Environmental Impact Assessment of a Mega Project in Portugal and Spain – the Alqueva Project

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Abstract: *The Alqueva is a mega project in Southern Portugal and Spain which includes a large Dam and reservoir (25.000ha, the largest in Europe), several smaller dams and a complex irrigation scheme which will benefit approximately 115.000 hectares. Several Environmental Impact Studies (EIS) were carried in order to access its environmental and socio-economic consequences. The project was twice submitted to public participation (in 1994 and 1995) in Portugal and Spain, with mixed results. Environmental authorities approved the dam and irrigation scheme but Environmental Non Governmental Organizations were extremely septic. After the initial Environmental Impact Assessment (EIA) several EIS were carried (1997-present) to deeply assess the impact of all the project components, on a step by step approach. The Dam was completed in 2002 and the irrigation scheme is scheduled to be completed by 2015. The assessment of major impacts controlled the development of some components. So far the EIA process proved to be an effective tool, providing a reliable basis for evaluation, discussion and public participation. Major impacts were eliminated or well managed with the study of hundreds of archaeological sites, the establishment of ecological sanctuaries and the adoption of restrictive practices in sensitive sites*.

Keywords: Environmental Impact Assessment, Mega Projects, Alqueva, dam, irrigation scheme.

1. INTRODUCTION – THE ALQUEVA PROJECT

The Alqueva Dam is located at Guadiana River, in Alentejo region, Southern Portugal. The reservoir is Portugal and Western Europe's largest (250 km^2).

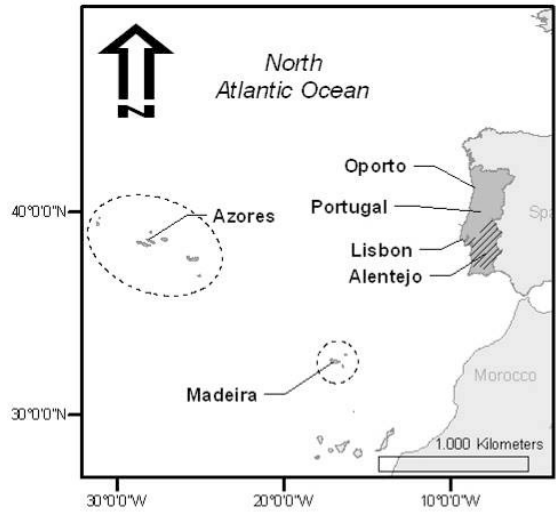

Figure 1 – Portugal's location.

The Alqueva multipurpose enterprise (EFMA, from *Empreendimento de Fins Múltiplos de Alqueva*) is a regional project which dates back to studies from the 50s, materialized in Alentejo Irrigation Plan. Following these studies, in February 1970 Guadiana's hydraulic system was first presented – Dam, Hydroelectric Power Plant and Alqueva Pumping Station.

Since then, EFMA components have been submitted to several environmental impact assessments and cost-benefit analysis, which have shaped the project's extent and form. One of the first global environmental assessments was done in 1992 – the EFMA's Global Evaluation Study (HP & SEIA, 1992), which analyzed 12 implementation scenarios. This work was responsible for the project's global outset that, for the most part, still stands: Alqueva Dam (Normal Water Level [NWL] of 152 meters), in Guadiana river, Pedrógão dam (NWL of 84,8 meters), downstream also at Guadiana river, Alqueva Hidroelectric Power Plant and irrigation infrastructures for about 115.000 hectares.

Project evaluation continued, namely with a cost-benefit analysis, in 1994 (HP), which altered the irrigation scheme concept from one water origin to two (Alqueva and Pedrógão). At this time EFMA was submitted to its first EIA – the Integrated Environmental Impact Study of Alqueva enterprise (SEIA, 1995) – that obtained a positive appraisal from the Ministry for Environment.

In the following year, project development led to the Global Irrigation System Design Development Project (HP, 1996), which resulted in the system's conceptual separation into three subsystems: Alqueva – for the irrigation of most of the land on the right bank of Guadiana river and water coming from Alqueva reservoir –, Pedrógão and Ardila, with Pedrógão reservoir as water source.

EFMA has been the subject of constant studies and evaluation processes, resulting in a regularly re-appraised and evolving project, in an ongoing optimization in terms of its operability and sustainability.

In Portugal's recent history, EFMA is one of the few cases of a truly structuring Project: with a maturity of more than a half century and including nineteen municipalities, continues to influence the way in which project development and evaluation, in general, and particularly environmental assessment are considered, on a national level.

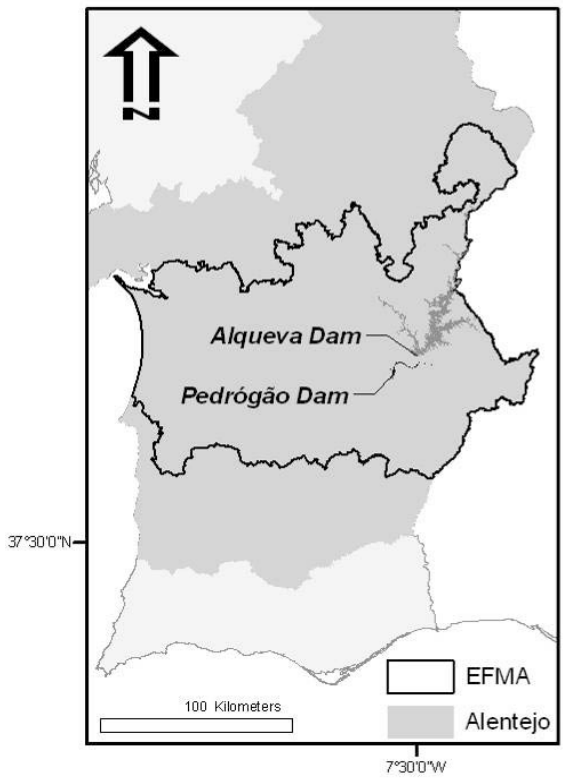

Figure 2 – Alqueva and Pedrógão Dams and reservoires and EFMA´s area of influence.

2. ALQUEVA ENVIRONMENTAL IMPACT ASSESSMENT

EFMA is a distinctive example of the application of an EIA process to a great project, on a national and Iberian scale.

EFMA's first formal Environmental Assessment occurred in 1995, with its Integrated Environmental Impact Study (SEIA, 1995). This study was considerably wide, analyzing all of EFMA's predictable impacts, including the whole Guadiana River and estuary system, surface and groundwater quality, ecological river flows, the ecological depiction of the entire area, the soils, structural hazards, etc.

The study gathered some of the best national experts in the fields of study and obtained a positive ruling from the Ministry for Environment for the whole EFMA. As a result, EFMA became a project of national public interest and one of the development strategies for Alentejo region. This was recently confirmed by the national plan for land management politics.

Subsequent to design evaluated in SEIA (1995) has been accompanied by several assessment moments, evaluated by the Alqueva Infrastructures Following and Evaluating Committee (CAIA) or through formal EIA procedures.

CAIA establishment is, in fact, one of the unique characteristics of EFMA's global EIA process and resulted from 1995's Ministry for Environment steers.

The ongoing assessment is also a consequence of this decision, as well as the commitment to invest significant amounts in environmental monitoring and compensation, since the Ministry's resolution acknowledged that the 1995's Integrated Environmental Impact Study was the first step of a complex evaluation process.

This statement from the Ministry for Environment was actually decisive for the project's approval by the European Union (EU), endorsing financing opportunities fundamental for project implementation, both within European Regional Development Fund and agricultural funds, and the Cohesion Fund.

The environmental assessments thus conducted have had different ranges of analysis, from more global evaluations, at the level of irrigation subsystems design, to the specific assessment of one project component, whether a dam, an irrigation block or a connection water pipe.

Till now, Alqueva Global Irrigation System as originated about 21 formal EIA procedures through EIS and 12 Construction Project Environmental Conformity Reports, not accounting for the numerous preliminary environmental impact studies developed so far and other environmental assessment reports evaluated by CAIA.

But more than the number of projects, what stands out from these EIS is the complexity of the analysis and the level of demand that they typically exhibit. In fact, projects like the ones emerging from Alqueva Global Irrigation System lead to simultaneous and important potential impacts coming from one single structure on environmental factors as diverse as soil, surface and groundwater resources, ecology, archaeology, land management, agricultural systems and socio-economy. The need to adequately integrate all these perspectives in a single assessment has promoted the growth of technical teams responsible for EIS and their diversification in terms of the expertise to be involved.

Furthermore, EFMA's visibility and magnitude has lead to a high public exposure of its EIA procedures and a significant contribution from Environmental Non Governmental Organizations (ENGO) in terms of critiques and commentaries to the reports produced.

All these factors contribute to EFMA's EIA procedures being characterized by a different level of demand when compared to current EIA practice. It has also led to the formation of multidisciplinary and longer lasting teams and the permanent cooperation with universities and experts from several domains of knowledge.

Most of the Alqueva Global Irrigation System infrastructures has been and would be submitted to more than one environmental assessment, most of them being subject to at least three: SEIA (1995), EIS or Preliminary EIS of the respective irrigation subsystem and EIS or Construction Project Environmental Conformity Report of the given infrastructure.

3. MAJOR IMPACTS (POSITIVE AND NEGATIVE)

Main negative environmental impacts of Alqueva infrastructures are expected to arise during construction phase, and affect surface water resources, ecology, landscape and archaeological sites. These will emanate from hydraulic circuits' components, especially dams and their reservoirs.

Figure 3 – *Linaria ricardoi* is a little annual and rare plant, considered of priority conservation by Habitat European Directive.

Figure 4 – This Roman Dam intersects a river bed which was supposed to be trimmed for a drainage network of an irrigation block but suffered only a mild intervention in order to preserve the classified monument.

Major negative impacts have been predicted to distress surface water resources, ecology and groundwater quality, in the case of irrigation blocks. These effects are related to the expected loss of riparian habitats and promotion of a less natural hydrographical network due to dam presence and also with animal mortality risk associated with canal presence, as well as its barrier effect. Other impacts concern fauna perturbation caused by habitat fragmentation associated with agriculture, water transference, storage and supply and irrigation infrastructures and groundwater degradation by the potential increase in fertilization and chemical use.

These projects will have vital positive impacts, mainly throughout operation phase. These effects are envisaged to occur on groundwater resources, on land management and on agricultural systems and socio-economy of the municipalities involved. Indeed, irrigation of this arid and poor part of the country was one of the reasons for the conceptualization of this project.

4. PROJECT IMPLEMENTATION AND POST EVALUATION

EIA procedures completed so far and plans for continuous environmental assessment of EFMA infrastructures, is helping to identify effective mitigation and compensation measures, as well as monitoring plans, for the implementation phase.

The EMP cover issues such as soils, surface and groundwater, ecology and archaeology. It will require a permanent technical structure within the company responsible for running the whole enterprise, capable of responding to data handling and course of action needs, especially if new or more significant environmental impacts arouse, compared with the ones predicted by EIA.

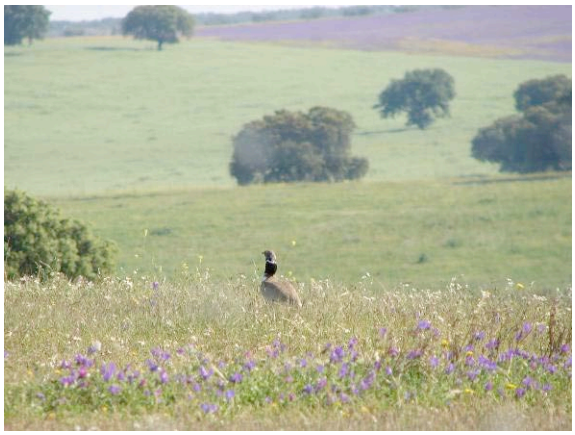

Figure 5 – Species found and intended to be preserved in Alentejo – the Little Bustard (*Tetrax tetrax*).

This systematic information gathering will inevitably and in the medium term, be questioned, in terms of its operability and advantage, considering its cost-benefit at a time the country is facing financial and resource constraints and in which requests and expectations posed to EIA are becoming more and more demanding (Sadler, 1997).

On the other hand, maintaining these monitoring procedures in the projects operation phase will keep on pressure on the technical and scientific community to respond the needs generated by the former.

5. CONCLUSION

The Alqueva multipurpose enterprise (EFMA) is a project whose spatial and time range and analysis width correspond to a practically unique case in Portugal, when it comes to development projects.

Its environmental assessment began in 1995 (by SEIA) and is on-going. Following the initial assessments, of a more general character, came dozens of EIA procedures concerning small or medium size infrastructures. These processes, which are currently going on, are characterized by a crossover analysis of multiple environmental factors, including surface and groundwater quality, soil, ecology, archaeology, etc. The range of analysis covered in these studies also varies considerably, from the local effect of implanting an irrigation pipe and its impact on a Palaeolithic archaeological site to large scale water transfer between river basins, with possible outcomes on the regional distribution of endemic species.

EFMA´s environmental assessment has sometimes been responsible for delays in project implementation schedule and numerous project changes in order to op-

timize its environmental performance, some of them minor adjustments but others of a significant weight compared to overall project investment. Indeed, despite the ever present criticism, it is obvious that environmental sustainability has found its way in the elaboration and implementation of EFMA projects, with a complexity and institution participation in the field that shows the commitment to the environmental and social promotion of this mega project.

The vast array of studies, projects and environmental assessments that were and are still being conducted concerning this project are redefining the expertise of technical and scientific consultancy.

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