KfW Development Bank

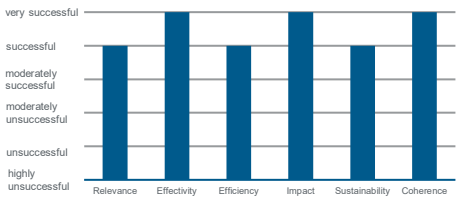
Ex-post evaluation
Mesihovina wind farm, Bosnia-Herzegovina

Title	Mesihovina wind farm		
Sector and CRS code	Wind power, 23240		
Project number	2007 65 933, 2008 70 063 (accompanying measure)		
Commissioned by	Federal Ministry for Economic Cooperation and Development (BMZ)		
Recipient/Project-executing	Bosnia-Herzegovina/J.P. Elektroprivreda Hrvatske Zajednice Herzeg Bosne (EP HZHB)		
Project volume/ Financing instrument	EUR 71 million reduced-interest loan, EUR 1 million grant (accompanying measure)		
Project duration	2010 - 2020		
Year of report	2022	**Year of random sample**	2022

Objectives and project outline

The outcome-level objective underlying the EPE was to contribute to an efficient, reliable and environmentally friendly electricity supply with long-term security by diversifying and expanding renewable energy generation capacities. This should contribute to environmental and climate protection and to reducing Bosnia-Herzegovina's dependence on electricity imports (impact). The construction of the first wind farm (44 MW) in Bosnia-Herzegovina at the Mesihovina site was planned to achieve these goals. In the end, capacity of 50.6 MW was achieved.

Overall rating:
very successful



Key findings

The project was characterised by its exemplary nature as the first wind farm in the country and had an exceptional broad impact for a local infrastructure project.

- The project addressed the core problem of the generation deficit in the executing agency's supply area. The use of the extraordinary potential for wind power provided for in the concept as well as the intended pioneering role in the wind power sector are particularly noteworthy here. The relevance is only clouded by the fact that, despite the additional accompanying measure, the consultant activity was conceptually more focused on implementation support and less on capacity building.
- In consultation with the interventions of other donors and in accordance with the national sector strategy, the project was able to make a decisive contribution to sector development. The coherence of the project is therefore "very successful".
- The project's objectives at outcome level were (over) achieved, from which the "very successful" effectiveness is derived.
- Due to the overall observed ratio of costs and results of the project, it is rated as "successful" in terms of its efficiency, even considering alternative approaches.
- The project paved the way for the construction of further wind farms. The project's positive developmental impacts thus go far beyond the direct impacts of the project and are rated as "very successful".
- The ongoing operation of the constructed turbines is guaranteed both technically and financially on a permanent basis. Sustainability is rated as "successful".

Conclusions

- The remarkable broad impact of the project can be attributed, among other things, to the fact that the project played a pioneering role in the sector.
- The downside of this pioneering role are enormous delays, which can be attributed to the first-time run-through of processes and the restraint of important stakeholders (suppliers, approval bodies).
- The "maturity" of the sector therefore requires special consideration when designing projects (e.g. regarding the choice of award procedure).
- Wind power can play an important role in regions affected by increasing drought to complement other renewable energies, in particular hydropower.

Ex post evaluation – rating according to OECD-DAC criteria

General conditions and classification of the project

Bosnia-Herzegovina has committed to reducing CO_2 emissions in the Kyoto Protocol and the Paris Agreement and has set itself the goal of achieving CO_2 neutrality by 2050. The country has a very high potential for generating renewable energies. While hydro power has long been used as an established source of energy, the potential for generating wind energy has only been utilised for the last 10 years or so. So far, solar energy has only been used to a very small extent. The evaluated project “Mesihovina wind farm” was the first wind farm in Bosnia-Herzegovina and came online in 2018. The country’s electricity supply is provided by three publicly owned companies: Elektroprivreda Bosne i Hercegovine (EP BiH), Elektroprivreda Hrvatske Zajednice Herceg Bosne (EP HZHB) and Elektroprivreda Republike Srpske (ERS). These are responsible for the electricity supply according to the ethnic division of Bosnia-Herzegovina (Bosnian, Croatian, Serbian). The executing agency of the evaluated project was EP HZHB. At the time of the appraisal, it was already possible to build on the existing cooperation with the executing agency.

Brief description of the project

The project involved the design and construction of a wind farm near the village of Mesihovina in Bosnia-Herzegovina with an installed output of 50.6 MW. It included the site’s development of agricultural land, the supply, construction and installation of 22 wind turbines with an output of 2.3 MW each, the installation of the necessary systems for managing the wind farm, connection to the grid and consulting services during the planning, implementation and operation of the wind farm.

Map of the project country incl. project location

Source: Openstreetmap.org

Breakdown of total costs

		Inv. (planned)	Inv. (actual)	Accompanying measure (planned)	Accompanying measure (actual)
Investment costs (total)	**EUR million**	**77.0**	**80.5**	**1.0**	**1.0**
Counterpart contribution	EUR million	6.0	9.5	0	0
Debt financing	EUR million	71.0	71.0	1.0	1.0
Of which BMZ funds	*EUR million*	*71.0*	*71.0*	*1.0*	*1.0*

Rating according to OECD-DAC criteria

Relevance

Policy and priority focus

At the time of the project appraisal, the fight against climate change was already one of the top priorities of international and German development cooperation. The BMZ's sector concept for sustainable energy for development (2007) explicitly mentions the expansion of renewable energies with the aim of avoiding CO_2 emissions, reducing import dependence and preventing supply bottlenecks. SDG 7 defines universal access to affordable, reliable and sustainable energy. Bosnia-Herzegovina joined the South-East Europe Energy Community[1] in 2005, signed the Kyoto Protocol in 2007 and committed to reducing CO_2 emissions in 2015 under the Paris Agreement. The country has set itself the goal of achieving its national reduction commitments to achieve National Determined Contributions (NDC) by 2030 and aims to achieve CO_2 neutrality by 2050. The national sector strategy on the energy sector sets concrete targets for increasing the share of renewable energies in national production. The "Indicative Generation Development Plan" (2007) included the Mesihovina wind farm and other investment projects suggested by EP HZHB in the renewable energies section. The project's objectives (see cover sheet) were fully in line with the policies and priorities outlined above.

Focus on needs and capacities of participants and stakeholders

After the war years 1992–1995, the reconstruction of energy infrastructure in Bosnia-Herzegovina and the restoration of the functionality of existing production and transmission capacities was the most important task of the newly created state. However, the generation deficit existing in the supply area of the executing agency EP HZHB at the time of the project appraisal (2008), as well as the increased demand for electricity in the supply area of EP HZHB over time, also made the construction of new power plants necessary. In 2006, EP HZHB had to import 1,450 GWh of electricity, as its own production (1,884 GWh) was unable to meet the consumption of 3,334 GWh in its own supply area. This corresponds to a supply deficit of 40%. The executing agency of the project was confronted with the particular challenge that there was a major customer in the supply area for which it was responsible, who alone took off a large portion of the electricity produced.[2] This high industrial demand meant that EP HZHB had to purchase large quantities of electricity on a regular basis in spite of the expansion of its installed output. The core problem – generation deficit in combination with increasing energy demand and the resulting increasing dependence of the executing agency on electricity imports (at programme appraisal (PA) 40% purchase) – was correctly identified.

Beyond the demand side, the project is also highly relevant in terms of diversifying the production capacities of the executing agency EP HZHB. At the time of the audit, EP HZHB had only hydropower plants. However, these are subject to seasonal fluctuations in rainfall volumes, which regularly result in lower electricity generation in the summer months. The combination with wind power was therefore suitable for contributing to security of supply in months of low rainfall (see also Fig. 1).

1 ECSEE aims to apply the EU aquis communautaire in the energy sector, including explicitly in the area of renewable energy regulation.

2 At the time of the appraisal, three industrial customers of EP HZHB were responsible for two thirds of the demand.

Appropriateness of design

The target system was conceptually comprehensible and verifiable. The objective of the programme proposal and its inherent impact chain was to expand and diversify the electricity generation base and feed renewable energy into the Bosnia-Herzegovina power grid (outcome) by building the first wind farm in Bosnia-Herzegovina with 44 MW[3] (output), thus contributing to sustainable economic growth and climate and environmental protection (impact). From today's perspective, the objective at the time at outcome level appears to be very much oriented towards output rather than its use. For this reason, the EPE is based on the following outcome-level objective: "*Contribution to an efficient, reliable and long-term, environmentally friendly electricity supply by diversifying and expanding generation capacities from renewable energies*". From today's perspective, the overarching developmental objective ("*Contribution to the sustained economic growth of Bosnia-Herzegovina and to climate and environmental protection*") shows an attribution gap regarding the expected contribution to economic growth in Bosnia-Herzegovina. The contribution of a 50.6 MW power plant, which represents 7% of the generation capacity of one of three energy suppliers or 1.3% of the total supply, to the economic growth of a country is overlaid by a large number of influencing factors and cannot be directly attributed. For this reason, the following target formulation at impact level is used for the EPE: *"Contribution to environmental and climate protection and to reducing Bosnia-Herzegovina's dependence on electricity imports."* This addresses both the intended environmental and economic dimension. The attribution of target achievement to the project's contributions is more direct and easier to understand. Irrespective of the adjustment of the target formulations described, the impact chain assumed at the appraisal, including the capacity building required for target achievement, was generally suitable for contributing to solving the core problem as part of the complementary measure. This also applies to the election of the executing agency EP HZHB and its function in the Bosnian-Herzegovinian state energy sector.

According to the programme proposal, the complementary measure aimed to enable the executing agency to prepare and implement the necessary tenders and thus contribute to rapid implementation. Conceptually, however, the design of the complementary measure appears weak: The focus of the consultant activities was primarily on supporting the executing agency in the implementation, coordination and management of the project and only focused to a limited extent on capacity building.

The concept was primarily aimed at environmental and economic sustainability, as the project represented an alternative in terms of meeting the increasing demand from thermal power plants and reducing the dependence of expensive electricity imports by expanding renewable energies. The use of the extraordinary potential for wind power provided for in the concept as well as the intended pioneering role in the wind power sector are particularly noteworthy here. To increase social sustainability and acceptance of the project, it was also planned to involve communities directly affected at the project site.

The location of the project was selected based on extensive studies on the wind volume in the region. From today's perspective, a larger capacity could have been planned. However, limiting factors at the time of the appraisal were the capacity of the transmission lines on site, which was limited to 55 MW. In order to assess the appropriateness of the dimensioning of the wind farm envisaged in the design, it must also be taken into account that this was the first project of this type for the executing agency and the entire country and therefore there was a high risk due to a lack of experience with the approval processes and the availability of suitable suppliers and service providers for the required technology. Compared to the 44 MW envisaged in the appraisal, the executing agency decided to increase it to 50.6 MW and to finance the additional costs from its own funds. This was mainly due to the availability of more powerful turbines in the meantime.

From today's perspective, the concept of the construction of the wind farm by a general contractor is considered unsuitable as a turnkey project: The responsibility associated with this procedure for the entirety of the trades, including planning, building and delivery, posed too great a risk for the providers of wind turbines in the environment at the time, less than 20 years after the war in Bosnia-Herzegovina and the country's first wind power project. Retrospectively, this was reflected in the fact that the tender for the construction of the wind power plant initially remained unsuccessful. The award of contracts was only successfully concluded after long negotiations following a change to the tendering procedure, which separated the components of the substation, wind turbine and foundations. Since then, tendering as a turnkey project has no longer been used by the executing agency (several wind farms are currently in the design phase).

[3] The increase to 50.6 MW was only decided once the programme proposal had been drawn up.

Response to changes/adaptability

The project exploited the potential of more powerful turbines resulting from technological progress, which were procured differently from the original concept and increased the installed capacity from 44 MW (planned) to 50.6 MW (implemented).

Summary of the rating

The project and its objectives fit seamlessly into the strategies of international, German and Bosnian-Herzegovinian policies and were fundamentally suitable for contributing to solving the core problem. The use of the extraordinary potential for wind power provided for in the concept as well as the intended pioneering role in the wind power sector are particularly noteworthy here. Only the conceptual design of the tendering process and capacity building were of limited success. Overall, the relevance is rated as successful.

Relevance: 2

Coherence

Internal coherence

The project was implemented in accordance with the norms and standards of German and international cooperation and was integrated into TC and FC involvement, which is primarily aimed at promoting renewable energies. It is highly complementary to the TC project "Decarbonisation of the energy sector in Bosnia-Herzegovina", which aims, among other things, to improve the regulatory environment for investments in renewable energies through policy consulting and to help Bosnia-Herzegovina achieve its own environmental and climate change adaptation goals. Discussions with the TC contract managers on site showed that the Mesihovina wind farm contributed as a pilot project to identifying and specifically addressing the hurdles that exist for investors in the renewable energy sector. This brought synergy effects to the above-mentioned project and could be incorporated into it.

On the FC side, the project complemented other FC activities in the renewable energy sector (rehabilitation of existing hydropower plants, construction of additional wind farms and photovoltaic plants). An FC project originally planned with the executing agency to build a pumped storage power plant could have made a significant contribution to improving the use of surplus (wind) energy. After the project-executing agency failed to obtain the concession required to operate a pumped storage power plant for several years, FC phased out the project. Nevertheless, the executing agency continues to pursue the project idea.

External coherence

The project supports Bosnia-Herzegovina in achieving its NDC targets for 2030 and CO_2 neutrality by 2050.

The project was implemented with the Bosnian executing agency EP HZHB and was based on concrete preparations (studies regarding the wind power potential, financed by Spanish DC) of the executing agency for the expansion of wind power. It is therefore in line with its own efforts as well as its development plans at the time and today, which are strongly geared towards wind power in the expansion of renewable energies.

According to numerous statements by interviewees on site, the first-time going through the complex approval processes for a wind farm required in Bosnia-Herzegovina was an important experience and learning process not only for the executing agency, but also for all institutions and authorities involved. These were also shared with other donors and government representatives in numerous workshops and conferences.

Analogous to the synergy with the TC project mentioned above, the pioneering work of the project created synergies with later projects of other donors. For example, the USAID-financed Energy Policy Activity (EPA) project used the Mesihovina wind farm as a case study to identify potential for improvement in the approval processes for wind turbines and, based on this, formulate recommendations for a change in relevant laws. FC's experience with the Mesihovina wind farm and the Podveležje wind farm, which became the first wind farm of the utility EP BiH in 2021, was also a significant reason for the EIB to co-finance the construction of another wind farm (Vlašić) with the producer EP BiH in Bosnia-Herzegovina with FC as the lead investor. This one is not yet in operation at

the time of the EPE. There is regular exchange between European donors within the EU Coordination Group, which meets quarterly.

Summary of the rating

Coherence is rated as very high both internally and externally. The project was not only complementary to interventions by other donors of German and international DC, but also generated synergy effects with projects of other donors, in particular due to its pioneering nature.

Coherence: 1

Effectiveness

Achievement of (intended) targets

The outcome-level objective underlying the EPE was to contribute to an efficient, reliable and environmentally friendly electricity supply with long-term security by diversifying and expanding renewable energy generation capacities.

The target achievement at outcome level is summarised in the table below:

Indicator	Status PA	Target value PA/EPE	Actual value EPE**
(1) Energy generated electrically in the Mesihovina wind farm in GWh p.a. (feed-in)	0	132*	162 (Achieved)
(2) Availability of the plant in %	0	>97%	97.6 (Achieved)
(3) Expansion of renewable energy generation capacity in MW	0	PA: 44 EPE: 50.6	50.6 (Achieved)
(4) Share of wind power in the total generation capacity of EP HZHB (diversification) in %	0	5	7 (Achieved)

* Adjusted from 115 to 132 GWh p.a. in view of the increase in installed output from 44 to 50.6 MW

** Three-year average 2019–2021 generation

Contribution to achieving targets

Due to more powerful turbines now available on the market, the capacity was increased over the course of the project from the 44 MW originally planned to 50.6 MW. All planned components of the wind farm were built and commissioned. The wind farm generated an average of 162 GWh over three years (2019–21). The Mesihovina wind farm has a very high availability of 97.6% since commissioning, which is in line with international standards. Only one turbine failed for three months due to damage, as COVID-19 delayed the procurement of a replacement under the warranty contract. On average, the utilisation of the plant, measured by the capacity factor, is very good at approx. 37%. This is at the top of the range of what can be achieved with the technology available at the time of construction. The turbines financed by the project were randomly inspected as part of the EPE and found to be in perfect condition.

Annual electricity generation both at the final inspection and at the time of the EPE (i.e. 2021 as a whole) was significantly above the target value. The electricity generated in the Mesihovina wind farm is fed into the grid as planned. Even without the major customer, which has since become insolvent, the energy generated by the wind farm is used to meet demand in the executing agency's supply area.

Although the wind farm's share of 7% of the executing agency's total production is relatively small, the contribution to the diversification of EP HZHB generation must be highlighted, as the executing agency's installed capacity at the time of the appraisal consisted exclusively of hydropower. To date, the wind farm is the only alternative source of generation to the executing agency's hydropower capacities. The Mesihovina wind farm supplies comparatively constant electricity all year round due to the continuously high wind volume. Although there are fluctuations here, they are far less pronounced than in hydropower plants, which generate significantly lower amounts of electricity during the low-rainfall summer months than in the winter months. The wind farm is therefore complementary to the installed generation capacity from hydropower and thus contributes to securing the supply of electric power to the target group (cf. Fig. 1). This is rather unusual for wind power due to the naturally high volatility of wind volumes, but in this case is due to the constant wind conditions at the site. In addition to its contribution to a reliable energy supply, the project also contributes to an efficient energy supply thanks to the comparatively low production costs (see Efficiency).

The existing technical know-how and the organisational structure of the executing agency as internal success factors for the project were decisive for the achievement of the objectives. This was achieved independently of the complementary measure. The executing agency's solid financial situation also made it possible to assume the additional costs for more powerful plants and thus contributed to expanding the wind farm's capacity compared to the original design. The predicted high wind volume that actually occurred and its continuity were the external factors that were decisive for the achievement of the target.

The very successful target achievement described above is only clouded by the complementary measure, which only contributed to the target achievement to a limited extent due to its concept. According to the programme proposal, the complementary measure aimed to enable the executing agency to prepare and implement the necessary tenders and thus contribute to rapid execution. Irrespective of the conceptual weakness (see Relevance), there was neither swift execution (see Efficiency) nor a significant contribution to the capacity building at the executing agency intended by complementary measures. According to its own statements, EP HZHB was rather dependent on acquiring the necessary knowledge largely itself.

Quality of implementation

The decisive factor for the successful implementation of the project was the remarkable commitment and perseverance of the project managers within the executing agency's organisation. The same people have been entrusted with the Mesihovina wind farm since the start of the project up to the time of the EPE. This made it easier for the executing agency to build up practical experience through execution and to reduce frictional losses due to possible staff changes. In particular, the challenging path to obtaining all official approvals was an output that could not have been achieved without this personal commitment of those responsible.

Unintended consequences (positive or negative)

The previously described exceptionally constant wind conditions even allow the executing agency to temporarily cover the base load. This contribution to security of supply represents a positive unintended effect.

Summary of the rating:

The project significantly exceeded its objectives at outcome level. The executing agency's outstanding commitment, both personnel and financially, contributed significantly to this success. In addition to the technically flawless condition and operation of the turbines, the high and constant wind conditions also contribute to the (over)achievement of the objectives.

Effectiveness: 1

Efficiency

Production efficiency

The total costs of the project amounted to approx. EUR 81.5 million, including the complementary measure. They were therefore 4.5% higher than estimated during the appraisal (EUR 78 million). The cost increase is justifiable and, in addition to the higher than anticipated consulting costs, can be attributed to the procurement of more powerful turbines (2.3 MW per turbine instead of 2 MW), which increased the total capacity from 44 MW to 50.6 MW. The specific costs thus fell from EUR 1.77 million/MW (originally estimated) to EUR 1.61 million/MW. This value

corresponds almost exactly to the (worldwide) average costs calculated by IRENA of 1,614 EUR/kWp (2014, start of contract negotiations). The specific cost per MW in Europe over the period 2013–14 was around EUR 1.5 million. Given these figures, the specific costs are considered reasonable. Accordingly, the risks of price increases regarding the deliveries and services to be procured specified in the project proposal have not occurred.

The project costs of the wind farm also include the construction of a local control centre, which will not only serve the Mesihovina wind farm in the future but can and should be used for other plants of the executing agency in the surrounding area.

However, delays in project implementation also contributed to the aforementioned cost increases, which extended the consultant's contract and increased the costs compared to its original contract by around 23%. Overall, from an implementation perspective, the consulting costs for such a project are within the framework. The main criticism is the inadequate capacity building of the complementary measure (see Relevance and Effectiveness). The delays also led to additional costs on the part of the executing agency due to its own deployment of staff, even if these costs were not included in the above-mentioned investment costs.

The delays are primarily due to the originally planned tender as a turnkey project (see Relevance) and the Bosnian approval procedures along the project cycle. In total, the invitations to tender for supplies and services took 63 months longer than estimated in the programme proposal. However, the delays are considered to be tolerable given that it was the country's first wind farm project.

With regard to the maintenance contract (not included in the above cost of the project but financed by the executing agency) it should be noted that the restriction of the contract duration of no more than three years imposed by the Bosnian-Herzegovinian procurement law led to a weakening of the negotiating position of the executing agency towards the service provider. In addition to the effects of this non-industry-specific term on sustainability (see section on the sustainability evaluation), this also led to higher prices for this service from the perspective of the evaluators or to a lower scope of services at the same price.

Allocation efficiency

A solar power plant as an alternative measure to the existing concept would have had to be installed roughly on the same area to achieve the intended objectives at outcome level (generated MWh) and impact level (CO_2 savings) of approx. 93 MW. However, this would have been around 78% more expensive (values for 2014, start of contract negotiations). Against this background, it would be worth also considering installing solar panels on the wind farm's premises. This is currently being investigated by the executing agency. Due to the infrastructure already in place, this may be a sensible investment to generate additional yield efficiently.

At the time of the evaluation, the production costs of the wind farm were approx. EUR 47 per MW/h. They are significantly lower than the expected production costs of solar power plants of the same year of construction. The overall economic contribution of the wind farm also lies in the reduction of the required purchase of electricity (in months with low rainfall) as well as for possible income from electricity exports in the case of surplus generation (in months with high rainfall). This is particularly true in the current situation, where electricity is traded at significantly higher prices (EUR 400–500 per MWh).

The executing agency can achieve a price of EUR 43–63 per MW/h for sales to the domestic grid. When exporting electricity, prices of EUR 400–500 per MW/h are possible depending on the market situation. In total, according to the executing agency, the revenues from the wind farm are fully cost-covering. Additional profits are generated depending on the market and weather conditions.

Furthermore, the wind farm contributes to reducing the average cost per MWh of energy fed in by the executing agency (including costs for external acquisition). This is due to the fact that the need to purchase (expensive) electricity in the event of insufficient generation by the hydropower plants in the event of lower rainfall has decreased due to the commissioning of the wind farm (see also overarching developmental impacts).

Summary of the rating

The (specific) costs are considered to be appropriate from a sectoral perspective. Alternative renewable technologies such as photovoltaics could only have achieved the desired effects with considerable additional costs. The capacities created can be operated economically by the executing agency and contribute to improving its cost structure. Despite the delays, efficiency is therefore still rated as successful.

Efficiency: 2

Impact

Overarching developmental changes (intended)

The impact-level objective underlying the EPE was to contribute to environmental and climate protection and to reduce Bosnia-Herzegovina's dependence on electricity imports.

Target achievement at the impact level can be summarised as follows:

Indicator	Status PA	Target value PA	Actual value at EPE
(1) Avoidance of CO_2 emissions in t CO_2 p.a.	0	125,000*	Achieved: 151,296
(2) Net electricity purchase in GWh (4-year average)	660 (2014–17)**	<660**	Achieved: -512***

* Adjusted from 100,000 to 125,000 t given the increase in installed capacity from 44 to 50.6 MW

** New indicator added

*** Net sale

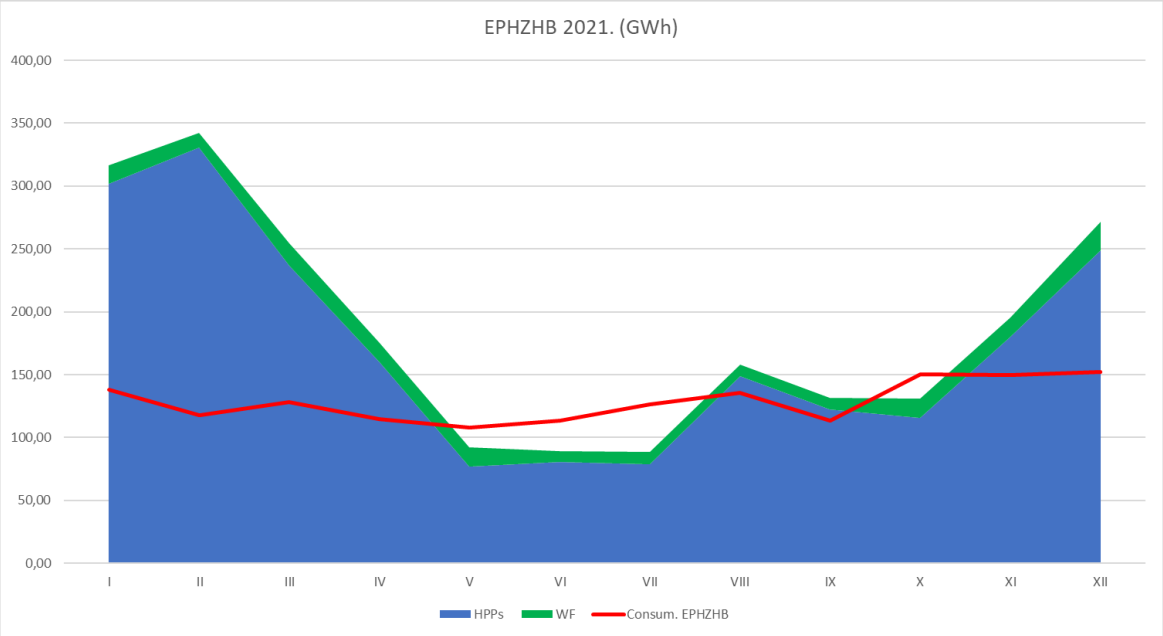
Contribution to overarching developmental changes (intended)

Both indicators for measuring target achievement were (over) achieved. The impacts of the project on environmental and climate protection are approximated by the indicator "Avoidance of CO_2 emissions". The calculation of avoided CO_2 emissions is based on the installed capacity, the emission factor (0.95) that has remained constant since the PA and the Capacity Utilisation Factor (CUF). The target value was increased due to the increase in installed capacity (50.6 instead of 44 MW) achieved at the time of the PA compared to the design. The CUF was estimated at 30% at the time of the PA, which was in line with the average values in the region at the time. Since the final inspection, the CUF actually achieved was significantly above this value (36–37%), which significantly exceeded the target contribution of the Mesihovina wind farm to CO_2 prevention.

The wind farm also made a significant contribution to the intended reduction of the structural generation deficit in the summer months and to the intended reduction of external electricity purchases (cf. Fig. 1 below). The potential to replace thermal energy outside the executing agency's supply area with wind energy could have been further exploited: However, the Bosnian-Herzegovinian regulations stipulate that each of the three state electricity suppliers is responsible for its load control. In other words, in the event of surplus generation by the Mesihovina wind farm, the executing agency cannot (automatically) feed this into the rest of the Bosnian grid in the area of responsibility of the other suppliers but must compensate for it with less generation from its own hydropower plants, curtail the wind farm or find buyers abroad. Unless sold, according to the executing agency, the generation from hydropower plants may be reduced while coal-fired power plants are running at full load in other parts of the country. Political reasons are likely to play a role here, given that thermal power plants are operated by the other state electricity companies. The division of the responsibilities of the three state electricity companies corresponds to the ethnic classification of the country (Croatian, Serbian, Bosnian). In this respect, a conflict of interest on the part of electricity companies is also a sensitive political issue. This is particularly true in the case of coal-fired power generation, as it affects not only the profits of electricity companies, but also potentially other population groups whose income depends on coal mining.

Furthermore, the significant reduction in electricity purchased on the market made an important contribution to the executing agency's profitability in view of the sharp rise in electricity prices. Ensuring economic efficiency is a basic prerequisite for the executing agency's ability to fulfil its state mandate to provide the population and companies in its catchment area with affordable electricity. With regard to the purchase of electricity, it should be noted that this has changed into a net sale over the course of the year after commissioning of the wind farm. This development cannot be attributed solely to the wind farm due to the installed capacity. Probably the most significant influencing factor here is the insolvency of a major customer. As a result, EP HZHB can now make profits from the sale of its surplus generation, particularly in the rainy months, and thus compensate for the comparatively low tariffs set by policy, which make it less profitable for domestic retail customers.

Fig. 1: Comparison of electricity production



Water (blue), electricity production wind (green) and consumption (red); source: EP HZHB

The above positive developmental impacts are also reinforced by the executing agency's own efforts, which reduced the grid losses, still high at the time of the appraisal, from 18% (2008) to 9% (2022).

At local level, the project in the municipality of Tomislavgrad contributed to improving the situation of the public budget and met with cross-party approval. A good 3–4% of the budget of the structurally weak municipality is covered by concession income from the wind farm. The municipality expects further income from similar projects by private and public investors on its municipality boundary. According to the mayor, the concession income is already being used to expand wastewater disposal. In addition to the executing agency's employees, the maintenance service provider is also based in Tomislavgrad. In total, two further wind farms are being designed in and around Tomislavgrad, in addition to the Mesihovina wind farm, and one is already in operation. With the current and future wind farms as well as the first photovoltaic projects in the municipality's district, the municipality has the potential to develop into a cluster for renewable energies in the region and to develop corresponding service providers, e.g. in the maintenance sector with correspondingly good jobs. Today already, the mayor of the municipality describes renewable energy as the second cornerstone of the municipality's economic development, alongside agriculture.

The broad impact of the project is unmistakable and was confirmed by all interviewees during the EPE. Over the past ten years, many new wind energy investment projects have been initiated in the country, some of which have already been completed. These were carried out by both state electricity suppliers and private investors. With regard to FC, the FC project Podveležje wind farm with the executing agency EP BiH has been in operation since 2021 and the FC project Hrgud with ERS in Republika Srpska is being implemented (suspended since 2022). The Vlašić wind farm, Bitovnja wind farm and Poklečani wind farm with EP HPHZ, co-financed by FC and EIB under the Mutual Reliance Initiative (MRI) are also at preparation stage.

From 2017 to 2021, the production of renewable energies (excluding hydropower) in Bosnia and Herzegovina increased approximately tenfold. The addition of wind turbines was decisive for this development. The share of renewable energies in total energy production has increased from 18.5% (2009) to 37.6% (2020). The government's target (40% by 2020) was therefore only just missed.

As the first wind farm in Bosnia-Herzegovina, the project played a pioneering role in many ways. One of the most significant was probably the first application of the authorisation procedures necessary for this type of investment. Both approving bodies and applicants reported significant learning effects on both sides as part of the EPE, which were applied to later projects and led to significant time savings. These efficiencies have not only been increased by the executing agency but are also benefiting the entire sector. For example, the state-owned electricity company EP BiH reported that when planning the above-mentioned wind farms in Podveležje (FC project) there was lively informal exchange with the executing agency, to for example better understand the content, form and scope of documents to be submitted in the respective approval steps. As already mentioned in the coherence evaluation, the learning experience from the Mesihovina wind farm was also taken up by other donor-financed projects in order to develop improvements to the legal texts or approval procedures. Without going through the procedures in practice, these lessons learned would not have been possible, even though there is still great potential for improvement, especially in terms of legal and regulatory conditions. The same applies to the technical operation of wind turbines, which applies to the learning experience with regard to the permit procedures. On average, the executing agency receives visitor groups (students, specialists from electricity suppliers, investors, etc.) from Bosnia-Herzegovina and even Croatia once a month who wish to find out about the operation of a wind farm of this scale. The strong identification with the project and the willingness of the executing agency to pass on what has been learned both contribute to the broad impact of the project. The exemplary nature of the Mesihovina wind farm is particularly important because the potential for similar projects in the mountains of the region is very great and the project is replicable. EP HZHB uses the experience gained and plans to build four more wind farms with a total planned capacity of approx. 350 MW in the region.

The failure of the tender twice due to a lack of interest on the part of the bidders shows how great the scepticism and reluctance of these actors with regard to the Bosnian-Herzegovinian market was before the start of the project. If the project had not materialised, this reluctance may have lasted even longer. This wait-and-see approach would not have made important contributions to climate change mitigation until later. Since the project was implemented, the energy generated by wind power in Bosnia-Herzegovina has increased to approx. 382 GWh (incl. Mesihovina). It is quite plausible that the project, due to its pioneering role, contributed to this development beyond its own capacity.

Contribution to (unintended) overarching developmental changes

The evaluation did not identify any unintended changes in development policy. The nearest residential buildings are so far away from the wind farm that there have been no complaints from residents about noise emissions or shading. Noise emissions were measured over a period of three years. Even during the EPE, there were no indications of negative effects. Bird or bat strikes were also detected to a very low and unobjectionable extent during the monitoring. Furthermore, there were no occupational accidents during the construction or operation of the wind farm.

Summary of the rating

The objectives of the direct overarching developmental impacts were (over)achieved. In addition, the Mesihovina wind farm was the first wind farm in the country to set an extraordinary example for Bosnia-Herzegovina and is still regarded today as a flagship project for electricity producers, politicians, donors, suppliers and private investors. Both locally and nationally, an impressive dynamic has unfolded in the sector. At the Tomislavgrad site, a cluster for renewable energies is emerging, which originated from the evaluated FC project. The fact that the Mesihovina wind farm FC project contributed to this overall positive development for wind power in Bosnia-Herzegovina was highlighted by various stakeholders during the EPE.

Impact: 1

Sustainability

Capacities of participants and stakeholders

EP HZHB is well-positioned both financially and organisationally to ensure the operation of the Mesihovina wind farm in the future. The ongoing excellent commitment and staffing continuity (see Effectiveness), the high output of the wind farm and the complementarity with the current power generation portfolio enable long-term economical operation. Maintenance of the wind turbines is ensured by a maintenance contract financed by the executing agency (see below).

There are risks due to the executing agency's dependence on political decisions. In principle, there is a risk that the costs of popular measures (non-cost-covering electricity tariffs, waiver of claims) will restrict the ability of the executing agency EP HZHB to continue to make replacement investments in the existing infrastructure in the future. At the moment, however, such risks are considered to be low and unlikely to occur.

Contribution to supporting sustainable capacities

It is plausible that the role played by the executing agency as a pioneer in the expansion of renewable energies and the associated recognition have further strengthened its existing ownership.

The expansion of efficient generation capacity from wind power and its complementarity with the existing hydropower capacity make a significant contribution to the economic efficiency of the executing agency by reducing the purchase of externally generated electricity. This is particularly important in the context of the development of electricity prices in Europe. In future, the importance of complementarity between wind power and hydropower in the executing agency's generation portfolio also appears to continue to grow due to the increasing droughts, which make hydropower generation increasingly difficult, especially in the summer months (see photos of the Rama hydropower plant operated by the executing agency). Although the complementary measure made little contribution to capacity building from the executing agency's perspective, the implementation of the investment measure strengthened the institutional and specialist skills for operating wind turbines and managing the maintenance contract.

For the target group, EP HZHB's customers, the project has contributed to the continued purchase of electricity from renewable energies at very low prices. This can be seen as strengthening the target group's resilience in the context of globally rising energy prices.

Durability of impacts over time

The plant has been executed to a high quality and is in perfect condition, which has a positive effect regarding the expected (technical) operating time, which is designed for 20 years. With good maintenance, an operating time of up to 25 years is realistic. The first 24 months after commissioning were covered by a maintenance contract with the turbine manufacturer, which was financed from the project funds. A further maintenance contract was concluded with the same company, which has a term until 2024. The short term of this maintenance contract of three years is critical. Long-term maintenance contracts (10–15 years) are common in the industry. However, it was not possible to conclude such a maintenance contract due to the Bosnian-Herzegovinian procurement guidelines. This weakened the executing agency's negotiating position and led to lower time quotas on the part of the executing agency staff for participation in maintenance work. Specific manuals for all plant components have not yet been handed over to EP HZHB. This reduces the transfer of knowledge to the executing agency. If the maintenance company were to change, continuity would also be impaired.

The political context in Bosnia-Herzegovina is rated as increasingly unstable. Nationalist and separatist movements are strong. However, moderate forces were also able to assert themselves in the elections held at the time of the evaluation. Due to this development, there is no immediately recognisable risk for the sustainability of the project's positive impacts.

The migration of young people from Bosnia Herzegovina is problematic. There is already a shortage of skilled workers in certain sectors. This is particularly true for structurally weak regions such as the municipality of Tomislavgrad. However, given the extraordinarily low turnover of the executing agency's workforce, this problem does not seem to have any impact, at least at present, on the executing agency's ability to guarantee the operation of its facilities on a permanent and professional basis.

Summary of the rating

The financially and organisationally sound positioning of the executing agency, its commitment and staffing continuity, the high-quality execution and the maintenance contract with a specialised company speak in favour of the long-term operation of the plant and corresponding intended impacts. Opportunities to further expand the executing agency's technical capacities were missed due to rather weak support under the complementary measure and short maintenance contracts. Overall, sustainability is considered successful.

Sustainability: 2

Overall rating: 1

Regarding all OECD DAC criteria, the project has good (relevance, efficiency and sustainability) to very good (coherence, effectiveness and overarching developmental impacts) evaluation results. However, the exemplary nature of the project, which led to an exceptional broad impact that goes beyond what could be expected from a local infrastructure project of this dimension, is particularly noteworthy. Another notable strength of the project is the complementarity of the power generation capacities created with the executing agency's existing generation capacities. This has a positive impact both on the relevance and effectiveness of the project, as well as its impact and sustainability. The exploitation of the extraordinary potential of wind power appears more relevant than ever in view of the current developments (consequences of climate change, energy crisis). Only the complementary measure lagged behind its capacity-building capabilities in view of its conceptual weaknesses. The objectives of the project were achieved despite the insignificant contribution of the complementary measure. However, due to the very good results overall, this weakness is less relevant.

Contributions to the Agenda 2030

The project reflects the principles of the Agenda 2030 in several respects. As expected, the energy project focuses on the contribution to SDG 7, which is supported in almost all dimensions (affordable, modern, reliable and sustainable energy supply). The availability of low-cost energy is an increasingly important location factor for companies, which is why the Mesihovina wind farm is also contributing to economic development (SDG 8). Electricity tariffs for private customers cannot be freely defined by the executing agency, but are subject to government regulation, which takes social aspects into account. Overall, the project strengthens the profitability of the executing agency's operations and thus also its ability to cope economically with the specified (low-cost) end customer tariffs. In particular, through complementarity with hydropower, the project has contributed to the resilience of energy infrastructure (SDG 9) with regard to drought periods, which are more likely to occur in the future due to climate change (SDG 13). This applies to the executing agency's supply area, but also to some extent to the whole of Bosnia-Herzegovina due to the project's broad impact.

Project-specific strengths and weaknesses as well as cross-project conclusions and lessons learned

The project had the following strengths and weaknesses in particular:

- From today's perspective, the conceptually planned award procedure (created by a general contractor as a turnkey project) is considered unsuitable: The responsibility associated with this procedure for the entirety of the trades, including planning, building and delivery, posed too great a risk for the providers of wind power plants in the context at the time, less than 20 years after the war in Bosnia-Herzegovina and for the country's first wind power project.
- As the first wind farm in Bosnia-Herzegovina, the project had a pioneering role with a signalling effect for all relevant actors in the sector and was able to achieve an extraordinary broad impact for a local infrastructure project.
- The complementary nature of the wind farm to the executing agency's existing generation portfolio (100% hydropower) increases the project's effectiveness at several levels, such as in terms of economic efficiency and resilience to climate change.

Conclusions and lessons learned:

The “maturity” of the sector requires special attention in the design of the project (e.g. choice of award procedure). In markets where new technological territory is being entered, the reluctance of providers is obvious. A two-stage award procedure with an upstream pre-selection procedure does not add value in such scenarios and can lead to significant delays. Likewise, in such a market context, the call for tenders as a turnkey project appears to be less attractive and promising.

Projects involving the introduction of a new technology in the respective market/sector have great potential for broad impact due to the associated learning processes and signalling effects for other actors. The downside of this pioneering role is potentially associated delays, which can be associated with the initial run-through of processes and the restraint of important stakeholders (suppliers, approval bodies).

The effects of climate change on electricity generation are leading to new challenges. However, this also has the potential for DC projects to make a targeted contribution to increasing the resilience of the electricity supply in relation to these changes. Specifically, electricity generation from wind power can play an important role in regions affected by increasing drought, with corresponding potential, to complement other renewable energies, in particular hydropower.

Evaluation approach and methods

Methodology of the ex-post evaluation

The ex-post evaluation applied the methodology of a rapid appraisal, which is a data-supported qualitative contribution analysis and constitutes an expert judgement. This approach ascribes impacts to the project through plausibility considerations which are based on a careful analysis of documents, data, facts and impressions. This also includes – when possible – the use of digital data sources and the use of modern technologies (e.g. satellite data, online surveys, geocoding). The reasons for any contradicting information are investigated and attempts are made to clarify such issues and base the evaluation on statements that can be confirmed by several sources of information wherever possible (triangulation).

Documents:
Programme proposal, final inspection report, feasibility study, BMZ sector concept for sustainable energy (2007), ECSEE World Bank project evaluation report, Country Report Economist Intelligence Unit Bosnia & Herzegovina, Annual Implementation Report Energy Community, Strategic Framework Bosnia and Herzegovina, bat and bird strike study EP HZHB

Data sources and analysis tools:
IRENA, on-site data collection, partner monitoring data, IEA, UNDP.

Interview partners:
Project-executing agency EP HZHB, Ministry of Energy, key account of EP HZHB, EPBiH, municipality of Tomislavgrad, approval inspection FERK, other donors, target group.

The analysis of impacts is based on assumed causal relationships, documented in the results matrix developed during the project appraisal and, if necessary, updated during the ex-post evaluation. The evaluation report sets out arguments as to why the influencing factors in question were identified for the experienced effects and why the project under investigation was likely to make the contribution that it did (contribution analysis). The context of the development measure and its influence on results is taken into account. The conclusions are reported in relation to the availability and quality of the data. An evaluation concept is the frame of reference for the evaluation.

On average, the methods offer a balanced cost-benefit ratio for project evaluations that maintains a balance between the knowledge gained and the evaluation costs and allows an assessment of the effectiveness of FC projects across all project evaluations. The individual ex post evaluation therefore does not meet the requirements of a scientific assessment in line with a clear causal analysis.

The following aspects limit the evaluation:
The evaluation of the implementation consultant's services is based almost exclusively on the statements of the executing agency.

Methods used to evaluate project success

To evaluate the project according to OECD-DAC criteria, a six-step scale is used. The scale is as follows:

Level 1 very successful: result that clearly exceeds expectations

Level 2 successful: fully in line with expectations and without any significant shortcomings

Level 3 moderately successful: project falls short of expectations, but the positive results dominate

Level 4 moderately unsuccessful: significantly below expectations, with negative results dominating despite discernible positive results.

Level 5 unsuccessful: despite some positive partial results, the negative results clearly dominate

Level 6 highly unsuccessful: the project has no impact or the situation has actually deteriorated

The overall rating on the six-point scale is compiled from a weighting of all six 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 (“impact”) and the sustainability are rated at least “moderately successful” (level 3).

Publication details

Contact:
FC Evaluation Department
Evaluation department of KfW Development Bank
FZ-Evaluierung@kfw.de

KfW Group
Palmengartenstraße 5-9
60325 Frankfurt am Main, Germany

List of annexes:

Target system and indicators annex

Risk analysis annex

Project measures and results annex

Recommendations for operation annex

Evaluation questions in line with OECD DAC criteria/ex post evaluation matrix annex

Target system and indicators annex

Project objective at outcome level	Rating of appropriateness (former and current view)
During project appraisal: to expand and diversify the electricity generation base and feed renewable energy into the BaH power grid	Reformulate according to the state of the art, as this is strongly formulated for the output side
During EPE (if target modified): to contribute to an efficient, reliable and environmentally friendly electricity supply with long-term security by diversifying and expanding renewable energy generation capacities	

Indicator	Rating of appropriateness (for example, regarding impact level, accuracy of fit, target level, smart criteria)	PA target level Optional: EPE target level	PA status (year)	Status at final inspection (year)	Optional: EPE status (year)
Indicator 1 (PA): Electricity generated at the Mesihovina wind farm in GWh p.a. (feed-in)	Appropriate; adjustment of target level due to increase in installed output (from 44 to 50.6MW)	115 EPE: 132	0	166 (2018)	163 (2021)
NEW: Availability of the plant in %		EPE: 97	n/a	97.5 (2018)	97.7 (2021)
NEW: Expansion of generation capacity		44 EPE 50.6	0	50.6	50.6
NEW: Share of wind power in the total generation capacity of EP HZHB (diversification)		5%	0	7%	7%

Project objective at impact level	Rating of appropriateness (former and current view)
During project appraisal: to contribute to the sustainable economic growth of BaH and to climate and environmental protection	Not appropriate; there is an allocation gap with regard to the defined impact level, as the project only makes up around 1.3% of the total generation capacity in BaH and only around 0.8% of the output generated in BaH based on 2006 data (at appraisal). In addition, the feed-in and thus use takes place exclusively in the catchment area of the executing agency (EP HZHB).

During EPE (if target modified): to contribute to environmental and climate protection and to reducing Bosnia-Herzegovina's dependence on electricity imports.					
Indicator	**Rating of appropriateness** (for example, regarding impact level, accuracy of fit, target level, smart criteria)	**Target level PA / EPE (new)**	**PA status (year)**	**Status at final inspection (year)**	**EPE status (year)**
Indicator 1 (PA) Economic growth in %	Not appropriate, because there is an allocation gap (see above)	n/a	5%	2.8% (2019) -4.3% (2020) (World Bank)	5.7% (2021) 3.5% (2022) (EIU)
Indicator 2 (PA) Avoidance of CO_2 emissions in t CO_2 p.a.	Appropriate	PA: 100,000 EPE: 125,000	0	157,683 (2019)	
NEW: Indicator 3: net electricity purchase in GWh (four-year average)		EPE: Reduction compared to the period before commissioning	n/a	n/a	2014–2017: 660 (net purchase) 2018–2021: -512 (net sales)

Risk analysis annex

All risks should be included in the following table as described above:

Risk	Relevant OECD-DAC criterion
Ex post: low interest of suppliers and choice of award procedure leads to unsuccessful tenders and thus to delayed occurrence of the intended effects.	Relevance/efficiency
Ex ante: delays in the tendering process lead to cost increases due to term extensions for the implementation consultant.	Efficiency
Ex post: complex approval procedures lead to delayed occurrence of the intended effects	Efficiency
Ex post: delays in the approval process lead to cost increases due to term extensions for the implementation consultant.	Efficiency
Ex post: national Award Law avoids concluding a maintenance contract at industry-standard conditions.	Efficiency and sustainability

Project measures and their results annex

The project involved the design and construction of a wind farm near the village of Mesihovina in Bosnia-Herzegovina with an installed output of 50.6 MW. The project included the site's development of agricultural land (construction of access roads and levelling some of the terrain), the supply, construction and installation of 22 wind turbines with an output of 2.3 MW each, the installation of the necessary systems for managing the wind farm (20/110 kV substations, electrical and optical cables), connection to the grid (110 kV overhead line and control system) and consulting services during the planning, implementation and operation of the wind farm.

Originally, an installed capacity of 44 MW was planned (programme proposal). Due to the availability of more powerful turbines in the meantime, the installed capacity has been increased to 50.6 MW.

Recommendations for operation annex

The planting of the site for noise reduction recommended as part of the final inspection has not taken place. However, the final inspection itself indicates that there was compliance with all legal limit values. The nearest residential buildings are so far away from the wind farm that there have been no complaints from residents about noise emissions or shading. Noise emissions were measured over a period of three years. Even during the EPE, there were no indications of negative effects.

A maintenance contract for the system (recommendation) has been concluded, but its term is unusually short at three years. If possible, a subsequent extension with a longer period of time is recommended.

Evaluation questions in line with OECD-DAC criteria/ex post evaluation matrix annex

Relevance

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Rationale for weighting if evaluation dimension was weighted with + or -: please justify in this column
Evaluation dimension: Policy and priority focus			2	o	
Are the objectives of the programme aligned with the (global, regional and country-specific) policies and priorities, in particular those of the (development policy) partners involved and affected and the BMZ?	To what extent is target alignment (expansion of generation capacity, use of renewable energies) in accordance with (a) Energy Community (b) national sector strategy, or World Bank sector study from 2008 (c) EP HZHB expansion plan (d) Federal Ministry for Economic Cooperation and Development (BMZ) energy sector strategy, 2007	(a) The Energy Community Treaty, Article 2(d) (b) World Bank sector study 2008 (c) Appendix 8, module proposal (d) Federal Ministry for Economic Cooperation and Development (BMZ) sector concept			
Do the objectives of the programme take into account the relevant political and institutional framework conditions (e.g. legislation, administrative capacity, actual power structures (including those related to ethnicity, gender, etc.))?	Are the goals in line with regional legislation (Energy Community) and the expansion goals for wind power from BaH / the executing agency?	See above documents			

Evaluation dimension: Focus on needs and capacities of participants and stakeholders			1	o	
Are the programme objectives focused on the developmental needs and capacities of the target group? Was the core problem identified correctly?	What was the core problem? Core problems: Increasing energy demand in combination with increasing dependence of EP HZHB on electricity imports (40% purchase at PA) / production deficit and anticipated price increases that jeopardise a secure and economically and ecologically sustainable electricity supply.	PP, section 2.15/2.18/3.09 (dependence on hydropower / increasing import costs) PP, section 3.10 (increasing electricity demand)			
Were the needs and capacities of particularly disadvantaged or vulnerable parts of the target group taken into account (possible differentiation according to age, income, gender, ethnicity, etc.)? How was the target group selected?	How was the target group defined? To what extent may particularly vulnerable parts of the population benefit from an ecologically and economically sustainable electricity supply in the catchment area of EP HZHB?	Non-target-group project, therefore not relevant. PP, section 3.04 The target group is electricity customers of EP HZHB (consumption 1/3 private households, 2/3 across three industrial companies)			
Would the programme (from an ex post perspective) have had other significant gender impact potentials if the concept had been designed differently? (FC-E-specific question)	n/a	Non-target-group project, therefore not relevant.			
Evaluation dimension: Appropriateness of design			2	o	
Was the design of the programme appropriate and realistic (technically, organisationally and financially) and in principle	Were the right executing agency and the right measures for solving the core problem identified?	MoM evaluation mission to evaluate the competitive bidding concept. PP section 3.15			

suitable for contributing to solving the core problem?	Were there fundamental organisational problems with the executing agency, at the location, with authorities during implementation? Was the design of the competitive bidding appropriate and realistic for the framework conditions? What were the reasons why no bids were received for the competitive bidding for the wind farm?	Planning, competitive bidding, construction and commissioning of a wind farm PP section 3.20 ff. Implementation by PIU of the executing agency with CM support.
Is the programme design sufficiently precise and plausible (transparency and verifiability of the target system and the underlying impact assumptions)?	Have inputs, outputs, outcomes and impacts been fully defined and is the respective connection comprehensible?	PP section 3.15 ff & Annex 6
Please describe the results chain, incl. complementary measures, if necessary in the form of a graphical representation. Is this plausible? As well as specifying the original and, if necessary, adjusted target system, taking into account the impact levels (outcome and impact). The (adjusted) target system can also be displayed graphically. (FC-E-specific question)	Does the construction of a wind farm contribute to a sustained diversification and expansion of generation capacity? What impact does the project have on a national level (economic growth, climate protection)?	
To what extent is the design of the programme based on a holistic approach to sustainable development (interplay of the social, environmental and economic dimensions of sustainability)?	To what extent was it possible to assume that the wind farm would contribute to economically sustainable production, given that LCOE was around 9% above the electricity import costs for EP HZHB at the time of the design?	PP section 3.19 The design is primarily aimed at ecological and economic sustainability (reducing the dependence on expensive electricity imports by expanding renewable energies). PV, section 2.05 (thermal): environmental sustainability as an alternative to

	What forecasts for the development of import costs were available at the time of the PA? Were there any particular E&S risks in the context of the project? How is the acceptance of the project at the location and in surrounding municipalities?	covering the increasing demand through thermal power plants (with regard to all of BaH) any E&S risks were assessed in the context of an ESIA in advance, and risks relating to fauna were subsequently re-examined (project completion report, section 2.12).			
For projects within the scope of DC programmes: is the programme, based on its design, suitable for achieving the objectives of the DC programme? To what extent is the impact level of the FC module meaningfully linked to the DC programme (e.g. outcome impact or output outcome)? (FC-E-specific question)	n/a	No DC programme, therefore not relevant.			
Evaluation dimension: Response to changes/adaptability			1	o	
Has the programme been adapted in the course of its implementation due to changed framework conditions (risks and potential)?	Why was the invitation to tender for the supply and service contracts adjusted as planned, i.e. several lots according to the Yellow Book instead of one lot to according to the Silver Book? Why were 2 MW turbines initially planned, then 2.3 MW later on?	MoM evaluation mission Project completion report section 2.08 Based on the tenders submitted, output was increased to a total of 50.6 MW.			

Coherence

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting
Evaluation dimension: Internal coherence (division of tasks and synergies within German development cooperation):			1	o	
To what extent is the programme designed in a complementary and collaborative manner within the German development cooperation (e.g. integration into DC programme, country/sector strategy)?	Was there a country strategy for BaH? Is there now a DC programme? Which other German DC institutions are active in the energy sector in BaH? In particular: Verify TC commitment as part of the EPE. Synergies? Complementarity? Is the measure in line with the Federal Ministry for Economic Cooperation and Development's (BMZ) sector strategy and other approaches to promoting energy projects as part of DC?	MoM evaluation mission Federal Ministry for Economic Cooperation and Development (BMZ) sector strategy, 2007.			
Do the instruments of the German development cooperation dovetail in a conceptually meaningful way, and are synergies put to use?	Which instruments does FC use in BaH and which FC projects were complementary to projects? Why was a low-interest loan selected for this project? In which areas of the energy sector is TC active and how does this affect the FC measures? Verify coherence with previous TC measures as part of the EPE.	2021 reporting TC: Decarbonisation of the energy sector in Bosnia and Herzegovina (giz.de) MoM evaluation mission			

Is the programme consistent with international norms and standards to which the German development cooperation is committed (e.g. human rights, Paris Climate Agreement, etc.)?	Was there compliance with international standards and norms on human rights / child labour and occupational safety during construction of the wind farm?	Project completion report section 2,20 MoM evaluation mission			
Evaluation dimension: External coherence (complementarity and coordination with actors external to German DC):			1	o	
To what extent does the programme complement and support the partner's own efforts (subsidiarity principle)?	What measures are being taken at country and entity level with regard to an ecologically and economically secure energy supply and to achieve the NDCs? What other measures has EP HZHB taken or are being taken to diversify and expand generation capacity? What measures have been/are being taken by EP HZHB to reduce losses in the distribution network? What strategy and measures are the other two EPs implementing (87% generation capacity in 2006)?	Discussions with representatives of the Ministry of Energy of BaH as part of the evaluation mission Annual Implementation Report 2021, Energy Community National Framework Energy Strategy of BaH until 2035			
Is the design of the programme and its implementation coordinated with the activities of other donors?	To what extent does the measure complement the World Bank's sector programmes with the involvement of EBRD, EIB and FC? How is coordination with and among donors/financiers carried out?	PP 2.08 World Bank Eval Report Sectoral Programme 2015 MoM evaluation mission			

Was the programme designed to use the existing systems and structures (of partners/other donors/international organisations) for the implementation of its activities and to what extent are these used?	What is the role of the PIU at EP HZHB and how is the expansion and operation of wind power organised today? Were or are other donors involved in the project and/or expansion of wind energy at EP HZHB?	MoM evaluation mission PP section 3,07 Project is integrated into the executing agency's expansion planning.
Are common systems (of partners/other donors/international organisations) used for monitoring/evaluation, learning and accountability?	How is sector planning/monitoring carried out at country level and in each case for the entities or EPs? How was and is the monitoring carried out with regard to the specific project?	GIZ promotes national monitoring system (decarbonisation of the energy sector in Bosnia and Herzegovina (giz.de) WB Evaluation Report Consultant progress reports.

Effectiveness

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting
Evaluation dimension: Achievement of (intended) targets			1	o	
Were the (if necessary, adjusted) objectives of the programme (incl. capacity development measures) achieved? Table of indicators: Comparison of actual/target	Operating data of the wind farm incl. wind speeds, availability of the plants, operating hours per year, etc.? Installed production capacity and generation capacity p.a. from EP HZHB according to technology?	Data from and discussions with the executing agency			
Evaluation dimension: Contribution to achieving objectives:			2	o	
To what extent were the outputs of the programme delivered as	Has the wind farm been built to the planned scale and is it in operation?	Project completion report section 2.04 Fichtner final report			

planned (or adapted to new developments)? *(Learning/help question)*		
Are the outputs provided and the capacities created used?	Is the plant, which has been in operation since April 2018, still in operation and does a maintenance contract exist?	Project completion report section 2,09
To what extent is equal access to the outputs provided and the capacities created guaranteed (e.g. non-discriminatory, physically accessible, financially affordable, qualitatively, socially and culturally acceptable)?	What is the proportion of households connected to the electricity grid in the executing agency's catchment area?	Conversations with executing agency
To what extent did the programme contribute to achieving the objectives?	With regard to supply from RE / electricity mix / reduction of imports How high are the electricity imports and at what cost between 2006 and today? How high is the LCOE of the wind farm? How much capacity does EP HZHB currently have from which technologies? What share of EP HZHB's generation capacity & output does the wind farm have and what share of the costs p.a. are taken into account for setting tariffs? How did power outages develop at EP HZHB between PP and EPE?	PP and final inspection Conversations with executing agency Data from the executing agency

To what extent did the programme contribute to achieving the objectives at the level of the intended beneficiaries?	Electricity balance from 2007 to date compared to PP Annex 2? How has generation and distribution developed in BaH and EP HZHB? How has the customer and tariff structure developed compared to PP Annex 4? Are there dedicated tariffs for electricity from renewable sources?	Programme proposal Conversations with executing agency Data from the executing agency
Did the programme contribute to the achievement of objectives at the level of the particularly disadvantaged or vulnerable groups involved and affected (potential differentiation according to age, income, gender, ethnicity, etc.)?	Question not directly relevant for the project.	Non-target-group project, therefore not relevant.
Were there measures that specifically addressed gender impact potential (e.g. through the involvement of women in project committees, water committees, use of social workers for women, etc.)? (FC-E-specific question)	Question not directly relevant for the project.	Non-target-group project, therefore not relevant.
Which project-internal factors (technical, organisational or financial) were decisive for the achievement or non-achievement of the intended objectives of the programme? *(Learning/help question)*	On what basis was the project designed, e.g. why wind power, at that site, at that scale? What role does the ext. consultant have and what long-term impact does this have (capacity building for own wind power department)? What role did the cooperation agreement with Tomislavgrad play in terms of local acceptance of the project and what does it involve?	Feasibility study on wind potential and verification for the site in accordance with PP section 2.15 Conversations with executing agency Discussions with the municipality of Tomislavgrad

Which external factors were decisive for the achievement or non-achievement of the intended objectives of the programme (also taking into account the risks anticipated beforehand)? *(Learning/help question)*	Was the existing expansion planning of BaH/EP HZHB a decisive factor during the PA? From today's perspective, were there other external factors for target achievement? What role did the institutions involved in the approval process play?	Conversations with executing agency Discussions with Ministry of Energy Discussions with approval authorities Conversations with other electricity suppliers Discussions with other donors			
Evaluation dimension: Quality of implementation			1	o	
How is the quality of the management and implementation of the programme (e.g. project-executing agency, consultant, taking into account ethnicity and gender in decision-making committees) evaluated with regard to the achievement of objectives?	Management appears in total to have been very central to achieving the goals. Awarding issues required a high level of commitment and expertise to ensure implementation. Who was in charge of adjustment? How is the structural quality to be assessed?	Project completion report, section 2.08 Consultant's final report, 4.2.2 On-site inspection as part of the EPE			
How is the quality of the management, implementation and participation in the programme by the partners/sponsors evaluated?	What were the reasons for a lack of and limited supply of wind turbines? Who was in charge of driving forward the adjustment of the competitive bidding? Who conducted significant contract negotiations with Siemens, consultant or the executing agency?	Project completion report, section 2.08 Consultant's final report, 4.2.2 Conversations with executing agency			
Were gender results and relevant risks in/through the project (gender-based violence, e.g. in the context of infrastructure or empowerment projects) regularly monitored or otherwise taken into account during implementation?	Question not relevant	Non-target-group project, therefore not relevant.			

Have corresponding measures (e.g. as part of a CM) been implemented in a timely manner? (FC-E-specific question)					
Evaluation dimension: Unintended consequences (positive or negative)			1	o	
Can unintended positive/negative direct impacts (social, economic, ecological and, where applicable, those affecting vulnerable groups) be seen (or are they foreseeable)?	Were there unintended positive/negative direct effects? Which ones? To what extent has the local wind farm lead to pos./neg. changes? Has the expansion of wind power had effects on the executing agency (staffing, management attention)? Has a significant local wind energy sector developed in the country since the project? Pos./neg. direct effects on the community of Tomislavgrad?	Bat and bird strike study Discussions with the municipality of Tomislavgrad Discussions with Ministry of Energy Conversations with executing agency On-site inspection as part of the EPE			
What potential/risks arise from the positive/negative unintended effects and how should they be evaluated?	Is there increased local awareness about the type of energy supply, climate change and other measures derived from this that have taken place since commissioning with regard to mitigation or adjustment? Is there a local opposition to the wind farm / wind power (bird protection, agricultural land, view, etc.)? What is the executing agency's perception of wind power, future technology or not? Do renewables or wind power in particular have the potential to strengthen	Discussions with the municipality of Tomislavgrad Conversations with executing agency On-site inspection as part of the EPE			

	the country's economy (design, installation, maintenance, etc.)?	
How did the programme respond to the potential/risks of the positive/negative unintended effects?	Were any potentially unintended pos./neg. effects identified during implementation? Was there a positive/negative interaction with the local population (stakeholder engagement) during the planning and implementation?	Discussion with Tomislavgrad's local administration Conversations with executing agency

Efficiency

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting
Evaluation dimension: Production efficiency			2	o	
How are the inputs (financial and material resources) of the programme distributed (e.g. by instruments, sectors, sub-measures, also taking into account the cost contributions of the partners/executing agency/other participants and affected parties, etc.)? (Learning and help question)	No further specification necessary	Final inspection			
To what extent were the inputs of the programme used sparingly in relation to the outputs produced (products, capital goods and services) (if possible in a comparison with data from other evaluations of a region, sector, etc.)? For example, comparison of specific costs.	How high are the costs/MW in an international/regional comparison?	Project completion report section 3.01 IRENA Wind Cost Analyses			

If necessary, as a complementary perspective: To what extent could the outputs of the programme have been increased by an alternative use of inputs (if possible in a comparison with data from other evaluations of a region, sector, etc.)?	Why was the wind turbine size expanded from the planned 2 MW to 2.3 MW? Why were no larger wind turbines installed to achieve the maximum possible 55 MW from the grid operator? Are there 2.5 MW wind turbines?	Final inspection Consultant's final report IRENA Wind Cost Analyses			
Were the outputs produced on time and within the planned period?	Time schedule according to PP? Implementation in accordance with project completion report? Reasons for delays? To what extent have delays adversely affected the executing agency and the expansion of wind power overall?	PP Final inspection Conversations with executing agency Consultant's final report			
Were the coordination and management costs reasonable (e.g. implementation consultant's cost component)? (FC-E-specific question)	How high were the consulting costs? Int./reg. comparison? Appropriate? How high was the coordination effort for the executing agency, in particular also compared to other construction projects and, from today's perspective, does this show that the effort involved in new projects is different?	Final inspection IRENA Wind Cost Analyses Conversations with executing agency			
Evaluation dimension: Allocation efficiency			2	o	
In what other ways and at what costs could the effects achieved (outcome/impact) have been attained? *(Learning/help question)*	Why did they choose wind power instead of other RE technologies to expand generation capacity? How did the LCOE of the wind farm vs. electricity imports develop? Are the LCOE of the wind farm lower than import tariffs at the time of the review?	PP Data from the executing agency Conversations with executing agency Own rough calculation			

	What is the current tariff structure of EP HZHB and are they lower/higher/adequate compared to the appraisal? Are other RE technologies also used today by the executing agency/in the country and is there LCOE data for this? How many MW of solar/PV would have been required and at what cost to achieve the output and CO2 savings achieved? Could investment in loss reduction in the distribution grid have achieved a higher outcome at the same costs? What is the size of the wind farm?	
To what extent could the effects achieved have been attained in a more cost-effective manner, compared with an alternatively designed programme?	Was concessional financing necessary and proven for microeconomic profitability? Were there alternative financing options via the local banking market at the time of the PA (what is the current situation with regard to financing via the local banking market for such projects	see above Conversations with executing agency
If necessary, as a complementary perspective: To what extent could the positive effects have been increased with the resources available, compared to an alternatively designed programme?	Question already covered above.	see above

Impact

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting

Evaluation dimension: Overarching developmental changes (intended)			1	o	
Is it possible to identify overarching developmental changes to which the programme should contribute? (Or if foreseeable, please be as specific as possible in terms of time).	Will EP HZHB and/or other EPs continue to expand wind energy and/or other RE technologies? Are the LCOE in wind power lower than import electricity costs? Has dependency on import flow decreased for EP HZHB? Has electricity generation in BaH been achieved in a more environmentally friendly manner / with lower carbon emissions compared to the time of the appraisal and NDCs?	Discussions with other EPs Discussions with ministries Conversations with executing agency Energy Community data Executing agency data Budapest electricity exchange data BaH strategic framework Discussions with the municipality of Tomislavgrad			
Is it possible to identify overarching developmental changes (social, economic, environmental and their interactions) at the level of the intended beneficiaries? (Or if foreseeable, please be as specific as possible in terms of time).	To what extent has the project led to a change in perception of climate change and RE technologies in the location region and in the energy sector? Has a significant wind power and/or RE technologies sector developed in the country?	Conversations with executing agency Discussions with Ministry of Energy Discussions with other donors Discussions with the municipality of Tomislavgrad			
To what extent can overarching developmental changes be identified at the level of particularly disadvantaged or vulnerable parts of the target group to which the programme should contribute (Or, if foreseeable, please be as specific as possible in terms of time).	Question not relevant here	Non-target-group project, therefore not relevant.			

Evaluation dimension: Contribution to overarching developmental changes (intended)		1	+	Model function of the project exceeded expectations. Important signalling effect for different stakeholders. A contribution was made to learning.
To what extent did the programme actually contribute to the identified or foreseeable overarching developmental changes (also taking into account the political stability) to which the programme should contribute?	What share of EP HZHB's generation capacity & output does the wind farm have and what share of the costs p.a. are taken into account for setting tariffs? See follow-up question. How have carbon emissions developed in BaH? How has the electricity mix developed in BaH?	Executing agency data IEA		
To what extent did the programme achieve its intended (possibly adjusted) developmental objectives? In other words, are the project impacts sufficiently tangible not only at outcome level, but also at impact level? (E.g. drinking water supply/health effects).	Goal: Contribution to environmental and climate protection as well as to achieving the NDCs of BaH. - Are LCOE for the wind farm lower than electricity import tariffs? - Does EP HZHB fully cover its costs? - Are end customer tariffs lower compared to PP? - How far along is BaH towards the NDCs - How have the CO_2 savings of the wind farm developed and the underlying CO_2 coefficients?	IEA UNDP Data from the executing agency		
Did the programme contribute to achieving its (possibly adjusted) developmental objectives at the level of the intended beneficiaries?	Does the neighbouring municipality have tax/lease income from the wind power plant? Did the project have direct negative effects on employees in thermal generation plants?	Discussions with the municipality of Tomislavgrad Conversations with executing agency Discussions with Ministry of Energy Discussions with other donors EIU Country Report		

Has the programme contributed to overarching developmental changes or changes in life situations at the level of particularly disadvantaged or vulnerable parts of the target group (potential differentiation according to age, income, gender, ethnicity, etc.) to which the programme was intended to contribute?	Question not relevant here	Non-target-group project, therefore not relevant.
Which project-internal factors (technical, organisational or financial) were decisive for the achievement or non-achievement of the intended developmental objectives of the programme? *(Learning/help question)*	Were there any decisive factors? Which ones? Can wind power compensate for hydroelectric power during periods of reduced rainfall and utilisation of HPPs?	Conversations with the executing agency
Which external factors were decisive for the achievement or non-achievement of the intended developmental objectives of the programme? *(Learning/help question)*	Did the Paris Climate Agreement influence any regulatory or other approvals? To what extent is membership in the Energy Community relevant for the expansion of RE production capacity? How did the approval authorities perceive the project? What role did they play? How did investors perceive the project?	Discussions with other EPs Conversations with executing agency Discussions with other donors UNDP
Does the project have a broad-based impact? - To what extent has the programme led to structural or institutional changes (e.g.in organisations, systems and regulations)? (Structure formation)	How is the executing agency organised in terms of wind energy or alternative RE technologies and what influence did the CM have on this? To what extent has the project led to legal and/or regulatory adjustments by the grid operator? Have approval procedures been adapted/simplified?	Conversations with executing agency Discussions with donors Discussions with regulatory authorities and institutions involved in the approval process. Discussions with the municipality of Tomislavgrad Discussions with other EPs Visit to other local wind farms

- Was the programme exemplary and/or broadly effective and is it reproducible? (Model character)	How has the duration of permit processes for wind farms developed? Has EP HZHB and/or have other EPs in BaH expanded their wind capacity? Were there delays or increased supplier interest in other wind farms?				
How would the development have gone without the programme? (Learning and help question)	What influence would it have had on EP HZHB if the project had not taken place with regard to a secure and economically sustainable energy supply?	Discussions with EPs in BaH Conversations with executing agency			
Evaluation dimension: Contribution to (unintended) overarching developmental changes			2	o	/
To what extent can unintended overarching developmental changes (also taking into account political stability) be identified (or, if foreseeable, please be as specific as possible in terms of time)?		Interviews with local residents Discussions with the municipality of Tomislavgrad Bat and bird strike study Final inspection Conversations with executing agency			
Did the programme noticeably or foreseeably contribute to unintended (positive and/or negative) overarching developmental impacts?	- Noise development? - Bird/bat strikes? - Other? Has the final report based on the two-year monitoring report been completed? Were any negative effects identified? Were there complaints? Has a significant local wind energy sector developed in the country since the project?	Interviews with local residents Discussions with the municipality of Tomislavgrad Bat and bird strike study Final inspection Conversations with executing agency			

Did the programme noticeably (or foreseeably) contribute to unintended (positive or negative) overarching developmental changes at the level of particularly disadvantaged or vulnerable groups (within or outside the target group) (do no harm, e.g. no strengthening of inequality (gender/ethnicity))?	Question not relevant	Non-target-group project, therefore not relevant.

Sustainability

Evaluation question	Specification of the question for the present project	Data source (or rationale if the question is not relevant/applicable)	Rating	Weighting (- / o / +)	Reason for weighting
Evaluation dimension: Capacities of participants and stakeholders			2	o	
Are the target group, executing agencies and partners institutionally, personally and financially able and willing (ownership) to maintain the positive effects of the programme over time (after the end of the promotion)?	Is there a long-term maintenance contract, with whom, for how long and at what cost? How is the executing agency positioned at an organisational, staffing/technical, financial level? What is the staff turnover rate with regard to employee retention? Cost coverage (operation/full costs)?	Conversations with executing agency Final inspection			
To what extent do the target group, executing agencies and partners demonstrate resilience to future risks that could jeopardise the impact of the programme?	How high is EP HZHB's current electricity import demand at what costs? What is the impact of increased raw material costs (for gas, oil, coal) in this regard and what measures are being taken to counteract this?	Executing agency data Conversations with executing agency			

	How has the utilisation of EP HZHB's HPPs developed since PP? Is there a significant change in rain fall and correspondingly lower capacity? Were there significant variations in wind speed?				
Evaluation dimension: Contribution to supporting sustainable capacities:			2	+	Complementarity between wind and hydroelectric power leads to increased resilience to climate change (decrease in precipitation)
Did the programme contribute to the target group, executing agencies and partners being institutionally, personally and financially able and willing (ownership) to maintain the positive effects of the programme over time and, where necessary, to curb negative effects?	How is the executing agency institutionally positioned with regard to wind power and RE technologies in particular? What contribution did the CM make in terms of capacity development? Are the wind farm's LCOE lower than import tariffs? Are the current tariffs above the LCOE? Is wind power a technology of the future for the executing agency or not? What is the executing agency's financial situation? Balance sheet data / cost recovery ratio of the executing agency?	Conversations with executing agency Executing agency data			
Did the programme contribute to strengthening the resilience of the target group, executing agencies	Does the wind farm show a significant counter-effect in terms of dependence on electricity imports, possibly volatile	Conversations with executing agency Executing agency data On-site visit to local hydropower plant (EPE)			

and partners to risks that could jeopardise the effects of the programme?	capacity of HPPs and cost structure at EP HZHB?				
Did the programme contribute to strengthening the resilience of particularly disadvantaged groups to risks that could jeopardise the effects of the programme?	Question not relevant in this context.	-			
Evaluation dimension: Durability of impacts over time			2	o	
How stable is the context of the programme (e.g. social justice, economic performance, political stability, environmental balance)? (*Learning/help question*)	What is the anticipated service life of the wind farm? Is there a long-term maintenance concept (permanent maintenance contract)? What maintenance/repairs have been necessary so far? How high is the capacity? How do the LCOE of the wind farm behave in relation to electricity import prices and, if applicable, LCOE of alternative RE technologies? For which periods do the off-take tariffs apply? Is there a defined development path for them?	Visit to local plants (EPE) Conversations with executing agency Executing agency data			
To what extent is the durability of the positive effects of the programme influenced by the context? *(Learning/help question)*	Will wind power be further expanded and will wind power be a significant part of the country's production capacity or at EP HZHB in the foreseeable future?	Conversations with executing agency Reporting 2020			

	Is there a scenario in which the wind farm would no longer be operated?	
To what extent are the positive and, where applicable, the negative effects of the programme likely to be long-lasting?	Question matches the versions above.	see above