The Argentinian experience of designing and implementing renewable energy auctions

Lessons for sub-Saharan Africa

Energy and Economic Growth Research Programme
PO Number: PO00022908

October 2020

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Frequently used acronyms and abbreviations

AOP	Adjusted offered price
Biogas-SL	Biogas from sanitary landfill
CAMMESA	Compañía Administradora del Mercado Mayorista Eléctrico (Wholesale Electricity Market Management Company, non-profit)
DFI	Development finance institution
ENRE	National Electricity Regulatory Entity
FODER	Fondo Fiduciario para el Desarrollo de Energías Renovables (Renewable Energy Trust Fund)
IFC	International Finance Corporation
IPP	Independent power producer
MINEM	Ministerio de Energia y Minería, Argentina
O&M	Operations and maintenance
PPA	Power purchase agreement
PV	Photovoltaic
RE	Renewable energy
RfP	Request for proposal
ROI	Return on investment
SLC	Stated local content
SOE	State-owned enterprise
Tcf	Trillion cubic feet
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

In May 2016, the Argentinian government launched its RenovAr programme to manage the auction of renewable energy (RE) generation projects. In the four auction rounds run between 2016 and 2019, the programme attracted bids amounting to 18 573 MW, of which 4 654 MW[1] were awarded at an average price of US$55.4/MWh. Of the awarded projects, 31 per cent (1 411 MW) began operations on schedule. This meant that the share of RE in Argentina increased from 1.9 per cent of total generation in 2015 to 6.5 per cent by December 2019.

The RenovAr programme differed from previous ones in two basic respects. The first was the use of competitive auctions to assign 20-year power purchase agreements (PPAs). The second was the establishment of a trust fund – the Fondo Fiduciario para el Desarrollo de Energías Renovables (FODER) – to provide loan guarantees and investment financing in an attempt to mitigate the macroeconomic and sectoral risks linked to RE investment in Argentina.[2]

The auctions have been highly competitive, particularly with regard to solar and wind energy, with bids repeatedly exceeding the auctioned volumes. This, has in turn, given rise to highly competitive and downwardly trending prices, comparable to those achieved by other countries in the region that are exposed to substantially lower financial risks.

When analysing the growth of RE usage in Argentina, certain distinctive elements of its economy and its energy sector are worth highlighting. Going from the general to the particular, these are:

- Chronic macroeconomic instability;
- Competitive primary energy sources;
- The institutional fragility of the electricity sector;
- The lack of a comprehensive sectoral investment plan;
- Limitations of the transmission system.

Macroeconomic instability has characterised the country since the late 1990s. This is reflected in a high country-risk premium; meaning that the cost of capital is high.[3] This has had a direct impact on RE installations in Argentina in three ways. First, the RE sector is capital intensive – with capital costs representing 80 to 90 per cent of total costs. Second, it requires foreign investment. Third, RE is politically sensitive because its adoption has the potential to affect end-user electricity prices. As for many countries, finding mechanisms to mitigate and control the financial risks has therefore been fundamental to the design and implementation of Argentina's RE development policy.

Argentina's wind and solar resources are among the most abundant in the world (for a graphic representation of these, see Appendix A). In the northwest region, solar radiation ranges from about 1.8 MWh/m^2 to 2.2 MWh/m^2 per year (Righini and Gallegos 2011). In Patagonia, in the extreme south of the country, wind resources allow utilisation factors greater than 50 per cent (Jimeno et al. 2017). On the other hand, Argentina also has the third-largest reservoir of shale gas and shale oil, with estimated reserves of over 802 Tcf of natural gas in Northern

1 In fact, 4 726 MW was awarded, but five contracts for 73 MW were subsequently cancelled.

2 FODER is a fiduciary fund, with a publicly owned bank (Banco de Inversión y Comercio Exterior) as trustee, through which the state initially guaranteed energy payments as per the PPAs, and made it possible that projects could exercise a 'put option' if the state failed to meet certain contracted obligations.

3 See Garrison (2020). Between 2009 and 2019, the interest rate on Argentina's sovereign bonds averaged more than 755 basis points over US bonds, with values exceeding 1 000 basis points over more than 20 per cent of this period.

Patagonia's Vaca Muerta formation (*RunRún Energético* 2018). The abundance and diversity of primary energy sources means that no single technology dominates the country's energy sector. It therefore makes sense for the country to try to adopt strategies that optimise the contribution of different sectors by balancing minimum cost, and ensuring the security of supply, the diversification of primary sources, and the minimisation of emissions, etc.).

In the early 1990s, Argentina's electricity sector was organised as a highly competitive market. After a massive macroeconomic crisis struck in 2002, the sector slowly mutated into a single-buyer system in which the government plays a central role in investment. However, the system has neither a well-defined institutional framework nor a clear allocation of responsibilities. For several years, the government has delegated the functions of procurement agent and sole buyer to the wholesale electricity market administrator, CAMMESA (Compañía Administradora del Mercado Mayorista Eléctrico).[4] As shown in this report, the absence of a clearly defined institutional energy system and well-coordinated governance mechanisms has placed some limits and conditionalities on the design and implementation of RE policies. In addition, the lack of an agency or mechanism that is responsible for medium and long-term planning for the energy sector as a whole has proven a significant obstacle to the development of RE.

In 2015, Argentina adopted a renewable portfolio standard, with a target of 20 per cent RE in the country's total generation mix by 2025. Based on in this legal mandate, the RenovAr programme began a series of auctions for the incorporation of RE installations. At the same time, the government ran other auctions in the electricity sector (for thermal power, cogeneration, gas power plant closure, transmission expansion, etc.) and implemented other non-regulatory policies (such as subsidies for the development of shale gas) with no coordination across the energy sector as a whole. Furthermore, the elements of these programmes – volumes, locations, price differentiation by technology, etc. – do not respond to an optimised expansion plan and are in some cases clearly inconsistent. This increased the financial risks related to the RenovAr programme.

A specific issue related to the lack of long-term planning is the expansion of the electricity transmission network. The primary energy sources in Argentina are located at great distances from the main load centres. For example, wind resources in the south and solar resources in the west and northwest, are thousands of kilometres from the greater Buenos Aires metropolitan area, which uses approximately 35 per cent of the electricity generated in the country (CAMMESA, 2019: 21). Naturally, transmission capacity has limited the volumes and sites available for RE installations. Thus, mechanisms for planning and allocating transmission capacity and expanding the network have to be closely coordinated with new generation projects (both RE and conventional).

The RenovAr programme has been influenced, both in its design and implementation, by these factors. The success of the first rounds – in terms of attracting offers at highly competitive prices – decelerated strongly as a result of Argentina's 2018 macroeconomic crisis. Not surprisingly, fewer bidders took part, and bid prices were higher in the fourth round, which was held in 2018 and 2019. Similarly, with the change of administration after the 2019 presidential election, and the Covid-19 crisis that began in early 2020, the construction of awarded projects has slowed considerably.

In this report, we analyse the design, implementation and results of the first four rounds of the RenovAr programme that took place between May 2016 and mid-2019. The next section

4 CAMMESA was originally established to manage dispatch and act as a clearing house for financial transactions in the energy sector.

provides some basic background about Argentina and its energy sector. In Section 3, we focus on the energy auctions. In Section 4, we present the programme's results. In Section 5, we outline the main lessons learned and make some recommendations. Our conclusions are contained in Section 6, and an overview of the analytical framework used in the study can be found in Appendix B.

2 Country overview

Located in the southern cone of Latin America, Argentina is large, geographically diverse and sparsely populated. With a total area of 2.78 million km^2, the country is the second largest in the region (behind Brazil) and the eighth largest in the world. As of December 2019, the human population was 45 million, yielding a population density of 16 inhabitants per square kilometre.[5] The country stretches about 3 800 km, north to south, and is about 1 400 km at its widest point, east to west. It contains a great diversity of climates (with historical minimum and maximum and temperatures of –35ºC and 49.1ºC) and terrain that varies from rainforest in the northeast to large fertile plains in the centre, mountain ranges in the west and semi-arid desert regions in the south.

With a GDP of approximately US$450 billion, Argentina has one of Latin America's largest economies. With its extraordinarily fertile land, it is a leading food producer, and its natural resources in the form of gas and lithium reserves offer great potential for RE. However, historical volatility, linked to an accumulation of institutional obstacles, has impeded development so that approximately 35.4 per cent of the urban population live in poverty.[6]

In 2018, a series of external and internal difficulties hit hard. These included severe drought, financial volatility following the US Federal Reserve's adjustment of its interest rate,[7] and negative perceptions regarding the pace of fiscal reforms. The peso devalued significantly. At the time of writing in mid 2020, the annual inflation rate was above 50 per cent, with GDP having contracted by 2.5 per cent in 2018 and 3 per cent in 2019.

2.1 Argentina's power sector

2.1.1 Introduction

Argentina's electricity mix is dominated by thermal generation (mainly combined-cycle gas turbines) followed by large hydro. By December 2019, installed capacity in Argentina's national grid was almost 40 GW.

The evolution of installed capacity from 2009 to 2019 is shown in Figure 1. Although Argentina's energy mix is still dominated by thermal and large hydro generation (see Table 1), energy from RE sources has risen in importance since 2015, and now amounts to 6.5 per cent.

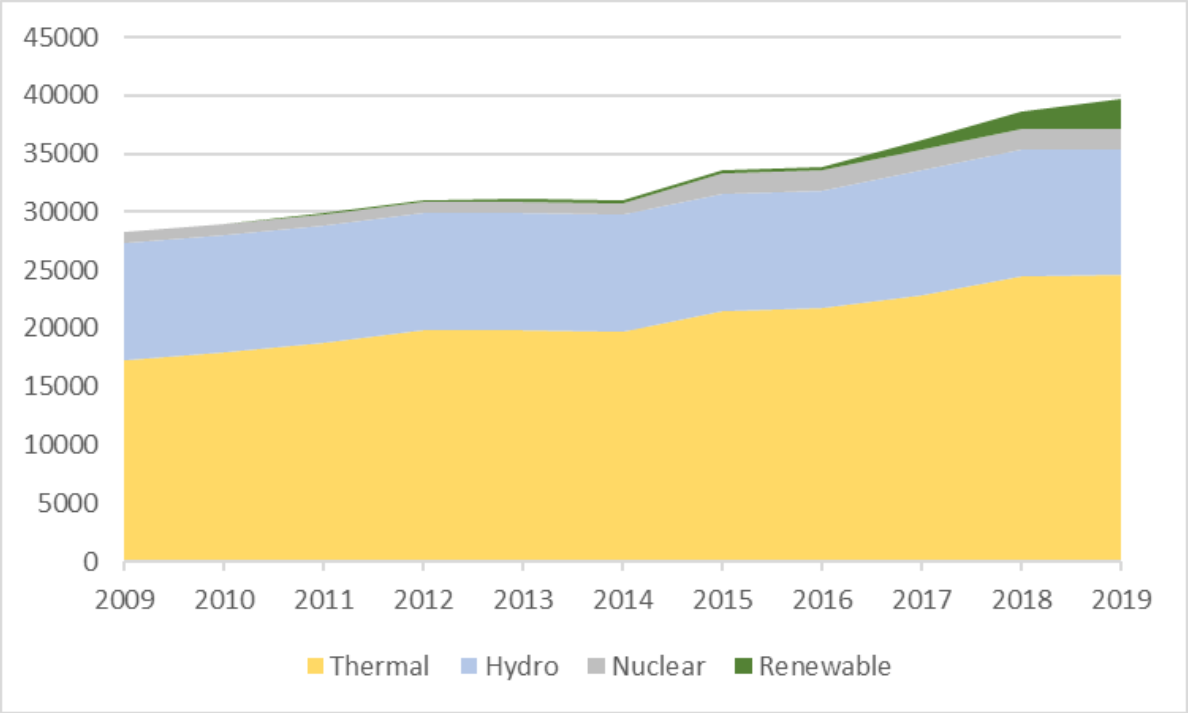
Peak demand in the system reached 26.3 GW (on 8 February 2018). Adjusting installed capacity by average availability and load factors for each technology (hydro and renewables have particularly low load factors of around 40 per cent), net installed capacity stands at 37 GW, which means the country has a reserve margin of 40 per cent. This is due partly to over-investment since 2015 (including in renewables), and partly to economic stagnation.

5 As estimated by Argentina's National Statistics Institute (INDEC, n.d.); according to World Bank data, this is 70 per cent less than overall population density in sub-Saharan Africa in 2018, which they estimated at 51 people per square kilometre (World Bank, 2018b).

6 https://www.worldbank.org/en/country/argentina/overview

7 When the US Federal Reserve increases interest rates, the cost of debt in emerging economies tends to increase, and disinvestment often follows.

Figure 1: Installed electricity (MW): Argentina 2009–2019



Data source: CAMMESA (various); Secretaría de Energía (2019)

Table 1: Argentina's installed capacity, December 2019

Capacity	GW	%
Thermal		
Combined cycle	11.25	28.3
Gas turbine	7.4	18.6
Steam turbine*	4.25	10.7
Diesel	1.66	4.2
Total thermal	24.56	61.8
Renewable		
Wind	1.61	4.1
Hydro	0.50	1.3
Solar	0.44	1.1
Biogas	0.04	0.1
Biomass	0.002	0.01
Total renewable	2.59	6.5
Hydro	10.81	27.2
Nuclear	1.76	4.4
Total	39.70	100.0

Note: * Uses gas or heavy fuel oil for heating
Data source: CAMMESA (December 2019)

Electricity access is widespread, with overall coverage of over 95 per cent reported in 2018.[8] Nevertheless, some differences are evident with rural coverage at 85 per cent and urban at more than 95 per cent (IEA 2019). In 2000, the Renewable Energies in Rural Markets Project was established to facilitate the provision of energy access to dispersed rural populations far from distribution networks. The programme subsidises 100 per cent of the capital costs

8 International Energy Agency Electricity Access Database, see: https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity

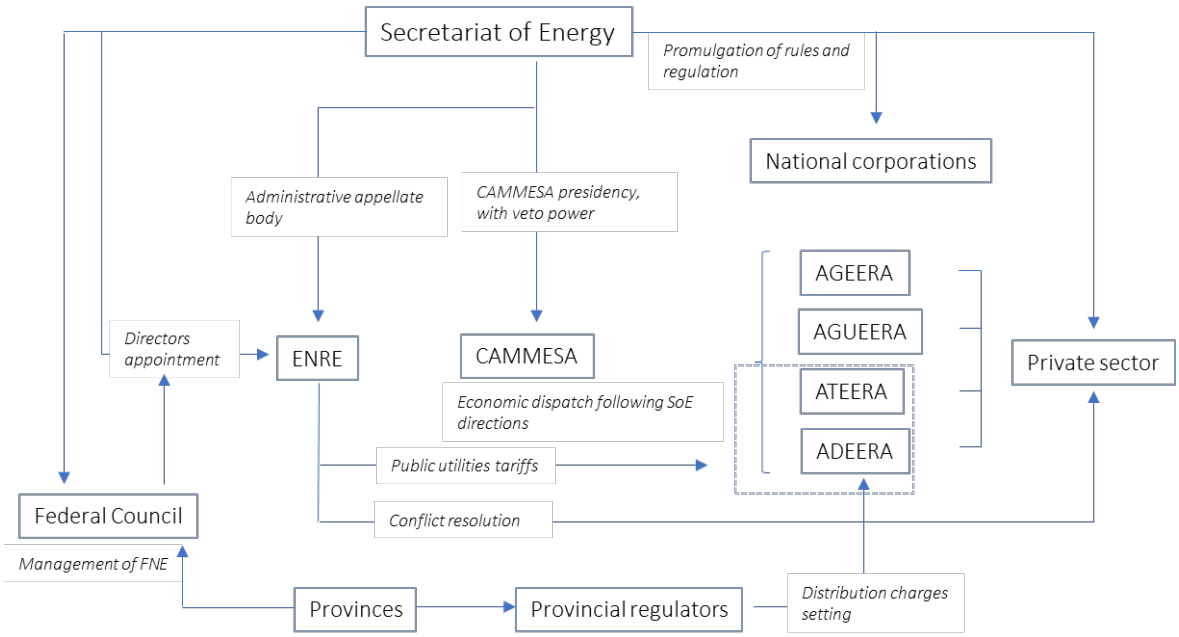
related to the installation of: individual PV and/or wind systems; mini-grids (hydro/solar/wind/hybrid); solar systems for thermal purposes (cookers, ovens and hot water tanks); and PV systems for pumping drinking water and other productive uses.

2.1.2 Power sector structure

Starting in 1992, the restructuring of Argentina's power sector (through Act 24.065) was a textbook example of the reform paradigm that gripped the sector globally in the 1990s. The reforms included massive privatisation, vertical and horizontal unbundling, the introduction of a competitive wholesale market, and the creation of an autonomous regulator. Figure 2 shows the outcome of this process as of 2019 and Table 2 provides a brief description of the main players.

As the main representative of the executive branch of the federal government, the Energy Secretariat is the central player and is in charge of several functions. First, it is responsible for defining and implementing policy through the promulgation of rules and regulations governing the wholesale electricity market. Second, the Secretariat chairs the CAMMESA Board and holds veto power. Third, it has indirect competence on regulatory matters, which makes it responsible for the appointment of three of ENRE's five directors, and the administrative appellate body for all decisions made by ENRE. Fourth, it is involved in monitoring state-owned generation companies. Finally, it chairs the Federal Electricity Council (Consejo Federal de la Energía Eléctrica, CFEE), which is responsible for the management of the National Energy Fund (Fondo Nacional de la Energía).[9]

Figure 2: An overview of Argentina's energy sector, 2019



9 The National Energy Fund was established to help finance further electrification. The Fund derives its income from a surcharge on the rates paid by distribution companies and large users in the wholesale market, as well as from interest on loans it provides.

Table 2: Key institutions in Argentina's electricity sector, 2019

Energy Secretariat, within the Ministry of Productive Development*	The Energy Secretariat is the main government body responsible for the design and implementation of energy sector policies. Its main functions include: defining wholesale market rules to be implemented by CAMMESA; chairing CAMMESA (with the power of veto); serving as an appeal body to ENRE decisions; appointing directors of SOEs in the energy sector; chairing Federal Energy Council, etc.
National Electricity Regulatory Entity (ENRE)	ENRE is an autonomous body responsible for regulating electrical activity and ensuring that companies in the sector (generators, transmitters and distributors) comply with their obligations as established in the regulatory framework and in their concession contracts
Wholesale electricity market administrator (private company) (CAMMESA)	CAMMESA plans the operation of the interconnected system, including the seasonal planning used by the Energy Secretariat to determine the seasonal price that is charged to distribution companies' customers. In addition, CAMMESA plans yearly, semi-annual, quarterly, monthly, weekly and hourly electricity dispatch
Generation companies	Between them, 45 mostly private companies own 410 generation units, 27 self-generation units, and 8 cogeneration units
Transmission companies	A total of 8 companies are involved in transmission (1 extra-high voltage, and 7 backbone/trunk network)
Distribution companies	Of the 29 distribution companies, 17 are 'concessioned' to the private sector and 12 are provincial SOEs. In addition, 584 cooperatives are also involved in distribution.
IEASA (formerly ENARSA)	IEASA is an SOE engaged in the exploitation of oil and natural gas, and in the production, industrialisation, transport and commercialisation of oil, natural gas and electricity. It serves as the main gas provider to CAMMESA
CFEE (Federal Electricity Council)	The Council advises on and coordinates energy policies developed by the federal government and the provinces. It also administers the Fondo Nacional de Energía Eléctrica (National Energy Fund)
Financial institutions	Banco de la Nación Argentina and Banco de Inversión y Comercio Exterior (BICE), a trustee of FODER

Note: The Ministry of Productive Development is a relatively new structure; before 2019, there was a Ministry of Energy, and between 2015 and 2018, a Ministry of Mines and Energy (MINEM).
Data source: CAMMESA (December 2019)

As, the sector regulator, ENRE's main role is to protect users' rights. This includes establishing and enforcing transmission and distribution tariffs, as well as quality standards and service rules and regulations. It is also the first stop for all sector stakeholders when dispute resolution is required.

Argentina's 23 provinces hold power over electricity distribution through concession contracts or, in some cases, as direct owners of electricity companies, and are key stakeholders in the system. An important part of provincial responsibility is channelled through the provincial regulatory authorities (which fix distribution tariffs at provincial level) and the CFEE (which manages the Energy National Fund and nominates two of ENRE's five directors).

Private actors are the other key stakeholders in the electricity sector. As mentioned, almost all generation (with the exception of nuclear plants and two large binational hydro generators), transmission and more than half of the distribution (in terms of number of users) is under private ownership (in the case of thermal generators) or private management (through concession contracts in the case of hydro generation, transmission and distribution).

In the generation segment, all electricity is traded via a wholesale electricity market (Mercado Eléctrico Mayorista, MEM). As originally conceived, the MEM was a competitive space in which thermal generators bid for fuel prices and hydro generators bid for energy prices on a quarterly basis. The marginal cost of the marginal generator in each hour defined the system

marginal price that was paid to every generator producing in that hour. In addition, a capacity payment was paid to all generators included in an unconstrained pre-dispatch.

As a result of the 1990s reforms, international competitive bidding was carried out to privatise all existing thermal generation, and 30-year concession contracts were awarded for the operation and maintenance of hydro generation plants. Two large international hydro generators – Yacyretá and Salto Grande – and the two existing nuclear plants remained under state control.[10] Further generation expansion was then left to market forces with free entry to all new generation companies.

During the 1990s, unbundling process, the transmission system was also split into a single extra-high-voltage (500/220 kV) company – Transener – and seven regional, high-voltage (220/132 kV) transmission companies. The operation and maintenance of these companies was concessioned for 95 years through an internationally competitive bidding process. Transmission services are regulated by ENRE through a revenue cap mechanism. Connection and use-of-system charges are levied on generators, distributors and large users to cover the annual revenue cap. Independent transmission companies are expected to bid for the construction as well as the operations and maintenance of new transmission lines when coalitions of beneficiaries (generators, distributors and large users) request such expansion.

As noted, electricity distribution falls under provincial jurisdiction except for the greater Buenos Aires metropolitan area which is under federal control. The federal government and 11 of the 23 provinces (representing approximately 60 per cent of total users) have privatised distribution through long-term concession contracts. Distribution companies are able to sign long-term PPAs with any generator or buy from the wholesale market.[11] For most privatised companies, distribution tariffs are subject to a price cap, with pass through of transmission and wholesale electricity prices.

Large electricity users are allowed to buy directly from any generator or supplier while paying distributors and transmission companies a tolling (use of wires) fee. Initially, the threshold for large users was set at 1 MW but this has gradually been lowered to 30 kW. As of 2019, the system had 2 600 large users, with another 6 000 in distribution companies; their total demand amounted to 23 561 GWh (18 per cent of system demand).[12]

In 2002, following a massive macroeconomic crisis, the government froze energy (electricity and gas) prices at the wholesale and retail level. This lasted, with minor adjustments, for over 13 years. As a result, the power sector evolved towards a de facto single-buyer system, in which the government provided most of the gas to thermal generators, and paid them an energy conversion fee. During this period, the government undertook most new investment in generation through a newly created state-owned energy company (ENARSA).

By 2015, subsidies to the energy (electricity and gas) sector, which were almost nil in 2001, had climbed to nearly 3 per cent of GDP (Secretaría de Energía 2019). In 2016, a new administration ended the price freeze but made no major changes to the wholesale electricity market, which still functions as a single-buyer model. Also in 2016, the government began auctioning PPAs with new and existing generation companies for additional capacity. CAMMESA acted as the off-taker for all contracts with an explicit warranty from the federal government.

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10 The hydro stations are ‘international’ in the sense that Yacyretá is on Argentina’s border with Uruguay and Salto Grande is on the border with Panama.

11 Distributors bought from MEM at a seasonal price defined by the Secretary of Energy as the average of the expected spot price for the following quarter.

12 CAMMESA, *Informe Mensual*, December 2019.

2.1.3 Tariff levels and financial sustainability

The legal framework adopted in 1992 made economic and financial sustainability a clear objective for the energy sector. However, as noted, after the 2002 crisis, end-user rates and wholesale market prices were frozen within a high-inflation context, creating a large financial gap in the sector.

After an almost 13-year tariff freeze, the new administration that took office in December 2015 began a process of normalisation. This included a review of transmission and federal distribution companies' tariffs, and increasing the wholesale prices paid to generators. Thus, the electricity sector deficit decreased from US$11 812 million in 2015 (representing 1.8% of GDP) to US$3 737 million in 2019 (0.9% of GDP) (Secretaría de Energía, 2019a).

In December 2019, another new administration took office and immediately decreed a new six-month rate freeze. Given high inflation and the CoViD-19 crisis, this freeze is likely to be extended for a longer period, thus deepening the deficit once again.

In the wholesale market, CAMMESA has assumed the role of sole buyer in all PPA contracts signed with both thermal and new renewable generators. As per the regulations, CAMMESA's collection and payment mechanism 'socialises' the collectability risks. If in any month, the money collected by CAMMESA from distributors doesn't cover the cost of generation, the shortfall is meant to be covered by an interest-free loan from the treasury. If the treasury does not provide a loan – and, so far, it has not – CAMMESA reduces payments to all generators and transmission companies in proportion to the shortfall. This means that the collectability risk should be borne first by the state and then collectively by all creditor agents (that is, generator and transmission companies).

Some PPAs (including for RE projects) contain clauses giving them priority in this situation, such that the rule of proportionality among all participants is limited by the existence of privileged creditors. By the end of 2019, distributors' debt to CAMMESA amounted to nearly US$650 million (approximately 11% of annual sales to distributors) (Secretaría de Energía, 2019b).

The precarious financial situation of the sector, combined with the chronic macroeconomic crisis, led to specific risk mitigation mechanisms being established for PPAs involved in RE auctions; these are discussed in Section 3.1.8.

2.1.4 Regulatory and policy framework

As noted, the power sector's regulatory framework is set out in laws and regulations drafted by the Energy Secretariat. At the start of the 1990s reform process, Act 24.065 of 1991 established the following objectives for the sector: protecting users' rights; promoting competitiveness in the electricity market; encouraging investments to secure long-term supply; promoting operational reliability and efficiency; enhancing equity and freedom of access, non-discrimination; encouraging widespread use of electricity transmission and distribution facilities; regulating transmission and distribution, ensuring fair and reasonable tariffs; and creating adequate tariff-setting structures.

Since 1998, specific laws have been promulgated to advance the development of RE. In that year, Act 25.019 declared electricity generation from RE to be of national interest, and established various incentives (mainly tax exemptions) to ensure its prioritisation. Act 26.190 of 2006 affirmed all tax incentives and created a renewable energy feed-in tariff programme. The values for the feed-in tariff were established and the Act indicated that these were to be funded through the National Energy Fund (see Note 9). However, neither of these laws had much effect in terms of attracting RE investment. Part of the reason for this was that the laws

set out tariffs payable in the local currency (pesos/kWh), with a quarterly adjustment mechanism based on the variation of the average cost of generation in the wholesale market. In the context of the country's high inflation rates (which have consistently been above 15 per cent per annum since 2000) and the freezing of wholesale tariffs, payment in pesos was unattractive for investors.

At the end of 2015, Act 27.191 amended the 2006 legislation. The 2015 Act established a renewable energy portfolio standard, with the short-term objective of ensuring that 8 per cent of national electricity consumption would be supplied from RE sources by the end of 2017. The medium-term objective was stated as being to increase the contribution of RE to the energy mix to 20 per cent by the end of 2025. The new law was a key element in international commitments made by Argentina to addressing climate change.[13]

Argentina's current legal framework provides a set of short- and medium-term objectives for RE in an attempt to provide predictability for investments.[14] The regulatory framework has been adapted and improved to encourage the diversification of the national energy matrix, to increase the participation of RE, thus reducing dependence on fossil fuels. As mentioned in the introduction, one of the most significant aspects of the framework was the creation of a trust fund for renewable energy development, FODER, to mitigate macroeconomic risks and address the financing difficulties facing the sector. The legislation also includes provisions for fiscal incentives, such as exemption from import duties and certain other taxes, accelerated amortisation, advance VAT refunds, and incentives for the incorporation of local components, equipment and products in the generation business. The then-Ministry of Energy and Mining was also instructed to establish the contracting mechanisms needed to meet the stated RE participation goals and to promote technological and geographical diversification.

However, as in so many countries, one of the major limitations of Argentina's electricity sector is the absence of a medium- and long-term planning mechanism. The sectoral reform of the 1990s was based on a concept that delegated all generation and transmission investment decisions to the market. Since 2002, the reform process has been rolled back, significantly increasing the role of the state in the sector, but without introducing any formal planning mechanisms. For example, the RE tenders have been developed without coordination and consideration of other tenders being issued for the electricity and gas sectors.

13 Renewable energies are a major component of the national determined contribution (NDC) presented by the Argentinian government to the UN Framework Convention on Climate Change. The revised version of Argentina's NDC, published in November 2016, set the unconditional GHG emission reductions target at 18 per cent, and the overall target (conditional plus unconditional) at 37 per cent by 2030 (World Bank, 2017).

14 Act 27.191 has since been complemented by Decree 531.16 and other pieces of legislation, which sets out the policy objectives in more detail and indicates how these objectives could be achieved.

3 Renewable energy auctions – The RenovAr Programme

Framed by Act 27.191, and hence shaped by its objectives and instruments, the RenovAr programme was launched in 2016, seeking to incorporate 10 000 MW of RE into the energy matrix by 2025. So far, the programme has been carried out through periodic auctions in which companies present investment projects and the price at which they are willing to sell electricity if they are awarded a 20-year PPA. Between 2016 and 2018, four auction 'rounds' occurred, (RenovAr1, RenovAr1.5, RenovAr2, and RenovAr3), with few variations in their main features (see Table 3).

The RenovAr programme is designed to achieve several objectives. These are: to allocate contracts transparently and competitively; to minimise the long-term costs to consumers; to respect the legal mandate regarding the technological and geographical diversification of the energy sector, and; to set incentives for the development of a national industry capable of manufacturing RE generation equipment.

The first round, RenovAr1, required 1 000 MW of RE, split between technologies (wind, solar PV, biomass, biogas, and small hydro). The bidding terms and conditions set out the maximum available tax benefits they could claim through accelerated depreciation, advance VAT returns, etc.) and the investment reference value (per MW and per technology) (see Section 3.1.8).

For Round 1, a reserve (or ceiling) price was set per technology (in US$/MW), but the amount was not made public until after bids had been submitted, and projects exceeding this price were automatically disqualified. The government did not explain why they withheld this information, and its impact is unclear. However, according to the International Finance Corporation, which played an advisory role in the process, this resulted in lower prices:

Table 3: Key features of RenovAr auctions, Argentina, 2016–2019

Round number	RenovAr1	RenovAr1.5	RenovAr2	RenovAr3
Date of RfP	May 2016	Oct 2016	Sept 2017	Nov 2018
Design				
Volume requested*	1 GW	600 MW	1 768 MW	400 MW
PPA length	20 years			
Currency	US$ (indexed)			
Regional capacity required	No	Yes		
Implementation				
Policy and regulation authority	Undersecretariat for Renewable Energies and Energy Efficiency			
Regulator	Ente Nacional Regulador de la Electricidad (ENRE)			
Procurer	CAMMESA			
Off-taker	CAMMESA			
Outcomes				
MW adjudicated	1 142 MW	1 282 MW	2 043 MW	259 MW
Prices weighted average (US¢/MWh)	Solar: 59.8 Wind: 59.4 Mini hydro: 105.0 Biomass: 110.0 Biogas: 154.0	Solar: 54.9 Wind: 53.3	Solar: 42.8 Wind: 40.9 Mini hydro: 98.9 Biomass: 117.2 Biogas: 160.6 Biogas-SL: 129.2	Solar: 57.5 Wind: 58.0 Mini hydro: 103.4 Biomass: 106.1 Biogas: 158.6 Biogas-SL: 129.5

Note: * The MW requested in Round 1.5 was small because it was aimed at bidders who had been unsuccessful in Round 1. Round 3 was dubbed 'Mini-RenovAr' because it aimed to attract companies that run small power plants.
Data source: CAMMESA (December 2019)

> IFC advised the government not to disclose its price cap until bids were opened. This was prescient, as the average price for Round 1 ultimately was US$20–30/MWh below the envisaged price cap. In Round 1.5, the average price from Round 1 was announced as the new cap. (IFC 2018: 11)

On the other hand, Menzies et al. (2019) have argued that the secret reserve price might have discouraged some participants, particularly providers of biogas, biomass and small hydro. Offers received for these technologies amounted to far less than the auctioned volumes. As Menzies et al, pointed out.

> The bid ceiling price was undisclosed, which created some uncertainty amongst potential bidders as regards pricing their bids and it is probable that at least some would-be bidders opted not to participate in round 1 due, to some extent, to this uncertainty. (Menzies et al. 2019: 17)

3.1 Auction design

RenovAr was designed as a two-envelope single-round auction, with the process from the publication of the request for proposals (RfP) to contract signing lasting between six (RenovAr1) and 14 months (RenovAr3). All interested bidders were required to buy the RfP at a cost of around US$12 000, payable to CAMMESA.

For RenovAr1, however, a draft of the RfP was first made available to all interested parties (not only prospective bidders) via an open and non-binding public-consultation process that lasted about six weeks. In this phase, any interested party could make comments and suggestions on the draft. After this, the final RfP was subject to a consultation process that lasted about a month. Several modifications were made and eight circulars were issued to clarify different aspects of the process. A similar process was followed in subsequent rounds – seven circulars went out for RenovAr2 and RenovAr3.

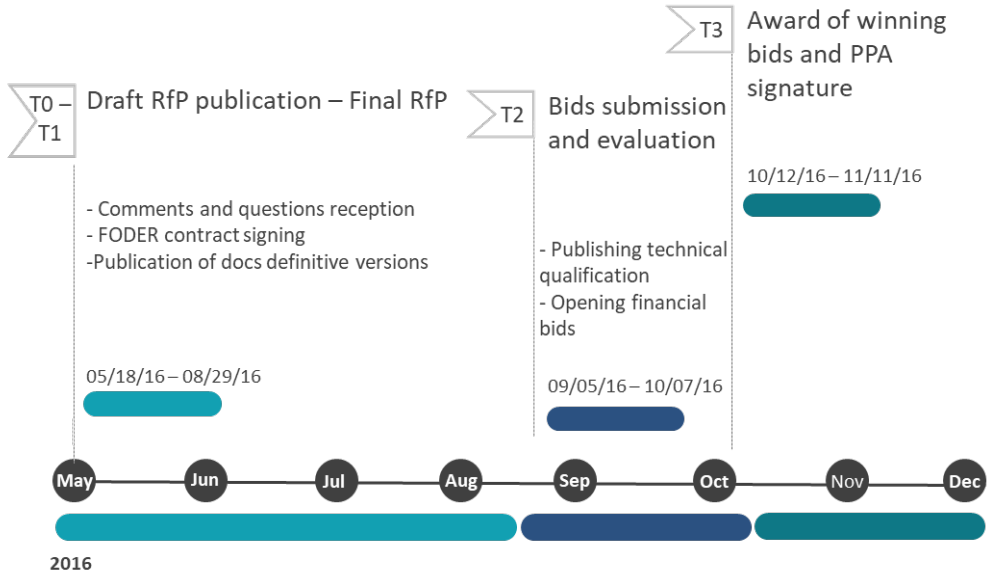
For RenovAr1, interested bidders had from 25 July to 5 September 2016 (40 days) to prepare and submit proposals, although they had access to the draft RfP from late May of that year. The assessment process, from bid opening to award notification, lasted about a month. Rounds 2 and 3 followed a similar schedule, while RenovAr1.5 was shorter because it involved projects that had already been part of RenovAr1.

As regards the signing of the PPAs, RenovAr1 allocated a short period that was probably too optimistic. From RenovAr2 onwards, the time period varied between 167 and 179 days. Figure 3 shows the timeline of RenovAr 1 and Table 4 summarises the timeframe of each round, allowing for comparison between them.

RenovAr1.5 had no open non-binding consultation process linked to the RfP, only a binding one that was limited to those participating in the auction. This was because RenovAr1.5 was seen as an extension or a ‘second phase’ of RenovAr1, with participation limited to bidders that had been unsuccessful in the first round. In RenovAr2, the consultation period was extended by about two weeks. However, the evaluation period and the consequent awarding of bids was similar across these two rounds, although in RenovAr2, PPA signing was scheduled over five months after awards.

In the case of RenovAr3, the final RfP was published over three months after the release of the draft. Bidders had ten weeks to prepare and present their offers. The evaluation period took over 40 days, which was longer than previous rounds, and the awarding of winning bids also took slightly more time (11 versus 5 or 6 days). PPA signing, on the other hand, began only a week later.

Figure 3: The timeline for RenovAr1



Data source: CAMMESA (various)

Table 4: Timetables for RenovAr's first four rounds

Milestones	RenovAr1	RenovAr1.5	RenovAr2	RenovAr3
Draft RfP issued (T0)	05/18/2016	10/28/2016	08/16/2017	11/14/2018
Public comment & questions	T0+96	-	T0+42	T0+119
Final RfP available for purchase (T1)	8/29/2016 T0+103	10/28/2016 T0	10/14/2017 T0+59	3/13/2019 T0+119
Bid submission (T2)	9/5/2016 T1+7	11/11/2016 T1+14	10/19/2017 T1+5	5/30/2019 T1+78
Technical qualification published	T2+28	T2+11	T2+32	T2+36
Financial bids open	T2+32	T2+12	T2+35	T2+42
Winning bids awarded (T3)	10/12/2016 T2+37	11/25/2016 T2+14	11/29/2017 T2+41	7/22/2019 T2+53
PPA signed	T3+30	T3+168	T3+167	T3+179

Data source: CAMMESA (various)

3.1.1 The two-envelope process

Technical bids, submitted in Envelope A, were first assessed by CAMMESA, which ensured that all legal and technical requirements were met, and then ranked bids based on stated local content (SLC).[15] These rankings were then sent to the Energy Secretariat as a non-binding recommendation. The Secretariat assessed the recommendations, approved a final ranking, and informed CAMMESA (for a more detailed explanation of the bid qualification process, see Section 3.1.5).

At this point, CAMMESA opened the financial proposals, submitted in Envelope B. The financial proposals had to state: the offered price; whether a World Bank guarantee was required; the minimum capacity for partial allocation; the energy commitment; and the minimum energy commitment. When comparing bids, CAMMESA had to consider, the

15 The SLC was computed as the value of local content in electromechanical equipment as a proportion of total value (that is, the cost of imported electromechanical components, plus international insurance, plus international freight, all calculated at the destination in Argentina plus the sum of the national components incorporated).

information submitted in both envelopes, and estimate the adjusted offered price (AOP) per technology (see Table 10).

CAMMESA sorted the B Envelopes according to each technology and discarded bids in which the AOP exceeded the maximum award price established for each technology type. The bids were then ranked according to the merit order established per technology until the offered capacity equalled the required capacity (by technology), or the maximum capacity per interconnection point as set out in the RfP (for more on ranking, see Section 3.15).

CAMMESA then submitted a non-binding report to the Energy Secretariat, recommending the award of PPAs to the selected bidders. Shortly after this, the ministry instructed CAMMESA to confirm the awards and proceed with the signing of PPAs.

On signing a PPA, successful bidders received confirmation of the price per kWh as stated in their bids (pay-as-bid). Thus their 'offered price' became the 'awarded price', with the addition of annual adjustments and incentives.

3.1.2 Auction demand

As noted, Argentina's electricity sector lacks a medium- and long-term planning mechanism that guides investment decisions. Without a coherent investment programme, the expansion of generation and transmission infrastructure tends to take place as a result of short-term decisions that often lack adequate economic justification. RE is no exception.

Alongside RenovAr's auctions, the government implemented auctions for thermal units (Res 021) and cogeneration units (Res 287). They also planned but did not carry out auctions related to the expansion of transmission capacity. Each of these processes were developed autonomously, and without reference to any integrated plan for the electricity sector or for the energy sector as a whole.[16]

As noted, the main objective of the RenovAr auctions was to achieve the RE volumes established in Act 27.191. However, achieving the goals set out in the law required the installation of nearly 2.7 GW of renewable capacity by 2017 and an additional 750 MW each year from 2018 to 2025.[17] Table 5 shows the volumes auctioned in the first four rounds. Besides the lack of an integrated plan for the energy sector, the RenovAr programme itself lacks a mechanism for setting the frequency and volume of its own auctions. Each round has simply been announced by the government a few months before issuing the final RfP.

The second round (RenovAr1.5) deserves to be highlighted because it responded directly to the 'excess supply' evident in the response to RenovAr1, when offers for 6.3 GW were received in answer to the call for 1 GW. On the one hand this led to the awarding of 1.14 GW (14% more than stipulated). On the other hand, two weeks after awarding winning bids from the first round, the government announced RenovAr1.5, and called for an additional 400 MW to be supplied by those projects that had qualified in the first round but had not been offered an award.[18]

16 In fact, while the RE auctions were taking place, the government was subsidising the development of shale gas extraction in the Vaca Muerta field by paying guaranteed minimum prices for gas that were above international prices.

17 This assumes energy growth of 4 per cent per annum between 2017 and 2025 and an average utilization factor of 40 per cent for RE.

18 In RenovAr 1.5, maximum prices applied (based on the weighted average of awarded projects in RenovAr1), and bidders had to resubmit all documentation. Technical aspects could be changed (so that they could lower bid prices) but bid capacity and project location had to stay the same.

Table 5: Auctioned RE volumes, by MW, Argentina 2016–2019

RenovAr1	RenovAr1.5	RenovAr2	RenovAr3
Total demand			
1 000 MW	600 MW	1 200 MW (Phase 1) 567.5 MW (Phase 2)	400 MW
Requested technology			
600 MW wind 300 MW solar 80 MW biomass & biogas 20 MW small hydro	400 MW wind 200 MW solar	Phase 1 550 MW wind 450 MW solar PV 100 MW biomass 50 MW hydroelectric 35 MW biogas 15 MW biogas-SL	350 MW wind & solar 25 MW biomass 10 MW biogas 5 MW biogas-SL 10 MW small hydro
		Phase 2 275 MW wind 225 MW solar PV 67.5 MW biomass & biogas	

Data source: CAMMESA (various)

A similar process was followed in RenovAr2 but this time identified as two phases of a single round. In the first phase, 1200 MW of capacity were auctioned and offers for over 9300 MW were received. The excess offers were concentrated in solar (with a demand of 550 MW and bids received for 3 811 MW) and wind (with a demand of 450 MW, and bids received for nearly 5 300 MW). In the face of this excess capacity (over 675% at the aggregated level), a second phase was opened in which projects not awarded during the first phase were offered the option of signing PPAs at a price given by the weighted average of bids awarded in the first phase (for each technology). For wind and solar bids, only projects in the most competitive regions were considered (that is, Buenos Aires, Patagonia and Comahue regions for wind, and Northwest and Cuyo regions for solar); see Appendix A for maps of Argentina's solar and wind resources. As a result of the second phase, an additional 568 MW of capacity was awarded.[19]

In all rounds, apart from RenovAr1, a regional requirement was set out in the respective RfPs. The country was divided into regions and maximum capacity additions, per technology, were set for each region (see Table 6). Similarly, restrictions regarding the distribution of RE projects were applied to the provinces within each region. No other site restrictions were applied.

Table 6: Regional MW quotas allocated for solar and wind in RE auctions, Argentina 2016–2019

RenovAr1	RenovAr1.5	RenovAr2	RenovAr3
None	**Wind:** Argentina divided into 4 regions (Comahue, Patagonia, Buenos Aires and 'the rest') allocated 100 MW each. **Solar:** 2 regions (NOA, 'the rest') allocated 100 MW each.	**Wind:** 4 regions (Comahue, Patagonia, Buenos Aires, 'the rest'): 200 MW each but 'rest' 100 MW and (Comahue + Patagonia + Buenos Aires) < 450 MW **Solar:** 3 regions (NOA, Cuyo, 'the rest'): 200 MW each but 'rest' 100 MW and (NOA + Cuyo) < 350 MW	**Wind** and **solar** Region 1: 40 MW Region 2, 3 and 7: 60 MW Region 4 and 5: 30 MW Region 6: 70 MW + < 20 MW was allocated to each province (except Buenos Aires)

Data source: CAMMESA (various)

19 A cap was applied per technology as follows: 275 MW for wind, 225 MW for solar, and 67.5 MW for biomass and biogas combined.

The allocation of regional quotas responded, to some extent, to the limitations of the transmission system. However, by setting limits per province, the government could make progress with its political objective of ensuring balance in RE investments across regions.

3.1.3 General conditions set for the auctions

In addition to volume quotas, some general conditions were set for the different RenovAr rounds as summarised in Table 7. As noted, in Round 1, bidders were not informed of the reserve (ceiling) price that had been set for each technology. The first step in the economic assessments of the offers required CAMMESA to check that the offered price was below the reserve price. If it was not, the offer was automatically rejected.

In the next two rounds, the reserve price for each technology was established as the average of the offers awarded in the previous tenders and this was made public. For RenovAr3, the RenovAr2 figure became the reserve price – except for wind and solar, for which the combined reserve price was slightly increased.

Restrictions on the minimum and maximum size of each project were also specified. Minimum size restrictions generally related to ensuring certain economies of scale. Maximum size limits, on the other hand, were aimed at preventing too much concentration in the market. In the first three rounds, the objective was to attract offers for large projects (that is, solar and wind power at up to 100 MW, and biogas and biomass at up to 15 and 30 MW, respectively).

Table 7: General conditions set for RE auctions, Argentina, 2016–2019

Parameter	RenovAr1	RenovAr1.5	RenovAr2	RenovAr3
Reserve price per technology (US$/MWh)	Kept secret (RfP Article 3.6) Wind: 82 Solar: 90 BM: 110 BG: 160 MH: 105	Made public (weighted average of awarded offers in Round 1) Wind: 59.39 Solar: 59.75	Made public (weighted average of awarded offers in Rounds 1 & 1.5)* Wind: 56.25 Solar: 57.04 BM: 110 BG: 160 BG-SL: 130 MH: 105	Made public Wind & solar: 60 BM: 110 BG: 160 BG-SL: 130 MH: 105
Projects' required capacity (min, max MW)	Wind & solar: 1–100 BM: 1–65 BG: 1–15 MH:0.5–20	Wind & solar: 1–100	Wind & Solar: 1–100 BM & MH:0.5–50 BG: 0.5–10	Wind, solar, BM, BG, BG-SL & MH: 0.5–10
Investment reference value (million US$/MW)	Wind: 1.6 Solar: 1.3 BM: 2.5 BG: 5 MH: 3	Wind: 1.6 Solar: 1.3	Wind: 1.4 Solar: 0.9 BM: 3 BG: 5.5 BG-SL: 2.5 MH: 3	Wind: 1.4 Solar: 0.9 BM: 2.5 BG: 4.5 BG-SL: 1.3 MH: 2.8
Maximum execution period	All: 730 days (but solar in certain interconnection points, 900 days)	All: 900 days	Wind, Solar, BG, BG-SL & MH: 730 days (but solar at certain interconnection points, 900 days) BM: 1065 days.	Wind & solar: 730 days BM, BG, BG-SL & MH: 1 095 days.

Note: * For RenovAr2's second phase, the reserve prices in US$/MWh were: Wind: 40.27; Solar: 41.76; BM: 106.73; BG: 156.85 (Res 473, MINEM)
Data source: CAMMESA (various)

By contrast, RenovAr3 targeted small projects (known as MiniRen) with the aim of attracting capital from non-traditional sources into RE, as well as to optimise the use of capacities available in medium-voltage networks and to promote regional development.[20]

In all rounds, the specifications included an investment reference value (in million US$/MW) for each technology. These values did not enter the bid analysis process or the determination of the merit order. However, they constituted a maximum value for eventual investor compensation in the event of default by any of the parties (see Section 3.1.7). The values set remained unchanged for the first two rounds and were modified (with reductions for solar and wind power and increases for other technologies) from RenovAr2 onwards.

The maximum authorised tax benefits (such as accelerated amortisation and advance VAT refunds) relevant for each technology were also specified in the auction design as shown in Table 8.

For each technology, a maximum project execution time was also established. These periods were kept unchanged across rounds. However, in RenovAr 1.5, it was extended from 730 to 900 days, and in RenovAr 3, 1 095 days was allowed for biomass, biogas and mini hydro. In all rounds except RenovAr3, extra points were awarded to bids in which commitments were made to shorter construction periods. The AOP resulted from multiplying the offered price by a loss factor[21] and also by an amount (in US$/MWh) for the period of time between the offered execution term and the maximum execution term.[22] Projects could be fined if agreed deadlines were not met (see Section 3.1.7).

Table 8: Maximum fiscal benefits linked to RenovAr auction rounds in US$/MW, 2016–2019

Technology	RenovAr1 (US$/MW)	RenovAr1.5 (US$/MW)	RenovAr2 (US$/MW)	RenovAr3 (US$/MW)
Wind	960 000	960 000	700 000	630 000
Solar PV	720 000	720 000	425 000	382 500
Biomass	1 250 000	1 250 000	1 500 000	1 125 000
Biogas	2 500 000	2 500 000	2 750 000	2 025 000
Biogas-SL	–	–	1 250 000	585 000
Mini hydro	1 500 000	1 500 000	1 500 000	1 260 000

Data source: CAMMESA (various)

The inclusion of an incentive for early installation of generation facilities responded, in part, to a perceived risk of a lack of generation capacity in the market. In practice, however, time differences between offers (with a maximum of 975 days in advance for a biomass project in RenovAr2 versus zero days in 60 offers made across the first three rounds) did not affect their ranking in the adjudication process.

3.1.4 Site selection and transmission access

Land availability is not a major problem for RE development in Argentina (see Menzies et al. 2019). According to Jimeno, et al. (2017), the rental price of land for wind farms, is US$5 000–10 000 MW/year. For land with potential for solar PV installations in Mendoza province, the purchase price is about US$2 000/ha. In other provinces with high solar

20 See the Energy Secretariat's Resolution 100/2018 (RESOL-2018-100-APN-SGE#MHA) of 14 November 2018. https://www.argentina.gob.ar/normativa/nacional/resoluci%C3%B3n-100-2018-316407/actualizacion

21 In RenovAr3 the offered price was adjusted by the forced generation displacement (US$ 5/MWh).

22 In RenovAr1, this was US$ 0.15/MWh for every 30 consecutive days between the offered and maximum execution term. In RenovAr1.5 and RenovAr2, the amount was US$ 0.005/MWh for each day between the offered and maximum execution term.

potential, the price ranges from US$2 000 to US$5 000/ha. In provinces such as Jujuy and Salta, government land (*terrenos fiscales*) can be accessed very affordably.

Because Argentina's traditional primary energy sources (gas and large hydroelectric projects) are located at great distance from the main centres of energy consumption, its high-voltage transmission grid is central to national energy provision. The greater Buenos Aires metropolitan area, for example, accounts for around 35 per cent of the country's electricity demand. Similarly, for RE, the areas that have the greatest abundance of solar radiation (the northwest) and consistently high wind speeds (the south) are thousands of kilometres from the main centres of consumption (see Appendix A). Access to the national grid is therefore crucial to RenovAr's success.

The rules regarding access to the transmission network have varied slightly from round to round. In RenovAr1, the tender included an annex that specified the maximum capacity that could be connected at each point in the network. As the specifications were clarified, it became evident that the number specified did not necessarily correspond to a technical maximum, but was instead the MW limit available to bidders. Although the total limit available for the 500 kV network was 1 700 MW (or 70% greater than the volume tendered), specific restrictions applied at each line, substation and node point in the network. These limits affected the final awards to the extent that more bids were received for certain connection points than the available capacity at that point would handle. RenovAr1.5, kept the same rules as well as the connection limits per connection point (net of the volumes awarded in RenovAr1).

In RenovAr2, transmission availability was based on an 'expanded transmission system', which included transmission investments due to be completed in the following 30 months. A take-or-pay clause was included to shield bidders from the risk of transmission works not reaching completion. This covered generators for demand risks linked to delays in grid expansion by guaranteeing payment for energy they couldn't deliver as a result of transmission restrictions. In RenovAr3, which focused on small projects, the delivery point was specified as a connection between 13.2 kV and 66 kV, and no predetermined limits were set.

Regarding costs, a 'shallow connection' approach has been adopted; that is, bidders have to cover the costs of all investments necessary to ensure the correct operation of connections at the delivery point, but can exclude any adaptation costs that the system might need. In Argentina, electricity transmission concessionaires are obliged to operate and maintain *existing infrastructure only*. Expansion of the system is carried out by independent carriers and tends to be linked to specific tenders, with the costs being borne by the 'beneficiaries' of said expansions. Any deep connection costs arising from the incorporation of RenovAr projects have been subject to these rules. Accordingly, all project bids had to include the costs of installing transmission lines and transformer stations, as well as the measurement and control equipment required to connect the generation plant to the delivery point.[23]

3.1.5 Qualification criteria and process

Participation in all four rounds was open to local and international individuals, as well as private legal entities. Bids had to be submitted by means of a specific purpose entity constituted in the Argentine Republic. Both foreign and local individuals or legal entities that are legally disqualified from entering into contracts (for reasons such as bankruptcy, criminal records, etc.) were not permitted to bid.

23 Following the general regulations of the electrical transmission system, and having built the transmission facilities, bidders could transfer these to a concessionaire for operations and maintenances.

As described in Section 3.1.1, the auctions were run as single-stage, two-envelope sealed bids. Besides providing background information, such as statutory and legal data, bidders had to provide a bid bond, and provide evidence of minimum amount for each MW of offered bid capacity. This helped reduce the risk of awarded projects not having sufficient financial or legal capacity to become operational.

3.1.5.1 Level of project preparation

The technical qualification criteria for all four rounds can be described as intermediate. In their bids, participants had to show evidence of only basic feasibility studies and preliminary commitments related to their chosen site, connections to the transmission network, and the availability of equipment. Apart from an environmental impact study, bidders were not required to submit detailed research on any technical or financial aspect.

The environmental study had to comply with established national standards and show that construction of the project could start on the stipulated date. Environmental impact assessments had to include a feasibility study and cover the construction phase as well as ensure that surveillance programmes would be established to monitor environmental impact throughout the useful life of the project. According to interviews with actors involved in the preparation of the environmental studies, these were quite standard, took only a couple of weeks to prepare and were reasonably affordable – costing about US$3 000–US$4 000 for a 20 MW wind project. [24]

Bidders were responsible for securing rights and permits for the use of the properties on which projects would be developed. As part of the technical description, they had to provide documentation proving the properties' availability for the full term of the supply contract. This could be through provision of a property title, a rental or a usufruct contract, and/or an irrevocable option to purchase, rent or benefit from usufruct. In the case of real estate in the public domain, certified copies of the status of the land had to be accompanied by copies of the administrative acts that allow their use by such projects.

All sites involved had to be identified and located on maps, satellite charts, with plans and diagrams detailing the location of the generation plant, as well as access and circulation routes. Bidders also had to show that they had obtained any necessary federal, provincial and municipal permits related to the use of land.

In addition, bidders' technical offers had to include a static and dynamic study of the transmission network, with the opinion of an independent consultant confirming the feasibility of injecting the projects' power at the relevant delivery points. This study also had to be approved by the carriers to which projects were to be connected. These studies cost from US$10 000–US$15 000 and take about a month to complete.

Information regarding the availability or feasibility of the RE resources also had to be included in the technical offer. Bidders had to guarantee that the resources were available and that no restrictions had been imposed their use. This information had to be confirmed by an independent consultant in a report that contained details about the resource measured at, or

24 According to the IFC (2018: 11), 'Each province initially wanted its own Environmental and Social (E&S) rules to apply in the projects located in their jurisdictions. IFC recommended a universal approach whereby IFC Performance Standards would apply across provinces. This standardisation of E&S requirements provided comfort to bidders pursuing projects in multiple locations and to lenders accustomed to IFC's standards. The use of IFC performance standards was also critical to ensure project eligibility for the World Bank guarantee and increased preference for RenovAr over one-off tenders.'

close to, the site. If the measurement mechanism was located outside the site, the bidders had to prove that they were entitled to use the information.[25] Accordingly, the technical bids had to include expected energy production, assuming the proposed plant design and its respective typical curves according to the technology applied, as well as an estimate of associated losses and uncertainties informing energy production estimates at different probability levels.[26]

Data on the proposed technologies had to include studies and documentation certifying the performance of the equipment to be used, the capacity to be installed and a technical description of all components and ancillary facilities. For each electromechanical component, the percentage of local content had to be stated.[27] Along with this, plant operation and maintenance plans had to be submitted.

No specific requirements were set out regarding the financial resources required for bids. Bidders just had to present a proposed date for financial close as part of the general performance term and schedule of works, including terms for financial close as well as dates for the start of construction, equipment delivery and commercial operation authorisation.

In summary, technical requirements at the bidding stage were limited to reports on project feasibility by independent consultants and/or affidavits from bidders. No in-depth studies were required. Given the high rate of qualification, it seems that these requirements were not considered stringent. In practice, the majority of bids passed the technical assessment phase. On average, over the four rounds, only 13 per cent of bids were rejected on technical grounds. Details regarding offers presented and accepted in each round are shown in Table 9.

Clearly, this approach maximised competition by facilitating bidder participation but it ran the risk of a high number of projects not materialising. However, by including a bid bond and a performance guarantee with relatively high values once the contract had been awarded, the RenovAr programme attempted to minimise the risk of projects not reaching completion.

Table 9: Received, qualifying and non-qualifying bids per RE auction, Argentina 2016–2019

Round	Bids				
	Number received	Qualifying		Non-qualifying	
		Number	%	Number	%
RenovAr1	123	105	85	18	15
RenovAr1.5	47	45	96	2	4
RenovAr2	228	192	84	35	16
RenovAr3	56	52	93	4	7
Total	454	394	87	60	13

Data source: CAMMESA (various)

The fact that bidders did not have to show evidence that they had access to the financial resources committed to their projects has probably been the riskiest aspect of the RenovAr bidding process. The risk is that awarded projects might not reach financial closure and must

25 For wind, bidders had to present a minimum of a year of wind measurements and an EPR by an independent consultant. For solar, they had to submit an EPR by independent consultant. For BM, BG and BG-SL, bidders had to state the source and sustainability of the biomass/biogas resource. For mini-hydro projects, they had to supply an affidavit confirming resource availability and energy production calculations.

26 Expected production at P50-P90-P99 for wind, solar and hydro projects, and expected gross and net production for the rest of the technologies.

27 The percentage of local content had to be computed as mandated by Joint Resolution No.123 of the Ministry of Energy and Mining and No. 313 of the Ministry of Production, passed on 5 July 2016.

therefore face the loss of the guarantee bond. In practice, several projects have not reached financial close, particularly after the 2018 financial crisis (see Section 4 for more on this).

3.1.6 Bidder ranking and winner selection

Once compliance with the formal and technical requirements (guarantees, permissions, etc.) had been verified, CAMMESA proceeded to rank accepted bidders for each technology. For this stage, CAMMESA calculated a score based on each bid's stated local content (SLC) and the maximum SLC set for each technology. The SLC score was computed based on the value of local content in electromechanics facilities as a proportion of total value.[28]

The SLC ranking was added to all the documentation contained in each bid's Envelope A, and sent to the Energy Secretariat. The Secretariat assessed the tax benefits requested by each bidder. Based on the bidders' requests and the maximum applicable benefits, they determined the benefits to be allocated to each project, and provided a justification for each amount. From this, the Secretariat determined which bids qualified and instructed CAMMESA to inform the qualifying bidders.[29]

CAMMESA then opened the sealed financial proposals (Envelope B) submitted by the qualifying bidders. Based on the parameters of the economic offer, CAMMESA defined a merit order for each technology; the specifics of which, for each round, are shown in Table 10.

To rank the bids, an AOP was computed according to the rules defined in the RfP as follows:

$$AOP = OP \times PDI_{LF} - (US\$\ 0.005/MWh \times D_{OPT\text{-}MPT})$$

Where: AOP = adjusted offered price
OP = offered price
PDI_{LF} = loss factor related to the interconnection point
$D_{OPT\text{-}MPT}$ = number of days by which the offered execution term is shorter than the maximum execution term[30]

Given the large distances between the primary energy sources and the centres of energy consumption, the inclusion in the formula of a loss factor – a known parameter that was part of the RfP[31] – allowed the auction process to reflect the impact that different locations have on transmission costs.[32] The second adjustment ($D_{OPT\text{-}MPT}$) incentivised early development of the generation facility.

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28 The offer with the highest SLC obtained 100 points and the others were allocated a proportional percentage based on the 'Poner Formula', whereby the offer with the highest SLC obtained 100 points, and the others a proportional percentage that was calculated as follows:
Score based on SLC = SLC x 100 / SLCMax,
Where: 'SLC' means the SLC included in the bid, and 'SLCMax' means the maximum SLC of all bids submitted for each technology.

29 Mostly a formal review of the process carried out by CAMMESA.

30 For example, for RenovAr1, the maximum execution term was 730 days, so a project with an offered price of US$95/MWh (and a PDI_{LF} of 1 049) to be completed in 550 days (180 days less than the maximum) would have an AOP of 98.72; that is, 95 *x* 1 049 – (0.005 *x* 180).

31 The loss factor of RenovAr1 interconnection points, for example, varies between a minimum of 0.9578 and a maximum of 1.1193.

32 This is consistent with the energy ministry's general rules, whereby the remuneration of all generators is computed using transmission-node factors.

Table 10: Adjusted offered price calculations and ranking criteria, RenovAr 2016–2019

Aspect	RenovAr1	RenovAr1.5	RenovAr2	RenovAr3
Adjusted offered price (AOP) calculation	Offered price x relevant interconnection point (PDI) loss factor, minus US$0.15/MWh for each 30 consecutive days between the offered and maximum execution term*	Offered price x relevant PDI loss factor, minus US$0.005/MWh for each day in which the offered execution term is advanced with respect to the maximum execution term		Wind & solar: offered price Biomass, biogas, Biogas-SL, mini-hydro: offered price minus differential for forced generation displacement† (US$5/MWh)
Ranking criterion	AOP ranking, per technology. If tie (less than 3% difference), then according to SLC. If still tie, then draw.	AOP ranking, per technology. If tie, (less than 3% difference), then according to SLC. If still tie, then by lower fiscal unitary benefits. If still tie, then draw.	AOP ranking, per technology. If tie (according to technology, with wind & solar less than US$ 1/MWh difference; MB & MH at US$2/MWh; BG & BG-SL US$ 3/MWh), then by SLC. If still tie, then by earliest commercial operation date. If still tie, then draw.	Wind & solar: based on offered price. If tie (less than US$1/MWh difference), then by SLC. If tie, then by lower fiscal benefits. If still tie, draw. Biomass, biogas, Biogas-SL, mini-hydro: based on AOP. If tie (MB, BG-SL & MH less than US$2/MWh difference, BG less than US$3/MWh difference), then by SLC. If tie, then by lower fiscal benefits. If still tie, then draw.

Note: * This means that the sooner a project came online, the lower its evaluated price was.
† The forced generation displacement difference was applied to projects that proved the replacement or displacement of fossil-fuel-based generation (other than natural gas) by means of corresponding electrical studies, and in accordance with the Letter of Agreement on Technical and Commercial Connection. CAMMESA analysed the effectiveness of the proposed displacement when analysing bids and, if relevant, used this to help calculate the AOP.
Data source: CAMMESA (various)

For RenovAr 3, the formula was changed slightly. The loss factor was replaced by a factor that reflected liquid fuels savings associated with the reduction of network restrictions – that is, a differential for the forced generation displacement of US$5/MWh.[33] The change was made because there are no computed node factors for medium-voltage (13.2–66 kV) connections. In addition, the change reflects the programme's objective of locating RE generation facilities in areas where the use of available transmission capacity in medium-voltage networks can be optimised. In this instance, no incentives were offered for early installation.

Once the AOP for each bid was computed, CAMMESA sorted the financial proposals according to technology and discarded all bids in which the AOP exceeded the reserve price. Bids were then ranked by AOP, from lowest to highest by technology, and adjudicated until the offered capacity equalled the required capacity (by technology and region, where applicable),[34] or the maximum capacity at the interconnection point; both set in the RfP. As shown in Table 10, if prices between bids differed by less than 3 per cent, the one with a greater proportion of SLC was ranked higher.

33 This refers to the displacement of thermal generation using fossil fuels, other than natural gas.
34 Bids were pre-awarded according to the established POA merit order, verifying in each case that the bid capacity added to the capacity already pre-awarded did not exceed the required capacity by technology and region indicated, nor the maximum power in the interconnection point.

At the end of this process, CAMMESA submitted a non-binding report to the energy ministry recommending that PPAs be awarded to the selected bidders. After analysing the report, the ministry instructed CAMMESA to notify bidders of the awarding of the contracts and proceed with the signing of PPAs. If the Secretariat decides to modify or reject CAMMESA's analysis, in whole or in part, a well-founded report substantiating this has to be prepared and made public.

3.1.7 Buyer and seller liabilities

While requirements for participation in the auction were relatively low, stringent provisions were established if awarded developers failed to comply with PPAs, with different penalties linked to construction and production delays (see Table 11).

At the bidding stage, participants had to agree to all the obligations contained in the bidding terms and conditions. This included a bid bond in favour of CAMMESA for US$35 000 per MW of offered capacity. The guarantees were executed in the event that any bidders: withdrew their offer before the expiration of the original term; were found to have falsified information; refused to sign the supply contract in accordance with the provisions of the RfP if awarded; or would not supply the contract performance guarantee.[35] This provision sought to discourage the submission of reckless offers.

Complementing this measure was the minimum capital requirement, which sought to ensure bidder solvency once awards had been allocated. Effectively, the successful bidders had to sign a PPA that replaced the bid bond with a contract-compliance guarantee (performance bond) of US$250 000 per MW of bid capacity. This guarantee remained in force until 180 days after the start of commercial operation. The high value of this compliance guarantee sought to ensure that the development of the investment project fulfilled the terms promised in the bid. The aim was to discourage aggressive offers while ensuring that the technical qualification requirements were kept relatively low.

Although no penalties were put in place for missing the partial milestones (such as financial close, start of construction, arrival of equipment, etc.), if the proposed schedule was delayed, bidders had to increase their contract compliance guarantee by 20 per cent. Together with the guarantees, the bidding rules established sanctions for bidder breaches. These included fines for each day if the scheduled commercial start date was delayed, and penalites for any generation deficit with respect to the minimum guaranteed volume.

As shown in Table 11, the PPA also granted the buyer an option to acquire the project in the event of certain breaches by the seller. The price of the call option was set at an amount equal to 75 per cent of the net book value,[36] plus any outstanding debts to the seller. These measures all sought to ensure contractual compliance. However, the amounts involved created substantial financial risks for bidders. Consequently, after the 2018 financial crisis saw Argentina losing access to capital markets and having to resort to an IMF bailout, many of the awarded projects were unable to obtain the necessary financing to carry out the investments. The Energy Secretariat then granted extensions to avoid the suspension of projects.[37]

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35 The bid bond was returned to non-awarded bidders and to awarded bidders once they signed the PPA contract.

36 Original value depreciated linearly over 20 years (that is, 5% per year).

37 For example, Resolution No. 285/2018 (of June 2018) and Resolution No. 52/2019 (of February 2019) authorised successful bidders to request an extension to the dates agreed to in the PPAs, subject to certain conditions. In addition, on 9 September 2019, the Undersecretariat for Renewable Energies issued a note instructing CAMMESA to temporarily suspend all warning notices regarding non-compliance with dates committed to in the PPAs: a month later, on 7 October, the Undersecretariat withdrew the instruction.

Table 11: Guarantees and penalties, RenovAr

Guarantee	RenovAr1	RenovAr1.5	RenovAr2	RenovAr3
Bid bond	Guarantees of US$35 000/MW of offered capacity for at least 180 consecutive days, automatically renewable for 90 consecutive days,* had to accompany each bid submitted			Same logic, but US$50k/MW of offered capacity
Supply contract compliance (performance bond)	US$250k/MW of contracted power, for not less than 1 year, and renewable for a period of 180 days following the scheduled operation date. Bidders had to submit a guarantee for every supply contract awarded			
Contract compliance	In case of delays longer than 60 days, the seller had to increase the contract compliance guarantee by 20% of the amount in force at the time to reach: scheduled financial close, the scheduled construction start date, or the scheduled equipment arrival date†			
Commercial operation	A penalty of US$1 388/MW of contracted capacity was payable for each day of delay in reaching the scheduled commercial operation date			
Energy supply	US$160/MWh was payable for each MWh of energy supplied below the minimum committed for each year			
Sell option	The seller gives the buyer a call option to annex the project if: • Commercial operation does not begin on or before the scheduled date • The performance bond is not increased as required • A strategic partner is changed without the buyer's prior written consent • Safety and quality standards are not met			

Notes: * The duration of the bond was tied to the expected duration of the awards process. The number of days is specified so that, if the government doesn't make a decision or takes longer than anticipated, bidders are not required to keep to the terms of their bids. This is standard practice, and reflects the fact that some government tenders are never awarded or formally cancelled.

† The rationale was that any partial delay would increase the chances of the project not reaching commercial operation on time, thus requiring an increase in the guarantee.

Data source: CAMMESA (various)

3.1.8 Securing the revenue stream and addressing off-taker risk

The main challenge to RE development in Argentina is the risk facing private investors in the context of chronic macroeconomic instability. The costs of debt and equity capital are high and access to sources of long-term finance is limited.

The RenovAr programme seeks to shield investors from these risks in several ways. These include: a standardised 20-year PPA; dollar-denominated energy pricing; protection against the possible non-transferability of the peso; the establishment of FODER to guarantee payments with sovereign support; provision for international arbitration in case of disputes; an option for the investor to buy projects in cases of non-compliance by CAMMESA; and the option of access to a World Bank guarantee. In addition, both the PPA and the FODER contracts were standardised and non-negotiable, and both contracts were made public as part of the draft RfP during the consultation process held before each round.

For Argentina's RE market to be efficient and dynamic, foreign investment is crucial. To protect investors and lenders from exchange-rate risks, the RenovAr programme has so far offered investors 20-year PPAs with dollar-denominated prices (US$/MWh).[38] As the market administrator and off-taker, CAMMESA acts on behalf of all wholesale market agents, and even though it is backed by a sovereign guarantee, it remains a private company. Consequently, the PPAs are governed by private law.

38 Although payments are made in pesos according to a 'reference exchange rate' published by the Central Bank (BCRA), various clauses give investors partial protection against the risk of non-convertibility and non-transferability.

Projects' energy remuneration (US$ per MWh) arises from the bid (now called the awarded) price) and subject to an *annual adjustment factor* (growing at 1.7 per cent per year) plus an *incentive factor* (payable each year at a decreasing rate).

The *annual adjustment factor* was set to reflect the expected US inflation rate, and was used instead of a price index based on actual inflation.[39] Complementing the dollar-denominated rates, FODER covers investors for the risk of the peso becoming difficult to convert into dollars or other currencies and the possibility of limits being placed on transferring money out of Argentina.

According to the RfP, the purpose of the *incentive factor* is 'to favour and encourage the prompt installation and commercial start-up of the generation plants by means of a nominal increase in the awarded price that improves the revenues and financial situation of the projects.' The factor values were presented in the RfP, (see Table 12).[40] From a financial point of view, by increasing payments at the beginning of the project and decreasing them at the end, the incentive factor is equivalent to a reduction in the cost of capital. The specific impact is a function of the rate of return.[41]

Table 12: RenovAr1 incentive factor values

Year	Incentive factor value
2016–2018	1.25
2019–2020	1.15
2021–2024	1.10
2025–2028	1.00
2029–2032	0.90
2033–	0.80

Data source: RfP (2016: Annex 9)

The most innovative element in the regulatory framework was the establishment of FODER, a trust fund aimed at fostering investment in RE. In addition to PPAs, all RenovAr awarded projects had to sign a standard agreement with FODER. FODER was set up to play two roles: one linked to finance and the other as a guarantor (see **Error! Not a valid bookmark self-reference.**).

In its financing role, FODER was meant to supply long-term finance to RE projects through loans, equity, subsidised interest rates and/or any other financial instrument that could facilitate the execution and financing of RE projects. In practice, the Fund has not yet played this role. In the first RenovAr rounds, Argentina's financial situation was good, and access to international capital markets was fluid. In this context, there was little need to allocate public funds to FODER's financing account since the sector authorities expected all the projects to

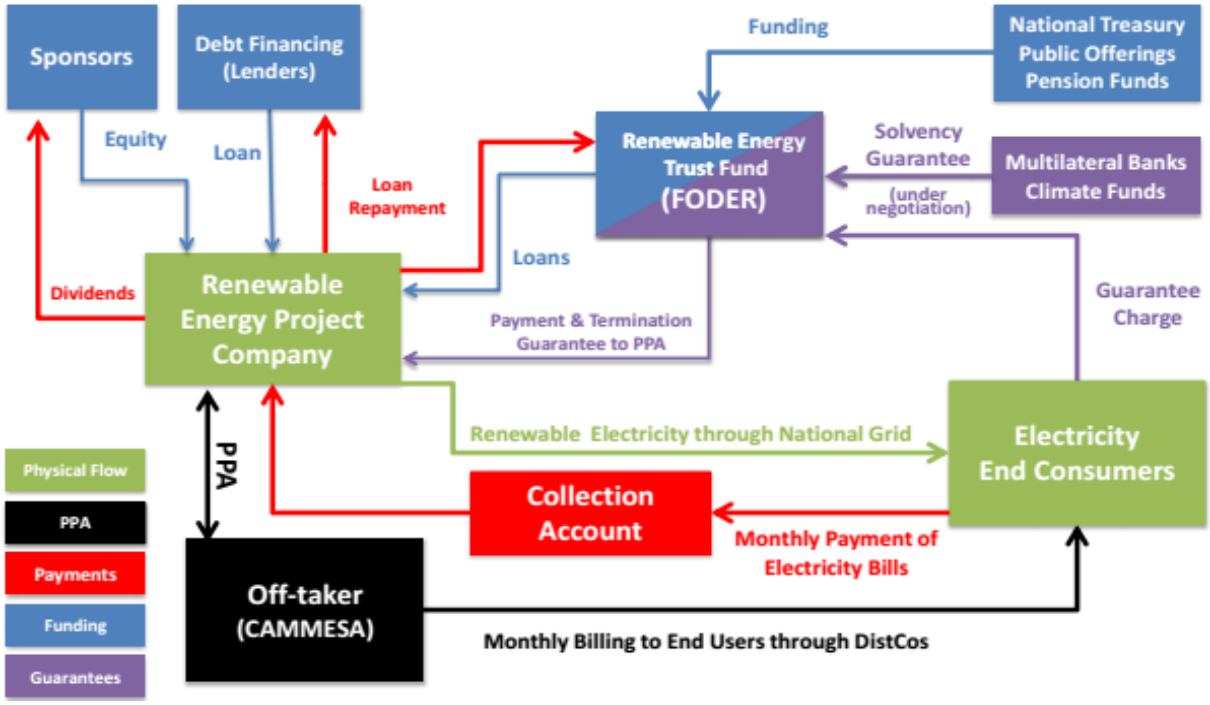
39 Some historical precedents exist for dollar-denominated contracts in Argentina; during unbundling and privatisation of the energy sector in the 1990s, some end-user tariffs were set in dollars and indexed according to US inflation. However, as a result of the 2002 crisis, laws were passed 'pesifying' tariffs and prohibiting indexation. The inclusion of an adjustment factor, rather than an indexing rate, in the RenovAr PPAs is partly an attempt to avoid restrictions on indexation.

40 Incentive factors were modified slightly in the following rounds. In RenovAr1.5, the factor started at 1.2 in 2017, reaching 0.80 by 2036. RenovAr2 had the same factor as RenovAr1.5, but moved on a year, starting at 1.2 in 2018 and reached 0.80 by 2037.

41 For example, an internal rate of return of 7 per cent per year without an incentive factor produces an increase of 80 basis points; that is, it results in a return of 7.8 per cent.

qualify for market finance.[42] When the financial situation deteriorated in 2018, no public funds were available and FODER had no access to external funding.

Figure 4: The role of the Renewable Energy Trust Fund (FODER)



Data source: Energy Secretariat (various)

In its role as guarantor, the primary financial instruments developed by FODER are payment guarantees that are implemented through escrow accounts (the Cuenta de Garantía and its sub-accounts). These were designed to provide liquidity support for ongoing PPA payments, and ensure that any payment obligations emerging from the rights of IPPs to sell their project to FODER if macroeconomic conditions or sector-specific risks materialise.[43] Often referred to as a 'put option', this kind of termination coverage is often ought by the private sector in emerging markets.

If CAMMESA failed to make a PPA payment, the seller could request that FODER make the payment, which, after confirming with CAMMESA, would proceed with the payment. Consequently, FODER's guarantee account had to have sufficient funds to cover all of CAMMESA's monthly energy-payment obligations for a given time period. In Rounds 1 and 1.5, the guarantee covered a 12-month period. From Round 2 onwards, this was reduced to 180 days. If funds in the guarantee account were insufficient, FODER would ask the Ministry of Energy to replenish its funds. If the ministry was unable to do so, the World Bank guarantee would kick in, and/or the generators could exercise their 'put option', which allowed them to terminate the PPA early and/or sell the project

42 A private initiative proposing a financing mechanism to FODER´s financing account through simultaneous financing and energy auctions was dismissed by government officials as unnecessary.

43 These risks include: non-payment by the buyer not that goes unremedied by FODER for more than four consecutive months or six months in a year; currency non-convertibility or non-transferability that materially harms the buyer; and modifications to the World Bank guarantee or FODER that are detrimental to the buyer.

The payment for the put option was established as 100 per cent of the net (that is, linearly amortised) assets, considering as initial value the lesser of the reference value by technology (as set out terms and conditions of the bid) and the audited value (according to commonly accepted international standards and approved by FODER's executive committee).

Table 13: Fees associated with the World Bank guarantee

Cost item	Composition and value
Up-front fees	Front-end fee of 25 basis points of the guaranteed amount Initiation fee of 15 basis points of the guaranteed amount Processing fee of 50 basis points of the guaranteed amount Reimbursement of external legal counsel expenses incurred by the World Bank's International Bank for Reconstruction and Development (proportional to the guaranteed amount)
Guarantee fees	8 year-term and below: 50 basis points 8 to 10 years term: 60 basis points 10 to 12 years term: 70 basis points 12 to 15 years term: 80 basis points 15 to 18 years term: 90 basis points 18 to 20 years term: 100 basis points

Data source: CAMMESA information

As part of their economic proposal, bidders could also choose to take a World Bank guarantee. In this case, the World Bank acts as guarantor for the state's obligation to send the necessary resources to the FODER so that it can meet the project selling price.[44] This further mitigates country-based risks such as payment failures, policy changes, and exchange-rate fluctuations.

The World Bank guarantee included up-front fees. These were payable once, on a date set by FODER in accordance with the date on which the World Bank Guarantee Agreement was signed. In addition, ongoing guarantee fees had to be paid up-front and thereafter twice a year, depending on the guarantee term (see Table 13). These costs were defined and set by the World Bank's International Bank for Reconstruction and Development, and were the same as those to which the FODER was subject, under the World Bank Guarantee Agreement.

In case of disputes, the PPA and the FODER agreements allow for arbitration in accordance with the Arbitration Rules of the United Nations Commission on International Trade Law.

All these measures sought to ensure, to the extent possible within the Argentine context, the revenue stream for RenovAr projects. Initially, the programme was successful in attracting a large number of investors, as shown in the success of the first RenovAr rounds.

However, after the 2018 crisis, the country's macroeconomic situation made it extremely difficult for projects in their initial stages to reach financial close. In practice, FODER has not been able to act as a hedge against sovereign risk beyond the World Bank guarantees. Accordingly, the deterioration of the country's financial situation has had a direct impact on the attractiveness of investing in RE.

44 The World Bank's International Bank for Reconstruction and Development guarantee an aggregate amount of US$480 million to backstop government's failure to fund FODER when it has to pay a Put Price to eligible RE sub-projects as a result of IPPs exercising a Put Option. At the sub-project level, the guarantee is limited to a maximum of US$500 000 per MW (World Bank 2017).

3.2 Auction implementation

RenovAr was launched relatively quickly and initially enjoyed strong and widespread political support. In October 2015, congress approved Act 27.191. After the administration change in December 2015, the incoming authorities created a new Undersecretariat for Renewable Energy. Sebastian Kind, a former advisor to the (then-opposition) senator who had proposed the law, was appointed as undersecretary by President Mauricio Macri. By the end of March 2016, Decree 531/2016 was approved, specifying the rules governing the practical implementation of Act 27.191, and the first auction took place in May of the same year.

To help run the auction, Argentina sought technical support from multilateral credit organisations. Accordingly, the Ministry of Energy and Mining, with World Bank Group encouragement, conducted investor roadshows in the United States, Europe and Argentina (see World Bank 2018a). In the face of persistent investor reluctance, the World Bank launched its package of guarantees to backstop the guarantees that the government had put in place through FODER.

According to a World Bank report:

> The WBG supported GoA to size the program, based on estimated needs and financing available, and develop standardized legal documents for RenovAr auctions. The International Bank for Reconstruction and Development and teams from the IFC reviewed all key Program documents and provided feedback to GoA based on international experience in similar programs, with a particular focus on ensuring a fair and balanced project risk allocation between the private and public sector, with an objective of minimizing the public sector financing/support and to ensure a market success of the program. The Bank also supported GoA, as needed, to expand its reach to the global private sector investor base. (World Bank 2017)

Discussions with the Argentine government, bidders, and lenders indicated that the World Bank's engagement played a critical catalytic role in attracting the large number of bids to the initial auctions rounds (World Bank 2018a).

Although the role of the WBG was important as a catalyst for private investment, its participation in the auction design and implementation didn't involve significant resources as it was not part of a long-term programme. According to the IFC (2018):

> Scaling can be done with limited resources if the incentives are in place: IFC's engagement in RenovAr did not require a large, fully staffed, multi-year, funded programme. IFC's upstream engagement was carried out by a few people with a limited budget for external advisors. Within IFC, RenovAr was possible because of driven individuals with keen knowledge of the market as well as supportive management that worked with the team to get funding and remove barriers. The team was driven by a direct request from a very committed government client that wanted to make things happen and that sought advice from both the Bank and IFC.

The energy ministry made CAMMESA responsible for the technical implementation of the auction programme. CAMMESA is in charge of the physical dispatch and also acts as a clearing house for all financial flows in the sector. Although not part of its original mandate, CAMMESA had proven experience in the implementation of auction processes. It had previously, at the request of government, occasionally acted as a procurement agent in the purchase of gas for generators and the expansion of gas transportation capacity, as well as in helping to manage capacity and cogeneration auctions.

In general, the process has been seen as highly transparent. Following local regulations, all envelope opening events were carried out in public with the participation of bidders who wanted to attend, and before a notary who certified the procedure. The results of each evaluation – both technical and financial – were made public. As noted, CAMMESA also had to prepare a report evaluating the technical bids and submit this to the Energy Secretariat.

Under the Macri administration, from 2015 to 2019, RE development clearly had political support. Although no comprehensive plan was developed for the energy sector as a whole, REs seemed to a priority. With the subsequent change of administration, in December 2019, political support for RE has decreased significantly. The fact that rates have been set in dollars has become controversial in the context of the strong devaluation of the peso.

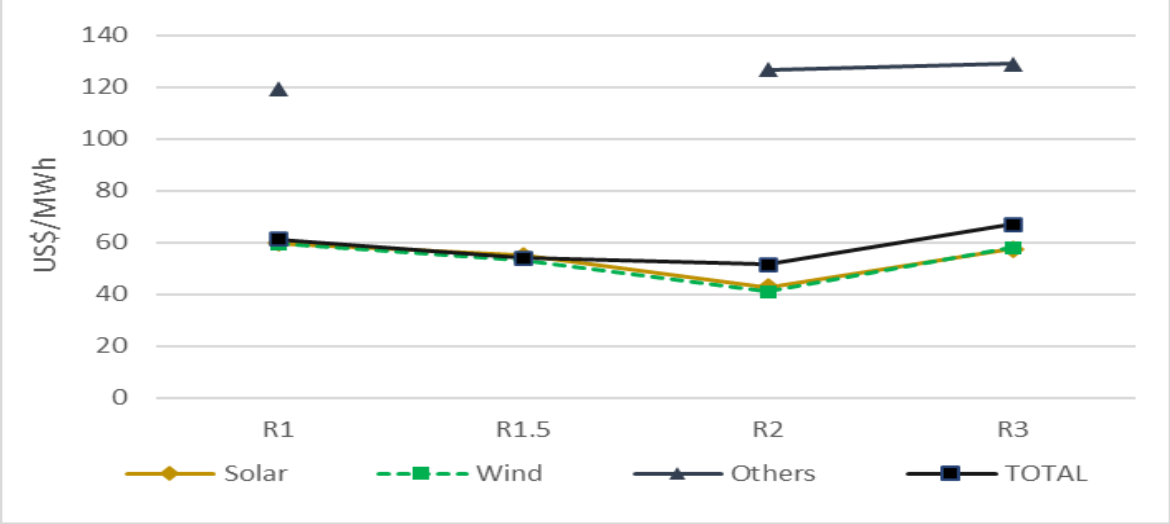
4 Results

It can be argued that the RenovAr programme has been successful in its primary objectives. In the four rounds held so far, investments for over 4 726 MW were awarded, of which 1 411 MW were in operation by January 2020. Bid prices were competitive when compared to those in the wider region, and particularly so given the macroeconomic context.

Figure 5 shows the shift in prices for awarded projects, per technology and round. When considering all technologies, the weighted average price fell 16 per cent between RenovAr1 (US$ 61.33/MW) and RenovAr2 (US$ 51.48/MW), and increased by 30 per cent in RenovAr3. The shifts at the aggregate level are also reflected in the individual technologies. In all cases, prices decreased from the first to the third rounds and increased in the fourth.

The first two rounds are worth a closer look. RenovAr1 and RenovAr1.5 unfolded within a short period of time. In economic terms, RenovAr1.5 can be seen as a price-improving iteration of RenovAr1. The outcome was successful: an average price decrease of 12 per cent was accomplished with 64 per cent of accepted offers.[45] This price decrease challenges the wisdom of the programme having contracted 1 142 MW – 14 per cent more than the 1 000 MW volume originally set for RenovAr1. If the originally tendered volume had been awarded, it is likely that more bidders excluded from RenovAr1 would have submitted lower bids for RenovAr1.5. In effect, contracting above the set objective of 1 000 MW created a cost overrun for the system that can be estimated at over US$3.1 million/year.[46]

Figure 5: The evolution of prices for awarded projects per technology, RenovAr 2016–2019



Data source: CAMMESA (various)

45 The most extreme case was that of Project EOL-32, which was the bid with the highest price in RenovAr1. The same project was submitted for RenovAr1.5 at the lowest price in the auction, having decreased its offer by over 50 per cent (from US$114 to US$55/MWh).

46 For example, EOL-46, a wind project above the required capacity of 600 MW had a price of US$67.19/MW (and a capacity of 99.75 MW). Similarly, SFV-13, a solar project above the required capacity of 300 MW, bid a price of US$ 58.98/MW (and a capacity of 100 MW). Had these projects not been awarded in RenovAr1, and still participated in RenovAr1.5, they might have offered discounts similar to the average offered for their respective technologies. Their prices would then have come down to US$ 60.34/MW and US$ 54.23/MW, respectively. Assuming a utilisation factor of 25 per cent for SFV and 35 per cent for wind, the average annual energy generated by these two projects would be around 525 000 MWh/year, and the monetary difference would be worth over US$ 3 million a year.

The average price in the third round (RenovAr2) was also affected by the mechanism adopted. In the first phase of this round 1 200 MW were requested and 1 409 MW were awarded. Offers for over 9 400 MW were received, resulting in an average price of US$ 53.27/MW for awarded technologies. In the second phase, non-awarded bidders were invited to come on board with a price computed based on Phase 1 results. Per technology these were: US$ 40.27/MW for wind; US$ 41.76/MW for solar; US$ 106.73/MW for biomass; and US$ 156.85/MW for biogas).[47] In this phase, an additional 634 MW was awarded, giving rise to an average price for this phase of US$ 47.54/MW.

Three factors help explain the higher prices evident in the fourth round. The first is related to the design of the auction: unlike in the previous rounds, no incentives nor adjustment factors applied to the bid price, and with no adjustments over time, bid prices have to be higher to achieve the same financial results.[48] The second factor relates to the fact that RenovAr 3 (Mini RenovAr) was aimed at smaller developments: the average awarded project size in the first three rounds was 30 MW, while in RenovAr3 it was 6.8 MW. Economies of scale help explain the higher prices. The third factor relates to conditions at the time of the auction: the impact of the country's macroeconomic crisis cannot be overstated.

Table 14 shows the estimated country risk for Argentina, as measured by JP Morgan's Emerging Market Bond Index Plus, at the time of each round.[49] In May 2019, when the RenovAr bids were submitted, the country risk was between 450 and 560 basis points above the average observed at the time of the previous rounds. The resulting higher cost of capital also helps to explain why bids were higher.[50]

Table 14: Country risk for Argentina according to JP Morgan, 2016–2018

Round	RenovAr1	RenovAr1.5	RenovAr2	RenovAr3
Bid submission	9/5/2016	10/28/2016	10/19/2017	5/30/2019
EMBI+	4.50	4.48	3.60	9.14

Data source: CAMMESA (various)

However, caution must be taken when analysing these figures. Even if competitive prices were undeniably obtained, the costs associated with the (free) guarantees given by FODER should be considered an economic subsidy. On the other hand, the variable nature of RE – particularly wind and solar – renders the comparison between renewable and energy sources that offer more stable levels of capacity and supply inaccurate.

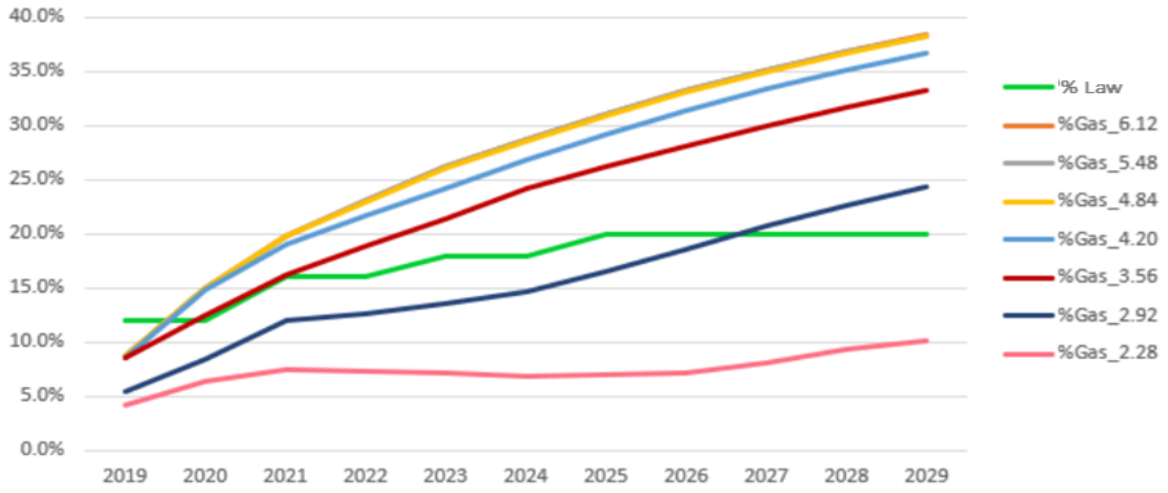
47 Specifically, prices for biomass and biogas technologies were computed as the weighted average price of the awarded contracts in Phase 1, and considering only 50% of the scale incentive. For wind and solar, on the other hand, the prices were computed as the weighted average price of the awarded contracts in Phase 1, but considering projects in certain regions (Buenos Aires, Patagonia and Comahue for wind projects and NOA and Cuyo for solar).

48 As compared with auctions that include adjustment and incentive factors, supressing these factors requires, *ceteris paribus*, an increase in the bid price of around 11 per cent to keep projects' internal rate of return constant at 10 per cent.

49 JPMorgan's Emerging Markets Bond Index Plus (EMBI+) tracks total returns for traded external debt instruments (external meaning foreign currency denominated fixed income) in the emerging markets. Values shown are indicator's average over the 10 days before bids presentation.

50 According to figures on investment, operational expenditure, and utilisation factors supplied by Lazard Asset Management, a 500 basis-point difference in the cost of capital – going, for example, from 7% to 12% – provokes a 33% difference in the cost per MWh of a wind project (from US$28.34 to US$37.77) and of 38% in a solar project (from US$43.64 to US$60.22).

Figure 6: Projected renewable energy penetration at varying gas prices, Argentina 2019–2030



Note: The green line displays the RE share values established by Act 27.191. These values were obtained using an integrated gas and electricity dispatch model that simulates the Argentine market assuming a 5% real and expected inflation in the US of around 2% per annum.
Data source: CAMMESA

The comparison of RE generation prices with the cost of other traditional technologies is particularly relevant in Argentina, where shale gas potential is vast.[51] Figure 6 shows RE penetration in a least-cost expansion programme at different gas prices, assuming a cost of capital equal to 7 per cent in nominal terms.

With gas prices around US$ 2.28/million BTU, RE generation is not competitive and its optimal penetration will not reach even 10 per cent of total system generation by 2030. In fact, the portfolio dictated by Act 27.191 will become a cost overrun for the system if the gas price goes below US$3 /million BTU. However, if gas costs more than US$ 4.48/million BTU, RE technologies could become dominant, and their participation could reach almost 40 per cent by 2030. Clearly, a higher cost of capital has a substantial effect on optimal RE penetration.

In terms of technologies, wind and solar have dominated both received bids and awarded capacity. With the exception of RenovAr1.5 (which was aimed only at wind and solar projects), all rounds established limits for awarded capacity for each technology. Substitution between technologies was not allowed, so each round can be seen as having constituted a set of two to six simultaneous and independent auctions.[52]

In the first three rounds, bids of between five and ten times the required volumes were received for wind and solar generation, while for the other technologies, the bids received were lower than the auctioned volumes. This situation reversed in the last round. The focus on small projects meant that the solar and wind bids were below the available volume (283 MW offered against 350 MW requested) and those of the other technologies exceeded the auctioned capacity. The aggregated results of the four rounds are shown in Figure 7.

Table 15 shows tendered, offered and awarded capacity for each technology in each round.

51 Argentina has some of the world's largest reserves of shale gas and shale oil in the Vaca Muerta formation. https://www.argentina.gob.ar/energia/vaca-muerta/inversiones

52 Technology limits were sometimes aggregated, so that the number of simultaneous auctions varies per round.

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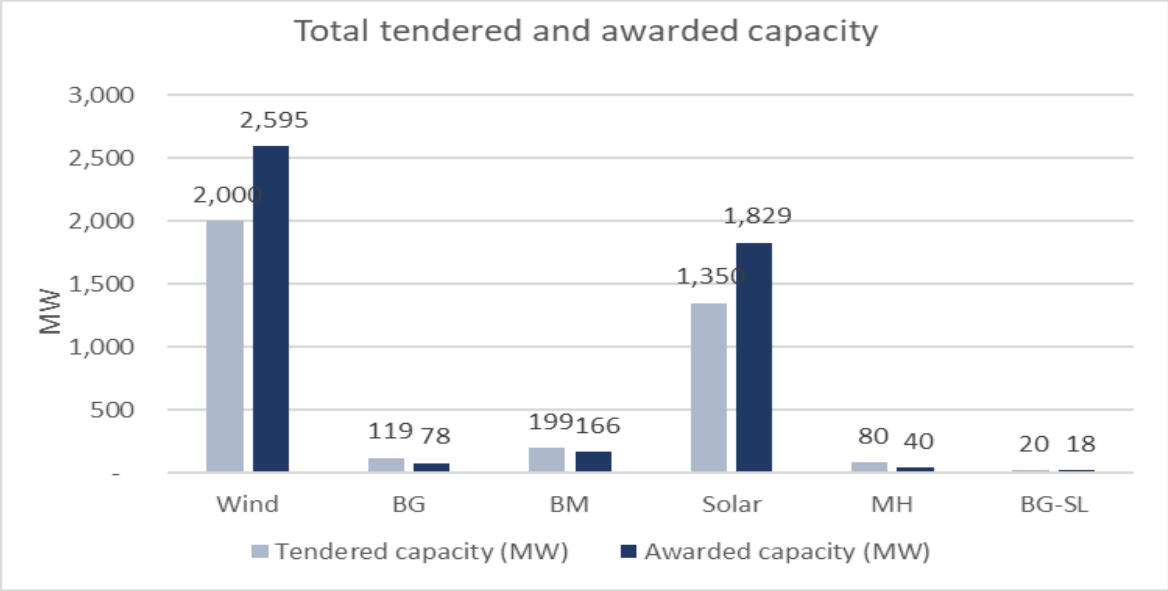
Table 15: MW tendered, offered, and awarded by round, RenovAr 2016–2018

Round	MW status		Wind	Solar	Biogas	Biomass	Mini hydro	Biogas-SL	Total
RenovAr1	Required		600	300	15	65	20	–	1 000
	Received		3 468	2 811	9	45	11		6 344
	Awarded		707	400	9	15	11		1 142
RenovAr1.5	Required		400	200	–				600
	Received		1 561	925					2 486
	Awarded		765	516					1 281
RenovAr2 Phases 1&2	Required	Ph 1	550	450	35	100	50	15	1 200
		Ph2	275	225		68		–	568
	Received		3 811	5 291	57	187	32	15	9 393
	Awarded	Ph 1	666	557	35	117	21	13	1 409
		Ph 2	328	260	21	26	–		635
RenovAr3*	Required		350		10	25	10	5	400
	Received		155	128	19	26	10	15	353
	Awarded		129	97	13	9	7	5	260

Note: *In this round, 12 projects (with a total capacity of 62.75 MW) qualified technically but were not awarded. They were then invited to enter into supply contracts, and to sign an agreement with FODER, based on the minimum price per technology awarded in the auction.
Data source: CAMMESA (various)

Figure 7: Total tendered and awarded capacity per technology, RenovAr 2016–2019



Note: BG = biogas; BM = biomass; MH = mini=hydro; BG-SL = biogas-sanitary landfill
Data source: CAMMESA (various)

A similar pattern is evident in awarded projects. In the first three rounds, both wind and solar were over-contracted, while bids for the remaining technologies did not cover the available quota (with the exception of biomass in the second round, which was also over-contracted). In the third round, more biogas was awarded than the available quota (13 MW awarded against 10 MWrequired) and for biogas-SL the quota was filled exactly (5 MW). For all other technologies, the awarded capacity was lower than the available quota. It should be noted that this round was the only one in which the awards bids amounted to substantially less than the quota offered (259 MW awarded out of 400 MW available). As noted, Argentina's macroeconomic situation in 2019 partly explains this difference.

The relatively low number of biogas, biomass and small hydro bids that were submitted in Round 1 was partly due to the fact that RenovAr programme was developed and launched quite fast. The developers of power generation projects based on these technologies were relatively unprepared for the development of auction bids (Menzies et al., 2019).

One of the objectives of Argentina's RE legislation was to foster the development of a local RE-related industry (with jobs and other benefits). Nevertheless, to maximise price competition, the IFC advised the government to remove local content as one of the components in the formula for evaluating bids (IFC, 2018). They argued that this was key to attracting financing from bilateral institutions. In the trade-off between the developmental objective set out in the law (developing local manufacturing capacity), and the objective of maximising price competition by attracting as many bidders as possible, a compromise had to be reached. The solution was to make the stated local content (SLC) not a direct awarding criterion, but to include it as tiebreaker criterion. Thus, if two projects bid at the same price, SLC was used to determine fiscal benefits and to compute the cost of the World Bank guarantee.[53] See Table 16 for average SLC in qualifying and awarded projects in each round.

Some distinctive features arise from our analysis of this. First, in most cases, the sub-set of awarded projects shows a higher average SLC than the average across all qualifying projects.[54] Since the selection was based on bid price, regardless of local content, this suggests that incorporating more local content did not adversely affect project costs. Second, average local content of projects seems to be gradually increasing over time. However, this funding should be treated with caution since the third round focused on smaller projects, and its values are not strictly comparable. Taking just the first three rounds into account, the simple average of SLC is larger than the weighted average in most cases, which indicates that local content decreased according to project size in these rounds too. In terms of technologies, SLC for wind projects increased over time but decreased for solar (Figure 8).

Table 16: Average stated local content per round, RenovAr 2016-2019

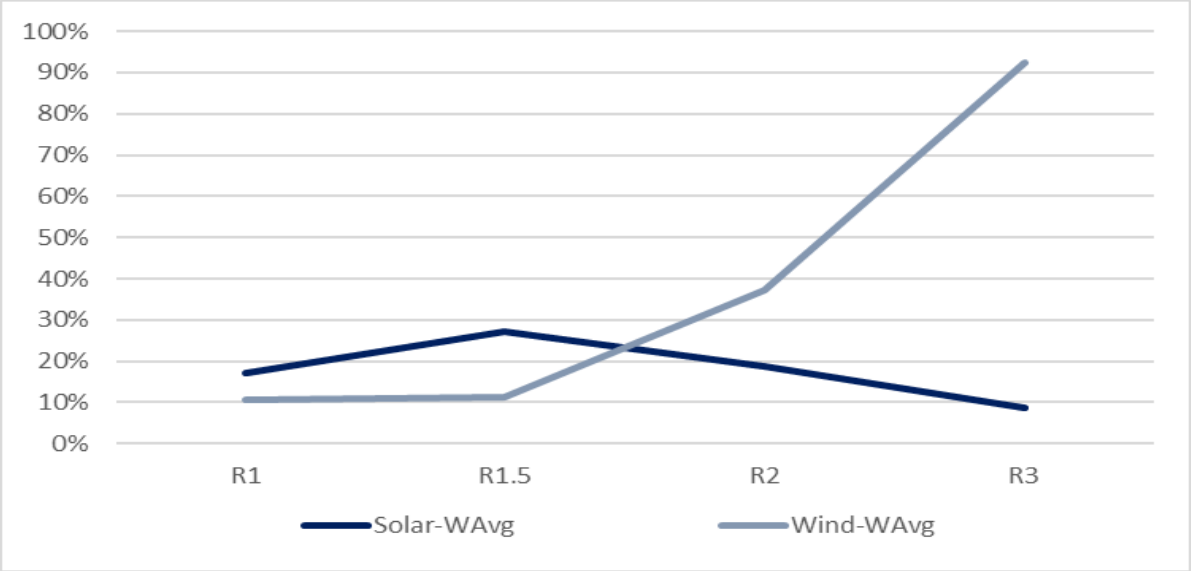
Round	All qualifying bidders		Awarded bids	
	Weighted %	Simple %	Weighted %	Simple %
RenovAr1	12.5	20.1	13.8	27.0
RenovAr1.5	18.1	24.7	17.6	27.4
RenovAr2	23.6	26.9	29.6	26.7
RenovAr3	52.4	38.8	52.5	40.1
Average	20.0	26.4	23.8	29.6

Data source: CAMMESA (various)

53 The World Bank guarantee was discounted by 1 basis point per percentage point of SLC.

54 This was not true for RenovAr1.5's weighted average, but RenovAr1.5 was a subset of RenovAr1, and was limited to wind and solar, so its SLC is not strictly comparable to that of other rounds.

Figure 8: Weighted average capacity of wind and solar projects by stated local content, RenovAr 2016–2019



Data source: CAMMESA (various)

According to Walter Lanosa, (CEO of Genneia one of Argentina's larger energy companies) and vice-president of the Cámara Eólica Argentina), the wind-energy value chain associated with the construction of turbines is similar to that of the automotive sector and Argentina has well-established track record the assembly of auto parts (Lanosa 2020). For this reason, wind projects in the RenovAr programme created good opportunities for local metal-working and mechanical engineering businesses.

Third. if the results are analysed by awarded companies, the concentration of awards is generally high – with a few companies winning several projects. Provincial companies were awarded 825.3 MW (17% of the total awarded capacity). Provincial participation is even higher when considering total capacity per technology; with provincial companies winning 22 per cent of awarded capacity in mini hydro, 15 per cent of total wind capacity and 24 per cent of solar capacity.

Table 17 shows the number of companies with projects awarded in each round and the percentage of the total MW won by the top three and the top five companies. Concentration decreased over the first three rounds, and considerably increased in the fourth, where just one company (Elawan Energy Developments SL) accounts for 46 per cent of total awarded capacity (with over 115 MW of wind capacity). The companies accounting for 50 per cent of overall capacity contracted over the four rounds are presented in Table 18.

Interestingly companies controlled by provincial governments (through total or partial ownership) feature prominently among award winners. As SOEs, these companies are arguably less driven by market considerations and profit-maximisation. They also have certain advantages, such as land ownership and access to direct finance from foreign governments. Table 19 shows the projects awarded to provincial companies per technology.

Provincial companies were awarded 825.3 MW (17% of the total awarded capacity). Provincial participation is even higher when considering total capacity per technology; with provincial companies winning 22 per cent of awarded capacity in mini hydro, 15 per cent of total wind capacity and 24 per cent of solar capacity.

Table 17: Number of awarded companies per round, RenovAr, 2016–2019

Round	1	1.5	2	3	Total
Number of projects	29	30	88	38	185
Number of companies	20	18	59	22	107
Capacity	1 142	1 282	2 043	259	4 726
Per cent won by the top 3 companies	50%	41%	33%	61%	19%
Per cent won by the top 5 companies	68%	56%	44%	69%	29%
Number of firms accounting for 50%	3	5	6	1 (46%)	11

Note: * This is less than the sum of all companies in all rounds as some companies won projects in more than one round.
Data source: CAMMESA (various)

Table 18: Capacity concentration across the four RenovAr rounds, 2016–2019

Company	Awarded capacity		# projects and technology
	MW	%	
Latinoamericana de Energía	311.9	7	6 (solar, wind, mini hydro)
JEMSE	300.0	6	3 (solar)
PE Arauco	294.8	6	3 (wind)
Isolux Ingenieria	277.7	6	3 (solar, wind)
Genneia	259.4	5	4 (wind, BM)
CP Renovables	233.6	5	3 (wind)
PCR	200.0	4	2 (wind)
Envision Energy	175.0	4	3 (wind)
Empresa Mendocina se Energía	148.1	3	11 (solar, wind, mini-hydro)
Energia Sustentable	126.8	3	5 (solar)

Data source: CAMMESA (various)

Table 19: MW awarded to companies owned (or partly owned) by provincial governments, RenovAr 2016–2019

Firm	Province	Solar	Wind	Mini hydro	Total
JEMSE	Jujuy	300.0	–	–	300.0
PE Arauco	La Rioja	–	294.8	–	294.8
EMESA	Mendoza	93.7	50.0	4.4	148.1
Centrales de la Costa	Buenos Aires	–	38.0	–	38.0
EPEC	Córdoba	40.0	–	4.5	44.5
Total		433.7	382.7	8.9	825.3
Percentage of total capacity		24%	15%	22%	17%

Data source: CAMMESA (various)

To cite just a few examples:

- When JEMSE, the provincial energy and mining company in Jujuy Province was awarded a 300 MW solar plant, it won the largest project awarded in the RenovAr programme (See Box 1).
- La Rioja province owns Parque Eólico Arauco (Arauco Wind Farm). Originally developed under Resolution No. 108/2011, the wind farm started operations in 2011, with an installed capacity of 25 MW. Through the first three rounds of RenovAr, the company was awarded a further 294.8 MW.
- Mendoza province's energy company, EMESA, was awarded solar, wind and mini hydro projects. In total, these represent 148.1 MW, making this company the third highest awarded among the provinces and the ninth highest nationally.

Box 1: JEMSE's Cauchari Project

The Cauchari Solar Park, located in Jujuy Province, is one of the largest PV projects in Argentina, harvesting 300 MW over an area of 650 hectares. JEMSE (Jujuy Energía y Minería Sociedad del Estado), a company owned by the provincial authorities, was awarded the project in the first RenovAr auction, held in September 2016. The national authorities have since complemented this with the construction of a substation to transmit the generated energy.

The Exim Bank of China provided a loan of US$331.5 million to help finance the solar park, which (officially) cost US$ 541.5 million. The loan is backed up by a sovereign guarantee from the Argentinian government. In addition, the provincial authorities issued a 'green bond' in the US financial market for another US$210 million.

The construction and supply of materials is being carried out by two Chinese companies, Power China and Shanghai Electric Power Construction (SEPC).

JEMSE is negotiating with Chinese entrepreneurs to expand of the project by another 200 MW at an estimated cost of US$300 million. If successful, the solar project will end up costing more than US$ 900 million, with a ten-year repayment term on the principal debt.

Before the approval of the law, several provinces had started planning – generally with the support of development agencies in developed countries[55] – to boost investment in RE. For these provinces, the RenovAr program helped projects that had been planned for years to materialise. To an extent part of RenovAr's initial success can be explained by the fact that these provincial firms already had projects in the pipeline when the programme was launched.

4.1 Project status by early 2020

While the RenovAr programme has so far been successful in attracting bidders across its different rounds, project implementation is taking longer than the stipulated time periods. Once a project is awarded, the first step is signing the PPA and the standard contract with FODER. The signing of the PPA is significant because this is when bidders have to replace the offer guarantee or bid bond (US$ 35k/MW in all rounds, except RenovAr3 where it was US$ 50k/MW) with a supply contract compliance guarantee (US$ 250k/MW). This clearly raises the financial risk if the project is not developed as per the contract.

Different rounds stipulated different time periods for the signing of the PPA, with RenovAr1 (at 30 days) being much shorter than the subsequent rounds (around 170 days) (see Section 3.1). As shown in Table 20, all awarded projects from the first three rounds were signed (except for those cancelled).

After the financial crisis of 2018, Argentina lost access to capital markets and had to resort to an IMF bailout. Consequently, several of the awarded projects were unable to obtain the necessary financing. To avoid projects being suspended, the energy ministry granted extensions. For the fourth round, RenovAr3, only five PPAs have not been signed but the deadline has been extended again because of Covid-19.

55 For example, San Juan and San Luis provinces received support from the German Solar Association (BSW-Solar); Mendoza province also started its own projects several years before the RenovAr programme.

Table 20: Status of RenovAr project PPAs by January 2020

Round	Awarded±		Cancelled		PPA not yet signed		
	Number	MW	Number	MW	Number	MW	% MW
RenovAr1	29	1 142	1	2	0	0	0
RenovAr1.5	30	1 282	1	35	0	0	0
RenovAr2	88	2 042	3	36	0	0	0
RenovAr3	38	260	0	–	5	56	22
Total	185	4 726	5	73	5	56	1.2

Data source: CAMMESA (various)

Table 21: RE power projects awarded in RenovAr1, 1.5 and 2, and subsequently cancelled

Project name	Round	Technology	MW
Huinca Renancó	1	Biogas	1.6
P.S. Sarmiento	1.5	Solar	35.0
C.T. Generacion Virasoro	2	Biomass	3.0
C.T. Kuera Santo Tome	2	Biomass	12.9
P.S. SAUJIL II	2	Solar	20.0
Total			72.5

Data source: CAMMESA (various)

Table 22: Number, size and status of projects with signed PPAs from RenovAr1, 1.5 and 2

Round	PPA signed		In production			Under construction / not started		
	No. of projects	MW	No. of projects	MW	% MW	No. of projects	MW	% MW
R1	28	1 140	15	438	38	13	702	62
R1.5	29	1 247	18	638	51	11	608	49
R2	85	2 007	21	335	17	64	1 672	83
Total	142	4 394	54	1 411	32	88	2 983	68

Note: RenovAr3 projects are not shown because the deadline for signing the corresponding PPAs had not expired when this data was collated

Data source: CAMMESA (various)

Five project contracts have been terminated (one from RenovAr1, one from RenovAr1.5 and three from RenovAr2), representing a total of 72.5 MW (1.5% of awarded capacity); see Table 21.[56] The projects that have signed PPAs can be categorised as in production, under construction, and not-started (see Table 22).

While the status of projects not yet in operation is not officially tracked and updated, data from March 2019 indicates that construction had not started on over a third of the projects (three from RenovAr1, six from RenovAr1.5 and 47 from RenovAr2). As noted. this large proportion can be explained by problems associated with securing financing after 2018.

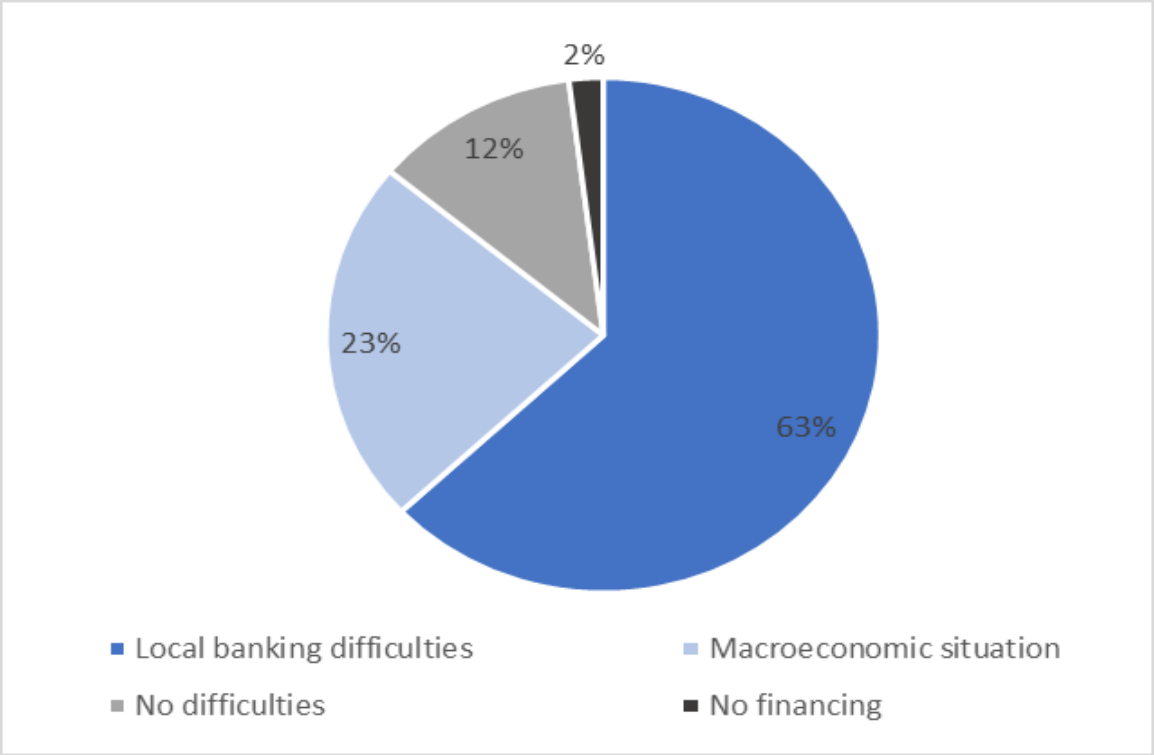
According to Constantini & Di Paola (2019), a survey of firms that have awarded with PPAs in the RenovAr programme identified the inexperience of local banks with project finance (not only linked to RE) as the major financial obstacle they have faced; they indicated that the macroeconomic situation was the second major issue (Figure 9).

56 Little information is available on the causes of the cancellations; one was cancelled for breach of milestones, another was cancelled by CAMMESA and the other three had not signed PPAs before the corresponding deadline. The capacity has not been reallocated.

While the two issues are clearly related, it is important note the kinds of restrictions that can arise within the local financial sector when designing RE auctions.

On average, of the 4 394 MW linked to signed PPAs, 32 per cent is operational. Distribution varies across rounds. As noted, the first two rounds occurred within a fairly short time period. From these rounds, the percentage of capacity that is already operating is larger than that from RenovAr2 (38% and 51%, versus 17%).

Figure 9: Sources of financial difficulties identified by awarded projects after signing PPAs



Source: Constantini & Di Paola (2019: 7)

Since mid-2018, the government has extended the deadlines several times. While extensions have been necessary in the deteriorating macroeconomic conditions, they have also prevented the execution of the corresponding guarantees, and contributed to delays on contracted projects. This, in turn, casts doubt on the efficiency and appropriacy of the auction mechanism adopted, which was based on relatively low entry requirements (in terms of progress in the technical and financial aspects necessary to qualify in the tender) and high fines for non-compliance.

5 Lessons and recommendations

5.1 Auction implementation

The adoption of a clear legal framework with well-defined objectives and mechanisms aimed at mitigating macroeconomic risks has been a determining factor in the development of RE in Argentina. Since the 1990s, several RE promotion programmes have been run in Argentina, but until the legal framework was adopted in 2016, none of these had much impact. The legal framework now includes RE portfolio standards, an auction mechanism for project selection, and a guarantee fund to mitigate economic risks.

By 2016, after 13 years of an electricity-tariff freeze, the government was taking various steps to improve the financial situation of the electricity sector. For example, apart from a social tariff that protects the poorest 1.5 million households, a three-year plan was announced to eliminate energy subsidies by 2019.[57] The latter step improved CAMMESA's credit standing and sent a positive signal to investors.

Political support for RE was a key factor. Fundamental to the success of the RenovAr programme was strong commitment from the government that took office in December 2015, and the presence of a sector champion in the office of the Undersecretary for Renewable energy who, as noted, had been involved in drafting new legislation to govern the auctions. The RenovAr programme also successfully secured political support countrywide. Regional quotas and restrictions on the distribution of projects within in each region helped secure the support of provincial authorities. While the quotas were partly based on the limitations of the country's transmission system, they also reflected an attempt to achieve a balance of RE investment across the various regions.

In addition, the Macri administration developed a clear strategy to ensure that the new law was implemented. The first element in this strategy was enlisting the help of international agencies – specifically the World Bank Group – to ensure that international best practices were adopted and that investors' concerns were well understood. As the IFC (2018: 7) put it, 'The IFC team was tasked with providing advice on the overall attractiveness of the program for private investors and developing bankable project documentation. The World Bank team started working on a guarantee program to support the financing of RenovAr projects.'

A second key element in the strategy was putting all the technical aspects of the process in the hands of CAMMESA. As manager of the dispatch and the clearing of all commercial transactions in the wholesale electricity market, and with extensive experience in managing tenders for gas and thermal power investments, CAMMESA had enough in-house know-how and credibility in the market.

A third element was the development of a highly participatory process. Consultation rounds held before the final RfP documents were issued, and a responsive communication mechanism during the auction, were essential in ensuring the transparency and integrity of the process.

Coordination with the transmission system was a fourth crucial element in the RenovAr programme. To ensure efficient use of existing capacity, the maximum power that could be connected at each point in the existing network was specified in the first two rounds. In the third round, transmission availability was based on an 'expanded transmission system', and

57 In 2015, these subsidies amounted to 4 per cent of GDP.

included transmission investments that had to be completed over the following 30 months. To shield bidders from the risk of transmission works failing to reach completion, a take-or-pay clause was included in PPAs. Transmission charges for new RE projects follow a 'shallow connection costs' approach.

One of the main limitations of the programme is the lack of a predefined schedule for the auction rounds. This is exacerbated by the fact no long-term investment plans for the energy sector or the renewables industry have been developed. The resulting uncertainty increases the risks related to the programme's sustainability medium and long-term. As Viscidi and Yepez (2019: 11) have pointed out, 'Auctions held at regular intervals or scheduled well in advance can improve long-term confidence in a country and encourage bidders to invest the time and resources necessary to familiarise themselves with the market.'

5.2 Auction design

Perhaps the major factor in the success of the RenovAr programme so far has been its comprehensive approach to mitigating risks for investors and developers. Payment and termination guarantees – provided through FODER – substantially reduced off-taker risk. The fact that most of the risk was transferred away from the developers and onto the state, helped increase investor appetite in early rounds, and played a considerable role in reducing bid prices (Menzies, et al., 2019). Although government leaders were initially reluctant to carry these risks, they eventually acknowledged that this was necessary for attracting investors and creating the kind of track record that would encourage those investors to carry some of these risks in future (IFC, 2018).[58]

Setting relatively low technical requirements for participation in the auction and relatively high penalties for non-compliance is, in theory, an efficient way of ensuring a reasonable level of competitiveness between bidders. To present bids in a RenovAr auction, participants had to provide only basic technical feasibility studies. This kept the costs of participation relatively low. However, to discourage irresponsible offers and ensure that only serious bids were submitted, costly bid and performance guarantees were imposed. For bidders with serious intentions to develop the offered capacity, these guarantees involve few sunk costs and do not represent a significant financial risk because the amounts are reimbursed if bids are unsuccessful or when commercial operations begin (as long as this occurs according to the agreed schedules) (Menzies, et al., 2019).

This mechanism successfully attracted a large number of bids to all rounds. However, not all accepted bids projects have reached financial close or met the dates stipulated for starting commercial operations. In part, the 2018 macroeconomic crisis is to blame for this. Although, as discussed, the RenovAr programme was designed to shield investors from certain sectoral and other economic risks, it was unable to protect them from macrosystemic failure. When the Argentinian government had to apply for an IMF bailout, it was cut off from international markets, and several investors were unable to finance their projects. In response, the government decided not to execute guarantees – that is, not to penalise investors for risk over which they had no control. In the short term, the decision can be considered a positive move – it is keeping projects alive in the event that the investment situation changes. However, not executing the guarantees has the potential to create a credibility problem for the programme that could have serious repercussions in the medium to long term.

58 According to the IFC (2018), the Argentinian government initially wanted investors to: carry energy-balancing costs through market clearing; include local content in their bids; allow provinces to use their own environmental and social rules for projects in their jurisdictions; and set a public reserve price in the first auction.

6 Conclusion

The RenovAr programme has been successful in attracting developers, despite high levels of economic uncertainty. In our view, two elements of the programme have been key to its success. The first was the use of competitive auctions to assign 20-year energy contracts. The second was the establishment of FODER – a guarantee and investment fund that aimed to mitigate the sectoral and the macroeconomic risks facing investors.

When analysing the Argentine experience, the distinctive elements of its economy and its energy sector have to be factored in. These include chronic economic instability; the existence of competitive primary energy sources; institutional fragility within the electricity sector; the absence of comprehensive sectoral investment planning; and the country's limited transmission system.

Developing mechanisms to mitigate and minimise financial risk thus became a basic condition for the development of the RE sector. Accordingly, as shown, the RenovAr programme includes several elements aimed at securing the successful bidders' revenue streams and shielding them from financial risks such as the lack of off-taker payments, currency devaluations as well as changes related to policy and exchange controls. These elements include: standardised 20-year PPAs with a trust fund that guarantees payments with sovereign support plus the option of a World Bank guarantee, US-dollar-denominated energy pricing, provisions for international arbitration, and a sell-option in favour of the investor in case of non-compliance by CAMMESA.

Initially, the programme was successful in attracting a large number of investors. However, after Argentina's 2018 financial crisis, it became clear that the trust fund could not, in fact, protect investors against sovereign risk (beyond the World Bank guarantee). Consequently, some projects that were still in their initial stages have found it extremely difficult to reach financial close, and the ongoing deterioration of the country's financial situation has had a direct impact on RE investments. In addition, the lack of an agency or mechanism with responsibility for sector-wide medium and long-term planning has also limited the development and implementation of Argentina's RE policies.

The main objective of the RenovAr programme was to ensure enough investment to cover the RE generation share as set out in the legislation. Nevertheless, when the programme was launched, Argentina was facing the risk of generation shortages. For this reason, in the three first rounds, points were awarded in the bid evaluations to projects that made commitments to shorter construction periods, and penalties were levied if projects failed to meet the deadlines they proposed.

Developing a local RE industry was a further general objective even though local content was not included in the criteria for evaluating bids. Instead, SLC was used as a criterion when two projects bid at the same price. SLC was also considered to determine possible tax benefits that projects could apply for, and to reduce the costs of the World Bank guarantee.

Overall, our assessment of the RenovAr programme is positive. However, some aspects of its design and implementation could be improved.

First, Argentina lacks a medium and long-term planning mechanism for the electricity sector to guide investment decisions. The development of RE has been no exception. Prior to RenovAr, RE tenders were held without any consideration of other tenders for electricity or gas. Furthermore, the RenovAr program itself lacked a public mechanism to set the frequency

and volume of the auctions to be held. Thus, each round was announced by the government only a few months before the call.

Interestingly, tax benefits are not considered in determining merit order for the economic offers.[59] This means that, for some projects, total costs (price plus fiscal support) can be higher than projects that have a higher price but a lower total cost. Of course, the narrow sectoral interest is to minimise project price but the total cost (including tax incentives) is ultimately the cost that electricity consumers pay. Thus, this oversight partly reflects the need for an overarching vision that is capable of utilising RenovAr as a tool of national energy and economic policy and not as an isolated programme.

Second, the RE legislation makes provision for several tax incentives. Nevertheless, the incentives were not considered when ranking the financial merits of the bids. Disregarding the incentives can result in favouring bids whose total cost (price plus fiscal support) is higher than bids that have a higher price but a lower total cost. This oversight also reflects the lack of a wider vision within the RenovAr program. That is, RE should be seen as one aspect of an overarching national energy and economic policy, and not as an isolated issue.

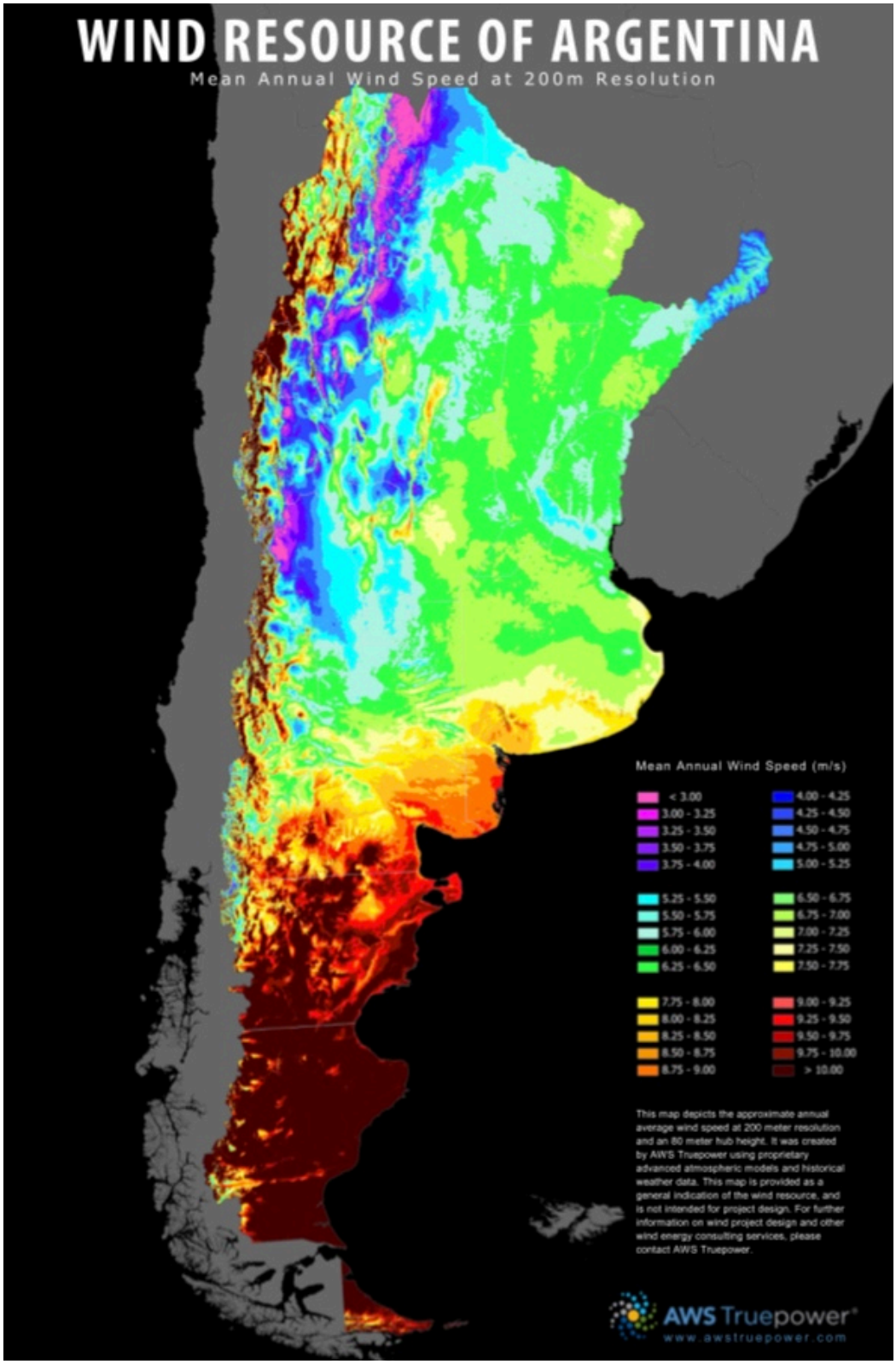
Third, delays in project implementation reflect the problems associated with securing financing after the deterioration of Argentina's macroeconomic situation in 2018. In hindsight, the lack of any requirement for bidders to provide evidence of the financial resources they had available to commit to the project has probably created the greatest risks for both bidders and the RenovAr program. Awarded projects that cannot reach financial close, in what has become a highly volatile economic context, risk losing their performance bond. Part of FODER's intended role was to supply long-term finance to RE projects through loans, equity, subsidies to interest rates, etc. In practice, however, the trust has not fulfilled this part of its mandate and its failure in this regard is likely to be costly in terms of developing RE in Argentina in the medium term.

Finally, while the RenovAr programme has not specified different SLC preferences for the different technologies, a differentiated approach aimed at maximising local impact might be worth exploring.

59 Only in the case of a tie between two projects (that is, a price difference of less than 3 per cent and the same local content), was fiscal cost considered in the merit ranking.

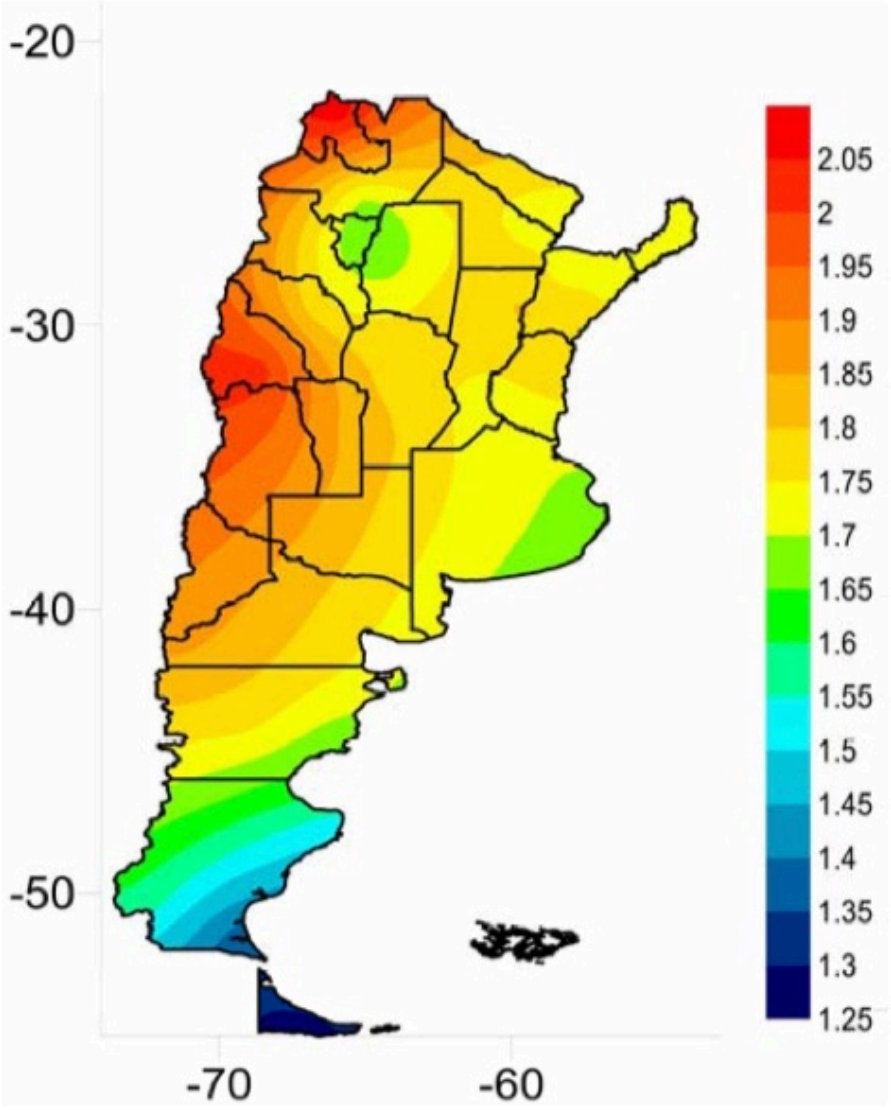
Appendix A: Argentina's wind and solar resources

Mean annual windspeed in Argentina



Source: https://aws-dewi.ul.com/assets/Wind-Resource-Map-Argentina-11x17.pdf

Argentina's average annual solar irradiation chart, by MWh/m2 (as collectable by planes inclined at an optimal angle)



Source: Righini & Gallagos (2011)

Appendix B: Analytical framework

The analytical framework used in this report represents a widening and deepening of the work done by Eberhard and Gratwick (2011) and Eberhard et al. (2017) in their analyses of factors contributing to the success of IPPs in sub-Saharan Africa. These authors identified a host of factors, at both country and project level, that influence the success of such projects. In particular, they emphasised the importance of competitive procurement processes (Eberhard et al. 2016), without making explicit recommendations concerning the design and implementation of procurement programmes (largely because the most of sub-Saharan Africa's IPP capacity has been tendered through direct negotiations, often initiated by unsolicited proposals).

How to best structure and manage procurement interactions between the public and private sectors is a key concern for the development of successful new renewable generation capacity. RE auction design is a field of growing scholarly and practitioner interest. The work of, for example, Del Río (2017); Dobrotkova, et al. (2018); Hochberg and Poudineh (2018); Kreiss, et al. (2016); Kruger and Eberhard (2018); Lucas et al. (2013); and Lucas et al. (2017) offers a useful body of literature for developing a deeper understanding of how choices made during the design of procurement programmes can influence bid and energy prices, investment outcomes, and so on. Eberhard and Naude (2016) as well as Eberhard et al. (2014) have also shown how choices related to procurement programme implementation can play a role in determining outcomes.

The analytical framework used in this study attempts to combine lessons from the literature on IPP success factors, with those on auction design and implementation, to offer a better understanding of the factors that have influenced the outcomes of four RenovAr auction rounds. Factors investigated and assessed in the study are outlined in the table below.

Factors	Details
Country level	
Stability of economic and legal context	Stability of macroeconomic policies Extent to which the legal system allows contracts to be enforced, laws to be upheld, and arbitration to be fair Debt repayment record and investment rating Previous experience with private investment
Energy policy framework	Framework enshrined in legislation Framework clearly specifies market structure and roles and terms for private- and public-sector investments (generally for a single-buyer model, since wholesale competition is not yet seen in the African context) Reform-minded 'champions' to lead and implement the framework with a long-term view
Regulatory transparency, consistency and fairness	Transparent and predictable licensing and tariff framework Cost-reflective tariffs Consumers protected
Coherent sectoral planning	Power-planning roles and functions clear and allocated Planners skilled, resourced, and empowered Fair allocation of new-build opportunities between utilities and IPPs Built-in contingencies to avoid emergency power plants and blackouts
Competitive bidding practices	Planning linked to timely initiation of competitive tenders/auctions Competitive procurement processes are adequately resourced, fair and transparent

Factors	Details
Programme level	
Programme design	Bidder participation is limited to serious, capable and committed companies Contracts are bankable and non-negotiable Balance between price (competition) and investment risks/outcomes is appropriate Programme is linked to and informed by planning frameworks (volume, transmission etc.) Investment risks and costs are allocated fairly Design takes local political and socio-economic context into consideration Transaction costs (bidders and procuring entity) offset by price and investment outcomes Qualification and evaluation criteria are transparent and quantifiable Design allows for multiple scheduled procurement rounds Measures to create local capacity/market are built in through local currency PPA, shareholding requirements, etc.
Programme implementation	Both the programme and the procuring entity have appropriate and unbiased political support, as well as an appropriate institutional setting and governance structures The procuring entity is capable, resourced and respected Co-ordination between various government entities is effective The procurement process is clear, transparent and predictable
Project level	
Favourable equity partners	Local capital/partner contributions are encouraged Partners have experience with, and an appetite for, project risk A DFI partner (and/or host country government) is involved Firms are development minded and ROIs are fair and reasonable
Favourable debt arrangements	Competitive financing Local capital/markets mitigate foreign-exchange risk Risk premium (demanded by financiers or capped by off-taker) matches country/project risk Some flexibility in terms and conditions (possible refinancing)
Creditworthy off-taker	Adequate managerial capacity Efficient operational practices Low technical losses Commercially sound metering, billing, and collection Sound customer service
Secure and adequate revenue stream	Robust PPA (stipulates capacity and payment as well as dispatch, fuel metering, interconnection, insurance, *force majeure*, transfer, termination, change-of-law provisions, refinancing arrangements, dispute resolution, etc). Security arrangements are in place where necessary (including escrow accounts, letters of credit, standby debt facilities, hedging and other derivative instruments, committed public budget and/or taxes/levies, targeted subsidies and output-based aid, hard-currency contracts, indexation in contracts)
Credit enhancements and other risk management and mitigation measures	Sovereign guarantees Political-risk insurance Partial risk guarantees International arbitration
Positive technical performance	Efficient technical performance (including availability) is rates high Sponsors anticipate potential risks (especially related to O&M and budgeting) and mitigate them
Strategic management and relationship building	Sponsors work to create a good image in the country through political relationships, development funds, effective communication, and managing contracts strategically, particularly in the face of exogenous shocks and other stresses

Source: Adapted from Eberhard et al. (2016)

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