

ENVIRONMENT PROTECTION AT LARGE INFRASTRUCTURE CONSTRUCTION PROJECTS – LOWER SAVA RIVER HYDROPOWER PLANTS CONSTRUCTION PROJECT

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Povzetek: Izgradnja hidroelektrarn na spodnji Savi je eden večjih energetskega projektov v Sloveniji. Ta projekt ima vplive na okolje in v tem članku so predstavljeni osnovni podatki o projektu, vplivi na okolje, aktivnosti in ukrepi varovanja okolja, odgovorni akterji ter nekatere dejansko izvedene aktivnosti in ukrepi varovanja okolja.

Ključne besede: hidroelektrarna, projekt, vplivi, okoljske zahteve, aktivnosti in ukrepi varovanja okolja

Abstract: The lower Sava river hydropower plants construction is one of the biggest ongoing power generation projects in Slovenia. This project has environmental impacts and this paper is presenting some basic project facts and figures, environmental impacts, environmental requirements, actions and measures for environmental protection, responsible parties and some real executed environmental protection actions and measures.

Key words: hydropower plant, project, impacts, environmental requirements, actions and measures for environmental protection

1. Lower Sava river hydropower plants construction project

Sava river is the longest river in Slovenia and was only partially used for power generation. Its hydro potential was recognized and Lower Sava river hydropower plants (HPPs) project (project) found its place in Slovenian national energetic program. Slovenia is with this project fulfilling several strategic goals such as:

- Increased power generation from renewable energy source (currently used 3970 GWh per year of technically possible 9.100 GWh per year).
- Decrease greenhouse gases emissions.

Basic project facts and figures are following:

- 5 hydropower plants (HPP Boštanj, HPP Blanca, HPP Krško, HPP Brežice, HPP Mokrice – Figure 1).
- Installed capacity of 187 MW (22% of current hydro capacities).
- Annual production of 720 GWh (21% of current hydro production).
- Covering 6% of Slovenian annual energy consumption.
- The project started in 2002 with the construction of HPP Boštanj. It is planned that all HPPs are constructed until 2015 in a sequence of three and a half years for construction of one HPP. Current project status is that HPP Boštanj and HPP Blanca are constructed and are in a trial operation, HPP Krško is under construction, HPP Brežice and HPP Mokrice are in a phase of spatial planning.

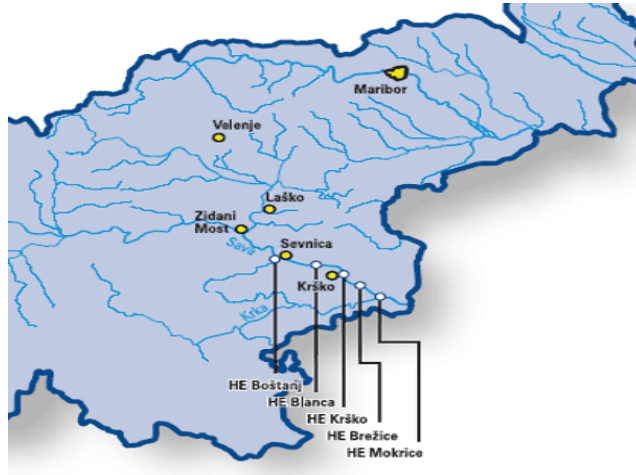


Figure 1: Lower Sava river hydropower plants

The project has the following impacts:

- Environmental
 - o Increase share of renewable energy production
 - o Decrease CO2 emissions
 - o Environment friendly power generation
- Energetic
 - o New generation units for increased consumption
 - o Improved energy supply
 - o Improved market competitiveness
 - o Improved independency
- Infrastructural
 - o Improved flood protection
 - o New waste water treatment plants
 - o Improved other infrastructure (roads, drinking water, ...)
- Agricultural
 - o Improved possibilities for irrigation
 - o Higher levels of underground water
 - o Reducing potential drought
- Local
 - o Boost for local economy
 - o New touristic opportunities
 - o New recreational possibilities

The project is split into two major parts with two investors:

- Energetic; investor is HESS company
- Infrastructural; investor is the State of Slovenia with public company INFRA

The project has following legislation frame:

- The law of concession conditions for the lower Sava river hydro potential use
- Concession contract between the State of Slovenia (represented by the Ministry of the environment and spatial planning - MOP) and HESS company (concessionaire)
- Other legislation

2. Environmental impacts

The project has impacts on environment during construction and operation phase. The first and basic goal is the environmental legislation is fulfilled. Environmental impacts during each project phase are identified, evaluated and assessed; surface water, underground water, animals, plants, air, noise, waste, landscape identity, social, and cultural impacts. For these impacts appropriate measures are used with monitoring program for construction and operation phase.

During the initial project phase many studies related to environment are executed such as identification of habitats ..., assessment of impacts on wild life, etc. Then a very important document Environmental report is generated by appropriate experts covering all environmental impacts. Then an official process of a complete environmental impacts assessment is executed by the MOP. The next very important step is the environmental impact assessment with Environmental impact report. Once again appropriate experts are involved. Once all these legislation processes are successfully finished, an environmental permit is issued by MOP.

Another safety margin in terms of appropriate environmental management is the fact the project consultant has established and certified international standard ISO 14001 for the environmental management system.

3. Concession contract - environmental requirements

General environmental requirements are set by legislation, but more detailed environmental requirements are set in the Concession contract. Following key requirements are set:

- Implement actions that water regime is not aggravated more than necessary for works execution and accumulation filling.
- Reestablish well settled condition after works completion in accordance with the issued permissions and concession contract.
- Implement actions to protect biotic diversity.
- Water quality must not be deteriorated, oil and grease catchers must be used, and monitoring must be implemented in accordance with legislation.
- Concessionaire must have a contract with a local company for floating wastes disposal.
- Natural and cultural worsening must be prevented.
- The state of Slovenia is responsible to assure prescribed water quality.

4. Actions and measures for environmental protection

At the initial stage of the project the necessary studies that identify and assess project environmental impacts are executed, such as Survey of animal and plant species, habitats with special concern on ecologically important and prevented areas, assessment of impact on wild life, ichthyological study, etc. All these studies are used for the Environmental report and in the next step also for Report of impacts on the environment. The Slovenian state's Institute for nature protection issues guidelines for environment (nature) protection. Before the project is moved into execution phase the Environmental protection conformity must be issued by MOP.

Environmental requirements and guidelines are considered during various design phases and converted into various design documents which serve for Building permit, HPP construction and, at the end, also for HPP operation and maintenance. In design documents substitution habitats, passes for water organisms (fish passes), requirements for river banks and subsidiary streams and other detailed regulations are set.

One very important and powerful tool for environmental protection is environmental monitoring which is split into three main phases:

- Environmental monitoring before the construction
- Environmental monitoring during construction
- Environmental monitoring after construction, during operation and maintenance

Monitoring scope is set by the consultant and based upon the relevant documentation; studies, reports, guidelines, and permits. Monitoring is important as it actually measures impacts and, if results are outside

permitted values then corrective measures are to be implemented. Results are also used for preventive measures and environmental management system improvements.

During the pre-construction phase it is the responsibility of the investor to executed studies and environmental monitoring. For environmental monitoring during construction and to implement regulations from design documentation for construction and in accordance with Building permit the civil works contractor is responsible. Supervision is assured with the project engineer in accordance with FIDIC requirements and responsible supervision engineers. A Technical survey is executed after the construction where state bodies (including Slovenian state's Institute for nature protection) check if execution is in accordance with the permit. Corrective actions are implemented if necessary. Investor, i.e. the HPP owner is responsible for environmental monitoring after construction, during operation and maintenance.

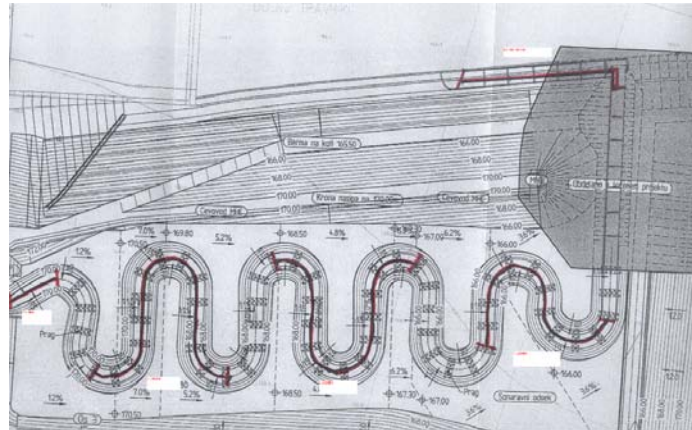


Figure 2: Water organisms pass (fish pass-path) at the HPP Blanca

Many new waste water treatment plants (communities, industry) are constructed and put in operation and contribute to improving of the Sava river water quality and consequently to improved conditions for water and by-water life.

Only a part of the project is executed at the moment, but still some examples of actions and measures for environmental protection can already be presented:

- Water organisms pass (fish pass-path) at the HPP Blanca (Figure 2)
- So called “co-natural” subsidiary streams regulations at the HPP Blanca accumulation basin
- Substitution habitats at the HPP Blanca accumulation basin

As the HPP Brežice accumulation basin is the largest in terms of surface; it also has the biggest impacts. Therefore major caution is put in designing substitution water habitats; the substitution area is one and half times bigger than the area lost (figure 3). In a designing process there is close cooperation between HPP designer, environment experts and Slovenian state establishment for nature protection.

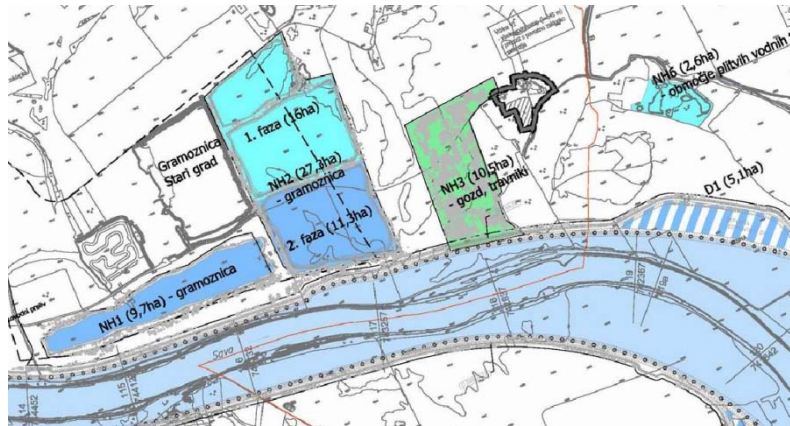


Figure 3: Substitution habitats at the HPP Brežice

5. Conclusion

The lower Sava river hydropower plants construction is a big project, not only in terms of new power generation capacities and capital investment, but also in terms of environmental impacts of all kinds. Some impacts are positive (new renewable energy source, reduced air emissions, ...) and some impacts are such that appropriate measures and actions are needed to maintain and if possible improve the environment. All involved parties are aware of these impacts and are also aware that appropriate environment management is needed. There have not been any major HPP projects in Slovenia for a long time, so large HPP construction environmental impact experience is missing and at the moment literature and experience from abroad are used for environmental actions and measures. As the project develops, more and more experience is gained also in Slovenia, and these experiences is already used and will be used even more in the future. But one thing is sure: cooperation and communication are the most powerful tools for the best outcome of the project, as well as for the environment (including nature) and humankind.