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Mini Review

Water Supply in Greater Bilbao

Legarda F[1], Alegría N[1]*, Peñalva I[1], and Silveiro A[2]

[1]*Energy Engineering Department, University of the Basque Country (UPV/EHU), 48013 Bilbao, Spain*

[2]*Ingider, 48013 Bilbao, Spain*

***Corresponding author:** Alegría N, Energy Engineering Department, University of the Basque Country, Spain.

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Abstract

Although rain in Bilbao and surroundings reaches 1200 mm of accumulated average rainfall annually [1], there are not reservoirs that are able to keep the necessary water for the domestic and industrial supply of the one million residents that live in its metropolitan area. These days, talking about water transfer between basins implies a political and social conflict, but thanks to the water transfers that were agreed in the 50s-60s, the water needed by this region has been provided continuously during the last decades.

Keywords: Water transfer; Water supply; Water storage

Introduction

The town of Bilbao and the municipalities that make up its influence area, bathed most of them by the waters of River Nervión, are located in the north of the Iberian Peninsula, as shown in Figure 1 [2].

This urban area has a unique population density. It was known as the metropolitan area of Greater Bilbao and is it is also called the Bilbao Metropolitan Area nowadays. It comprises 30 towns that gather near one million residents, which represents 80 % of the population of the province of Bizkaia [3].

According to a continental climate, with soft winters and summers, it receives an annual accumulated rainfall of approximately 1200 mm (Figure 2).

Figure 1: Map of Europe [2].

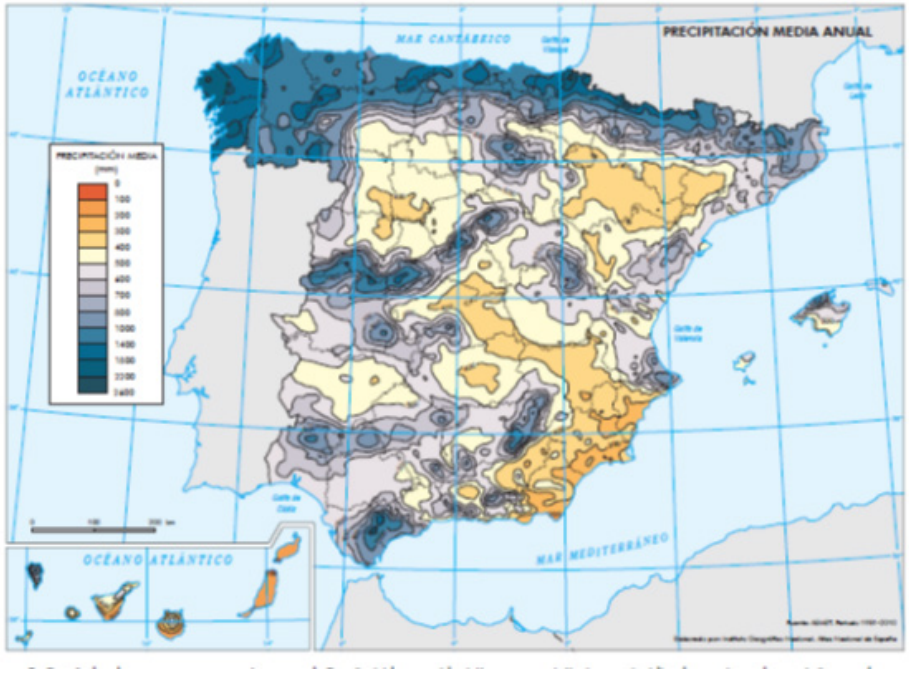

Figure 2: Average values of the precipitation in Spain [1].

In 1979, after the end of the dictatorship and together with the approval of the Constitution, Spain was divided into communities and these, in turn, into provinces, which constitute political delimitations with special characteristics. Bilbao is the capital of the province of Bizkaia, one of the three provinces that belong to the Community of the Basque Country.

The area that corresponds to the province of Bizkaia has a special feature: there are not reservoirs that can supply water to the population. As shown in Figure 3, Bilbao is located in the north region colored in white that has no water storage.

The management of the water in Spain is carried out by the confederations that are defined by the big basins: Duero, Tajo, Guadiana, Guadalquivir, Segura, Ebro and the one of the norths, that brings together all the basins of the rivers that flow into in the Cantabrian Sea. Figure 4 shows the rivers and the seas where these flow into according to the three possible watersheds.

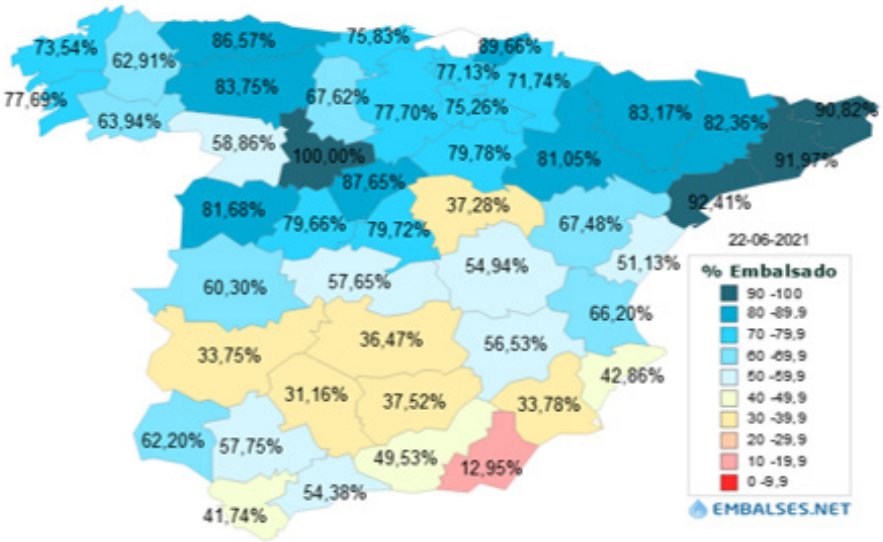

Figure 3: Water storage divided by provinces [4].

Figure 4: Watersheds in Spain [5].

In the region of Bizkaia, due to its orography and population, it has not been possible to store water in big quantities in order to supply the water needed by the residents for their life.

Therefore, in the 50s-60s two very important concessions were authorized to carry out water transfers from the Mediterranean basin to the Cantabrian basin. The first and most important one in terms of water supply is the water transfer from River Zadorra, located in the province of Araba, that provides between 70% and 80% of the water needed. The second one is the water transfer from River Cerneja, located in the province of Burgos, that reinforces the water supply regulated by River Ordunte, providing the remaining 20-30%.

Discussion

Zadorra-Arratia water transfer

This water transfer has its origin in one concession that was processed between 1925 and 1935 to use the transferred water for hydroelectric purposes and for supply of towns. Anyway, it was not until 1957 when the Zadorra-Arratia water transfer was built. This way, the water from a tributary of River Ebro that flows into the Mediterranean Sea was transferred to River Arratia that flows into the Cantabrian Sea. Two reservoirs, connected between them by an underground pipe, were built: Ulibarri-Ganboa with 146 hm^3 and Urrunaga with 72 hm^3.

Figure 5: Scheme of the Zadorra-Arratia water transfer.

The transferred flow rates regulated by these reservoirs are used to run turbines in Barazar hydroelectric power plant before discharging in River Arratia in their way to the Cantabrian Sea. From 1967 these same flow rates started to be used for the supply of Greater Bilbao (Bilbao Metropolitan Area nowadays) thanks to an agreement among the users. The average value of the transferred water is 120 Hm3/year, among which 100 Hm3/year are for water supply and 20 Hm3/year are surplus-water flows that are transferred in order to avoid floods in the city of Vitoria-Gasteiz. As a compensation, the reservoirs of River Zadorra return an ecological flow to the basin of 1,2 m^3/s in summer and 0,9 m^3/s in winter. Thanks to this water transfer an average electricity production of 80 GWh/year is generated. Figure 5 shows a scheme of this water transfer.

Cerneja-Ordunte water transfer

In 1928 a Royal Law stablished that the town of Bilbao could manage the exploitation of River Ordunte and River Cerneja in

Mena Valley. The water transfer from River Cerneja was built in 1961, providing 13 Hm3/year approximately to the reservoir of Ordunte for the supply of water to Bilbao. The capacity of this reservoir is 22 hm^3 on an area of 48 km^2. The dam-toe hydroelectric power plant located in this reservoir generates an average electricity production of GWh/year.

Conclusion

The economic and social development of the Bilbao Metropolitan Area, with noticeable industrial impact in the past years, would not had been possible if the water supply were not guaranteed thanks to the water transfer from the Zadorra system.

The planning that has been developed in Spain during the last years restricts the water transfers to the point that new water transfers are almost unfeasible, in most cases due to political interests. If these water supply needs had to be covered nowadays, desalination would play an important role. It is important to note that when considering a population close to one million residents, these desalination techniques, in particular the ones based on membranes technology, are less competitive and almost unviable due to the big quantity of energy that needs to be consumed for the water filtering processes and for reaching the consumption pressures.

Assuming that the cleanest energy is the one that is not used, the catchment of water resources in reservoirs that are located at elevated altitudes, do not need energy for the distribution and only a negligible quantity of energy will be needed for the treatment.

Acknowledgement

None.

Conflict of Interest

No conflict of interest.

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