Supplementary material for the paper "Freshwater for Cooling Needs: A Long-Run Approach to the Nuclear Water Footprint in Spain"

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INDIVIDUAL REACTOR PUBLISHED DATA AVAILABLE

Cofrentes data have been compared with official statistics appearing in the Cofrentes webpage and some research papers. For example, Asensio et al., (2000) state that water consumption is around 21 hm^3/year. Likewise, Cofrentes website provides information about its flow rate (i.e. maximum total consumption volume of 20 hm^3/year and an amount of water catchment of 34.7 authorized hm^3/year). Finally, the Boletín Oficial del Estado establish a water withdrawal flow of 23.65 hm^3/year, coinciding with the figure of maximum withdrawals granted.

Data for Trillo, Almaraz, and Zorita have been contrasted with data from Greenpeace environmental reports and Tajo Hydrographic Confederation. First, Greenpeace states that Trillo´s water consumption is 21 hm^3/year, whereas Nuclear Jose Cabrera (Zorita, as known) consumes 15 hm^3/year and Almaraz 16 hm^3/year. On the other hand, the Tajo´s Hydrographic Confederation speaks that water withdrawals for Trillo are around 37.8 hm^3/year and its consumptive use is around 20.50 hm^3/year. For Almaraz the same source offers 436 hm^3/year for withdrawals and 46.30 hm^3/year for consumption. Additionally, other sources provide data for water withdrawals from these plants. Water withdrawals data for Trillo from BOE coincides with the maximum water flow of the River Basin (45 hm^3/year). The Consejo de Seguridad Nuclear (CSN) estimates in 210 hm^3/year the water withdrawals for Zorita. Other figures for this nuclear power plant are 362.66 hm^3/year (maximum water flows) and 224 hm^3/year (BOE). Finally, Almaraz data for water withdrawals vary from 583 hm^3/year (BOE and Libro Blanco del Agua), 1,461 hm^3/year (CSN), and 2,522 hm^3/year (max. water flows).

Similarly, Greenpeace environmental reports and Ebro´s Hydrographic Confederation provide some data about Ascó and Santa María de Garoña. In this way, the Ebro River Basin states that the data on freshwater demands for cooling for Ascó (units I and II) and Garoña are 2,270 hm^3/year and 766 hm^3/year (these figures also coincides with data from Libro Blanco del Agua for both cases), respectively. On the other hand, Greenpeace estimates that Garoña employs 720 hm^3/year for cooling. Data for Garoña and Ascó (units I and II) from the CSN are 756 hm^3/year and 1,140 hm^3/year. In case of Ascó the BOE states around 2,324 hm^3/year (equal to maximum flows) and for Garoña, around 767 hm^3/year.

We have assumed that nuclear power plants run 24 hours 365 days a year to transform the available data to cubic meter per year (m^3/year).

As shown above, the few cases where some figures are provided, the available data cover either water withdrawals or water consumption but not both. In other occasions the sources obviate to define whether the figure provided refers to withdrawals or consumptions or to differentiate between cooling technologies or individual facilities. As explicit data for each nuclear power plant are lacking for most Spanish reactors, we resorted to estimations based on the international literature. In this way, we compare the different WW and WC factors for each of the Spanish nuclear reactors resulting from homogenizing as much as possible the available published data on water needs and contrast them with the estimations of the water factors of the different cooling technologies by the international literature.