

Ex post evaluation – Montenegro

>>>

Sector: Hydropower plants (CRS Code 23065)
Programme/Project: Rehabilitation of Perućica hydropower plant/ HPP(Phase I);
 A) BMZ No. 2002 66 981 (Investment)* and
 B) BMZ No. 2002 70 553 (Accompanying measure)**
Implementing agency: Elektroprivreda Crne Gore AD Nikšić (EPCG)



Ex post evaluation report: 2016

		Project A (Planned)	Project A (Actual)	Project B (Planned)	Project B (Actual)
Investment costs (total)	EUR millior	16.19	16.19	0.54	0.73
Counterpart contribution	EUR millior	8.15	8.15		
Funding	EUR millior	8.04	8.04	0.54	0.73
of which BMZ budget funds	EUR millior	16.19	16.19	0.54	0.73

*) Projects in 2016 random sample

**) including EUR 0.23 million from Studies and Consultancy Fund

Summary: The Perućica hydropower plant was put into operation in 1960 (mainly used for base load supply). The project’s most important components comprised the rehabilitation and modernisation of the electro-technical equipment for generator sets 1-4, along with auxiliary machinery. Those were particularly urgent interventions - financed as Phase I (project scope). Parallel to this, support was given to the implementing agency in an accompanying measure that identified measures to remove the output limit at 285 MW, as well as identifying other priority rehabilitation and modernisation measures.

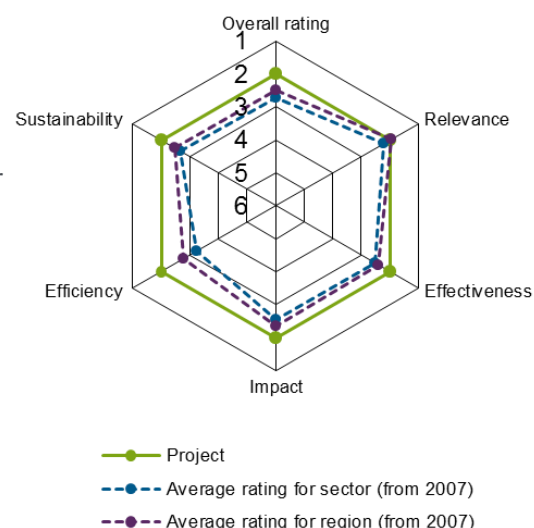
Objectives: The project aimed at a reliable, cost-effective and environmentally viable supply of electrical energy to Montenegro’s interconnected grid ("outcome"). The intended impact was to contribute to the economic growth of Montenegro and to climate protection.

Target group: The target group of the project is all consumers in Montenegro who are connected to the electricity grid.

Overall rating: 2

Rationale: The rehabilitation of the power plant was necessary from a technical perspective. It was highly relevant owing to its significance for electricity production in the country (accounting for between 25 and 33% of the annual production). The targets were largely achieved. A limit placed on the output of the HPP introduced for safety reasons was lifted, not least thanks to the accompanying measure. The annual generation capacity figures show that the power plant is able to achieve the expected volume of electricity, depending primarily on available water levels. With an average of 1,000 GWh per year over the last six years, the target value was exceeded. The energy sector in Montenegro is relatively efficient, enabling the effects of the project to evolve. The power plant's production contributes to the economic growth of Montenegro and to climate protection. Sustainability should be secured owing to the deficit in power generation in the region and the export opportunities for Montenegro in a deregulated trans-boundary market.

Highlights: The implementing agency EPCG is seeking financing for the continued rehabilitation and modernisation work required, as outlined above.



Rating according to DAC criteria

Overall rating: 2

General conditions and classification of the project

The project (partial modernisation of the Perućica hydro power plant/HPP) is the first FC commitment in a series of projects in Montenegro's energy sector.

At 875 MW, Montenegro's generation capacity has not increased significantly since project appraisal (PA). Meanwhile, its peak load lies between 550 and 700 MW, with demand fluctuations by the largest consumer, the KAP aluminum plant, being the primary influencing factor. The major sources of generation capacity are the HPPs at Perućica (307 MW) and Piva (342 MW), as well as the antiquated Pljevlja coal power plant (218.5 MW). Although Piva has a large reservoir, the limited reservoirs at the Perućica HPP allow only for daily and weekly adjustments. Therefore Perućica is used for ongoing supply at base load levels, as available water supplies permit, whilst Piva HPP is used (when possible) to cover peak loads. The Pljevlja thermal power plant is used for base load supply and is temporarily taken out of service at times when sufficient power is available from HPPs. Ultimately; however, the power plants' operations - to the extent that they are available in terms of the necessary technical and water resources - are determined by demand on the deregulated international power market. Montenegro has a transmission network of 1,366 km and an expansive distribution network. Nearly the entire population has access to the power grid, and supply security is generally ensured. The total interruptions reported for 2014 and 2015 were 6,008 and 6,639 minutes, respectively. In years with good water levels, power needs are met by internal production and imports.

Since PA in 2003, Montenegro's energy sector has experienced significant changes through its participation in the Energy Community Treaty signed in 2005, which aims to bring energy sectors closer to EU standards. Today, the power market is largely unbundled, important institutions have been established, and the project-executing agency CGES is a member of the European Network of Transmission System Operators (ENTSO-E), which plays an important role in the ongoing development of power markets. Montenegro is now connected to its neighbouring countries by 12 power lines and has its own functioning power market. The power transmission volume is considerable and nearly equals national power consumption. Upon completion of an undersea cable to Italy (planned for 2017) and of other measures (including some financed by FC) to enable a 400 kV connection to Serbia, Montenegro's role as a transit country will continue to expand. The opening of the power market offers both opportunities and risks for the EPCG: While the power trade will allow for increased revenue, there is also the risk of competition with less-expensive imported power. In light of the power needs in northern Italy (where price levels are higher) and elsewhere, EPCG sees good opportunities there.

Relevance

At the time of PA (2003), Montenegro had a generation capacity of just under 900 MW, of which 285 MW pertained to the project power plant (the nominal capacity of 307 MW could not be fully exploited due to safety limitations). About a third of the electricity generated in Montenegro came from the Perućica HPP; in addition, the plant played an important technical role in supplying the network with reactive power and in stabilising the network.

The project aligned with Montenegro's strategy of reforming the electricity sector in view of an eventual EU membership - and of ensuring generation capacity, which is also a priority area for German-Montenegrin DC efforts. It was part of a strategy already initiated by the project-executing agency to modernise the power plant, for which EPCG also received support through an accompanying measure. The project was suited to substantially contribute to the security of power generation (which represented a development bottleneck). It was highly relevant both at the time of PA and from today's perspective. The underlying intervention logic, by which rehabilitation and modernisation of an existing power plant would ensure cost-efficient and ecologically viable power production - thus contributing to economic growth and environmental protection - is convincing from today's perspective as well.

Relevance rating: 2

Effectiveness

The proposed project objective (“outcome”) was a reliable, cost-effective and environmentally viable supply of electrical energy to Montenegro’s interconnected grid. Outcome achievement since the start of operation in 2009 can be summarised as follows - based on the development of the indicators defined at the time of the PA :

Indicator	Status / Target value PA	Ex-post evaluation
(1) long-term availability of peak output from the HPP	Status PA: 285 MW Target value PA: 285 MW*)	307 MW
(2) average yearly input to grid of 845 GWh	Status PA: 845 GWh Target value PA: 845 GWh	2010 2011 2012 2013 2014 2015 1,435 630 809 1,334 1,008 784 Average: 1,000 GWh
(3) power plant’s availability	Status PA: min. 95% Target value PA: min. 95%	2010 2011 2012 2013 2014 2015 89.5 87.1 91.2 89.3 86.9 84.1 Average: 88.0%

*) the maximum output was restricted for technical reasons at the time of PA; it could only be increased later on (see text)

After extensive measurements and investigations (also supported by the FC accompanying measure), EPCG determined that - following some equipment upgrades - the power plant could be operated without problems at the limit of its installed capacity of 307 MW. Therefore the limit that had been imposed earlier for reasons of safety could be removed. In the context of the accompanying measure, additional measures were identified to modernise the power plant - and its hydraulic structures in particular.

The annual generation capacity figures show that the power plant is able to achieve the expected production, depending primarily on available water levels. With an average of 1,000 GWh per year over the last six years, the target value was exceeded; in 2014 and 2015, the power plant produced 30% and 27%, respectively, of the electricity generated in the country. Those output levels could not have been achieved without the rehabilitation of the outdated facilities.

However, the HPP’s production capacity is also influenced by market conditions. Depending on the market situation, its use is determined by current power sales and power prices (see above). In addition, EPCG makes a distinction between “availability” and “reliability”, with the latter referring to technical readiness regardless of whether water is available. The “availability” indicator refers to the actual possibility of use, which takes both technical availability and available water supply into account.

Long-term availability according to the “reliability” indicator reaches a high value of 96%, while the “availability” indicator is only 86%; this occurs particularly in summer months due to the limiting factor of water availability, which also explains the fluctuations in annual power generation mentioned above.

Effectiveness rating: 2

Efficiency

As part of a long-term rehabilitation and modernisation plan, the project began with high-priority measures for the maintenance and improvement of the HPP’s production. Those measures were implemented within the expected cost range. The costs per unit are appropriate. A variety of causes led to delays in project implementation, but those had no significant effect on the project’s ultimate success.

Even after the implementation of Phase I, considerable bottlenecks and areas for improvement in the HPP’s operation remain (e.g. optimising the capacity of transmission channels, inspection of a pressure line); those should be reduced or improved in the context of additional rehabilitation measures, however. In this context, EPCG demonstrated awareness of those challenges in discussions - as well as an interest in acquiring financing to address them.

Under the Energy Community Treaty signed in 2005, the Balkan countries committed to bringing their energy sectors up to EU standards. In the light of this obligation, Montenegro has unbundled and deregulated its power industry in recent years. In 2009, for example, the transmission sector was split off from the vertically-integrated industry corporation and began operating as CGES. After many years of delays, the distribution sector was separated from EPCG in June 2016. With the creation of the independent regulator REGAGEN, the Market Operator for Electrical Energy (COTEE Ltd.) and the creation of the South East Europe Coordination Auction Office (SEE CAO), important institutions were created for an efficient power market.

With regard to power losses and cost coverage, Montenegro meets the so-called “operational assessment criteria” for the power sector: In 2015, transmission and distribution losses amounted to 2.3% and 17.1%, respectively. Rates are set by REAGEN on the basis of a "revenue cap method", and they cover costs both in micro- and macroeconomic terms. However, the reported collection rate is significantly less than the 95% targeted at the time of the PA, and no further information was available in that respect. For the Perućica HPP itself, very moderate production costs of 0.01 EUR/kWh apply, which results in a good allocation efficiency rating for the project. EPCG achieved surpluses of EUR 34.8 million in 2014, and EUR 10.8 million in 2015.

Efficiency rating: 2

Overall developmental impact

The project was to contribute to sustained economic growth, which was to be measured (1) by a predominantly productive use of the (additional) power and (2) by full coverage of the economic costs of power supply. In addition, the project was intended to contribute to environmental protection.

The indicators defined at the time of the PA are of limited use, at best, in determining the project's impact: By today's estimates, indicator (1) for productive use of power is considered to be largely outdated, and also appears to have little relevance given the now sizeable exchange of power with neighbouring countries in a deregulated market (see above). Regardless of that, it can be reasonably assumed that the total proportion of productive users is above 50%. With regard to (2), the coverage of economic costs, a conceptual link may be derived from the fact that the project was part of a sector approach. That strategy was to bring the industry into line with EU standards (see “Relevance” above), with the target of full cost coverage being one element.

The question of access to energy, which - as per the current state of the art - must be included in the discussion based, does not really arise in Montenegro's case, given the near-total degree of access.

In the last few years (except for 2012), Montenegro achieved GDP growth rates between 1.8% and 3.5%. It is reasonable to assume that - without secure power production and the amount of power produced by the power plant - this level of growth would at best have been possible only with significantly higher costs for imported power.

In 2014 and 2015, the electric power produced by the Perućica HPP accounted for 33% and 27% of total production, which amounted to 3,038 and 2,871 GWh respectively. Given that demand for power in 2015 was recorded at about 3,394 GWh, the net import for 2015 was 523 GWh.

EPCG's third largest power plant is the Pljevića coal power plant, which produced 1,411 GWh in 2015. The average specific coal use was 1.18 kg/kWh. This consumption value would serve as reference to the environmentally favourable power production made possible by the project. On that basis, a reduction in coal use of 528,000 t for 2015 and 680,000 t for 2014, i.e. nearly 1.3 million and 1.7 million fewer tonnes of CO₂ emissions respectively can be derived. The project therefore contributes to environmental protection; however, the project measures are aimed at maintaining existing production and not creating new capacity.

In summary, the project's impact is rated as "good".

Overall developmental impact sub-rating: 2

Sustainability

With the modernisation of the power plant, EPCG has four rehabilitated generator sets which, if operated and maintained appropriately, should allow for 25 more years of power production. The rehabilitation of three additional units and the addition of an eighth generator set are also planned. EPCG is sufficiently qualified to operate and maintain the facilities. Based on the current financial situation, sufficient funds will be available. Due to the regulating authority REMAGEN's policy of approving rates that are adequate for the operators, this is also likely to be ensured in the future. There is an inherent risk of inadequate water supply to the HPP. However, no concrete indications of a critical reduction in the available water volume have been observed, beyond the usual hydrological fluctuations. Rather, water regulation should be improved in the context of further rehabilitation measures at the HPP, thereby increasing water availability.

The opening of the power market offers both opportunities and risks for the EPCG. While the power trade will allow for increased revenue, there is also the risk of competition with inexpensive imported power. From the EPCG's perspective, the opportunities outweigh risks.

From today's perspective - considering trouble-free production, the expected future demand for power and a responsible industrial policy - we expect good sustainability.

Sustainability rating: 2

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

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

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

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

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

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

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

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

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

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