

THE RANCE TIDAL POWER STATION AND ITS IMPACT ON THE ENVIRONMENT



Wiktor Sobczyk
Faculty of Energy and Fuels, AGH University of Krakow
Carlijn van der Luit
Eindhoven University of Technology, Netherlands
Darek Petersen
University of Hamburg, Germany
Delphine Souquet
INSA Centre Val de Loire, France
Jean-Dominique Bewoin-Fils
INSA Centre Val de Loire, France



ABSTRACT

This article presents an environmental risk assessment of the Rance Tidal Power Station, focusing on its potential impacts on local ecosystems, including flora, fauna, and water quality. Utilizing methods: Analytical Hierarchy Process (AHP) and Leopold's Matrix, this assessment evaluates the significance of various environmental elements affected by the power station's operations. The results indicate that the hydrosphere and biosphere are the most vulnerable to operational impacts, while the lithosphere, atmosphere, anthroposphere, and landscape aesthetics show comparatively minor effects. Key mitigation measures and recommendations for minimizing ecological disruption are also discussed.

The Rance Tidal Power Station is the world's first tidal barrage power station, close to Dinard in Brittany, France (Fig.1). Opened in 1966, it makes use of the water level differences due to tidal activities in the estuary of the Rance River and has an installed capacity of 240 MW to generate 500 GWh annually [2]. The local flora, fauna and other nature mainly comprises local fish species, underwater plants and trees in the adjacent parks. The barrage potentially influences water flow which can cause silting and the change in the tidal behavior can impact the ecosystem in the estuary [3]. To protect nature, it is crucial to implement conservation strategies that mitigate the potential adverse impacts of the power station. In the vicinity of the power plant, a couple forms of nature protection are established, including natural monuments and landscape parks. These protected areas play a significant role in safeguarding the biodiversity and ecological integrity of the region.

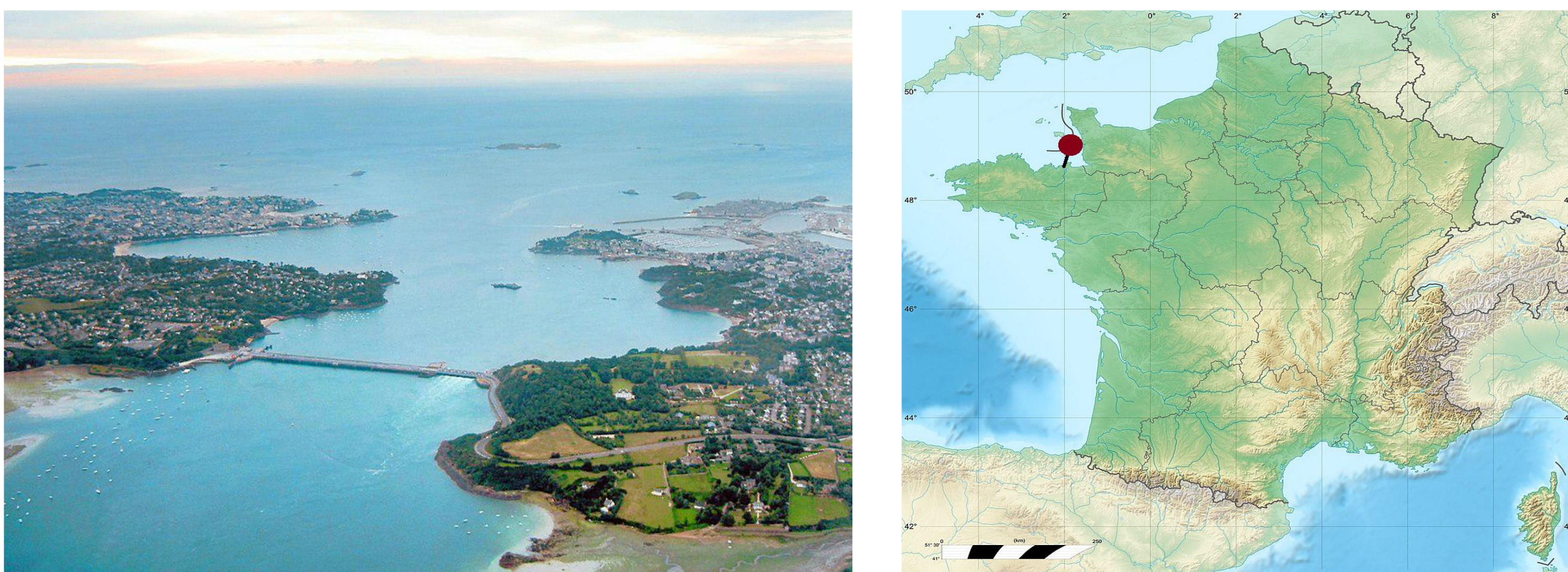


Figure 1: Location and aerial photograph of the Rance Tidal Power Station [1]

In conclusion, the environmental impact of the Rance Tidal Power Station, as assessed through the AHP model and Leopold's matrix, reveals a primarily significant influence on the biosphere and hydrosphere, with relatively minor effects on the other environmental categories. The biosphere is the most affected, particularly due to surface occupation and vibrations caused by the operation of the tidal plant (Figs.2, 3). The hydrosphere follows closely, as surface occupation and deforestation are the main concerns. In contrast, the lithosphere, atmosphere, anthroposphere, and landscape aesthetics show negligible to minimal impacts, as reflected in their low weights. These findings highlight that while the tidal power station contributes to renewable energy generation, its environmental footprint is most pronounced in the biological and aquatic domains, necessitating careful management of these areas to minimize long-term ecological consequences.

References:

- [1] E.Gaba, CC BY-SA 4.0 | [https://creativecommons.org/licenses/by-sa/](https://creativecommons.org/licenses/by-sa/4.0/).
- [2] d'Électricité de France. Produire de l'électricité sur la Rance. url: <https://www.doe.fr/>.
- [3] OES-Environnemental. La Rance Tidal Barrage. url: <https://tethys.pnnl.gov/project-sites/la-rance-tidal-barrage>.

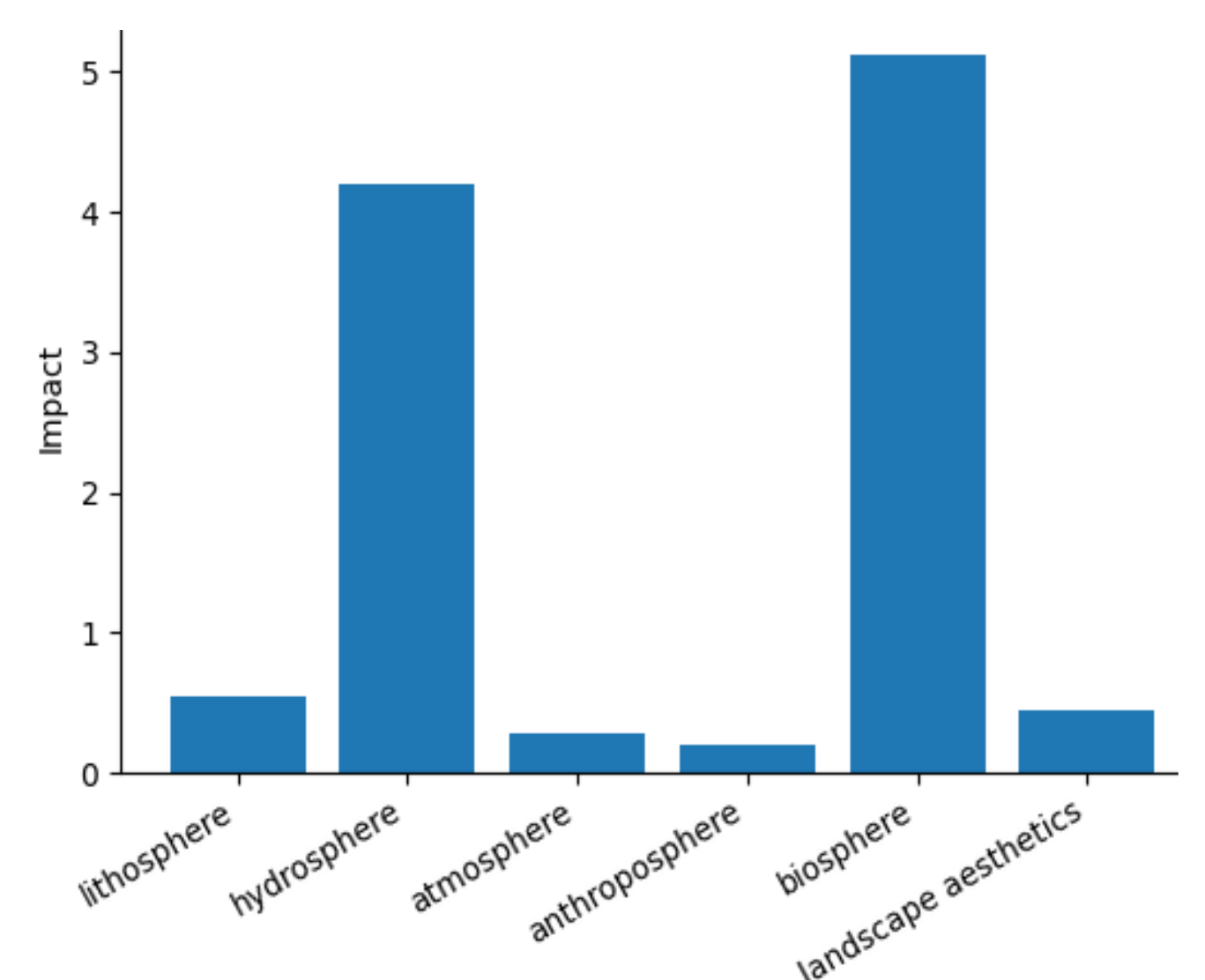


Figure 2. Impact on elements of environment

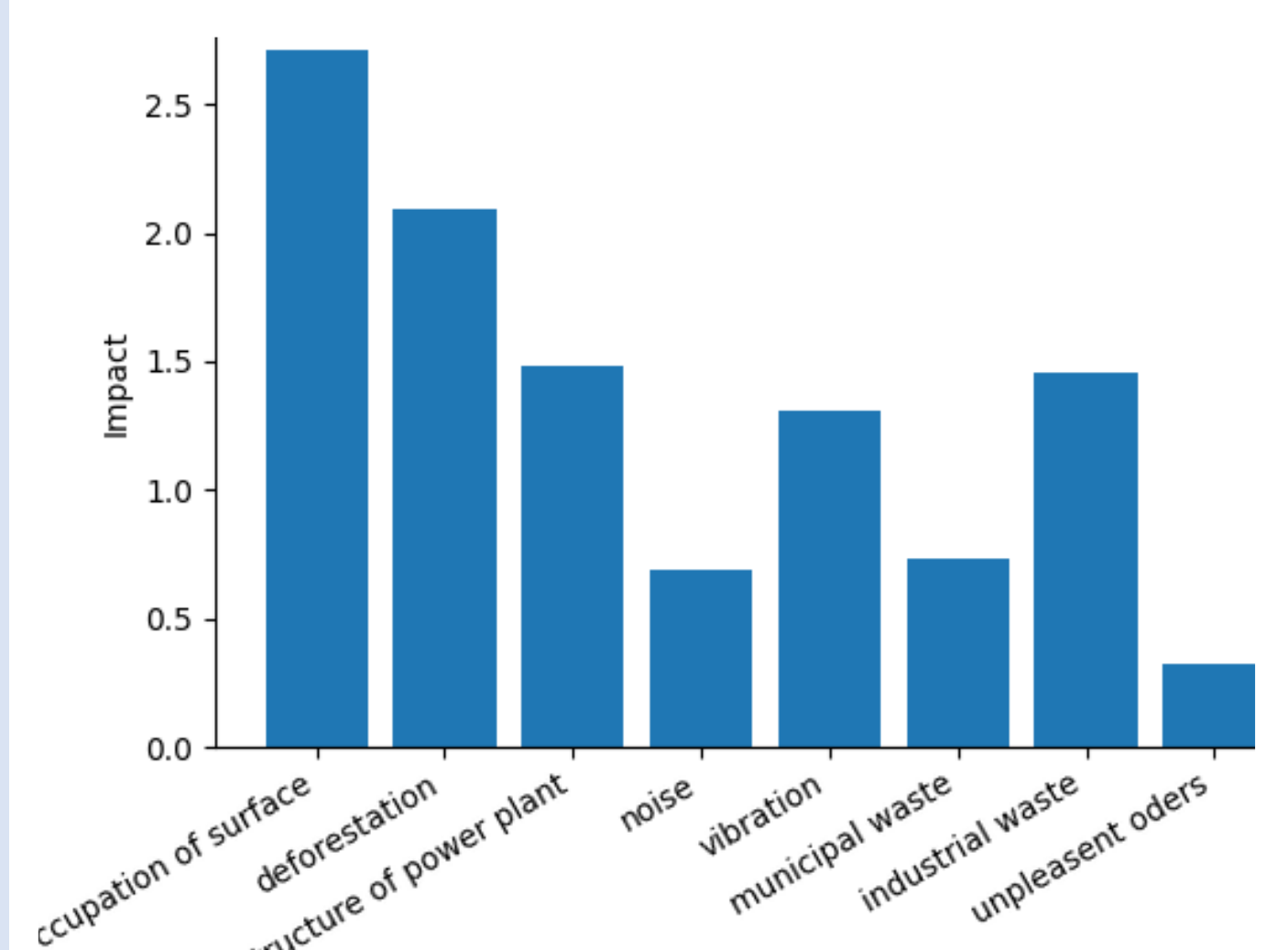


Figure 3. Impact on operations of power plant