer to Buenos Aires than the others. This meant that they were able to benefit from higher nodal prices when the line from further away from Buenos Aires was constrained. The new line would have relieved the transmission constraint facing the other 5 generators but reduced the local energy price facing the first 2 generators. Hence these two generators voted against it. They were joined by some distributors who did not want the amount of power that they bought from further away from Buenos Aires to increase. This was because they would not benefit from the reduced price of power (as this was passed through to customers) but they would face higher risk of transmission system failure and associated supply failures. In theory side payments were possible but in practice companies were very unlikely to pay them given that exerting political pressure to change the system was always an alternative to actually making such payments.

The failure to initially agree on the building of the fourth line has been seen by many in the industry as evidence that the ‘Public Contest’ mechanism was flawed. Proposals for National Transmission Plan were promoted as a consequence of the perceived problems with the ‘Public Contest’ mechanism. However Littlechild and Skerk (2004a) suggest that the evidence for such a position is weak. In particular they find that *at best* the decision to build the line was a marginal one. The line was eventually built some 18 months later than under the initial proposal. This implies that even if the benefits were positive the costs of delay were small. They also make the important observation that the voting system was successful in reducing the number of unnecessary transmission investments motivated by political interests. This had been a problem prior to privatisation, as regional governments lobbied for upgraded transmission links paid for by the system as a whole (and has re-emerged as a problem recently). Littlechild and

⁷² For details of the negotiations around the building of the fourth line see Abadala and Chambouleyron (1999) and Littlechild and Skerk (2004a). For proposals for alternative negotiation mechanisms see also Chisari, Dal-Bo and Romero (2001).

Skerk also note that a delay of a year and a half is small compared to delays in the planning process for major transmission upgrades in Europe and North America.

A system of system wide planning is desirable and necessary in a developing country context. In a developing country large and timely transmission expansions are important to meet the demands of electrification and rapid economic growth. In advanced countries with very low demand growth nodal pricing on the meshed transmission network may be a good way to price existing transmission capacity and may give good signals for transmission expansion along existing pathways. In developing countries with linear transmission systems merchant transmission expansion may be successful, as it generally was in Chile. This is because loop flows do not complicate the allocation of benefits. Such systems are unlikely to work well in rapidly growing meshed systems.

System wide planning in a meshed system is useful for identifying transmission expansions that should go ahead especially in the light of expected rather than actual demand growth. In Argentina it would seem sensible that one institution is charged with producing a transmission expansion plan and given some power to commission new lines. Allowing private companies alone to decide on transmission lines with important implications for the location of future economic development (and significant loop flow effects) is unlikely to lead to socially optimal (or indeed politically acceptable) outcomes. The case of the fourth line from Comahue to Buenos Aires, discussed above, illustrates this. Although the decision may have been marginal on economic grounds it would seem sensible to have a system which is, if anything, biased slightly towards transmission expansion, rather than against it. In suggesting this it is important to stress that the power to plan and implement transmission investments can be separated from the actual building of new lines. Incentives need to be in place to ensure that the system planner does not benefit unduly from over expansion of the transmission network and that alleged wider social benefits are evaluated systematically.

The current proposal for a National Transmission Plan to be produced by Transener needs to build in effective regulatory oversight of proposals. The problems raised by the building of the fourth line have lead the government to propose a National Transmission Plan which does provide for system wide planning lead by Transener. Indeed in December 2003 a plan for certain named transmission investments was approved (Law 25822). A regular national plan needs effective regulation to avoid being biased in favour of too much investment. Proposals need to be audited to ensure that they are necessary and effective incentives need to be put in place to ensure that new lines are built at least possible cost. The danger in the context of Argentina is that unless these are genuinely independently regulated the process of approval of transmission investments will become unduly politicised. This could lead to speculative expansions of the transmission network to politically valuable regions and with the costs being spread among all customers.

In the UK, centralised planning of capacity expansions is carried out by Transener's former parent company, National Grid, and capacity expansions are subject to external audit by consulting engineers commissioned by the energy regulator, Ofgem, as part of

the 5 year regulatory review process. Some equivalent process, with appropriate provision for the objective valuation of regional development benefits, should be required in Argentina under a centralised planning system. Worryingly, the current transmission investment law specifically exempts the proposed investments from regulatory review.

The regulation of Transener was subject to political interference and did not work well. There were problems with both the setting of the regulated revenue for Transener during the 1998 price review.⁷³ ENRE had responsibility for carrying out the review and carried out a detailed assessment of Transener's cost requirements. They concluded that Transener should face a significant revenue reduction and rebalancing of its charges. Transener subsequently appealed the ENRE decision to the Secretary of Energy. The government minister overturned the ENRE decision and increased the regulated charges. This process of events involved considerable lobbying of the Secretary of Energy by Transener and was not good for the cause of independent regulation in Argentina. Transener was the first price review it conducted and it worked hard to do a thorough job. The regulatory process should have involved the possibility of an appeal to the Competition Commission not to a politician. However for this to be effective the regulatory institutions (including the Competition Commission) need to be subject to reduced political interference. We discuss this further in section 4.5.

4.3 The Distribution and Retailing Sector

There is a need for a proper regulation of the third party access charge in order to correctly regulate the access to the monopoly distribution network by third party suppliers. In a competitive retail electricity market proper regulation of third party distribution system access charge is essential. This charge needs to be set in such a way as to encourage efficient financial bypass of the distribution network. In theory this should be a component of the regulation of final electricity tariffs to regulated customers. As ENRE is the regulatory body responsible for regulating these tariffs, it should also be responsible for setting the distribution access charge. However access charge is currently set by the Secretary of State. As there is not proper accounting separation of distribution and supply it is not clear what is the basis of Secretary's decision. The suggestion is that the access charge has been too low since 1992 encouraging inefficient financial bypass by free customers which results in regulated customers having to pick up the short fall in distribution revenue created.

The current system is subject to both political interference and double jeopardy caused by the fact that both the regulator and the Secretary need to work out the efficient level of marginal costs in order to make their determinations and hence may use different numbers. The result of this will be to raise the uncertainty facing the revenue of the distribution company and likelihood of mis-pricing. The political pressure on the Secretary of Energy is for lower access charges for large free customers, allowing this in turn produces politically difficult pressure on the price paid by regulated residential customers. If it is the regulatory agency's task to regulate the profitability of the distribution company then it should have control over both the final price and the access

⁷³ See Gomez-Ibanez and Rodriguez-Pardina (2001b) for the history of this price review.

charge. The access charge should be set according to the well-known Efficient Component Pricing Rule (ECPR).⁷⁴

Final Price flexibility is required if the access charge is kept below the efficient level in order to stimulate competition in the liberalised market. If an essentially political decision is taken to keep distribution access charges below the ECPR level then the distribution utility needs to be compensated for the loss of revenue. Prices to the remaining captive customers should be allowed to rise in order to allow revenue adequacy of the distribution company. The issue here is that the regulated firm should be given opportunity to rebalance its charges in order to allow it to maintain its pre-determined revenue stream. The suggestion is that the current charging mechanism is biased against distribution companies being able to maintain their regulated revenue.

Private ownership of distribution utilities combined with clear incentives to increase connection of poor customers can dramatically improve access among the poorest households. One of the striking achievements of the early years of Argentine electricity reform was the sharp increase in the number of poor households with electricity supply.⁷⁵ Between 1986/7 and 1996/7 electricity access rose from 65.2% for the poorest decile in the Greater Buenos Aires area to 98.98%. This was the result of the 4-year framework agreement following privatisation which saw government incentives paying off past debts of shanty town dwellers and paying for the installation of meters. Municipal governments paid for this with 60% of the tax on household electricity consumption, the other 40% subsidised new connections. For the new customers Edenor and Edesur had an 85% collection rate with some direct subsidy coming from the government in the form of payment for very poor groups of consumers on municipal meters and payments for pensioners collecting the minimum pension.

Many developing countries face problems of improving the access of the poorest while giving financial incentives to companies to supply them. Argentina handled this problem in an economically efficient way. The increase of access to poor consumers was calculated to have yielded large increases in social welfare and be a significant benefit of the restructuring of the sector.

In contrast to its success in connecting poor urban consumers, the government has limited success in extending the electricity network to include 2-3 million inhabitants of rural areas without access to electricity. In 1995 the Secretary of Energy launched a scheme to supply power to these areas.⁷⁶ The Disseminated Population Electricity Supply Program (PAEPRA) was to connect 314,000 rural users. Only a fraction of those connections were actually put in by 1999. The main problem for the PAEPRA was the unwillingness of provincial governments to contribute subsidy payments. This now being addressed.

⁷⁴ For details see Armstrong, Cowan and Vickers (1994).

⁷⁵ See Bouille et al. (2002) and Ennis and Pinto (2002) for discussions about the nature of the government's support for shanty town dwellers and the impact of privatisation on access to electricity.

⁷⁶ See Bouille et al. (2002).

The system of penalties for supply outages combined with the pass through of nodal prices to customers has created perverse incentives for distribution companies.

Distribution companies are directly liable for all failures to supply their customers regardless of the cause. In theory, where prices are not regulated, this should not matter for efficient investment in reducing the risk of supply failures. However in practice there are high transaction costs in writing supply quality contracts between transmission operators and distribution companies and a lack of incentive to minimise the total costs of electricity supply facing distribution companies. These two facts mean that distribution companies have had a strong incentive to minimise the risk of transmission failure by contracting with generators who are close by or even to engage in physical bypass of existing transmission networks. This may lead to under-utilisation of some parts of the transmission network and pass through of higher nodal power costs to customers.

The seasonal pricing system is unnecessary, inefficient and creates an opportunity for political interference.

50% of electricity demand is subject to the seasonal price for purchased power. The purpose of this price is to reduce the exposure of residential customers to price spikes, which might exist in a hydro system in years of extremely unfavourable hydrological conditions. This is misconceived. In a completely free market, customers who value price stability can buy stable prices direct from their suppliers who will then absorb or re-insure against the risks of high spot prices. In other words long term contracts (which allow recovery of a surplus in periods of low spot prices to compensate for losses in periods of high spot prices) can be entered into if valued by customers. The problem when there are regulated customers who have only one supplier is how to encourage the optimal amount of price smoothing.

The Argentine system (like the Chilean system of node pricing, which performs a similar function) imposes smoothing by only allowing distributors to pass through the smoothed price. However the smoothing mechanism itself is problematic. It represents a six month forward looking average of electricity prices and is reset every six months. As pointed out above the existence of a seasonal price puts a ceiling on the amount that distributors can pay for purchased power. This has worked to inhibit efficient long term contracting.

An open auction for long-term contracts to supply regulated customers combined with some benchmarking of the long-term contract prices paid by the distributors on behalf of their regulated customers would ensure a large degree of smoothing. It would also ensure that high prices at times of shortage would be reflected (at least in expectation and in the price of un-contracted demands) in the regulated price. If there was still a need for smoothing the final price there could be a smoothing mechanism introduced on the final price to spread the payment for the high cost electricity by regulated customers. This could easily be achieved by a limit on the maximum price rise in any six month period followed by a period of over recovery in prices to make up any revenue shortfall to cover the extra purchased power costs.

A major problem with the seasonal price recently has been the fact that it is formally set by the Secretary of Energy. From 1992 until 2002 this price was set at the value suggested by the CAMMESA model. However recently the Secretary of Energy set the

price at a lower level than the model suggested. Normally this would be problematic because it would lead to a shortfall in what generators would get paid by distributors. However the Secretary also had control over the fund which balanced the differences between the spot prices paid to the generators and the seasonal prices by distributors. He was able to use the accumulated surplus in this fund (arising from the period when the seasonal price lagged the downward movements in the spot price) to bridge this deficit. If there is to be a seasonal price it should always be based on a computer simulation not on a political decision.

The final customer market can be further liberalised. Currently customers with peak demands above 30 kW can choose supplier freely. Prior to the recent crisis the Argentine electricity sector had got all of the preconditions in force for full retail competition, as the ultimate target in the development of its electricity market. This would have important positive downstream effects in terms of reducing the degree of regulation in the industry and its potentially distortionary effects. Such a move towards full supply competition was part of the failed proposals for reform in 1999 (Resolution 545 of 1999). The advantages of full supply competition might include better long term contracting for electricity supply and the emergence of multi-utility consumer offerings should consumers value these.

4.4 The Practice of Regulation

Small users should have been formally represented in the regulatory process. One of the rationales for heavy central government involvement in the electricity sector is to represent the interests of small customers. However this can be done directly by involving small users on the CAMMESA board and via a separately constituted consumer body to handle customer complaints (currently these are handled within ENRE). Such a body would have created an informed consumer voice, which would have reduced the need for the involvement of the Secretary of Energy in the process. It would also have educated consumers of the benefits of the reforms and need for a quicker resolution of the current payments crisis within the sector.

Accounting separation of distribution and retailing should have been a priority for ENRE. A notable failure in the practice of regulating the electricity sector has been the failure to establish the detailed information collection systems on which modern regulation of incumbent network utilities depends. As we noted above there should be clear separation of the regulated and non-regulated businesses and between the non-competitive and potentially competitive businesses. If there is to be effective regulation of distribution access charges and further retail market opening it is essential to collect detailed information on distribution and retailing costs. It was the strict separation of these costs in the UK that eventually lead regulated distribution utilities to realise that they did not benefit from integration with supply companies. This has lead to the separation of many of the regional distribution wires businesses from the local retailing of power. ENRE has been existence for over a decade; most regulatory agencies make the establishment of appropriate financial reporting by regulated companies a top priority.

Regulatory oversight of crisis management at times of supply failure is crucial. The success of any reform process is threatened by a badly handled supply failure. As Auckland (1998), Buenos Aires (1999), California (2000) and New York (2003) demonstrate prolonged supply failures raise questions about the efficacy of reform. While supply failure penalties encourage investment to reduce supply failure risk, it is neither possible nor sensible to eliminate all risk of supply failure. This implies that there should be a crisis management plan should a bad supply failure occur. As the integrity of the system is called into question by such a failure it should be the job of the regulatory agency to ensure that all the relevant companies have an up to date crisis management plan. It should also be the case that the regulatory agency itself knows how to respond in a crisis. During the Edesur incident the company apparently did not have an adequate crisis management plan, particularly for handling the media. It also seems to be the case that ENRE did not have a similar crisis management plan and was itself slow to realise that its own competence and the competence of the whole privatised industry would be called into question by this incident.⁷⁷

ENRE enforced arbitrary quality standards. Distribution companies in Argentina complain about the enforcement of arbitrary quality standards by ENRE. ENRE were free under the legislation to define quality standards but these were significantly tightened during the 1990s to the extent that fine income was increasing in spite of the fact that general supply quality was improving. The effect of these apparently arbitrary standards was to threaten revenue adequacy and increase uncertainty. The serious ‘Edesur incident’ resulted in ENRE imposing a special fine of \$100m instead of the \$10m, which would have been due under the existing quality incentive scheme. Arbitrary fines of this nature violate the principle that fines should be levied on observed outcomes not on intermediate measures (such as the observation of management failure). The reason for this principle is to encourage efficient responses (especially among firms who are not fined) to well specified social preferences for quality.

Serious incidents, which call the existing penalty system into question, should be handled by ex post inquiry to learn lessons for the future. Edesur paid the fine rather than risk losing their concession, however in principle incompetent franchisees should not be given the opportunity to buy their way back into the franchise if the costs of leaving them in place in the future may outweigh the benefits. If ENRE were serious about learning the regulatory incentives from Edesur they would have enquired into it thoroughly. However there was not a full enquiry into the incident and the only document ENRE ever published on the incident was a chapter in their annual report. By contrast the recent New York power cut led to many pages of reports on the FERC website.

The regulatory agency, ENRE, has been politically undermined over the years. Instead of evolving a strong independent regulatory agency for electricity ENRE appears to have grown much weaker over the years.⁷⁸ This is because of continuing interference by the Secretary of Energy. This has manifested itself via: the pressure to impose a large

⁷⁷ See Ullsberg (2002).

⁷⁸ See Abdala (2001) for examples of the way that ENRE was undermined.

number of penalties; the continuing role for the Secretary of Energy in the setting of the access charge the contract price; and the overturning of the 1998 Transener price review and the delaying of the 2002 distribution price review. The number and quality of professional staff declined over time and for several months during 2003 ENRE only had 2 commissioners out of 5. As ENRE needs 3 commissioners to pass any resolutions it is effectively unable to function in its current state. Once established by statute, regulatory agencies should not be subject to operational oversight from a government minister but should be subject to judicial review by the Competition Authority or the independent government auditor.

4.5 The General Institutional Framework

Individual electricity customers should have to pay market-based prices for electricity. Between 1992 and 2001 Argentina successfully moved from a pricing system for electricity in which many poor customers were allowed to avoid paying for electricity to one where those who could pay, paid something, and those who could not received a direct subsidy to pay their electricity bill. Many developing countries face this non-payment problem and have struggled to deal with it. Argentina dealt with it in a way that is consistent with the economic principle that re-distributions of wealth should be achieved via taxes and subsidies not via cross subsidy. This principle encourages more efficient and safe use of energy and encourages companies to connect poor customers to their networks (as was the case with shanty town connections). Since the crisis, artificially low electricity and gas prices have served to create a disequilibrium between the demand and supply of electricity. The experience of 2002-2004 and the inevitable power cuts and increased government intervention amply illustrate that the laws of supply and demand should be allowed to apply to the electricity market.⁷⁹

In the electricity sector, as in the economy in general, one politically inspired distortion of prices and regulation tends to make additional political interference more likely. We have noted a number of examples of political interference in the Argentine electricity sector which have only led to further problems. These include: the keeping of the access charge in distribution too low leading to pressure on residential rates; the restriction of the rise in final prices leading to payment problems in the generation market; and the failure to appoint directors to ENRE leading to the inability of the regulatory agency to function properly leading to more political input into the regulation. Successful regulatory regimes involve self-restraint by politicians and political institutions in what is often the complex business of setting the right incentives in the electricity sector. Arbitrary intervention by politicians in the operation of a decentralised electricity market is likely to have unintended consequences, because ministers are less well informed than well resourced regulatory agencies. The setting up of a state owned energy company to respond to some of the ‘market failures’ associated with politically inspired price setting in the energy sector illustrates the vicious circle of ever increasing intervention to which badly thought out policies lead .

⁷⁹ ‘The laws of economics bite back’, *The Economist*, 24th April 2004, p.35

Government ministers should not be involved in approving or implementing regulatory decisions, which should properly be delegated to a regulatory agency. In general government ministers, such as the Secretary of Energy, should not undertake tasks that should properly be the task of regulatory agencies, such as setting regulated prices. They should not be able to control funds collected from electricity consumers for specific purposes, such as smoothing price differentials or paying for transmission capacity. Instead these funds should be in ring fenced funds. In the case of Argentina there should have been no role for the Secretary of Energy in the governance of CAMMESA, in the setting of the seasonal price, in the arbitration of disputes or in the approving of regulated tariff changes or in the control of electricity specific funds. In Argentina the Secretary of Energy continued to control the operation of the electricity market and its regulation despite the setting up of an ISO and an independent electricity regulator via his control of the governance structure of CAMMESA and his authority over ENRE.⁸⁰ The government should restrict itself to the setting of future policy developments and avoid having anything to do with the day to day running of the current system. Oversight of this should rest initially with another regulatory authority, namely the Competition Agency.

ENRE should have become a truly national regulatory agency with authority over all electricity utilities in the country. For a small country like Argentina the establishment of separate regulatory agencies for each province does not make sense. Even in the UK where there is now a Scottish Parliament the interconnected electricity system in England and Wales and Scotland is regulated by the national electricity regulator, OFGEM. Germany has recently been forced by the European Union to introduce a national energy regulatory agency, having previously left regulation of distribution utilities to its provinces. The seasonal pricing mechanism in Argentina was motivated by the inability to get the provinces to standardise their distribution tariffs. Distribution access pricing rules and regulated customer seasonal price pass through arrangements can differ by province. Many regulatory agencies in the provinces are small (they range for 7 to 40 staff and often cover several industries)⁸¹. ENRE has played a key role in providing support to provincial regulatory agencies. These agencies have limited capacity to regulate distribution and retail tariffs. ENRE itself would benefit from extension of its role as it could undertake benchmarking exercises between the large number of distribution utilities that there are in Argentina as opposed to the three that it regulates. A compromise measure might be to merge all of the provincial regulators into one body⁸², though this poses political problems given the unwillingness of the provinces to cede power to the central government.

The current position of ENRE was not inevitable. The government has let ENRE's credibility and expertise wither away because of neglect. While this is understandable given the magnitude of the macroeconomic crisis, it was not the only strategy available to them. It reflects an unwillingness to deal with the payments crisis facing the sector. Maintaining a strong ENRE would have allowed the government to use the regulatory

⁸⁰ See Rodriguez-Pardina (2004) for more details.

⁸¹ See Estache (1997).

⁸² See Artana et al. (2001).

agency to take a lead role in assessing financial requirements of the industry as part of pricing negotiation with the companies. The current strategy stores up trouble for the future as it demonstrates a predisposition on the part of state to circumvent an independent regulatory authority when convenient, rather than work with it. It is not an optimal policy response to a macroeconomic crisis to throw out what should be one of your most effective microeconomic institutions. It is interesting to observe that the inevitable political response to a crisis in the electricity sector is not to always get rid of the electricity regulatory agency or weaken its powers. The two agencies responsible for the regulation of the Californian electricity market (the FERC and the local California Public Utilities Commission) were heavily criticised but they did not have their powers weakened.

In an economy with significant overlapping electricity and gas interests the gas and electricity regulators should be merged. Currently there are separate electricity and gas regulators in Argentina. This has created inconsistencies in the way that the gas and electricity markets have been handled in recent years.⁸³ There is no spot market in gas and the gas price has been fixed in Pesos. This has led to scheduling distortions between stations using Argentine and Bolivian gas. There is a need to co-ordinate the expansion of the gas and electricity networks to ensure least cost optimisation of the two networks. It is currently (mid 2004) the case that it is easier to expand the gas network. There is a strong possibility of inefficient arbitrage between the gas and electricity markets to make optimal use of energy. To achieve this there is also a need to co-ordinate the regulated rate of return and the congestion charging regimes in the two networks in order to prevent inefficient arbitrage. Regulatory consistency is required. Incidentally, it may also be easier to keep the Secretary of Energy from interfering in the sector if there is a more powerful regulatory agency with responsibility for consistent regulation between the two sectors.

5. Conclusions

Argentina's electricity reform contains two sets of lessons for developing countries. First, comprehensive electricity reform can work in a developing country. Second, well organised markets and effective network regulation are undermined by political interference in the pricing of electricity.

Argentina's electricity reform is a fascinating test case. It represents the application of a combination of the successful Chilean and UK electricity models in a developing country context. Between 1992 and 2001 the reformed sector functioned very well. The generation market was very successful and was the least concentrated generation market then operating anywhere in the world. It managed to deliver falling prices, improving productivity and new investment. In transmission and distribution private ownership was successful at improving technical and cost efficiency and increasing investment. However some serious regulatory issues emerged. In particular the process for approval of large transmission upgrades was controversial and the regulator was subject to political influence, which unnecessarily increased the uncertainty of the regulated revenue of

⁸³ See Abdala (2001) for an articulation of this view.

network companies. Private ownership and the private institutions of the market (CAMMESA and the various industry associations) performed well. However the problems that existed in the sector prior to 2002 had been widely recognised and some were in the process of being solved.

At the heart of any well functioning private industry is the operation of the fundamental laws of supply and demand. This implies that prices must be allowed to rise to bring the supply and demand for electricity into balance. Private companies must be given the prospect of earning fair returns to new investments. If this is not allowed to happen either electricity shortages in Argentina will get worse and/or economic growth will be further reduced and/or other forms of government intervention (such as state ownership and subsidies) will increase. Electricity sector reform requires a minimum commitment on the part of the government to market based pricing of energy and to a stable regulatory environment. Clearly the macroeconomic crisis of 2002 profoundly affected the Argentine economy as a whole and the electricity sector in particular. The private sector has been remarkably disciplined in keeping the lights on while negotiations about current pricing and compensation for past losses continue. However the normal operation of the laws of supply and demand need to be re-established if the substantial advantages that private ownership and organisation of the electricity system have delivered in Argentina are not to be undone.

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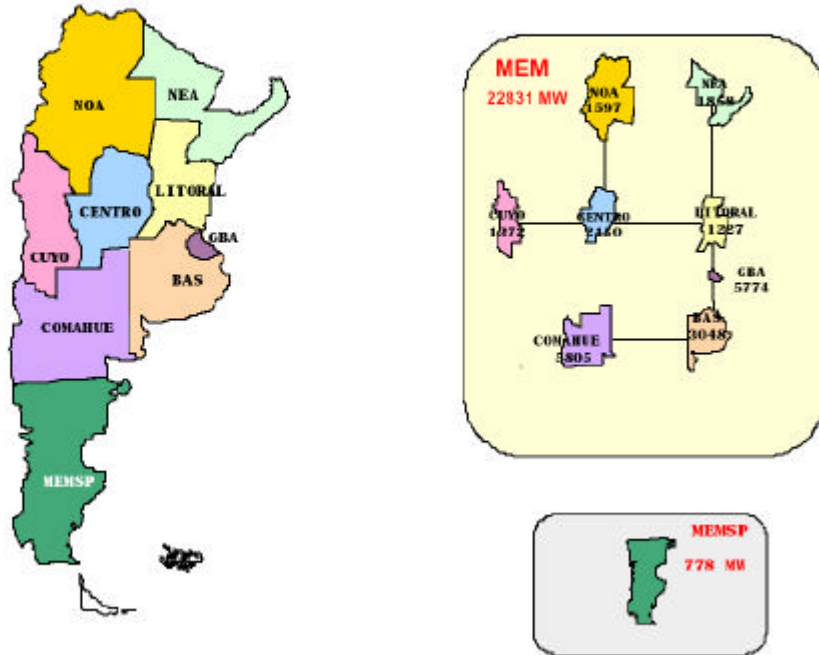
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Information Appendices

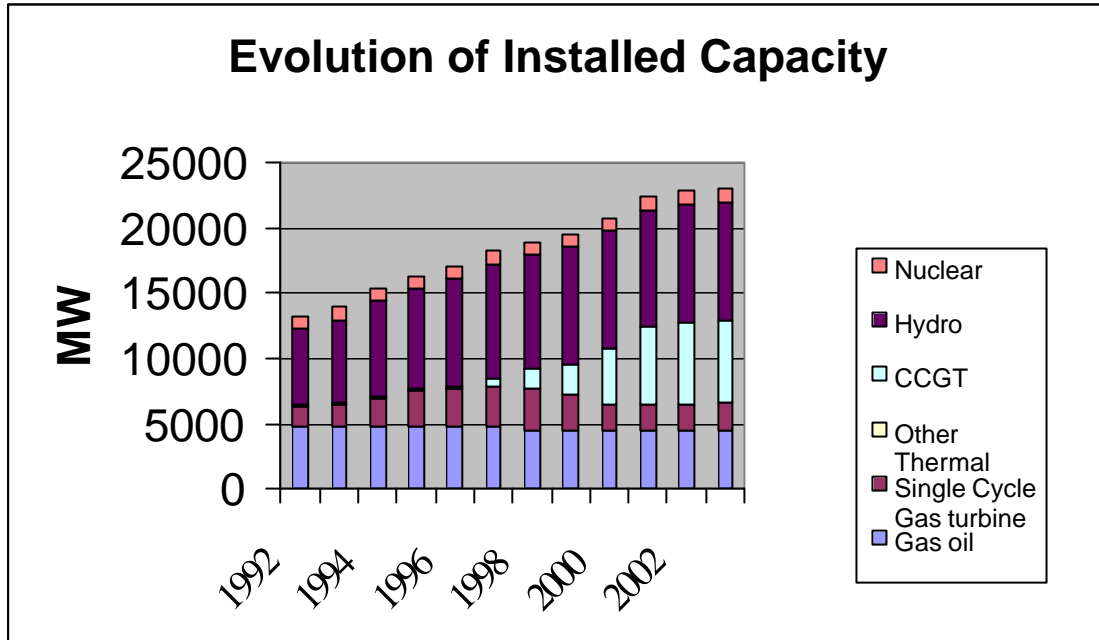
Figure 1: Basic capacity in the MEM and MEMSP systems

Potencia Instalada por Región (al 31-12-02)
Installed Capacity per Zone
Potência Instalada por Região



Source: CAMMESA 2002 Annual Report, p.24.

Figure 3: Evolution of Total Capacity in MW in the MEM



Source: CAMMESA website and 2002 Annual Report, p.8.

Figure 4: Generation market shares by company in 2002

Source: ENRE.

Note: Estatal = state owned companies (nuclear and hydro).

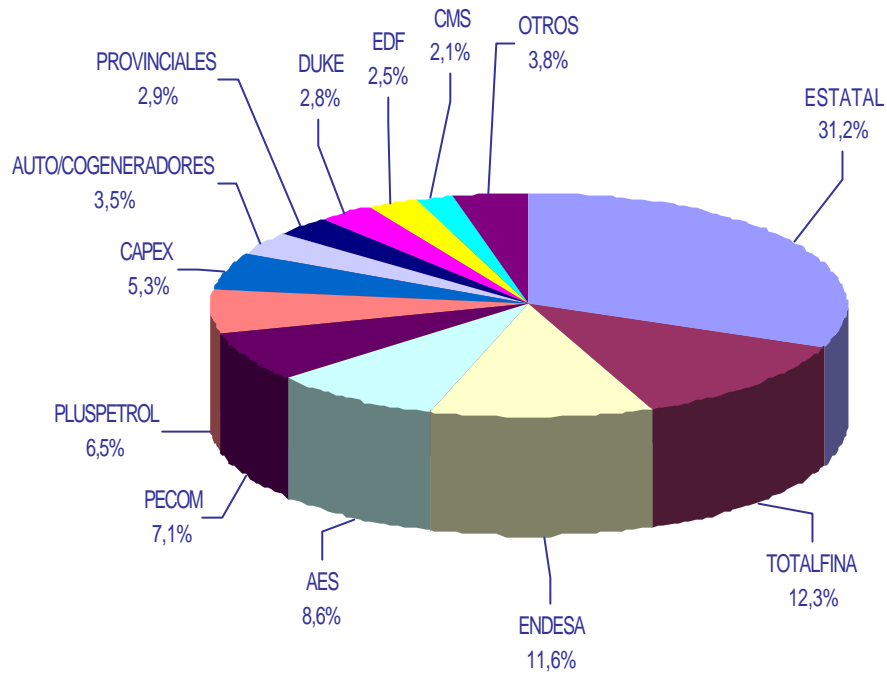


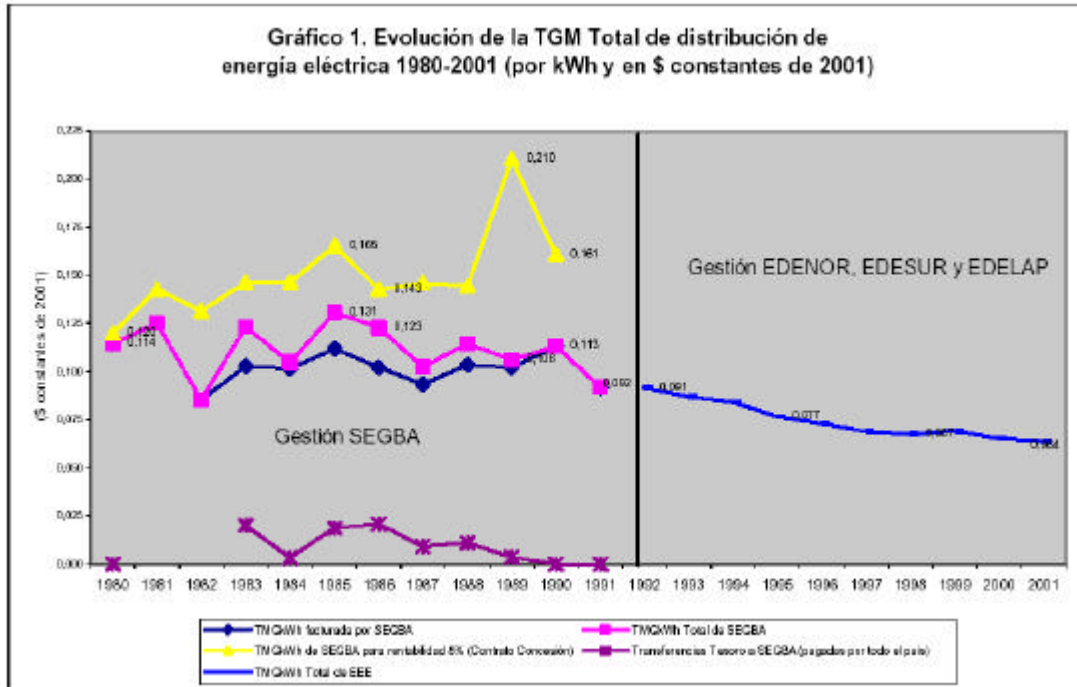
Table 1: Distribution Company Characteristics (end of 2001)

Empresa	Area Km2	Nº Clientes	Energ. Vend Gwh	FactxVent/si Miles de \$	Pot. Max. Mw	Perdidas %
EDENOR	4637	2249638	13034	853746	2793.5	12.32
EDESUR	3309	2089997	12166	821465	2547	11.55
APELP	75050	31	442.3	27292	90.47	4.56
EDESE	150536	153083	443.8	50860.3	113	16.7
SECHEEP	99663	200652	776	98967.1	211.5	21.91
EDESAL	76750	112311	548.5	53900	143.7	10.9
EDELAR	89680	78190	423	38413	112.8	9.5
EDESA	155488	214732	787.2	79180	170.5	10.8
ESJ S.A	85226	153381	592	53920	183	14.72
EDEA SA	105438	406865	1701	151713	388	12.86
EPEN	93603	47024	566.6	42253.5	100.2	9.12
EDEERSA	56287	235261	1122	102187	322	9.8
EdERSA	203000	142896	708.5	57762	175	11.22
EJESA	22060	122010	380.7	43575	88.77	9.7
EDEMSA	109908	320100	2127	146648	399	13.55
EDECAT	106,000	86540	268.1	28832	83	29.2
EDET SA	22524	318369	1164	108116	278	12.8
EMSA	16206	118851	833.3	69407.9	208.7	23.3
EPEC	165321	637413	3849.1	335724	1025	e/elabor
DPEC	88000	192981	647.8	90517	228.8	41.38
EDELAP	5780	275937	1113	92320.2	299.9	12.37
EDES	76259	140628	577.1	54046.8	123.8	15.6
EDEN	110543	272010	1707.4	133857	316.1	12.52
EPESF	114690	876934	3838	350392	899	25.8
EDEFOR	72000	90061	315.1	32216	103	31.2
EDESTESA	36668	34218	393.5	22471	81	7.32
Co.Salto	120	10011	58.1	5221.8	12.7	6.29
(Co. Colon)	883	8698	32	3196	5.95	8.04
Co.Pergam	595.8	31362	141.2	14867	34	13.9
(Co. Zarate)	1202	26651	219	17389	51.3	14.9
(CO. Lujan)	77.7	32574	207.8	19013	41.59	11.56
Co.M.Moren	2158	14966	45	5561.9	10.4	15.56
Co.Azul	6545	23639	85.2	8715.4	18.6	6
Co.San Pedro	1322	19357	83.86	8112.62	18.6	7.6
Co.Chacabuc.	2288	17525	59.5	10312.8	13.8	12.55
Co.Olavarria	7659	39643	132.4	13909	34.3	10.31
Co.Tandil	300.46	40115	166.99	14904.8	35	9.66
TOTAL	2167776.96	9834654	43431.35	3814857.42	11169.18	

Est. al 17/06/03 Los datos en rojo corresponden al año 2001

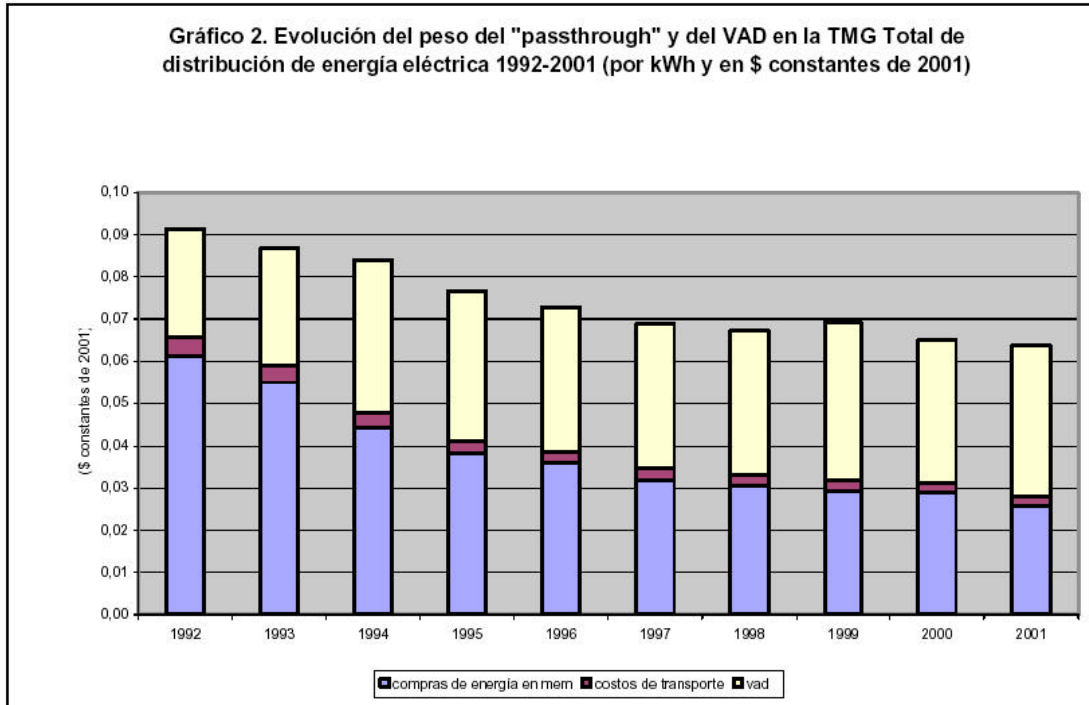
Source: www.adeera.com.ar

Figure 5: Real average tariffs (2001 pesos)



Source: Devoto and Cardozo (2002, p.16).

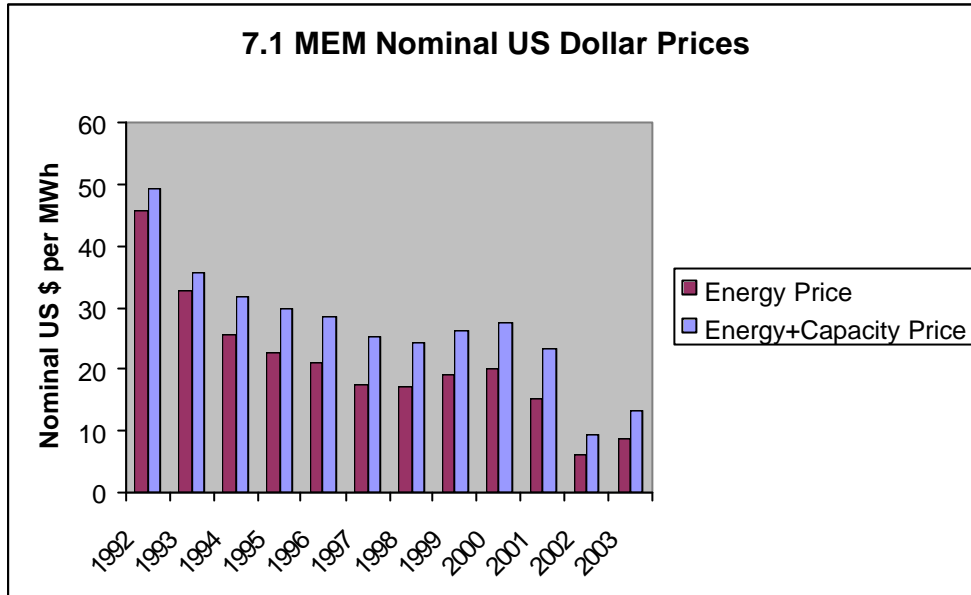
Figure 6: Breakdown of average tariff into generation (purple bar), transmission (red bar) and distribution (yellow bar) components (2001 pesos).



Source: Devoto and Cardozo (2002, p.20).

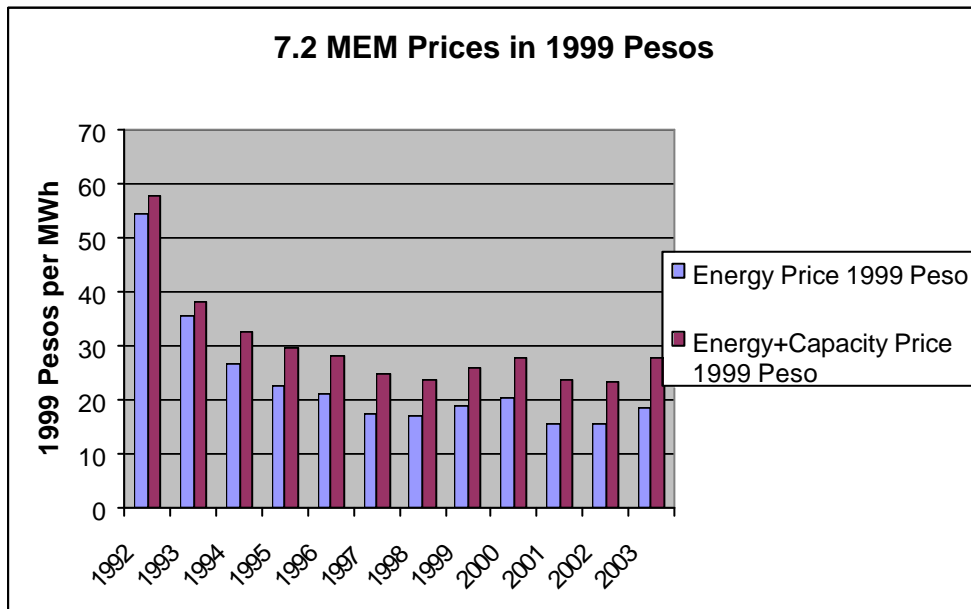
Note: VAD = value added in distribution.

Figure 7: Evolution of prices in bulk power prices in the MEM: energy price (blue bar) and energy plus capacity price (red bar).



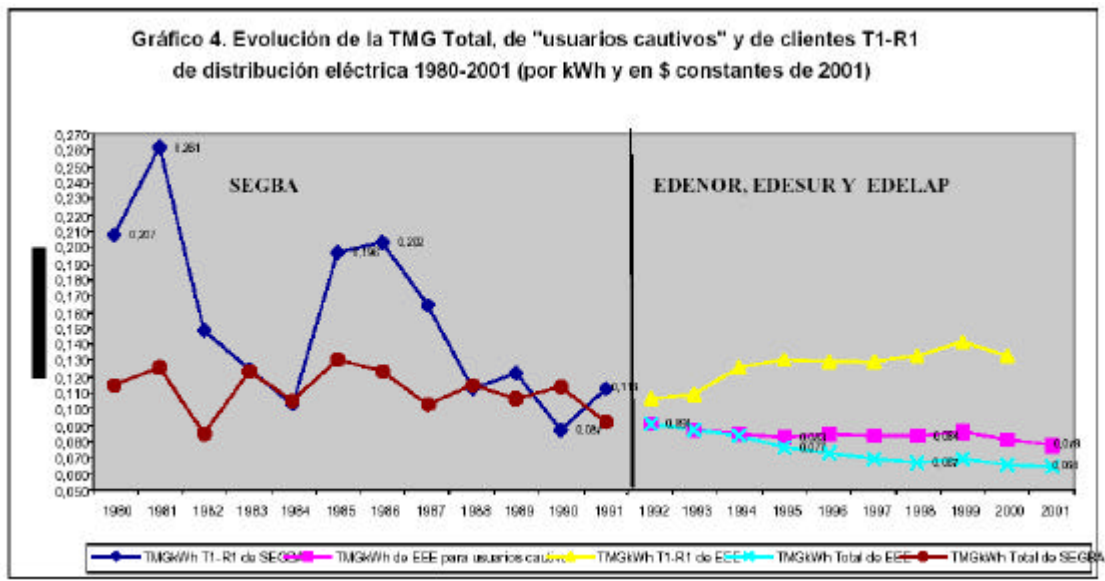
Source: CAMESA website, ENRE and INDEC Argentina.

Note: 1 Argentine Peso = 1 US Dollar from 1992 to 2001; 2002: 1 US\$=3.07 Peso; 2003: 1 US\$=2.95 Peso.



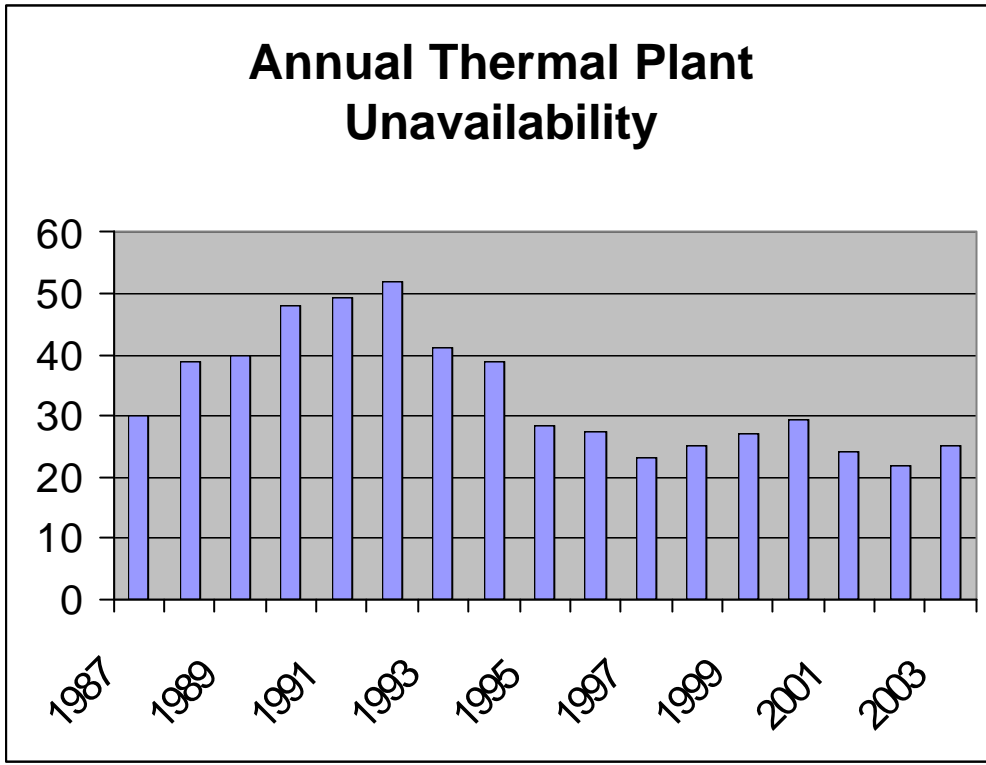
Source: CAMESA website, ENRE and INDEC Argentina.

Figure 8: Evolution of Tariffs for different types of customers (2001 pesos)



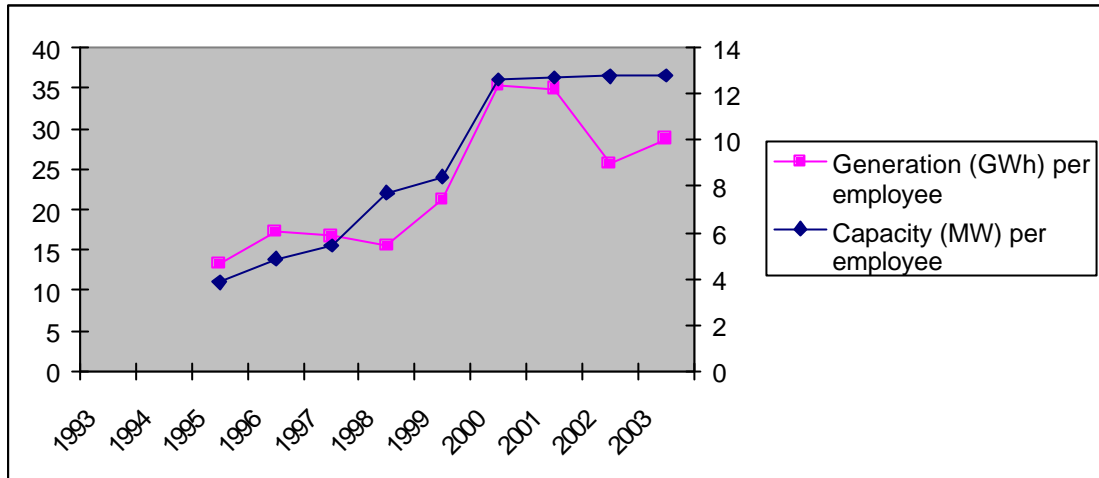
Source: Devoto and Cardozo (2002, p.22).

Figure 9: Thermal Plant Unavailability (% of capacity unavailable)



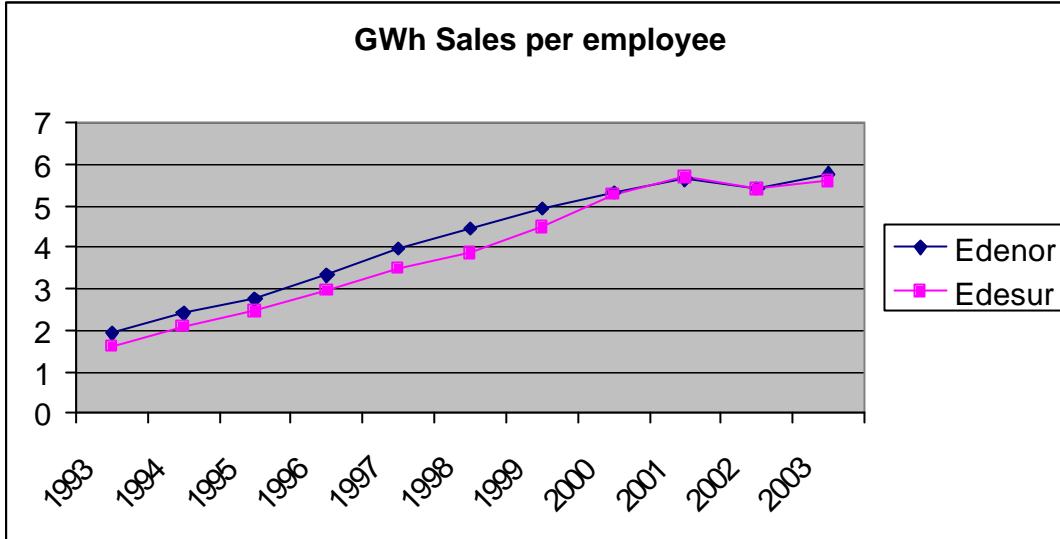
Source: CAMMESA website and CAISE (2002)

Figure 10: Labour Productivity in Endesa Argentina Generation



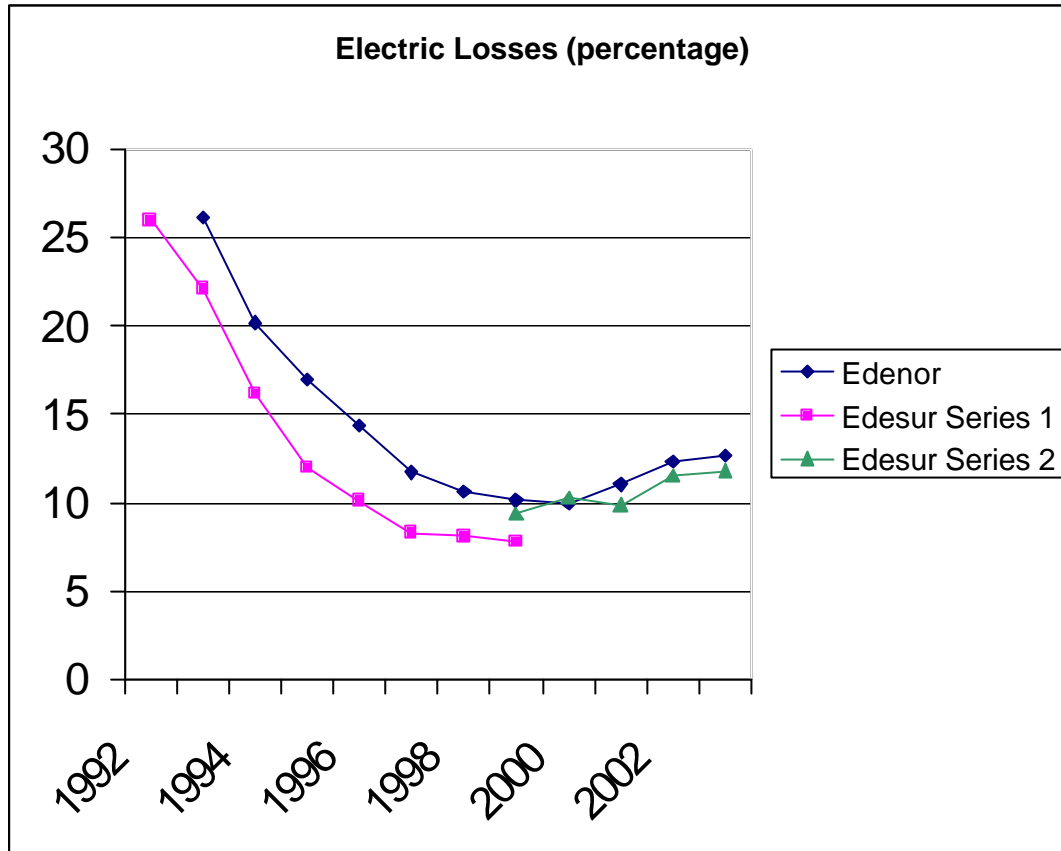
Source: Endesa Annual Report 1999 and 2003 (available at www.endesa.cl).

Figure 11: Labour Productivity in Distribution Companies in Greater Buenos Aires



Source: Edenor and Edesur Annual Reports

Figure 12: Technical and Non-technical losses (%) in Greater Buenos Aires



Source: Edenor and Edesur Annual Reports