Ex post evaluation – El Salvador

Sector: Solar energy (CRS code: 23230)
Project: Promotion of solar power in El Salvador (BMZ no. 2011 66 271)*
Implementing agency: Comisión Ejecutiva Hidroeléctrica del Rio Lempa (CEL)

Ex post evaluation report: 2020

		Project (Planned)	Project (Actual)
Investment costs (total)	EUR million	39.00	n/a
Counterpart contribution	EUR million	11.00	n/a
Funding	EUR million	28.00	n/a
of which BMZ budget funds	EUR million	17.00	n/a

*) Random sample 2019

Summary: The “Promotion of solar power in El Salvador” project planned to install a photovoltaic power plant with a peak output of 14.2 MW. Upon installation, it would have been the first large, grid-connected photovoltaic power plant in El Salvador and therefore would have contributed to more climate friendly energy generation in El Salvador, particularly as a result of the spill-over effects anticipated from the project. After multiple delays to implementation, the project was cancelled in early 2017 at the implementing agency’s request. The funds disbursed until that point and the receivables from the loan agreement were repaid as of 5 October 2017.

Objectives: The project objective used as a basis for the EPE (outcome) was to demonstrate the potential of grid-connected photovoltaic systems in El Salvador. This was intended to contribute to the diversification of energy production in El Salvador and to global climate change mitigation by increasing the climate friendly production of energy (impact).

Target group: The target group was the entire population of El Salvador.

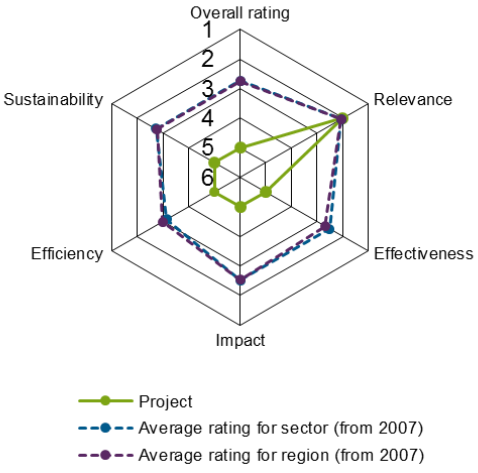
Overall rating: 5

Rationale: The FC project addressed a core problem in the country with relevance for development policy – securing a reliable, affordable and sustainable energy supply. The concept and its underlying results chain were generally suitable for helping to resolve the core problem.

However, the project was cancelled at the implementing agency’s request. At the time of the cancellation, the contract with the implementation consultant had been terminated and the construction work had not been contracted. Apart from the consultancy services needed to prepare for and tender the construction work, no other measures were implemented. No secondary results that could be used at a later date were identified during the ex post evaluation.

Due to its cancellation, the project is evaluated as clearly insufficient with regard to the aspects of effectiveness, efficiency, impact and sustainability, and thus as a whole.

Highlights: -



Rating according to DAC criteria

Overall rating: 5

Ratings:

Relevance	2
Effectiveness	5
Efficiency	5
Impact	5
Sustainability	4

Overall context

The “Promotion of solar power” project in El Salvador was cancelled in 2017 given the following situation:

The loan agreement was concluded in April 2013. Even before the contract was concluded, the implementing agency “Comisión Ejecutiva Hidroeléctrica del Rio Lempa (CEL)” had already issued an international tender for the services of an implementation consultant in accordance with KfW Guidelines and contracted the winner. The consultant began work in October 2012 and was supposed to provide the implementing agency with support in matters such as reviewing the technical concept, providing specifications for the project measures, organising the tendering process, handling contract negotiations, concluding the contract for the construction measures, as well as supervising the works and accepting goods and services.

The tendering process for the construction measures was initiated in autumn 2013. Even this process proved to be difficult. The tender was won by a German company. However, the company began to experience financial difficulties in 2013 as a result of falling sales and losses, and was restructured at the time when the contract was due to be signed. From the implementing agency’s perspective the offer was also unattractive, in view of the sharp fall in the price of solar modules on the global market. In view of the circumstances described above, a contract for the construction work was therefore not signed. Due to disagreements with the implementation consultant, the implementing agency terminated the consultancy agreement in December 2014 with FC’s approval. A new tender for the consultancy services was issued from May 2015. However, the ready to be signed agreement was ultimately not signed with the winner of the tender and the consultancy services were not awarded. The non-signature of the contract for the construction measures, the termination of the original consultant’s agreement and the re-tendering of the consultancy services resulted in extensive delays.

At the same time, energy prices fell and the implementing agency’s financial situation deteriorated. On 30 September 2016, the implementing agency therefore requested that key components of the contract be renegotiated. FC was unable to agree to this for risk-related reasons, in response to which the implementing agency confirmed in writing that it wished to cancel the project on 30 March 2017. All funds disbursed until that point and the receivables from the loan agreement were repaid as of 5 October 2017.

Since the project was cancelled, a simple target/actual comparison provides little information. For this reason, the EPE looks at the assessments for the planned project made at the time of the project appraisal (PA) in relation to the criteria of relevance, effectiveness, efficiency, impact and sustainability, as well as considering partial results and current developments.

Relevance

The aim of the “Promotion of solar power in El Salvador” project was to demonstrate the potential of grid-connected photovoltaic systems in El Salvador. This was intended to contribute to the diversification of

energy production and global climate change mitigation through an increase in the climate friendly production of energy.

It was based on the following results chain: building and operating the first large grid-connected photovoltaic power plant was supposed to demonstrate that solar power could contribute to a reliable, affordable and sustainable energy supply in El Salvador. In addition to directly diversifying the energy mix, the project was supposed to use spill-over effects from its role as a pilot project to encourage the construction of other photovoltaic power plants and, as a result, promote diversification. Furthermore, the goal was to reduce the amount of power generated from thermal power plants by the amount of energy generated from solar power, and thus avoid carbon emissions. The solar power plant itself and the construction of other solar power plants were intended to contribute to global climate change mitigation and reduce the dependence on imports of fossil energy sources (mainly oil and gas). The results chain appears plausible in principle, though it focuses on more long-term development, which as such is difficult to predict.

At the time of the project appraisal (2012), the core problem was the energy supply in El Salvador, which was inadequate in terms of reliability, cost efficiency/affordability and sustainability. The main causes for this were a complete dependence on imports of fossil energy sources and the resulting high dependence on global market prices for these energy sources. At the time of the PA, the installed capacity was roughly 32% hydropower, 14% geothermal power and 54% thermal power plants. According to the project proposal (PP), hydropower plants, with a share of 36.3% of total energy production (viewed as an average over the entire year), were the most important source of energy in terms of annual energy production. Geothermal energy made up 24.8%. However, the proportion of thermal energy was at an average of 34.4% and was by far the most important source of energy in rain-free periods given the high proportion of hydropower. The core problem described above was identified correctly and the aforementioned project approach was well suited to helping resolve this problem – particularly because solar power, as an ever more affordable source of renewable energy, had at the time and continues to have the potential to play an important role in El Salvador with its many hours of sunshine. With around 2000–3000[1] sunshine hours per year, El Salvador has one of the highest ranges in the world. With solar power making up less than 1% of the energy mix in El Salvador at the time of the PA (2012), making more use of solar resources was a sensible approach. At that time, El Salvador was in the middle of strengthening its use of renewable energies, while state-run incentive mechanisms, such as tax reductions, were implemented. However, this has yet to lead to a substantial increase in its solar power production capacity. Solar power production capacity (2018) on the wholesale market, which provided 1871 MW of the total installed capacity of 1969 MW, increased to 3%, though the share of thermal power plants (oil) in the total installed capacity was still dominant at 40%. In 2018, there was just one large solar power plant with an installed capacity of 60 MW, plus various decentralised, small-scale solar farms with a combined installed capacity of around 68 MW. Factoring in the decentralised photovoltaic capacity, photovoltaic systems made up around 6.5% of the total installed capacity in 2018. A further 154 MW in photovoltaic capacity was confirmed in invitations to tender in 2018.[2]

The assessment in the PA that the project would be highly relevant due to its significant contribution to assuring a reliable, affordable and sustainable energy supply in El Salvador would only have been achievable with the intended spill-over effects of the pilot project and the construction of similar (large) projects inspired by the pilot. The direct contribution of the project itself would not have been sufficient because the photovoltaic power plant's installed capacity was only due to have a peak output of 14.2 MW with annual power production of around 22,990 MWh. In relation to the implementing agency's annual production output of around 2,078 GWh, this corresponds to just 1%. The PP saw the pilot project as a regional pioneer. At the time, the photovoltaic power plant would have been the region's first plant outside of Mexico. Since the implementing agency was the country's largest energy producer at the time of the PP with 32% of the installed production capacity and also one of Central America's largest producers of power from renewable sources, the PP's assumption of spill-over effects due to the pilot-style nature of the project is

[1] http://earth.rice.edu/mtpe/geo/geosphere/hot/energyfuture/Sunlight.html

[2] Source: German-El Salvadorian Chamber of Industry and Commerce (2019). El Salvador – Decentralised energy supply with renewables, online at: https://www.german-energy-solutions.de/GES/Redaktion/DE/Publikationen/Marktanalysen/2019/zma-el-salvador-2019.pdf?__blob=publicationFile&v=6.

comprehensible, even though, in retrospect, the spill-over effects were more likely to be felt in El Salvador than Central America.

According to the PP, securing a reliable, affordable and sustainable supply of energy was a priority for the political decision-makers at the time. The national master plan for the expansion of renewables adopted in May 2012 aimed to further diversify the country's energy matrix and promote the expansion of renewable energy sources. According to the PP, there was a substantial investment pipeline of over 300 MW (+ 20% of the installed capacity at that time) in place.

At the time of the PA, El Salvador was neither a partner nor a main partner country of German FC, and this remains the status quo. Then, as now, cooperation only takes place under regional or theme-specific programmes such as the special facility "German Climate and Technology Initiative – DKTI" (previously Initiative for Climate and Environmental Protection, IKLU).

The project was therefore in line with both the partner country's objectives and the general development policy focus of German DC.

Points of contact with other donors in the energy sector primarily came as a result of work with the implementing agency and co-financing arrangements (including with the Central American development bank BCIE and the EU) in the context of other projects. FC liaised with its partners in these cases and agreed to a uniform process for implementing the measures, particularly in the case of co-financing.

Relevance rating: 2

Effectiveness

The goal of the FC measure (outcome) according to the PP was to demonstrate the potential of grid-connected photovoltaic systems in El Salvador and thereby make a contribution to diversifying the production of energy. Target achievement at outcome level was due to be measured using the following indicators.

Indicator	Target value PA	Actual value at EPE
Installed power generation capacity after completion (MWp)	>= 14.2	0
Annual carbon emissions prevented, measured one year after completion (t CO_2)	>= 16,000	0

If the project had been continued, it would have been recommended to adjust the targets and indicators at outcome level: the target of diversifying power production must be allocated to the impact level and not outcome level, because according to the results chain (see Relevance), this stems from the impact of demonstrating potential. In terms of the indicators, it must also be noted that, while these are typical for the sector, they must be assigned to other levels of impact: the installed power generation capacity after completion reflects the measures' output, and the annual carbon emissions prevented is a common indicator at impact level.

For demonstrating potential, making use of the standard sector indicators of "Secured annual power production in GWh" and "Availability of systems" would have been sensible in this case. On the one hand, these indicators would have recorded whether the production target values set for the Salvadorian context could actually be implemented. On the other hand, in terms of potential, the availability data could have emphasised that the technology in question was tried-and-tested and represented a reliable and relatively low-maintenance solution compared to other sources of renewable energy.

With regard to implementation, the basic assumption made for the PA concerning the project's effectiveness was that the technology was tried-and-tested, and that the implementing agency was experienced in the effective implementation of large-scale projects. Political influence over the implementing agency as a state-owned company was estimated to be low. In retrospect, however, the effectiveness of the

implementing agency is rated low, precisely because of the factor of political influence. Persistent state-triggered deductions of funds from the implementing agency's income to subsidise energy prices for low-income households and the electrification of rural areas, etc., temporarily grew to an extent, which put the implementing agency's financial capacity at risk.

Despite disagreements between the implementing agency and the consultant regarding the implementation of the project and the eventual termination of the consultancy agreement (see Overall context), the support services to be provided to the implementing agency by a consultant as envisaged in the implementation concept are plausible, even in retrospect, because the implementing agency previously only had negligible experience from operating one small photovoltaic system.

Due to the cancellation of the project, neither the original indicators nor the standard sector indicators could be achieved at outcome level. The effectiveness is therefore clearly inadequate.

Effectiveness rating: 5

Efficiency

An implementation period of roughly 30 months was calculated for the entire implementation process up to the final review. Implementation was due to take place in three phases: (i) selection of the implementation consultant (roughly 11 months); (ii) tendering of goods and services to a general contractor (roughly 9 months) and (iii) construction phase through to acceptance (roughly 10 months). The period from concluding the contract with the consultant (without factoring in the prior tendering process) through to the withdrawal of the quote for construction work alone took 23 months (see Overall context). Even if the project had not been cancelled, significant delays would have been inevitable due to the re-tendering of the consultancy and construction services.

In the PP, the specific costs were listed as roughly EUR 2,500 / kWp and were at the lower end of the range of EUR 2,500 – 3,500 / kWp observed in Germany in 2010. However, the actual specific costs for the project cannot be calculated ex post because no results were achieved apart from the consultancy services and the specifications for the construction work.

The PP already anticipated that prices would continue to fall in view of the very competitive global market for solar modules. This is already reflected in the investment costs at the start of the project. These were set at USD 46.2 million and were therefore already significantly below the costs estimated in the appraisal of USD 56.2 million.

In the PP (2012), the electricity production costs were calculated at roughly EUR 0.13/kWh. According to the PP, this figure was higher than that for hydropower stations and thermal power plants; however, the producing costs for the project were within the normal costs for photovoltaic projects according to the PP. This assessment is also confirmed by the producing costs of the International Renewable Energy Agency for photovoltaic power plants in Latin America in the same period. In this context, the producing costs estimated in the PP are in the middle of the spectrum.[3] Producing costs have fallen significantly in recent years and the globally weighted average was around EUR 0.06 / kWh in 2019.[4] Consequently, the producing costs would have been high from the current perspective.

In view of the pricing structures for energy at that time, the PP regarded the producing costs to be easily affordable, though also very high by international comparison. Looking back, the assumption of the affordability of these costs is called into question by the lower prices for energy at the time of the final review, meaning that the assumed profitability is also questionable. However, under certain circumstances, the producing costs calculation might have been lower in light of the falling investment costs if the construction work had been successfully re-tendered and could have balanced out factors including the lower prices for energy.

Even the PP stated that the CO2 avoidance costs of EUR 97 per tonne of CO2 were significantly higher than the roughly EUR 30 per tonne of CO2 specified in the operational appraisal criteria, though these

[3] https://www.irena.org/media/Files/IRENA/Agency/Publication/2013/Renewable_Power_Generation_Costs_in_2012_summary.pdf?la=en&hash=548B1D4A7BEAF616A19B26D8DF07011A8B8F49E7

[4] https://www.irena.org/costs/Power-Generation-Costs/Solar-Power

costs were deemed justifiable in view of the anticipated learning effect. The high CO2 avoidance costs are regarded as critical. Alternative investments in geothermal energy or biomass should have been considered or at least addressed as they could have been more efficient. In 2016, geothermal power made up 27% of installed capacity and biomass accounted for 11% of total energy production.[5]

Since only consultancy services were financed up to the cancellation of the project and these services did not deliver any results that would be useful at a later date, the efficiency is rated as clearly inadequate.

Efficiency rating: 5

Impact

The objective at impact level according to the PP was to contribute to global climate change mitigation by increasing the climate-friendly production of energy. Had the project been continued, it would have made sense to expand this formulation to include a contribution to diversifying power generation (see Effectiveness).

The PP did not specify any indicators to measure target achievement at impact level. The indicator "Annual carbon emissions prevented" would have been appropriate in terms of climate change mitigation. Furthermore, an increase in the proportion of solar power in the implementing agency's installed capacity x years after completion would have been a feasible proxy indicator for capturing the diversification of the energy mix or the increase to the climate-friendly production of energy.

While the project might have contributed at impact level to global environmental protection through the avoidance of carbon emissions, the project's direct contribution would have been marginal: the photovoltaic system's annual power production of 22,900 MWh would have replaced just 0.4% of annual power production with climate-friendly methods in relation to El Salvador's total annual production of 5,650,000 MWh in 2010. The potential figure of 16,000 t of CO2 avoided each year as a result of the photovoltaic power plant would have stood in contrast to the 7.9 million t of CO2 produced in El Salvador in 2018.

To make a noticeable contribution, the spill-over effects of the pilot project outlined in the results chain would definitely have had to occur to a large extent for the project's widespread effectiveness to have had any appreciable effects on the climate-friendly production of energy and the avoidance of carbon emissions. It is impossible to conclusively determine whether the pilot project would have been able to do this. This also applies to the question as to whether the cancellation of the project had negative effects on the development and implementation of other projects and potential investors. Since the PA there has been an increase in photovoltaic capacity, even though this has yet to be of a substantial magnitude (see Relevance).

Also in view of the challenge identified in the PP of securing a reliable, affordable and sustainable energy supply in El Salvador, only a wider scale construction of more photovoltaic power plants would have been able to contribute to solving the core problem, and thus to promoting the socio-economic development of El Salvador, given the link between energy supply and economic development[6].

Due to the failure to build the photovoltaic power plant, the aforementioned potential impacts were not achieved and the impact is rated as clearly inadequate.

Impact rating: 5

Sustainability

Since the project's cancellation meant that the photovoltaic power plant was not built, no impacts were achieved. As such, there can be no sustainability either. The implementing agency did not pursue the project any further. There were no secondary results that could be reused.

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[5] https://www.worldometers.info/electricity/el-salvador-electricity/

[6] Stern, D. I, Burkes, P. J, and Bruns, S. B. (2017). The Impact of Electricity on Economic Development: A Macroeconomic Perspective. UC Berkeley: Center for Effective Global Action.

At this point, it is worth noting that, in contrast to the PP's estimates, the implementing agency's financial situation was quite alarming at times (see Effectiveness). This could have had a negative effect on operations and maintenance had the project been executed, and therefore could have affected its sustainability.

The sustainability is clearly inadequate.

Sustainability rating: 4

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).