Simulating the cost of generating a combination of electricity sources

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Increasing reliance on renewable energies is the way to achieve greater CO2 emission sustainability and energy independence. As such energies are yet only available intermittently and energy cannot be stored easily, most countries aim to combine several energy sources. In a new study in EPJ Plus, French scientists have come up with an open source simulation method to calculate the actual cost of relying on a combination of electricity sources. Bernard Bonin from the Atomic Energy Research Centre CEA Saclay, France, and colleagues demonstrate that cost is not directly proportional to the demand level. Although recognised as crude by its creator, this method can be tailored to account for the public's interest-and not solely economic performance-when optimising the energy mix.

The authors consider wind, solar, hydraulic, nuclear, coal and gas as potential energy sources. In their model, the energy demand and availability are cast as random variables. The authors simulated the behaviour of the mix for a large number of tests of such variables, using so-called Monte-Carlo simulations.

For a given mix, they found the energy cost of the mix presents a minimum as a function of the installed power. This means that if it is too large, the fixed costs dominate the total and become overwhelming. In contrast, if it is too small, expensive energy sources need to be frequently solicited.

The authors are also able to optimise the energy mix, according to three

selected criteria, namely economy, environment and supply security.

The simulation tested on the case of France, based on 2011 data, shows that an optimal mix is 2.4 times the average demand in this territory. This mix contains a large amount of nuclear power, and a small amount of fluctuating energies: wind and solar. It is also strongly export-oriented.

More information: Bonin, B. et al. (2014). "MIXOPTIM: a tool for the evaluation and the optimization of the electricity mix in a territory." *European Physical Journal* Plus. DOI: 10.1140/epjp/i2014-14198-7

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