



# The Tous Multipurpose Dam and Reservoir System

## Descriptive Summary

Multipurpose reservoirs, like the Tous Dam and the Júcar river reservoir system in Spain, exemplify integrated water management using the NEXUS approach, addressing the complex demands of irrigation, industry, human consumption, flood control, ecosystems, and power generation. The key challenge is balancing the competing needs of various water users, which requires careful planning and transparent decision-making by Dam boards. These boards, representing different stakeholders, make seasonal release decisions based on expected demands and precipitation. The Tous Dam and the associated dam system in eastern Spain is one such case. Altogether it ensures water security in the Júcar River Basin by regulating water for hydroelectric production, irrigation, and urban use, while also providing flood control. This system highlights the importance of strategic management in optimizing water resource distribution among energy, agriculture, urban needs, and environmental conservation.

## Background

The flexibility of hydropower as a renewable resource is fundamental to matching electricity production and consumption. It contributes to the development of other renewable, intermittent sources of electricity, such as wind and solar power, which are less flexible and require additional means of production. Moreover, floods and periods of drought are the biggest water management problems for many countries. With climate change, these events will become more frequent and more serious. Against this backdrop, multipurpose reservoirs are a key component in mitigating water-related disasters and ensuring water security for all water uses. In Spain, the governance of reservoirs involves a multi-layered approach that emphasizes collaboration among key stakeholders to ensure effective management of water resources. At the national level, the legal framework sets out regulations and guidelines for reservoir management, including in laws such as the Water Act (*Ley de Aguas*) and Royal Decrees. River Basin Authorities (*Confederaciones Hidrográficas*) oversee the management of reservoirs, being responsible for water resource accounting, water allocation between users, and environmental protection of downstream water bodies by setting environmental flows. This framework is laid down in the river basin management plan, expanding the requirements of the EU Water Framework Directive. The Júcar River Basin Authority also operates infrastructure like public dams and canals that enable the System's operation. In the event of drought, River Basin Management Plans

foresee potential restriction on water use and conditions to dam operations. Stakeholder participation is integral to reservoir management in Spain, ensuring that diverse interests are considered in decision-making processes. Within each River Basin Authority, governance bodies and advisory committees such as governing boards and technical committees play key roles in decision-making and policy formulation, with representation from government agencies, water users, agricultural associations, municipalities, environmental NGOs, and industry representatives. Users' assemblies coordinate the operation of reservoirs and water infrastructure, reflecting the interests of water users in management decisions. The Dam's Board (*Comisión de Desembalse*) is responsible for proposing to the Presidency of the Júcar River Basin Authority the appropriate filling and emptying regime of the Dam, taking into account the water rights of the various users. Its composition and operation are regulated in such a way as to guarantee an adequate representation of the affected interests, involving the representation of administrations, energy, agricultural and water users. The whole Júcar System rests mainly upon 3 reservoirs, the Alarcón reservoir, (52% of the System's storage capacity) the Contreras and the Tous reservoir (18% of the System's storage each of them). The system's demand includes a population of around 2 million people, an irrigated area of around 91.000 ha and 1.412.907 MWh annual electricity production in 5 reservoirs and 11 run-on-the-river hydroelectric plants. The System's operation is further complicated if one considers the existence of a nuclear plant using the River's water for refrigeration, and the need to ensure environmental flows to a dependent Ramsar Wetland (L'Albufera Natural Park) and the River itself. Additionally, the dam acts as an intermediary in Spain's largest water transfer (the Tajo-Segura water transfer) and it also contributes significantly to securing yet another supply in a third basin through another water transfer (the Júcar-Vinalopó water transfer). The high relevance of the Tous Dam stems from two factors:

- On the one hand, thanks to its position in the final part of the river and its 378,6 hm<sup>3</sup> of storage capacity, its role is essential in regulating the system and meeting the demands of water users downstream in the Júcar River System.
- In addition, the Tous dam and the system's reservoirs have sufficient flood control capacity to manage and control the floods in the upper basin of the River Júcar, this abatement factor being a complementary function to the aforementioned regulatory function.

In the management of the Dam, there are several trade-offs to be managed, involving energy, agriculture and environmental uses: As per the Water Act, environmental flows and the L'Albufera lake water needs take precedence over water users'. That is, those needs have to be met before the rest of the water stored is distributed to the water uses. This way, the higher the environmental flows, the less water is stored for irrigation demands. As for the situation regarding a potential drought, in the current hydrological year, autumn and winter rains were at their lowest level in the last 33 years amounting to 89 mm as compared to 170mm in the previous year. Nevertheless, thanks to the careful management of previous years stored volumes in the system amounted to 634 hm<sup>3</sup>, 57% of total capacity, and higher than the average of the last 20 years. The Júcar exploitation system is thus not under drought currently, as opposed to nearby systems that are under "alarm" and "alert" scenarios, the two most acute drought risk situations.

## **Aims and Goals**

The aim of reservoirs and reservoir management is to ensure that water needs of downstream users are met. In the case of the Júcar System and the Tous dam, its relative size to the basin demands ensures that, with adequate management, demands can be met over several years. Moreover, the regulation of river flow and its large storage capacity allows the system to address hydrological risks to a large extent, including droughts and floods.

Regarding the production of electricity, the flexibility of hydropower as a renewable resource is fundamental to matching electricity production and consumption. It contributes to the development of other renewable, intermittent sources of electricity, such as wind and solar power, which are less flexible and require additional means of production. In Mediterranean rivers, without the regulation capacity of reservoirs, river flows would be too small to enable meaningful hydroelectric production.

### **Actions taken**

The inclusion of water users in the Dam's Board, has enabled the interests of hydroelectric uses, farmers, urban demands and environmental needs to be considered. The participation of the River Basin Authority and regional governments ensures that the decisions taken are balanced according to the different interests at stake.

From the planning point of view, the Júcar River Basin Authority approved the 2022-2027 River Basin Management plan in January 2023, setting the allocation of water volumes in the Júcar river exploitation system. The Dam's Board for the Júcar Exploitation System has been meeting at least twice a year to decide on the calendar for water releases. The last two meetings took place on November 2023 and March 2024. It is worth noting that the latter took place in March and not in April or May, as it is usually the case. This advancement was a precaution taken by the board given the looming drought risk in the Júcar River in 2024 ([Júcar River Basin Authority, 2024](#)). Nearby systems had been suffering from drought conditions and the situation in the Júcar River System needed careful consideration to ensure that released volumes would not be needed later on in the season. Furthermore, the Board deemed appropriate to convene again on April 2024 and May 2024, to ensure a close follow-up of the potential drought situation.

### **Main Achievement to date**

To date, the Tous dam and the rest of the reservoirs in the system continue releasing water volumes to enable energy and agricultural demands, and no restrictions have been deemed necessary thanks to the reservoir's capacity and management in previous years. Currently, dam levels remain at 62% in the last three months, as compared to an average of 51% the months of March-May of last decade. Nevertheless, a precautionary approach has been taken and a call was made to all users downstream to prepare and even consider starting already to implement water saving measures voluntarily to avoid potential impacts if the drought situation worsens in the coming months.

In more general terms, the regulation capacity of the dam and the whole reservoir system enables the satisfaction of water demands, including the upkeep of environmental flows of the Júcar river downstream from the dam. Water feeding the Albufera lake is also released from the dam and transported through the irrigation canals, as agreed with the farmers associations.

**Partners**

Jucar River Basin Organization Jucar river Dam board

**Lessons, replicability and scalability potential**

The participation of energy, agriculture and urban water users in the management and planning bodies of the RBO, and particularly in the Dam's Board (in charge of setting the reservoir exploitation regime) ensures that the various needs and views are considered and heard.

The normative setting derived from the Spanish Water act, the water planning regulations and other laws and regulations sets the legislative and institutional framework for the balancing of the various interests from energy, urban, agricultural uses and ecosystems. The development of a comparatively large reservoir system strengthened the water security of downstream users, including the irrigators, urban, wetlands but also the water availability for energy production.

Another contributing factor is the organization level and experience of the stakeholders after 20 years and 3 management plans.

The WFD requires stakeholder to be consulted and participate in water planning. With the addition of stakeholders' participation in management and governance of the water organization required by the Water Act, this governance framework strengthens the capability of the system to manage WEFE Nexus relations. The exploitation of the Dam constitutes an example of how the governance system, enabling a participatory regime in water management and planning, contributes to balancing Nexus trade-offs. This is also applied in other reservoirs in the country.

**Affiliation**

Júcar River Basin Authority Mediterranean Network of Basin Organizations

**Keywords**

Reservoir water management stakeholder participation hydroelectricity irrigation

**Country**

Spain

**Start year**

Mon, 01/01/2001 - 12:00

**End year**

Fri, 01/01/2027 - 12:00

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**Total funding**

+5M €

**Environmental**

Medium-High

**Social**

High

**Technological**

Medium

**Financial**

Medium-Low

**Institutional**

High

**SDGs**



**Website**

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**Nexus Dimensions**

Ecosystems

Energy

Food

Water

**City**

Tous

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