

Ex post evaluation – Brazil

>>>

Sector: 23030 Power generation/renewable energies
Programme/Project: Wind farm programme BNDES, BMZ No. 2008 65 097*)
Implementing agency: Banco Nacional de Desenvolvimento Econômico e Social (BNDES)



Ex post evaluation report: 2015

		Project A (Planned)	Project A (Actual)
Investment costs (total)	EUR million	150.0	210.0
Counterpart contribution	EUR million	50.0	112.7
Funding	EUR million	100.0	97.3

*) Projects in the 2014 random sample

Summary: This project comprised the financing of wind farm installations via the state-owned promotional bank BNDES, which lent the funds to private investors under long terms. It was part of the national PROINFA promotional programme for renewable energies and thus supported the efforts of the Brazilian government to attach greater importance to power generation from alternative energy sources in order to cover the rising demand for energy. Counterpart contributions from ultimate borrowers and the BNDES amounted to nearly EUR 113 million. The German contribution consisted of a low-interest development loan amounting to the equivalent of EUR 97.3 million.

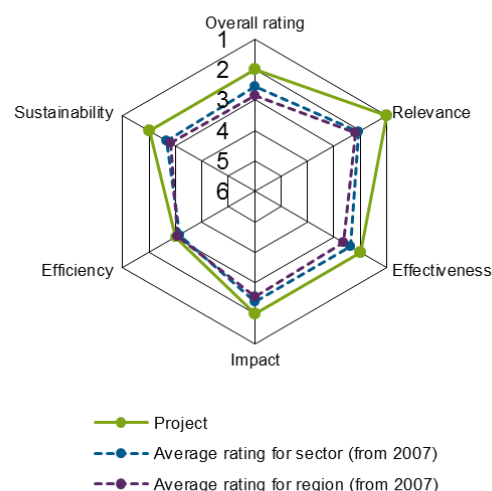
Objectives: The overall development goal ("impact") was to contribute to global environmental and climate protection as well as to the energy security of Brazil. To this end, electricity was to be generated efficiently and sustainably in ecological terms using renewable energy from wind power plants ("outcome"). The target indicators defined during the programme appraisal of 80 MW installed capacity, 200,000 GWh/a of sold electricity and 54,000 t/a of avoided CO2 were achieved.

Target group: Wind power operators and power users in Brazil, as well as the global population indirectly, given the focus on climate protection.

Overall rating: 2

Rationale: The project achieved its goals as measured by the indicators, and even exceeded the CO2 avoidance target. Yet, the first Brazilian promotional programme for wind energy (PROINFA) was characterised by high specific investment costs at the outset and high guaranteed feed-in tariffs. This impaired on economic efficiency. Nevertheless, PROINFA was the trigger for excellent growth in the Brazilian wind power market, which by now displays significantly lower specific investment costs and feed-in tariffs.

Highlights: Thanks to the meanwhile low specific investment costs, wind power has become the second least expensive source for generating electricity in Brazil.



Rating according to DAC criteria

Overall rating: 2

As an integral part of Brazil's promotional programme for renewable energies ('PROINFA'), the FC programme was in line with both Brazilian and German development strategies and was and is relevant for global climate protection. Its objectives – measured against the indicators defined at programme appraisal (PA) – were achieved comfortably and without serious negative side effects. The co-financed wind farms, however, displayed high specific investment costs as compared to other countries. This resulted in a high feed-in tariff (as was the case with PROINFA wind farms as a whole). As a result, PROINFA was much less efficient than subsequent wind power schemes. The three co-financed wind farms are operated and maintained to a professional standard. Power production corresponds to the expectations of wind assessment reports and is high by international comparison (based on the installed MW capacity). Thanks to its long-term project financing measures, the programme-executing agency, the "Banco Nacional de Desenvolvimento Econômico e Social" (BNDES), was and is the most important source of funding for wind energy ventures. Risks for the sustainable operation of wind farms as well as for the further expansion of wind power within the framework of Brazilian sector policy are low: Wind has now become competitive in Brazil also from a microeconomic point of view, and the national sector policy has become aware of Brazil's favourable natural conditions for wind power and acknowledges the complementarity of wind and hydro power.

General conditions and classification of the project

At the time of appraisal, wind power in Brazil was still "terra incognita" - and generally regarded with scepticism. In light of the pressure to expand power generation capacities (even in the short-term) during dynamic economic development, the government introduced a law in 2002, only coming into force in 2004. This resulted in the launch of a programme for the promotion of renewable energies: PROINFA. Among other things, PROINFA was designed to support wind power stations generating an initial 1,100 MW (achieved: approximately 1,300 MW) by means of a guaranteed fixed feed-in tariff. As an important long-term financier - and due to its favourable financing offers, BNDES was a cornerstone of PROINFA. As a key element of its business promotion policy, BNDES financing was and is linked to a high proportion of local production (60% at the time, with a continuing upward trend today). The implementation of PROINFA was delayed at appraisal, and its feasibility was uncertain. FC financing, supplementary Technical Cooperation (TC) interventions as well as support by means of the German-Brazilian energy agreement of 2008 therefore came at the right time.

In 2008, there were only two wind turbine manufacturers located in Brazil (Wobben/Enercon, Germany, and the Argentinian IMPSA, which recently went bankrupt). On the one hand, the construction, installation and operation of large wind farms counted as relatively novel ventures, whereas on the other, the feed-in tariff was perceived as "adequate". As a result, PROINFA wind farms were constructed at very high investment costs in international terms (over 3 million USD/MW). The selection criterion for PROINFA's "first-come first-served" principle (date of building permit and a quota system on the basis of federal states) was not focused primarily on economic criteria, and instead aimed to avoid delays by means of a lengthy licensing process with the objective of increasing generation capacity more quickly. The selection of wind farms co-financed by means of FC was rather determined by the process-related "start date" of the FC programme (loan agreements could be financed from the submission date of the programme's appraisal report). The FC programme supported around 7% of the 1,303 MW capacity funded by PROINFA and one third of the wind farms financed by the BNDES as part of PROINFA.

Relevance

The approach of contributing to global environmental and climate protection through the production of power from wind as a renewable energy source is still very relevant today. As was the case in the past, there is now also a need to provide additional power generation capacities (short-term) in the face of dynamic economic development. Today, this is exacerbated by low rainfall (now for the second consecutive year) and falling water levels, some critically so, in most hydroelectric plant reservoirs. The project focused on a core problem of the Brazilian electricity sector, which persists today. The "alignment" of donors

is of little importance for the “renewable energies and energy efficiency” sub-sector, since German development cooperation essentially has a unique selling point in this regard. This was also taken into account by the 2008 German-Brazilian energy agreement, from which the high relevance for German and Brazilian policies was derived. The promotion of renewable energy and energy efficiency is one of two focal sectors for German Development Cooperation (DC) with Brazil, which as a whole is oriented towards the protection of global goods. The FC programme was fully embedded in PROINFA’s Brazilian sector policy (“full policy alignment”) as well as in the lending process of the BNDES (“full system alignment”). The programme design - with BNDES as financial intermediary - enabled the broadest possible introduction of wind power via the private sector; additional start-up financing for PROINFA was provided from an existing national funding programme.

Relevance rating: 1

Effectiveness

The outcome indicators defined at appraisal were achieved comfortably in the three co-financed wind farms - with regard to installed capacity (target: 80 MW; installed: 94.05 MW) and electricity sales (target: 200,000 GWh/year; average achieved since the beginning of operation: approximately 233,700 GWh/year). The capital employed to achieve these objectives was around EUR 210 million higher than expected at appraisal (in absolute terms 40% more, per installed MW 20% more). Therefore, further wind farms, such as Beberibe wind farm which was fully financed from counterpart funds, were not further considered for this evaluation. A separate objective or indicator, relating to the programme’s impact on the financial sector, was not appropriate in this respect – nor would it have been in hindsight: as an ongoing support programme which was already fully operational at the time FC co-financing came about, no significant need for action or correction could be identified with regard to content and processes.

According to currently valid intervention logic, the avoidance of CO2 emissions – originally defined as impact indicator – counts at “outcome” level, and is thus incorporated into the evaluation of effectiveness. This CO2 avoidance (as measured against the indicators set by the Ministry of Science, Technology and Innovation of Brazil) was far higher than expected at appraisal (54,000 t CO2/year), with an average avoidance of approximately 95,000 t CO2/year. The “emission factor” in the Brazilian electricity sector, which is calculated as part of an incremental approach, served as a measurement parameter: at appraisal, this was estimated at 263.6 kg CO2 per MWh of electricity; however, it has increased steadily in recent years, reaching a high 511.8kg CO2/MWh in 2014. The reason for this is that, in recent years, additional power plant investments (“build margin”) and additional production (“operating margin”) – both relevant to the incremental approach – were mostly geared towards CO2-intensive thermal generation. The values for the CO2 savings obtained using the above calculation benefit from this to a significant extent.

The programme objectives (“outcomes”) were achieved overall as follows:

Indicator	Project appraisal target (Planned)	Ex post evaluation (Actual)
(1) Installed capacity	80 MW	94.05 MW
(2) Electric power sold	200,000 GWh/year	approximately 233,700 GWh/year
(3) CO2 avoidance	54,000 t/year	95,000 t/year

Effectiveness rating: 2

Efficiency

The three wind farms have good electricity yields in comparison to other countries (capacity factor 29% on average). At the same time however, the FC-financed parks (and PROINFA parks on the whole) had spe-

cific investment costs of approximately 3.1 million USD/MW each – high by international standards – and therefore fairly high dynamic production costs (9.5 to 15 USct/kWh at 2010 prices, depending on the farm). Capital expenditure was roughly 40% higher than the total costs anticipated at appraisal. However, PROINFA’s inflation-indexed feed-in tariffs, which are also high (in 2010 approximately 16.3 USct/kWh), allow for sufficient profitability and liquidity. The wind farms are, accordingly, in good condition and are operated and maintained to a professional standard (maintenance contracts with the turbine manufacturers).

BNDES’ operating procedures were and are generally satisfactory in terms of the implementation; however, in practice there is still room for improvement when it comes to the monitoring of environmental and social aspects in particular. In principle, the relevant environmental and social standards can be considered adequate.

In Brazil, the operational appraisal criteria for electricity projects in terms of cost coverage, loss rates and tariff collection are largely met. After a politically imposed 20-30% tariff reduction in 2013 tariff levels jeopardised the long-term ability of the sector to cover costs. To counter this threat, massive tariff increases of around 40% were implemented in 2015.

From today’s perspective, PROINFA initially represented an “overshooting” of funding that was inefficient from a macroeconomic viewpoint. At the same time, and probably also as a result, it could be demonstrated that wind power fits in very well with Brazil’s energy mix (which is dominated by hydropower) and that larger wind farms are technically feasible. Sector policy moved away from the guaranteed fixed feed-in tariff back in 2009 and instead introduced an auction system for the electricity market as well as for wind power (which is still in place today). Combined with price cuts during the economic crisis of 2008 and a surge in the number of locally established turbine manufacturers from the year 2011 onwards, this led to a sharp fall in investment costs and a much lower demand for remuneration (and thus to higher economic efficiency). Given the rapidly implemented corrective interventions and the adjusting dynamics in the sector, temporary over-subsidisation can be considered acceptable. Wind power is now established in Brazil and is currently the second least expensive source of production (after hydropower).

Efficiency rating: 3

Impact

The intended impact as defined at appraisal was to contribute to global climate protection, which primarily results from the CO₂ avoidance mentioned above. According to today’s standards, however, projects in the energy sector at development policy level should also promote the social and economic development of the country, going beyond the contribution to global climate protection.

PROINFA funding, which was advantageous in microeconomic terms, laid the foundations for establishing wind energy in Brazil and has contributed in both causal and structural terms to the excellent growth of local production capacity, to substantial foreign direct investments and to corresponding employment. Furthermore, as is called for by PROINFA and its successor programmes, a defined proportion of plant components are manufactured in Brazil, thereby benefiting the local economy.

With regard to potential environmental risks, the impact on birds and bird migration was scientifically examined only to a small extent in the licensing procedure, while the impact on bats was not examined at all. In the case of Pedra do Sal wind farm however, which lies in a conservation area and is the most critical in terms of birds, the University of Piauí conducted an ornithological monitoring study in 2011/12, confirming only a minor impact on the reserve’s birds. Evidently, the funded wind farms have had no serious negative side effects for the environment or the surrounding population.

Capacity-building effects were not expected with regard to the banking sector, as BNDES remains the sole financing institution for the long-term financing of wind power in Brazil. In contrast, commercial banks showed – and show – no willingness to become involved in this segment. With regard to the sectoral framework conditions for the funding of wind power, no significant need for action was identified – and in retrospect, rightly so (see above: “Effectiveness”).

Impact rating: 2

Sustainability

In view of their good condition after five to six years of operation, their professional operation by private companies, their professional maintenance by the respective wind turbine manufacturers and the adequate supply of liquidity, the risk of unsustainable operation for the three co-financed wind farms is assessed as low. It may well be that before the end of their economic lifetime, a “repowering” will occur, with more powerful turbines. Wind power is now established in Brazil. Although the PROINFA programme supported here can be criticised in some respects, even the sector-policy sustainability risks are low. Furthermore, with regard to the role and functionality of BNDES as a state promotional bank and the de facto only source of long-term financing for wind turbines, no significant risks have been identified.

Sustainability rating: 2

Notes on the methods used to evaluate project success (project rating)

Projects (and programmes) are evaluated on a six-point scale, the criteria being **relevance, effectiveness, efficiency** and **overarching developmental impact**. The ratings are also used to arrive at a **final assessment** of a project's overall developmental efficacy. The scale is as follows:

Level 1	Very good result that clearly exceeds expectations
Level 2	Good result, fully in line with expectations and without any significant shortcomings
Level 3	Satisfactory result – project falls short of expectations but the positive results dominate
Level 4	Unsatisfactory result – significantly below expectations, with negative results dominating despite discernible positive results
Level 5	Clearly inadequate result – despite some positive partial results, the negative results clearly dominate
Level 6	The project has no impact or the situation has actually deteriorated

Rating levels 1-3 denote a positive assessment or successful project while rating levels 4-6 denote a negative assessment.

Sustainability is evaluated according to the following four-point scale:

Sustainability level 1 (very good sustainability): The developmental efficacy of the project (positive to date) is very likely to continue undiminished or even increase.

Sustainability level 2 (good sustainability): The developmental efficacy of the project (positive to date) is very likely to decline only minimally but remain positive overall. (This is what can normally be expected).

Sustainability level 3 (satisfactory sustainability): The developmental efficacy of the project (positive to date) is very likely to decline significantly but remain positive overall. This rating is also assigned if the sustainability of a project is considered inadequate up to the time of the ex post evaluation but is very likely to evolve positively so that the project will ultimately achieve positive developmental efficacy.

Sustainability level 4 (inadequate sustainability): The developmental efficacy of the project is inadequate up to the time of the ex post evaluation and is very unlikely to improve. This rating is also assigned if the sustainability that has been positively evaluated to date is very likely to deteriorate severely and no longer meet the level 3 criteria.

The **overall rating** on the six-point scale is compiled from a weighting of all five individual criteria as appropriate to the project in question. Rating levels 1-3 of the overall rating denote a "successful" project while rating levels 4-6 denote an "unsuccessful" project. It should be noted that a project can generally be considered developmentally "successful" only if the achievement of the project objective ("effectiveness"), the impact on the overall objective ("overarching developmental impact") and the sustainability are rated at least "satisfactory" (level 3).