Relationship between water and energy consumption calculated

**Energy production** uses large quantities of water and, in turn, water provision requires considerable amounts of energy. A new study has investigated the interconnection between water and energy, the ‘water-energy nexus’, in Spain and found that 5.8% of total electricity consumption is for water-use and 25% of water withdrawals are for energy generation.

**Understanding the link** between water and energy becomes more critical as future demand for both resources intensifies. This study evaluated the electricity consumption associated with all stages of water use, from water extraction to wastewater treatment, in addition to the water withdrawn and consumed to generate energy in Spain.

It was found that, in 2008, total electricity used to manage the 35,000 Mm³ (million cubic metres) of water in the entire water use cycle was 16,323 GWh (gigawatt hours). This represented 5.8% of demand for electricity in Spain in that year.

The most energy consuming stage of the water use cycle was extraction and treatment prior to distribution, which, across all sectors, accounted for 64% of the total water-related electricity demand. For the other two stages of the water use cycle, distribution accounted for 21% of the water-related electricity demand in 2008 and wastewater treatment accounted for 16%.

Water use in agriculture accounted for about 58% of the water withdrawn in Spain in 2008 and, as a sector, irrigated agriculture accounts for 40% of total water-related electricity demand. Irrigation practices were modernised during the last decade and about 40% of the irrigated area changed from conventional flood and gravity irrigation to drip irrigation systems. Drip irrigation uses less water, but has increased energy use in the agricultural sector. However, alternative, less energy intensive water sources may become more preferable as the cost of generating energy rises.

In 2007, 25% of the total water withdrawals were used in the energy sector, although 96% of this amount of water was returned after use (i.e. it was not consumed). Nuclear power accounted for 50% of these energy-related water withdrawals and solar thermal power accounted for 0.03%.

Although renewable energy technologies typically require less water than fossil fuel technologies, some renewables, such as biomass, still require relatively high volumes of water - 31 litres per kWh (L/kWh), compared to 3 L/kWh for solar thermal. The study estimated the water footprint for biofuels in Spain, focusing on first-generation biofuels used in the transport sector. Growing biomass on dry land would increase agricultural demand for water by 10%, and by 26% if irrigated agricultural land was used.

The researchers recommend that water is used more efficiently to reduce energy costs in absolute terms, and must be considered in energy plans. In addition, measures are needed to ensure that a switch to renewable sources of energy is not compromised by future water shortages.

This study focussed on water-related electricity consumption before distributed water is actually used, and so excluded the energy needed to heat household water. However, the researchers note that significant amounts of energy are needed for this purpose: 21% of primary energy consumed in Spanish households is estimated to be associated with domestic hot water.


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