

# The governance model of power transmission in Argentina

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For more information on the e-HIGHWAY2050 project, including WP5 and other work packages, see [www.e-highway2050.eu](http://www.e-highway2050.eu)

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## Abstract

Based on a review of the literature, this paper gives a description of the governance model of the electricity transmission system in Argentina, including different aspects of this system such as network design, ownership, finance, cost allocation, and system operation. In particular, it pays attention to the so-called '*Public Contest*' method. The key feature of this method is that the decision on the undertaking of a transmission expansion is given to the users (or 'beneficiaries') themselves – who also pay for the expansion – rather than to the transmission company, the system operator, the regulator or the government. A major conclusion of this paper is that this PC method is an interesting design feature for the possible governance structure of the desired EU transmission grid architecture in 2050. In particular, this method could help to ensure that the interests of users and customers who pay the cost of transmission expansions are effectively represented in the decision making process regarding these extensions.

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# Summary

## **Network design and ownership**

Since the power sector reforms of the early 1990s, the transmission system in Argentina has been separated (unbundled) from power generation and distribution, privatised and subdivided into two systems:

- The national high-voltage transmission system (STEEAT), which operates at 500 kV and transports electricity between the regions. Since 1993, this system is owned and operated by the private company *Transener*.
- The regional sub-transmission system (STEEDT), which operates at 132/220 kV and connects generators, distributors and large users within the same region. This system is owned and operated by six private companies.

Transmission systems are operated under long-term (95-years) concessions for monopoly service supply within a certain area. These concessions are awarded by a process of competitive bidding and subject to management performance contracts that are renewed and rebid every 10 years (except for the first period, which lasts 15 years).

In contrast to the rather conventional regulation of existing transmission systems, the governance of new transmission facilities ('expansions') have followed a different approach. More specifically, at the initial reforms of the early 1990s, four methods were put in place to decide about grid expansions. In brief, these methods include:

- *Minor Expansions*, i.e. new grid facilities under \$ 2 million in the national transmission system or under \$ 1 million in the regional sub-transmission networks;
- *Contracts between Parties*, i.e. an agreement on a grid expansion between one or a few users and the transmission company;
- *Private Use*, i.e. the ability of the Secretary of Energy to authorise a generator, distributor or large user to construct and operate a new transmission line at its own cost and for its own private use;
- *Public Contest*, i.e. a major grid expansion that involves many parties and that requires a vote of users followed by a competitive tender.

The most important and innovative approach was the Public Contest (PC) method. The key feature of this method is that the decision on the undertaking of a transmission

expansion is given to the users (or ‘beneficiaries’) themselves – who also pay for the expansion – rather than to the transmission company, the system operator, the regulator or the government. A major conclusion of this paper is that this PC method is an interesting design feature for the possible governance structure of the desired EU transmission grid architecture in 2050. In particular, this method could help to ensure that the interests of users and customers who pay the cost of transmission expansions are effectively represented in the decision making process regarding these extensions.

### **Financing**

Since the early 1990s, transmission investments in Argentina have been financed upfront from a variety of sources, including:

- *External assistance.* Over the past decade, international development institutions such as the Inter-American Development Bank (IDB) or the Andean Development Corporation (CAF) have provided assistance to finance transmission investment projects in Argentina.
- *Private funding.* This source of funding includes both equity and debt finance from different private parties, depending on the method of transmission expansion.
- *Public funding.* Transmission expansions, notably those proposed by the Federal Transmission Plan, have also been financed through public funds such as the Federal Transmission Funds (FFTEF) or the Financial Trust for Investment in Transmission in the province of Buenos Aires (FITBA). In addition, transmission expansions have been financed by allocations of funds from the federal budget.
- *Salex funding.* In August 1994, the Secretary of Energy specified that future congestion revenues from nodal price differences should be put into so-called Salex Funds. These funds could be used to defray (up to 70% of the) initial construction costs as well as subsequent fees of transmission expansions.

### **Cost and benefit allocation**

Cost regulation of the transmission system in Argentina makes a distinction between existing and new facilities (expansions). For existing installations, the remuneration scheme of the transmission operator is based on both price and quality incentive regulation (derived from the UK’s RPI-X price control system).

For new transmission facilities under the Public Contest method - in particular during the amortisation period of these facilities – the annual transmission charge to cover the construction, operation and maintenance costs of the expansion is set through competitive bidding and shared by all beneficiaries identified by means of the Area of Influence method. After the amortisation period, however, charges for operation and maintenance of the installation basically follow the remuneration regime for existing facilities.

### **Market and system operation**

Incumbent transmission companies, such as Transener, are primarily responsible for the operation and maintenance of their network, but not for the planning or expansion of the system. While having exclusive monopoly rights within their concession area, they are obliged to provide open, non-discriminating access to all third parties at regulated tariffs. If capacity constraints arise, transmission companies cannot discriminate through rationing devices since the independent system operator, CAMMESA, decides which generators are called upon, based on an unconstrained dispatch merit list that

sorts producers by their fuel costs and guarantees access priority to the lowest-cost generators.

In the spot market, load dispatch and hourly electricity prices are determined mechanically by the Wholesale Energy Market Operator (CAMMESA), based on hourly demand forecasts and the short-run marginal costs (SRMC) of the generator that clears the market in each area in an efficient cost-based merit order dispatch. The reference point for determining the spot market price is the Ezeiza 500 kV node, i.e. the system load centre located near Buenos Aires. In each of the other nodes on the grid, the electricity price takes into account the cost of power transmission to or from this reference 'market' node. When a line is congested – i.e., there is a transmission constraint – CAMMESA determines a so-called 'local price' in the constrained generation node as well as the spot clearing price in the reference market node (Ezeiza), based on the most efficient merit order dispatch in each node.

Finally, besides regulated electricity consumers (who face regulated electricity tariffs), there are also free or non-captive end-users in Argentina's power market. These are mainly large users who are entitled to purchase their electricity consumption directly from generators or traders through bilateral contracts, at freely negotiated prices.

# 1

## Introduction

### **Historical evolution of Argentina's power sector**

By the late 1980s, the electricity sector in Argentina was predominantly state owned, highly vertically integrated and heavily controlled at the federal and provincial levels. In general, the sector was characterized by a poor performance, including severe financial and operational difficulties, poor management practices, inadequate and inefficient investments, high losses, power blackouts, and other poor quality services (Pollitt, 2008; Vagliasindi and Besant-Jones, 2013).

Since the early 1990s, a radical reform of Argentina's electricity sector was implemented, including (i) a vertical and horizontal unbundling of generation, transmission and distribution, (ii) an opening up of all segments to the private sector, and (iii) a separation of the regulatory function from policy setting. The large state and provincially owned companies were broken up into several smaller, separated firms and sold to the private sector. Overall, more than 75% of the generation capacity, all of the transmission sector and approximately two-thirds of the distribution sector were transferred into private hands. Remaining public ownership was limited to the state owned nuclear power industry and two large hydro-electric power plants (with shared foreign public ownership) in the generation sector and some provincially owned distribution companies (Pollitt, 2008; Wikipedia, 2013).

The breakup of the ownership of the generation sector into a large number of private companies was accompanied by the creation of a Wholesale Electricity Market (MEM). Under the new Electricity Law of 1992, power generation – and related electricity market transactions – are regarded as free, competitive activities. Therefore, these activities have been largely liberalized and less regulated. On the other hand, although transmission and distribution have also been transferred largely into private hands, these activities are considered by the Electricity Law as (open access) public services and defined as natural (network) monopolies. Hence, distribution and transmission activities are highly regulated by the government and require a concession that stipulates the terms and conditions of these activities.

A major novel approach in the transmission sector, however, was the so-called '*Public Contest method*', which provided that major transmission expansions were to take

place only where users proposed them and a majority of these users voted in favour, confirming that they were prepared to pay. Financing, construction, operation and maintenance of the agreed expansions were then to be put out to competitive tendering (Littlechild and Skerk, 2008a). Details on this approach, which has aroused a lot of foreign attention and debate among both scholars and practitioners, are further discussed in Section 2 below.

### **Institutional setting**

Moreover, as part of the reform process, some new governance institutions were created in the electricity sector, each with its own responsibilities, including:

- The *Wholesale Energy Market Administrator (CAMMESA)*. This is the independent system operator (ISO), which is responsible for the administration, management and operation of the wholesale energy market. It is a non-profit corporation owned equally by the federal government and four associations representing electricity generators, transmitters, distributors and major users. Its main functions include the efficient dispatch of power generation, the determination of wholesale electricity prices and the administration of transactions in the electricity market.
- The *National Electricity Regulator (ENRE)*. This is the independent, national regulatory authority (NRA), which is responsible for the application of the regulatory framework and the overall supervision of the electricity sector under federal control (while provincial regulators cover the rest of the sector). The main functions of ENRE (and the provincial regulators) include stipulating and supervising compliance of quality service standards, overseeing CAMMESA, authorising the construction and expansion of new grid infrastructure and resolving disputes between electricity market participants.
- The *Secretariat of Energy (SENER)*. This Secretariat – which is part of the Ministry of Economy, Public Works and Services – is responsible for setting and coordinating the overall policy and regulatory framework for the energy sector. More particularly, SENER heads the board of CAMMESA, monitors the remaining state owned power generation companies and appoints three of ENRE's five directors (while the provinces – via the Federal Electricity Council – appoint ENRE's two remaining directors).

### **Assessment of reform performance**

In general, the reform of the electricity sector in Argentina is regarded as a major success, in particular during the years 1992-2001 (Pollitt, 2008; Vagliasindi and Besant-Jones, 2013). For instance, during this period, the power sector was characterised by strong competition between private generators, high investment rates, large efficiency improvements, low electricity prices, strong financial results by electricity companies, and large improvements in quality of supply and customer services (Idem).

In the second half of the 1990s, however, government expenditures began to increase rapidly and both the fiscal and trade deficits began to worsen. In the years thereafter, the economy continued to deteriorate seriously, resulting in a severe macro-economic crisis by early 2002. In response, the government was forced to take some stringent measures, such as a strong devaluation of the peso (against the US dollar), while the tariffs for all regulated services – including electricity – were frozen at their previous peso levels. Although, apart from some (temporary) modifications, the policy reforms in the electricity sector were largely maintained – and the sector soon showed high physical output growth rates again – its financial performance suffered seriously in this

period due to the consequences of the macro-economic crisis, including the prolonged restrictions on the regulated electricity tariffs, i.e. these tariffs were largely frozen in the years beyond 2002 (Littlechild and Skerk, 2008c; Pollitt, 2008; Haselip and Potter, 2010). Over the years 1992-2012, both power capacity and electricity consumption have grown steadily in Argentina, totalling a cumulative expansion of about 120% and 140%, respectively (PLC, 2013). In 2011-2012, total power capacity amounted to some 30-31 GW, while total electricity consumption was approximately 120-130 TWh. About 60% of the power generated comes from thermal sources (in particular from natural gas), 32% from hydro-electric installations, 5% from nuclear plants, while the remaining part is imported from neighbouring countries such as Paraguay and Uruguay (EIA, 2013).

# 2

## Design of the network

### 2.1 Transmission reforms: existing systems versus new facilities

The transmission reforms of the early 1990s were based on the following considerations (Littlechild and Skerk, 2008a):

- Electricity demand was expected to increase significantly. Most of this demand, however, is concentrated in the Buenos Aires area, whereas generation sources (hydro; natural gas) are mainly located in the northwest and in the south of Argentina. Therefore, the location of new generation plants and, hence, adequate investments in transmission (gas, electricity) would be key to meet this increase in power demand.
- The pre-reform transmission sector was characterised by several deficiencies such as excessive expansions, inappropriate lines, low capacity use, over-staffing, excessive costs and delays in repairing capacity. These deficiencies showed the weakness of the public institutions and the failure of regulation itself. Therefore, the conventional concept of transmission regulation had no credibility in Argentina and, hence, transmission reforms were adopted in order to maximise the role for competition and minimise the role for regulation (Littlechild, 2008). A crucial consideration regarding these reforms was that new transmission facilities ('expansions') could be regulated separately and differently from existing ones (Littlechild and Skerk, 2008a).

Based on these considerations, transmission was separated (unbundled) from power generation and distribution, privatised and subdivided into two systems (PLC, 2013; Pampa Energia, 2013):

1. The national high-voltage transmission system (STEEAT), which operates at 500 kV and transports electricity between the regions. Since 1993, this system is operated by the private company *Transener*.

2. The regional sub-transmission system (STEEDT), which operates at 132/220 kV and connects generators, distributors and large users within the same region. This system is operated by six private companies.<sup>1</sup>

Transmission systems are operated under long-term (95-years) concessions for monopoly service supply within a certain area or grid. These concessions are awarded by a process of competitive bidding and subject to management performance contracts that are renewed and rebid every 10 years (except for the first period, which lasts 15 years; see also Section 3 below). The concession arrangements define service quality standards and penalties in case of failing to meet these standards (both set by the system regulator, ENRE). In return for their services, transmission companies receive regulated tariffs, which are set also by ENRE and reviewed every five years.

In contrast to the rather conventional regulation of existing transmission systems, the governance of new transmission facilities ('expansions') followed a rather different approach. More specifically, at the initial reforms of the early 1990s, four methods were put in place to decide about grid expansions. In brief, these methods include (Galetovic and Inostroza, 2008; Littlechild and Skerk, 2008c and 2008d):

- *Minor Expansions*, i.e. new grid facilities under \$ 2 million in the national transmission system or under \$ 1 million in the regional sub-transmission networks;
- *Contracts between Parties*, i.e. an agreement on a grid expansion between one or a few users and the transmission company;<sup>2</sup>
- *Private Use*, i.e. the ability of the Secretary of Energy to authorise a generator, distributor or large user to construct and operate a new transmission line at its own cost and for its own private use;
- *Public Contest*, i.e. a major grid expansion that involves many parties and that requires a vote of users followed by a competitive tender.

As noted above, the most important and innovative approach – which aroused a lot of international interest and debate – was the Public Contest method. Therefore, this method will be discussed in some detail in the section below.

## 2.2 The Public Contest Method

### 2.2.1 Main features

The key feature of the Public Contest (PC) method is that the decision on the undertaking of a transmission expansion is given to the users (or 'beneficiaries') themselves – who also pay for the expansion – rather than to the transmission

<sup>1</sup> In addition, there are also independent transmission companies that operate under a technical license provided by the STEEAT or STEEDT companies.

<sup>2</sup> Galetovic and Inostroza further explain Contracts between Parties: "When one or more market agents (generators, distributors or large customers) need to expand the capacity of the transmission system, they can enter into a build, operate and maintain (BOM) contract with the operator or an independent transmission firm. To enter into a BOM contract, an expansion request must be presented to the operator, who in turn notifies ENRE. The regulator holds a public hearing and authorizes the project if there is no justified opposition. This authorization enables the operator to issue the corresponding technical license. Once this has been done, expansions are remunerated in the same way as existing installations" (Galetovic and Inostroza, 2008).

company, the system operator, the regulator or the government. This bold, novel step in Argentina's reform process of the electricity sector was based on the consideration that if the costs of an expansion were charged to those who used it, then these users would have the incentive – and be in the best position – to identify, propose and accept economic expansions and to reject uneconomic ones (Littlechild and Skerk, 2008a).

More specifically, the main steps and features of the PC method include (Galetovic and Inostroza, 2008; Abdala, 2008a; Littlechild and Skerk, 2008a and 2008b; Littlechild and Cornwall, 2009):

1. A group of transmission users (generators, distributors, large power consumers), who are interested in a major expansion of the grid, submits a request – i.e. a project proposal – to the transmission company that holds the concession in the area of expansion, which subsequently reports on the technical feasibility of the request.
2. The transmission company passes the request to Argentina's national energy regulator (ENRE), which checks whether the proposed project meets the so-called '*Golden Rule*', i.e. whether the net present value of the expected costs of power supply is lower with the project than without the project (where costs refer to both investment, operation and maintenance costs of the network expansion from a social perspective).
3. Subsequently, for those proposed investments that meet the golden rule, the wholesale power market operator (CMMESA) carries out a technical study, using the so-called '*Area of Influence*' method to identify the beneficiaries of the expansion and to determine their proportion of votes in the public hearing process (see below) as well as the proportion in which each beneficiary would have to share the costs of the expansion (both in proportion to their shares as beneficiaries, based on their expected use of the expansion over the first two years of its operation).
4. If the proponents of the request represent at least 30% of the votes of the project's beneficiaries, ENRE organises a public hearing to obtain the views of parties affected by the project, including a vote on the project by the beneficiaries. A project is accepted if it is supported by at least 70% of the votes.
5. If a request is accepted, the proponents arrange a public tender for the construction, operation and maintenance (COM) of the expansion. The COM contract is granted to the bidder offering the lowest annual fee over a certain amortisation period that depends on the type of the expansion (for instance, 15 years for a new transmission line).
6. Once the expansion becomes operational, the owner charges the agreed annual fee across all those parties who have been identified as beneficiaries in the Area of Influence of the expansion, in proportion to their shares as beneficiaries. This calculation is updated during the amortisation period of the COM contract in order to avoid free-riding and to assure that all actual users pay for the costs of the expansion, not only the users that voted for it.
7. After the expiration of the amortisation period, the annual charge for operation of the expansion follows the remuneration regime applicable to existing installations of incumbent transmission companies, which essentially covers O&M costs only (Galetovic and Inostroza, 2008; Littlechild and Skerk, 2008a and 2008b).

## 2.2.2 Assessment – positive elements

Reviews of the PC method in Argentina have found several important benefits and other positive elements (see, for instance, Littlechild and Skerk, 2008b and 2008d; Pollitt, 2008; Littlechild, 2012; IEA, 2013). In brief, these positive elements include:

- The system of competitive tendering for new transmission facilities was successful as it encouraged the offering of competitive, lower-cost bids. Moreover, it limited the incentives of incumbent transmission operators to benefit from an overexpansion of the network or from a monopoly on new facilities in their areas (Pollitt, 2008; IEA, 2013). Similar to a real market, a system of competitive tendering uses the market mechanism to set tariffs for new facilities, resulting in lower tariffs. For instance, a modelling study that simulated the competitive auctioning of tariffs for the fourth Comahue transmission line in Argentina (see below) found that if tariffs had been regulated they would have been at least 61% higher (Galetovic and Inostroza, 2008). Moreover, another benefit of competitive tendering is that it changes the role of the regulator, i.e. from setting tariffs itself towards guarding the playing field for the tendering process and arbitrating in case of disputes. This may significantly reduce the regulatory burden, notably in countries with weak institutional systems (Abdala, 2008b; Tieben et al., 2012).
- The PC method showed some positive effects in the case of the so-called '*Fourth Line*', i.e. a major expansion of the transmission system from a main power-generation and gas-producing centre in Comahue in the southwest of Argentina to the main load centre in Buenos Aires in the northeast of the country. Initially (in 1994), the proposed Fourth Line was rejected during a public hearing of the identified beneficiaries (which for some commentators was evidence that the PC method failed to work). Later, however, detailed research found that the initially proposed Fourth Line was expensive, premature and uneconomic (indicating that the PC method had worked properly; Littlechild and Skerk, 2008b; Littlechild, 2012). When conditions later made the Fourth Line more attractive, beneficiaries worked together well to design, propose and accept almost unanimously a line at significantly lower costs than the original proposal (Idem).
- More generally, a review of the overall performance of the PC method over the years 1992-2007 revealed that substantial new transmission investments were made, especially in better grid control systems. This more than doubled transmission capacity, which was more than sufficient to meet increased power demand and was more cost-effective than building new transmission lines. By 2007, around 40 PC proposals for major expansions had been made, of which 35 were accepted by beneficiaries and all were implemented. The four largest approved expansions ranged from US\$ 25-236 million. Approved expansions were put out to competitive bidding with tenders attracting on average two to three offers. This was usually sufficient to generate significant competition and to reduce cost substantially. For instance, the cost of expanding 500 kV transmission lines roughly halved over the first five year period. Three quarters of the winning bids were below the minimum level specified by the proponents of the tender request. Finally, three quarters of the COM contracts were won by independent parties – at least 11 different ones – rather than by incumbent transmission companies (Littlechild and Skerk, 2008d; Littlechild, 2012; Productivity Commission, 2013).

### 2.2.3 Assessment – negative elements

On the other hand, the PC approach as applied in Argentina has also raised some concerns and criticisms due to some (assumed) flaws and other shortcomings. In particular, the specific *Area of Influence* method – to identify beneficiaries, calculate votes and allocate costs – has been criticised for some flaws. In summary, its main flaws include (Chisari et al., 2001; Chisari and Romero, 2008; Abdala, 2008a; Littlechild and Skerk, 2008a):

- Only generators, distributors and large electricity users are identified as beneficiaries – and, hence, may vote on transmission expansions – leaving small and medium power consumers out of the PC process from the beginning. However, if electricity costs are passed on to these consumers, they – rather than their distributors – have a major interest to express their willingness to pay for an expansion.
- In addition, the Area of Influence method also excludes transmission users in the reference node ('swing bus') from the expansion decision since it does not take into account the node's level of activity when calculating changes in the use of line flows due to the expansion. In Argentina, this means that transmission users in the Buenos Aires area have no vote on expansions that would reduce electricity prices in that area.
- Another flaw of the Area of Influence method is that it allocates votes (and costs) in proportion to *use* of the transmission expansion by the identified beneficiaries rather than in proportion to the *economic benefits* – or *profits* – they would gain from it.<sup>3</sup>

Due to these flaws, the subset of voting agents ('beneficiaries') was not well specified and integrated in the PC process, while the votes of these agents may represent their true economic interests in the transmission expansion. This may result in uneconomic or socially undesirable outcomes, particularly in under-investments in economic (socially desirable) expansions.

Moreover, the subset of voting agents was also not correctly specified and integrated in the PC mechanism due to the limited range of alternative projects taken into consideration, for instance by neglecting gas pipeline expansions and the location of generators (Chisari and Romero, 2008). This could result in less economic outcomes. For instance, Littlechild (2012) notes that, after the Fourth Line had been accepted and implemented, it became apparent that it was more economical to transport gas from

<sup>3</sup> Littlechild and Skerk (2008a) note that the designers and implementers of the Area of Influence method were aware of this flaw but opted consciously for a voting and cost allocation criterion based on use rather than economic benefit for considerations of objectivity and practicality as it reduced the extent of subjectivity required to apply the method. Use could be observed, recorded and verified – at least, historically – while economic benefit was a broad and not directly observable concept. The rules to calculate votes and allocate costs were thus specified to make the process workable and, as far as possible, immune to political pressure. Moreover, adopting a criterion of use rather than benefit had another advantage. It meant that CAMMESA's model of the electricity system could be used to calculate votes and allocate costs. Since this was the most developed model available at the time, adopting a criterion of use obviated the need and time-consuming (perhaps inconclusive) process to negotiate and develop a methodology to measure benefits (Littlechild and Skerk, 2008a). It has to be noted, however, that the level of use computed in the Area of Influence method critically depends on the node selected as the slack or responding bus (i.e. the reference bus located in the area of Buenos Aires). This is a subjective decision that in most cases is very arguable because there are no robust arguments to choose the node finally chosen as the slack one.

Comahue to Buenos Aires and built the power stations there than to build long-distance electricity transmission lines.

In addition to the above-mentioned flaws of the specific Area of Influence method, more generally the Public Contest method has been commented for some other deficiencies and shortcomings. In brief, these include:

- The PC method offers the possibility of strategic voting, for instance by incumbents to avoid new entrants from the system, which may lead to uneconomic or socially undesirable outcomes (Chisari et al., 2001).
- In some cases, transmission expansions could be financed by saved congestion rents (the so-called SALEX funds), which may have biased the PC process towards proposing and accepting uneconomic expansions (see Section 4 below).
- Another shortfall of the PC approach in Argentina is that it lacks a system-wide planning of major transmission expansions (Pollitt, 2008; IEA, 2013).<sup>4</sup> Such planning is useful for identifying 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 national transmission expansion plan and given some power to commission these new lines. Allowing private companies alone to decide on transmission lines with important implications for the location of future economic development is unlikely to lead to socially optimal and politically acceptable outcomes (Pollitt, 2008).
- The PC method is more (or even only) applicable in radial transmission systems, such as at the national level in Argentina – as only radial systems show low interdependencies and allow for detailed benefit allocation – but less (or not) in meshed systems, such as in several EU countries or at the regional (sub-transmission and distribution) level in Argentina (IEA, 2013). Littlechild and Ponzano (2008), however, show that the PC method has been adopted and, to some extent, applied successfully in the Buenos Aires province of Argentina (see also Littlechild, 2012).

To conclude, the PC method for transmission expansions was arguably the most innovative and radical aspect of electricity policy reforms in Argentina (Littlechild and Skerk, 2008a). In general, this method could help to ensure that the interests of users and customers who pay the cost of transmission expansions are effectively represented and that the size or cost of these expansions does not exceed what these users and customers are willing to pay for (Littlechild and Cornwall, 2009). In particular, the competitive tendering aspect of the PC method could serve to contain costs and to keep schemes to within budgeted or agreed costs (although, in general, competitive tendering could be used independently of the PC method; Littlechild and Cornwall, 2009). Moreover, the PC method could reduce the burden and cost of regulation, notably in countries with weak regulatory institutions (Abdala 2008b; Tieben et al., 2012).

On the other hand, the PC mechanism in general and its Area of Influence method in particular may result in uneconomic or socially undesirable outcomes if (i) the subset of voting agents ('beneficiaries') is not correctly specified and integrated in the mechanism, and/or (ii) the votes of these agents do not adequately represent their true

<sup>4</sup> Since 2003, however, there is a so-called '*Federal Transmission Plan*', but it is debatable how far it could be regarded as a real system-wide Plan (see Section 3 below).

economic interests in transmission expansions (Chisari et al., 2001; Chisari and Romero, 2008). Therefore, the PC method is generally less appropriate and applicable in meshed than in radial transmission systems (IEA, 2013) because only in radial systems can network use be computed in an easy way and in these systems benefits can be deemed somehow proportional to network use. Finally, another shortfall of the PC approach in Argentina is that it lacks a system-wide planning of identifying and commissioning expansions that should go ahead especially in the light of expected rather than actual demand growth (Pollitt, 2008).

## 2.3 Evolution of transmission expansion policy

Since the initial reforms of the early 1990s, the evolution of transmission expansion policy in Argentina has resulted in several modifications of this policy. In brief, the main modifications include (for details, see Littlechild and Skerk, 2008c):

- Since 1994, congestion rents from nodal price differences should be put into so-called SALEX funds, which could be used to defray initial construction costs as well as subsequent fees of transmission expansions (see Section 4 below on finance issues).
- Since 1998, a wider set of parties – including transmission companies and the system operator (CAMMESA) – is allowed to propose quality of service/security of supply expansions. This recognised and took advantage of the greater information and broader perspective possessed by these parties, while still leaving users responsible for actually deciding on expansions.
- In early 2003, a new process was announced for what were called ‘*upgrade expansions*’, to ensure that the networks continued to meet security conditions in the face of growth in demand. These upgrade expansions were of two types, i.e. *security expansions* and *adequacy expansions*. *Security expansions* were defined as those expansions required to meet a specified minimum standard, namely that the proportion of non-supplied energy should not exceed 30% of the demand in any area for ten days running. *Adequacy expansions* referred to small expansions required to achieve or maintain the original design standards of the transmission equipment, on the assumption that the economic crisis of early 2002 had delayed such expansions (Littlechild and Skerk, 2008c). Incumbent transmission concessionaires were invited to identify and define potential upgrade expansions. After consultation with the system regulator, ENRE, it would then be for the Secretary of Energy to decide which expansions to authorise. Adequacy expansions were awarded directly to the incumbent concessionaires, whereas there would be a competitive tender, where appropriate, for security expansions. Upgrade expansions were financed upfront by using SALEX funds, while the costs were recovered over time from capacity payments by consumers (and 30% of the cost from beneficiaries in the case of security expansions).
- In mid-2003, President Kirchner’s new government re-launched the so-called ‘Federal Transmission Plan’ (which was initially launched by the end of 2000 but terminated in mid-2001). This Plan had been designed by the Federal Electricity Council (a national, pre-reform organisation in which the provinces are represented together with the Secretary of Energy and which acts as an advisor to the national

government). It is debatable, however, how far it could be called a Plan as basically it reflected studies carried out by the Federal Electricity Council of transmission lines proposed by provincial governments (Littlechild and Skerk, 2008c). These lines are financed partly by private investors and partly (or sometimes wholly) by public funds from across-the-board surcharges or 'stamps' on transmission charges at the federal or provincial level, but increasingly by allocations of funds from the federal budget. In the years beyond 2003, this approach dwarfed the role of the Public Contest and other user-determined methods of transmission expansion, at least on the extra high-voltage (EHV) system (Littlechild and Skerk, 2008c).<sup>5</sup>

<sup>5</sup> In order to explain the change in policy (i.e. the re-instatement of the Federal Transmission Plan and the correspondingly diminished role of the Public Contest method), Littlechild and Skerk (2008c) note: "The Public Contest method was intended to achieve economic expansion of the transmission system, and to prevent uneconomic expansion, and it achieved both these aims. That, if anything, was its limitation. It was superseded at the federal level, especially, by arrangements designed to deliver political rather than economic expansions, especially additional EHV lines in the provinces."

# 3

## Ownership of the network

As noted above, since the policy reforms of the early 1990s, transmission has been fully privatised and unbundled from power generation and distribution. The national high-voltage system is owned and operated by the private company Transener, while the regional sub-transmission system is also owned and operated by private companies (each with exclusive monopoly rights in their regional concession area), except those major expansions under the PC method that have been granted to other, more competitive companies. All transmission companies are presently controlled by local investors (PLC, 2013). A transmission company, any of its controlled companies, or its controlling entity cannot be owner, majority shareholder or the controlling company of a generation company or a distribution company. In turn, a generation or distribution company, any of its controlled companies or its controlling company cannot own, be a majority shareholder or the controlling entity of a transmission company (PLC, 2013).

The national transmission company, Transener, was established and privatised in July 1993. Sixty-five percent of shares (51% class A and 14% class B) were sold for US\$ 234 million to a consortium formed by domestic (45%) and foreign (55%) shareholders, including the UK's National Grid Company. Ten percent of shares (class C) were transferred to employees and the Government kept the rest (class B) with the expectation of future sale or flotation (Abdala, 2008a). Later, however, foreign shareholders have generally sold their shares to local investors, in particular after the macro-economic crisis of 2002 and the subsequent policy measures, i.e. the devaluation of the peso and the freeze of publicly regulated tariffs in peso terms.

The duration of Transener's concession lasts for 95 years, although it is divided into performance contract periods of 10 years each (except for the first period, which lasts for 15 years). At the end of each performance period the government is assumed to call for a public tender for the sale of the majority stake of class A shares (51% of total company shares). The incumbent has a slight advantage in this tender, as all competing bids have to be compared to its own statement about the value of the company (submitted in a closed envelope before the bidding date). If none of the offers exceeds the incumbent reference price, the concession rights do not change hands. Otherwise, the group offering the highest bid pays this value to the incumbent and obtains the concession rights (Abdala, 2008a).

At the end of the 95-year period the government changes the legal status of the company to a new public corporation, and offers its shares in an international public tender. All parties receive equal treatment and the proceeds of the sale are used to reimburse the last concessionaire. The whole mechanism of periodic competition for the concession rights gives the incumbent the incentive to preserve the value of the assets under concession, dampening the traditional negative effect of franchising contracts with asset-reversion clauses (Abdala, 2008a).

# 4

## Financing

Since the early 1990s, transmission investments in Argentina have been financed upfront from a variety of sources, including:

- *External assistance.* Over the past decade, international development institutions such as the Inter-American Development Bank (IDB) or the Andean Development Corporation (CAF) have provided assistance to finance transmission investment projects in Argentina. For instance, in 2006, IDB approved a US\$ 580 million loan for the construction of a new 760-mile transmission line in northern Argentina, while CAF provided US\$ 500 million to finance two high-voltage lines included in the Federal Transmission Plan (Wikipedia, 2013). More recently, in 2011, IDB approved a US\$ 120 million loan to Argentina for strengthening its electricity network in 18 provinces, as laid down in Argentina's Federal Transmission Plan. The loan has an amortization period of 25 years with a grace period of 3.5 years and an interest rate based on the London Interbank Offered Rate (LIBOR). The government of Argentina contributes US\$ 120 million equivalent in local counterpart resources. A US\$ 84 million loan from CAP constitutes 70% of this counterpart contribution (IDB, 2013).
- *Private funding.* This source of funding includes both equity and debt finance from different private parties, depending on the method of transmission expansion. Under the (voluntary) Contract between Parties method, expansion is financed (partly) by the few, directly interested parties themselves and/or an (independent) transmission company or operator (who receives an annual or monthly fee from these parties – and, eventually, other beneficiaries – in order to cover the cost of the expansion). Under the Public Contest method, an expansion is usually financed by the company or consortium that wins the tender (and that gets the offered annual fee in return to cover the building, operation and maintenance cost of the expansion during its amortisation period). In addition, starting from 2001, the above-mentioned methods were complemented by allowing other private parties ('investors') to participate in the financing of expansions – including those proposed by the Federal Transmission Plan – by acquiring so-called '*Financial*

*Transmission Rights*’ in proportion to the extent to which they finance the cost of the expansion (Galetovic and Inostroza, 2008; Littlechild and Skerk, 2008c).<sup>6</sup>

- *Public funding.* Transmission expansions, notably those proposed by the Federal Transmission Plan, have also been financed through public funds such as the Federal Transmission Funds (FFTEF) or the Financial Trust for Investment in Transmission in the province of Buenos Aires (FITBA). These funds result from the proceeds of special ‘aggregate tariffs’, surcharges or ‘stamps’ on transmission charges at the federal and/or provincial levels. In addition, as noted before, transmission expansions have been financed by allocations of funds from the federal budget, in particular and increasingly in the years after the economic crisis of 2002 (Littlechild and Skerk, 2008c; Littlechild and Ponzano, 2008).
- *Salex funding.* In August 1994, the Secretary of Energy specified that future congestion revenues from nodal price differences should be put into so-called Salex Funds, one Fund for each of seven transmission corridors. As noted earlier, these funds could be used to defray (up to 70% of the) initial construction costs as well as subsequent fees of transmission expansions. To be eligible for support, however, the expansions had to produce reductions in the transmission constraints that generated local price differentials in the corresponding corridor. So, investments in each of the seven corridors benefit only from SALEX funds corresponding to congestion rents collected from differences in prices in this corridor. Since 1994, Salex funds have indeed been used to finance a major part of the costs of several expansions under the Public Contest or other (user-decision) methods. This has raised the concern that the use of these funds may have led to biased decision-making, resulting in socially uneconomic expansions, as beneficiaries had to evaluate if expected benefits would suffice to cover residual costs after using the Salex funds, and to vote accordingly for or against a project (Chisari and Romero, 2008). According to Littlechild and Skerk (2008b), this was indeed the case for the Fourth Line – see Section 2.2 – but this was an exception and not characteristic for PC expansions in general. They show that only 5 (out of 36) PC expansions benefitted from Salex funding and that four of them (i.e. except the Fourth Line) seem to be economic even without Salex funding.

The risks of financing expansions depend on the type of funding and the type or method of expansion. In general, there is the risk that the actual costs/benefits of an expansion are higher or lower than expected. Under the Contract between Parties method, these risks are predominantly born by these parties. Under the Public Contest method, these risks are born partly by the winning consortium (as charges levied cover expected costs of the expansion while actual costs may be higher or lower than these expected costs) and partly by all the beneficiaries identified by the Area of Influence method (as actual benefits may be higher or lower than expected). In the case of private capital funding in return for financial transmission rights (FTRs), the investors take the risk that the FTR revenues may be less or more than the costs. In the case of loan or debt financing, there is the risk – in particular for the lender – that the loan can or will not be repaid. Moreover, in the case of foreign lending, there is the additional risk – usually for the borrower – of a domestic currency devaluation, resulting in higher debt repayments in local currencies.

<sup>6</sup> A financial transmission right means the right to receive charges for transmission losses and congestion, i.e. differences in nodal process along the line that is (co-)financed by the private investor (Galetovic and Inostroza, 2008; Littlechild and Skerk, 2008c).

# 5

## Cost and benefit allocation

As noted above, regulation of the transmission system in Argentina makes a distinction between existing and new facilities (expansions). For existing installations, the remuneration scheme of the transmission operator is based on both price and quality incentive regulation (derived from the UK's RPI-X price control system). In brief, for the national transmission operator, Transener, the main components of the regulated remuneration scheme regarding its existing capacity include (for details, see Abdala, 2008a, as well as Galetovic and Inostroza, 2008):

- *Line losses.* For each line, revenue from line losses is calculated as the difference between quantities transported, evaluated at nodal prices for each of the two nodes involved.
- *Line reliability.* Reliability of the line, also referred to as network quality of supply, is paid through the spatial difference between the remuneration that buyers pay for active power reserves (D) and what sellers receive for this concept. The spatial difference is introduced through the concept of a so-called adaptation factor (A). The remuneration for line reliability is then collected indirectly through the total difference between what buyers pay and what sellers receive for D, adjusted by their respective adaptation factors (Abdala, 2008a).
- *Access charges.* Access (or connection) charges are unit charges for each connection point with the grid in order to cover the operating and maintenance costs of existing equipment needed to connect users of the grid. These charges are distributed between the users that are connected, according to their pro-rated share of the maximum total power at the point of connection. Maximum power demanded is used in the case of consumers, and nominal power in the case of generators. This charge is applied in the hours for which the equipment is really available, with penalties applied for non-availability (Galetovic and Inostroza, 2008). The regulation of these charges follows an RPI-X regime, where the efficiency adjustment factor is set by ENRE but cannot exceed 1% per annum (Pollitt, 2008).
- *Complementary charges.* Complementary (or revenue reconciliation) charges have two components (Abdala, 2008a). The first one is the so-called transmission capacity charge, which is a per-hour value based on line usage. To account for usage made by various customers, weights are determined according to each user load, measured at the system peak. Transmission capacity charges are also subject

to RPI-X regulation, in the same fashion as access charges. The second component of complementary charges is the difference between realized and estimated charges for line losses and line reliability (as mentioned above). These complementary charges are prorated among customers by means of the Area of Influence method (similar to the Public Contest method for allocating the costs of new lines, as discussed in Section 2.2).

There are two elements in the pricing regime, line losses and line reliability, which send correct price signals to grid users, but have a perverse effect on the behaviour of the grid owner. Indeed, the higher the losses and the lower the reliability of the line the higher the revenue for Transener. To counteract this negative signal on transmission quality, Transener is given special incentives to maintain full availability over the whole network. Transener pays penalty charges whenever lines are unavailable, and receives bonuses when its availability performance is outstanding (Abdala, 2008a).

Penalties for lack of availability have been set on a per-line basis. Their size increases with the duration and frequency of line outage, voltage, and by a fraction of the overrun costs incurred by the system due to the transmission failure (Abdala, 2008a; Littlechild and Skerk, 2008e).

Besides line availability, regulation of the provision and remuneration of transmission services includes also other quality requirements, in particular the regulation of voltage levels – which should not exceed a pre-established range – of reactive power equipment, transformation stations, and other operative and configuration issues (Abdala, 2008a).

For new transmission facilities under the Public Contest method ('major expansions'), the regime for transmission pricing and cost allocation has already been outlined in Section 2.2. In summary, during the amortisation period of an expansion, the annual transmission charge to cover the construction, operation and maintenance costs of the expansion is set through competitive bidding and shared by all beneficiaries identified by means of the Area of Influence method. After the amortisation period, charges for operation and maintenance of the installation basically follow the remuneration regime for existing facilities (as discussed above).

# 6

## Market and system operation

Incumbent transmission companies, such as Transener, are primarily responsible for the operation and maintenance of their network, but not for the planning or expansion of the system. While having exclusive monopoly rights within their concession area, they are obliged to provide open, non-discriminating access to all third parties at regulated tariffs. If capacity constraints arise, transmission companies cannot discriminate through rationing devices since the independent system operator, CAMMESA, decides which generators are called upon, based on an unconstrained dispatch merit list that sorts producers by their fuel costs and guarantees access priority to the lowest-cost generators (Abdala, 2008a).

In Argentina, the wholesale electricity market (MEM) – which is managed by CAMMESA – is actually a power pool that aggregates electricity supply from all generation sources of the country, including imports. It comprises (i) a term (futures) market, consisting of agreements for which quantities, prices and conditions are negotiated directly between buyers and sellers, (ii) a spot market with hourly electricity prices, and (iii) a balancing market (Vagliasindi and Besant-Jones, 2013).

In the spot market, load dispatch and hourly electricity prices are determined mechanically by CAMMESA, based on hourly demand forecasts and the short-run marginal costs (SRMC) of the generator that clears the market in each area in an efficient cost-based merit order dispatch (Joskow, 2008). The reference point for determining the spot market price is the Ezeiza 500 kV node, i.e. the system load centre located near Buenos Aires (Chisari et al., 2001; Pollitt, 2008). In each of the other nodes on the grid, the electricity price takes into account the cost of power transmission to or from this reference ‘market’ node. This means that when the system is uncongested – i.e., when there are no transmission constraints – the price at any other consumption node is equal to the price in the Ezeiza node plus marginal transmission costs (including marginal transmission losses) from Ezeiza, while the price at any generation node is equal to the reference price in Ezeiza less marginal transmission costs from that production node to Ezeiza (Littlechild and Skerk, 2008b).

When a line is congested – i.e., there is a transmission constraint – CAMMESA determines a so-called ‘local price’ in the constrained generation node as well as the spot clearing price in the reference market node (Ezeiza), based on the most efficient merit order dispatch in each node. Due to the transmission constraint, prices decrease in the constrained generation node – compared to the case of no congestion – whereas prices increase in the reference node (where power distribution and consumption is concentrated). As noted before, resulting congestion rents, i.e. revenues from nodal price differentials due to congestion, are put in Salex funds in order to finance expansions that reduce the severity of the transmission constraint.

All dispatched generators receive the (local/nodal) spot price, supplemented by a capacity charge (to support generation investment). The nodal factor is calculated by taking into account technical losses and restrictions in the transmission system. The capacity charge is only paid to generators when they are actually producing – under certain supply conditions – and not, as theory would suggest, for availability of capacity as such – which may lead to less beneficial outcomes (Pollitt, 2008; Joskow, 2008; Vagliasindi and Besant-Jones, 2013).

For regulated energy consumers – which include all residential customers, small commercial and small industrial customers – the regulated electricity tariff is a fixed, stable price, but can be adjusted every three months. The basis of this tariff is the seasonal electricity price, which is set every six months by the Secretary of Energy. This seasonal price is, in turn, based on estimates of spot prices calculated by CAMMESA on projections of electricity supply and demand.<sup>7</sup> The final prices for regulated customers are a combination of the seasonal electricity price, a capacity charge and transmission and distribution value added charges (Pollitt, 2008; PLC, 2013).

Finally, besides regulated electricity consumers, there are also free or non-captive end-users in Argentina’s power market. These are mainly large users who are entitled to purchase their electricity consumption directly from generators or traders through bilateral contracts, at freely negotiated prices (PLC, 2013; Vagliasindi and Besant-Jones, 2013).

<sup>7</sup> Since 2002, however, seasonal electricity prices have been fixed by the Secretary of Energy regardless of spot prices and projections of electricity supply and demand (PLC, 2013).

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