

Final Report:

Distributed Renewable Energy for Rural Argentina



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1. Summary

Maximum of 1 page, containing the most relevant information; particularly:

Why was this project implemented (Needs in the partner country)?

What was implemented (project's content)?

How was the project carried out and what objectives have been achieved?

What do you foresee as further actions to be undertaken?

<p>Needs in the partner country</p>	<p>Argentina is confronted with two major sustainability challenges: (1) the need to decarbonize their energy sector and (2) the need to adjust electricity tariffs to reflect the true cost of generation and reduce the financial burden on public budgets while minimizing the negative impacts of increased electricity bills on businesses and low-income households.</p> <p>The country's vast potential for renewable energy (RE), especially solar, wind and biogas, is key for reaching these sustainability goals. Since 2016, a decision to gradually eliminate fiscal subsidies on electricity tariffs for industrial and residential consumers has levelled the playing field for economically viable self-consumption projects. In 2017, Law 27.424 created a legal basis for distributed generation.</p> <p>However, the implementation of RE projects for rural communities is currently facing three important barriers: (1) a lack of implemented pilot projects, (2) a new and emerging institutional and legal setting (the above mentioned Law 27.424 has only been implemented in the province of Córdoba up to date), and (3) a shortage of financing and currency risks due to the volatile Argentinian Peso.</p> <p>International carbon finance and climate finance, both from public and private sources, can help mitigate these barriers. Carbon finance denominated in EUR improves the financial viability of RE projects and mitigates currency risk.</p>
<p>Project's content</p>	<p>The project aims at contributing to the broad implementation of decentralized RE solutions in rural areas of Argentina. Two pilot projects apply the community distributed generation (CDG) model, based on which the renewable energy is generated through a system belonging to several users with independent supply points within the concession area of the same distributor. This model allows local consumers to generate their own energy and to financially participate from the operational revenues of the project.</p>
<p>Achievement of objectives</p>	<p>The project has three main objectives; (1) having a design model (technical, legal, commercial and tax-related) for community RE projects adapted to the local context of rural Argentina and ready to be applied to a pilot project, (2) implementing at least one PV pilot project of approx. 100 kWp (or various of smaller scale) with local financing (size range: ca. 50 - 150 kWp depending on owner's needs), and (3) developing a concept for roll-out with international carbon finance, which is then submitted to reputed carbon credit buyers such as the KliK Foundation.</p> <p>Whereas the first and the second objectives have been clearly achieved, the achievement of the third objective, however, was hampered by Argentina's lack of commitment to apply corresponding adjustments to potential article 6 projects. Therefore, other options for carbon revenues have been investigated, namely the monetization of climate benefits via the voluntary carbon market (VCM) or energy</p>

	attribute certificates (EACs). Gold Standard carbon credits and I-RECs have been identified as the preferred options.
Further Actions to be undertaken	The consortium has already initiated the dialogue with Gold Standard to evaluate all different options (individual projects vs. a programmatic approach / small-scale and micro-scale exemptions) and will continue to do in the coming months. One aim in the interactions with Gold Standard will be to push for more attention for small scale projects and to provide those projects a viable alternative to monetize their carbon reductions. This should be in line with Gold Standard's proclaimed goals to move away from large-scale RE projects and focus on highly additional, highly impactful projects.

2. Optional: Abstract in local language

If relevant, an abstract in the language of the country where the project was implemented.

3. Starting Point

Short description of the initial situation at the project's start.

The grid connection of many rural communities in Argentina is too weak to support their increasing electricity demand, leading to unstable power supply and an increasing need for back-up diesel generations. The traditional strengthening of the centrally supplied grid is very costly.

Distributed electricity generation from PV and biogas offers energy solutions for rural communities and agriculture in Argentina that are environmentally, economically and socially sustainable. Law 27.191 sets a nationwide 20% target for RE (excluding large hydro) by 2025, with interim targets of 12%, 16% and 18% for 2019, 2021 and 2023. However, actual RE generation stood at only 7.5% in 2019, with the bulk of generation coming from thermal (61%), large hydro (27%) and some nuclear (4.5%) sources.

Adopted in December 2017, Law 27.424 created a key stepping stone for further growth by establishing a right for all electricity consumers to install RE generation capacity up to the maximum supply load guaranteed by their distributors, and feed any excess generation into the grid.

Implementation of this law is progressing, but not all provinces are equally advanced. In addition, aggregated RE projects to supply groups of consumers and entire communities are facing special challenges as the necessary norms and practices are still emerging at the level of provinces and distributors.

Commercially, the environment for RE projects focused on self-consumption is demanding in Argentina as the public wholesaler CAMMESA continues to sell electricity at subsidized rates to the distribution companies. As a result, the final cost of grid electricity for end-users is relatively low, with a range of 0.09 - 0.13 USD/kWh in Córdoba and even lower tariffs in some other provinces (e.g. Buenos Aires). However, end-users generally expect these tariffs to increase soon as the subsidy is known to result in unsustainable financial burdens for public coffers. In addition, distributed RE is, in principle, recognized as the most efficient solution for improving the stability of rural electricity grids.

In that sense, this solution tackles the two major sustainability challenges that Argentina's electricity system is currently confronted with: (i) the need to decarbonize, and (ii) the need to adjust electricity tariffs to reflect the true cost of generation and reduce the financial burden on public budgets while minimizing the negative impacts of increased electricity bills on businesses and low-income households.

Need to decarbonize

In 2006 the Argentinian government introduced Law 26,190 with the target of reaching a share of 8% renewable electricity generation by 2016. In 2015, the government passed Law 27,191 which is an amendment to the previous renewable energy Law 26190, extending the ambition by aiming for an increase of the total share of electricity consumed from renewable energy sources within the national grid to 20% until the end of 2025. To date, an average of 11% of the total electricity consumed is

provided by renewable energy sources¹. Thus, the interim goal for 2019 that aimed at reaching a minimum share of renewables of 12% of the total consumed electricity has not been reached. The next interim goal is to increase the share of renewable energy to 16% of the total electricity consumed until the end of 2021.

Many reasons hinder the faster adoption of RE sources such as lack of long-term financing associated to Argentinean weak macroeconomic situation and the need to build high voltage lines to transport electricity to main consumption centres (in the case of utility scale projects). Regarding distributed generation, there is a slow insertion in the energy matrix partially attributed to subsidized tariffs and that many jurisdictions have not adhered to national law. Finally, and in the case of rural or low-density communities where mostly energy distribution is provided by local cooperatives, there is a need to develop alternative models to distributed generation, such as community generation.

Reduce financial burden on public budgets

Next to gap between RE targets and the actual situation, another gap is characterizing Argentine's electricity market. Since the introduction of the Emergency Law (originally introduced as Law No. 25,561 in 2002 and then renewed several times until 2018) radical changes in Government policies, affected the electricity sector. Due to this, the power market has undergone numerous modifications through Secretariat of Energy resolutions until today.

The main changes in 2002 were:

- Electricity prices and transmission and distribution tariffs were converted from their original U.S. Dollar values to ARPesos;
- All regulated transmission and distribution tariffs were frozen, revoked all price adjustment provisions and inflation indexation mechanisms in public utility concessions.

These measures created a huge structural deficit in the operation of the WEM and combined with the devaluation of the Peso and high rates of inflation, had a severe effect on the electricity sector in Argentina, as electricity companies experienced a decline in revenues while the Government increased subsidies to this sector. These subsidies have to be covered and paid by the National Treasury to Argentine's Wholesale Electricity Market Clearing Company (CAMMESA). The evolution of those deficits can be seen in Figure 1.

¹ <https://cammesaweb.cammesa.com/>

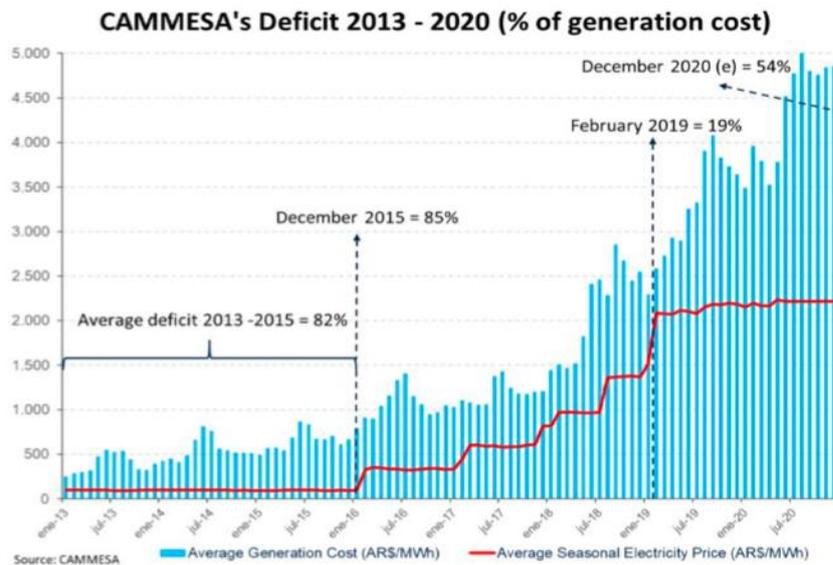


Figure 1: Deficits by Argentine's Wholesale Electricity Market Clearing Company (CAMMESA), indicated by the difference between the average seasonal electricity price and the average generation cost; Source: CAMMESA

Beginning in early 2016 and to mid-2019 past administration initiated a path of prices recovery that was stopped due to strong population reluctance. Currently, the annualized gap that needs to be subsidized by the federal budget is beyond US\$ 3 billion according to CAMMESA's demand reports for the year 2020.

4. Objectives

Description of the project's original objectives.

The project objective is to contribute to the broad implementation of decentralized RE solutions (PV, biogas) in rural Argentina, with initial focus on the provinces of Córdoba, Mendoza and Buenos Aires. Our approach combines local renewable energy generation and integrated load management as a cost- and energy-efficient alternative to expanding the existing weak connections to the national grid. The project includes three components: (i) adaptation of existing technical and contractual models to the local context; (ii) implementation of at least one pilot PV project, and (iii) developing the documentation required for attracting public and private climate finance for the subsequent large-scale roll-out.

5. Project Review

5.1 Project Implementation

How was the project carried out (approach, partner and project's main steps)?

First Climate has established partnerships and collaborations with leading service providers specialized in the Argentine RE market. HINS Energía, a firm established in Buenos Aires, with offices in Mendoza and Córdoba and a ten-year track record as a consultant and developer of RE projects, was identified as a priority partner for this project.

The main steps of the project consisted in elaborating a design model, implementing two pilot projects and develop a concept for the roll-out with international carbon finance.

Did the project's main objectives have to be modified during the course of the project? Describe any of the modifications made.

The project's main objectives were not modified during the course of the project, however, the lack of commitment to a bilateral agreement on Argentina's side brought considerable uncertainties after initial confidence that such an agreement would be reached. In January 2020, Argentina's Minister of Environment confirmed the country's interest in Swiss carbon finance pursuant to Article 6.2 of the Paris Agreement but modified their position later, when the project had reached an advanced

stage. Since such a bilateral agreement between Argentina and Switzerland would have provided the ideal framework for Swiss carbon finance to various sectors of the Argentine economy, including the activities subject of this project, Argentina's lack of commitment impacted the third objective. The focus, thus, shifted to the voluntary market in order to explore further options to commercialize the climate benefits of the of the individual projects.

5.2 Achievements of Objectives and Results

To what extent were the objectives achieved? Which results were achieved?

Objective	Description / KPIs	Achievement
Objective 1: Have a design model (technical, legal, commercial and tax-related) for community RE projects adapted to the local context of rural Argentina and ready to be applied to a pilot project.	<p>KPI 1.a): A technical design model for rural distributed energy generation and management has been successfully adapted to local needs, addressing detailed questions such as:</p> <ul style="list-style-type: none"> - How will losses between injection point and consumers' meters be determined and allocated? - How to deal with reverse flow to medium voltage line if solar generation exceeds local consumption, including allocation of associated revenues? <p>KPI 1.b): A commercial and contractual solution for electricity production and distribution has been de-fined that can be applied at scale and cost-efficiently, addressing detailed questions such as:</p> <ul style="list-style-type: none"> - How will the tax and financial benefits at National and Province level according to Law 27424 be implemented, when community projects are carried out? - Can a single consumer own PV capacity in excess of his own maximum demand under his contract with the distribution company? 	Objective 1 has been achieved within Work Package 1 (WP1): WP1 provides an analysis of the national and regional Argentinian electricity sector and an evaluation of existing technical and contractual models to be adapted to the local context. These serve as a basis for the pilot projects in Oncativo and Arroyo Cabral.
Objective 2: At least one PV pilot project of approx. 100 kWp (or various of smaller scale) is fully implemented with local financing (size range: ca. 50 - 150 kWp depending on owner's needs).	Develop at least one pilot project to investment readiness (initiated already in Phase 1), raise financing for these pilot projects together with the local cooperative and implement the pilot projects. Pilots are an essential part of this proposal as the local agricultural cooperatives (204 in the province of Córdoba alone) require proof of	Objective 2 has been achieved within WP2: the two community solar parks Oncativo and Arroyo Cabral were successfully implemented. Hereafter follows a description of the two projects: Oncativo Community Solar Park was built and successfully commissioned. Its inauguration took place

	<p>concept before engaging in new activities. To date (March 2020), several cooperatives have expressed in-principle interest in financing pilot projects in the range of 25 – 500 kW, with the size depending on local requirements and available finance, but the costs of the steps described under Work Package 1 remain a hurdle to be first overcome.</p> <p>KPI 2: At least 1 pilot project implemented</p>	<p>during the month of November 2021. In this first stage, a 76.44 kW test phase has been developed, with the objective of verifying the technical model operation. Subsequently, the plant will be expanded to 300 kW of installed capacity in order to obtain a recognized injection tariff of AR\$6.88/kWh.</p> <p>For the solar park development, the Oncativo electric cooperative, together with HINS Energía, has obtained local financing from the Special Fund for Interior Electricity Development (FEDEI) corresponding to USD 78,500 (AR\$ 8,500,000). As an additional benefit, this specific project was built in a location where an old dump has been recovered.</p> <p>Arroyo Cabral Community Solar Park was built and successfully commissioned. The inauguration took place during the month of December 2021.</p> <p>Even though an installed power of 61.6 kWp was initially planned (See REPIC REPORT WP1, page 25), the final installed power was adjusted to 70.07 kWp.</p> <p>Before the construction of the system, the possibility of using part of the energy generated for on-site self-consumption in the pumping station located on the property was under analysis (See REPIC REPORT WP1, page 24). However, after the publication and analysis of the regulations referring to the CDG model (Resolution N° 1/2021), the energy generated in the photovoltaic system has to be injected to the electric grid and self-consumption of energy may only be used for the PV system operation (inverter operation and monitoring system).</p>
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<p>Objective 3: Concept for roll-out with international carbon finance is developed and submitted to reputed carbon credit buyers such as the KliK Foundation.</p>	<p>Develop and promote a financing concept to support the multiple replication ("roll-out") in rural Argentina, including monetization of GHG emission reductions through international carbon finance or traditional climate finance. This includes compiling a pipeline of replication projects (PV, biogas) and elaborating a detailed plan for securing the required upfront financing from local investors.</p> <p>KPI 3): Program proposal for large-scale roll-out with carbon finance submitted to KliK Foundation and / or other international carbon buyers / donors, including approach for upfront financing.</p>	<p>Objective 3 has been achieved in WP3: All WP3 deliverables were developed according to the previously established dates. In this sense, the community model has been successfully accepted, with the support of different public and private institutions. HINS Energía is currently working in the design phase of different scale community projects and the construction phase of 2 community projects in Córdoba Province. Further developing that pipeline will be done in parallel with seeking the most efficient way to capitalize from additional carbon revenues.</p>

5.3 Multiplication / Replication Preparation

What preparatory work was carried out for the multiplication and replication within the project's framework?

HINS Energía has established a portfolio of CDG solar PV projects, which is being further developed. Moreover, several options of monetizing the climate benefits of CDG RE projects have been investigated and preferred options have been identified. The consortium has namely been in touch with Gold Standard to clarify the options and costs of registration of one or several CDG projects.

5.4 Impact / Sustainability

Which impacts were already noticeable up to the end of the project?

Impacts that were noticeable up to the end of the project include an increased percentage of renewable energies in the national energy mix as well as improved access to electricity for households in rural Argentina. Moreover, the project promotes regional development, energy independence, incentives for international and local private and public financing, the addition of locally added value and local employment generation. In addition, for the province of Cordoba, this model of CDG power generation has been tested, accepted as commercially viable and is being extended. The next step will be to implement this model in other provinces or/and on national level, in order to incorporate tax and financial incentives contemplated in national law.

Please provide qualitative text and quantitative information (in the table below) in the following three main categories, where applicable:

Ecological	Unit	At the REPIC Project's Completion
Installed renewable energy capacity	[kW]	146.51
Renewable energy produced	[kWh]/year	247'440
Amount of fossil fuel energy saved	[kWh]/year	247'440
Greenhouse gas reduction	[t CO ₂ -eq]/year	62'696.3472
Newly collected and separated waste	[t]	NA
Newly recycled waste	[t]	NA
Economic		
Energy costs (LCOE)	[CHF/MWh]	56
Triggered third-party funding/investments	[CHF]	133'397
Local private income generated	[CHF]	12.500/year
Social		
Number of beneficiaries	[Number]	Approx. 98 households
Number of new jobs	[Number]	5
Number of trained personnel	[Number]	13

Other Indicators		
Indicator 1	[Unit]	
Indicator 2	[Unit]	
Indicator 3	[Unit]	

6. Outlook / Further Actions

6.1 Multiplication / Replication

What are the next planned steps?

The next steps planned consist in the further evaluation of the possibilities and associated costs of registering CDG solar PV projects at Gold Standard.

What is being done to promote multiplication / replication?

As previously mentioned, a portfolio of further CDG projects has been established. Two projects of approx. 100kW each are already under construction, two more are currently in the stage of analysing conceptual engineering.

Which hurdles need to be overcome in order to have successful multiplication / replication?

The main barrier is the current complex macroeconomic context in Argentina, which is not optimal for the replication of these long-term recovery projects due to the fact that their costs are referenced in hard currency (USD) while electricity tariffs are defined in Argentine pesos (AR\$) in a scenario of high inflation and permanent devaluation.

Constrained public and private budgets are also slowing down the uptake of RE in rural Argentina. Country risks associated with political and economic instability make it difficult to access traditional international finance. With the volatile Peso, currency risk associated with foreign equipment purchases remains an important barrier for RE projects.

For the reasons set out above, it is important to incorporate economic support instruments at local level and to be able to obtain carbon finance, from both public and private sources, for the projects. Euro-denominated carbon finance improves the financial viability of RE projects and mitigates currency risk.

First Climate and HINS Energía will jointly manage the creation of a community projects portfolio in order to capitalize the emissions reductions through carbon finance.

In this sense, certain financial instruments with soft rates were established for leveraging DG projects. Province of Córdoba Bank (BANCOR) and Federal Investment Council (CFI) offer different credit lines. It is expected that new lines of financing will be developed for this type of concept.

With reference to the previous introduction, it is important to depict how First Climate and HINS Energía understand the near future for the roll-out process. Although the current macroeconomic situation is not ideal for the development of long-term projects such as those mentioned here, it is important to mention that CAMMESA has begun the process of removing subsidies on electricity tariffs. Since last year there has been a tendency to adjust the tariffs for consumers with contracted power over 300 kWp.

The aforementioned is part of the agreement reached with the IMF, by which Argentina committed to reduce its fiscal deficit, in which one of the main factors are energy subsidies.

On the other hand, it has also been announced that a path of subsidy removal for residential users and industries with lower consumption will begin in the coming months.

As previously mentioned, although the final tariffs and mainly the injection tariff recognized for community parks are denominated in ARPesos, it is expected that in the future they will be correlated with the monomic cost of energy generation, which is mainly tied to contracts in US dollars.

In view of this situation, several meetings have been held with potential local investors, most of whom have given positive responses about participating in the leverage of the community model.

Finally, the combination of private financing with financial tools that local banks can provide and a successful process through which capitalization for emission reduction projects can be incorporated, will converge in a successful roll-out process.

Latest update: although all the scenarios were elaborated with the tariff charts in force as of June 13th, it is relevant to mention that the electricity tariffs for users over 300 kWp have since been adjusted

again, incorporating the new values related to LNG imports, bringing seasonally the tariffs to values of approximately \$13.75/kWh. As a conclusion, it is assumed that tariffs will trend towards the actual costs of generation.

For now, CDG projects can only be realized in the province of Córdoba since only this province's legislation allows for this approach. Projects were planned to be implemented in other provinces such as Buenos Aires and Mendoza, but the current legislation in these provinces represents a major hurdle for this.

6.2 Impact / Sustainability

What are the sustainable effects (environmental, socio-economic aspects, CO₂ relevance, resource efficiency, etc.) expected during the multiplication phase, in the medium term?

In the medium term, the implementation of CDG solar PV projects is expected to significantly reduce the amount of energy produced from fossil fuels while improving access to electricity in rural areas as well as promoting regional development, energy independence, incentives for international and local private and public financing, the addition of locally added value and local employment generation. Finally, it is important to mention the amount of CO₂e reductions derived from these projects.

7. Lessons Learned / Conclusions

What are this project's main findings and conclusions?

Which recommendations can be made for similar projects, or within this context?

Interesting observations within the project's context: Which of your personal impressions would you like to share?

After construction of the first pilot projects, a great interest was demonstrated by other cooperatives and different industries not only from a technical point of view, but also for the contribution to the environmental and social impact of these type of projects.

The comprehensive concept of Community Distributed Generation implemented in the province of Córdoba demonstrated that it can be replicated at national level and, even in an adverse context given the macroeconomic and political situation, the benefits can be capitalized by a broad part of the population, including economic, social, and environmental.

After having analyzed the possibilities of registering the solar parks and/or similar projects with international carbon standards, we gained the insight that carbon standards do not focus on microscale renewable energy projects and transaction costs of registering these are typically rather high. A recommendation from our side is therefore for REPIC to continue to focus on the support of microscale projects since for projects of larger scale, a lot of support and knowledge already exists.

Another lesson learned has been that defining milestones from the beginning for all stages of the project can represent a challenge since external factors can significantly change and influence the achievement of these milestones. This has been the case for this project due to Argentina's lack of commitment to apply corresponding adjustments to potential article 6 projects which could not have been foreseen at the beginning of the project. Another recommendation would therefore be to define in the beginning that milestone 2 includes the definition of milestone 3, for example. Such an approach would avoid situations where milestones could not be achieved due to a changing context.

8. References

References list of publications, reports, etc.

Articles published in Argentinian newspapers and platforms
Energías renovables: se inauguraron parques solares comunitarios en Arroyo Cabral y Oncativo La Voz del Interior
Hins abrió un nuevo parque solar comunitario en Arroyo Cabral – Comercio y Justicia
Inauguración del Parque Solar Comunitario Oncativo (infonegocios.info)
Inauguraron el Parque Solar Comunitario en Oncativo – Futuro Sustentable
Article published on First Climate's website
Community Solar Power for 100 Households in Rural Argentina (firstclimate.com)

9. Annex

When available: Reports, press articles, brochures, test results, etc.