

Flexible management of hydropower plants would contribute to a secure electricity supply

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Researchers from the UPV/EHU's Institute of Public Economics and BC3, the Basque Centre for Climate Change, have been cooperating for several years on the study and projection of so-called security of electricity supply in Spain. The country is regarded as an 'electricity island' owing to its scant interconnection with neighboring countries. This feature underlies the projections of the country's power demand, generation capacity, and supply over the coming decades. Drawing on these projections the researchers evaluate the degree of security of supply and assess how it will change in response to the sources of electricity that are gradually abandoned or promoted. The scientific journal *Energy* has recently published the second article relating to this study in which another two BC3 researchers have taken part.

Starting from known values of power consumption and generation the group of researchers developed a model to project the evolution of these two variables in 2020, 2030, 2040 and 2050.

"Other authors have made projections of electricity consumption and reckon that it will grow one decade after another, a bit more than 1% per year. With respect to electricity sources, for the next 10 years the projections indicate that coal and nuclear will undergo a sizeable reduction, and by 2040 these two technologies will cease operation," said José Manuel Chamorro-Gómez, from the UPV/EHU's Institute of Public Economics. The former loss in [generation capacity](#) will be offset by an increase in renewables. Further, "the capacity of all the renewable plants due to come into operation will be greater than the one now available of non-renewable generation, but everything seems to suggest that the security of supply will nonetheless be affected," added the researcher.

By their very nature, renewable power sources are intermittent, uncertain, and non-dispatchable. All of these features impinge on the system and increase the risk that a fraction of demand will not be met by the available sources, which renders the supply less secure. "Right now, the existing system does not guarantee 100% of supply in any scenario, but in our models we have seen that the potentially unmet fraction will be much bigger in the future, and supply shortages will be more frequent," said the researcher.



The possibilities offered by hydraulic energy to ensure security of electricity supply are being studied in depth. Credit: Diego Cervo / Stockfresh

In this study they explored thoroughly the possibilities offered by a source of renewable energy that lends itself to a more flexible management, namely hydropower. "Hydro plants can be adjusted by the people in charge of operating them; the flow of water to the turbine can be regulated at any moment, which, no doubt, would partly alleviate the risk of a supply shortage. Furthermore, hydro stations with reversible turbines play a dual purpose: in addition to increasing power generation at times of higher demand, when this is lower the turbine can be used to pump water upwards to the reservoir (by using electricity); this way, water can be stored and used later on to generate electricity once more when demand increases again. According to our results, that would alleviate, to a certain extent, the risk of being unable to meet demand when it surges," he argued.

However, the authors also refer to the environmental aspects that have to be taken into account when addressing and planning the use and operation of hydro stations. "From the viewpoint of power generation, water is obviously a resource, but this resource is of course in a context. The impact that power plants and reservoirs have on river basins is undeniable. So the administrations or [policy makers](#) above the station operators have to set the rules of the game, and these rules need to be clear in terms of ecological flows, discharge

frequencies and other parameters," said Chamorro.

Besides the resource of hydro plants, the researcher listed another series of measures that could be adopted to fully address demand, thus guaranteeing security of supply. "Firstly, much research is being conducted on electricity storage. If you can come up with a system in which, say, you store the electricity generated by the wind during a period of low demand, you will have a way of using it when needed. Or you can encourage consumers to use their household appliances during non-peak hours when the price of [electricity](#) is lower. Furthermore, [electric vehicles](#) could feed their charge into the grid at a given moment to supplement supply. Progress is being made in different aspects to achieve a system in which demand peaks are met as fully as possible," he concluded.

More information: Luis M. Abadie et al, On flexible hydropower and security of supply: Spain beyond 2020, *Energy* (2020). DOI: [10.1016/j.energy.2020.117869](https://doi.org/10.1016/j.energy.2020.117869)

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