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SMARTER CALCULATIONS KEEP GRID COSTS DOWN

Miguel F. Anjos

One of the biggest challenges of managing the electricity grid is the so-called unit commitment (UC) problem: how to match electricity supply and demand over a specific period of time while keeping costs as low as possible.

The more accurate the answer, the more efficiently and cost-effectively the grid can operate. But with a host of variables at play, from how quickly each generating unit can ramp up and down to the daily peaks and valleys in electricity demand, the calculations can quickly become unmanageable. So how do you come up with good answers in a timely way?

WISE's Miguel Anjos and his colleagues began by looking at binary or "yes/no" variables: things like whether a particular generating unit is on or off. When they compared different UC formulations, they discovered - surprisingly - that minimizing the number of binary variables actually reduces the efficiency of the calculations. In this case, more variables mean faster answers.

Next, they examined inequality constraints: the upper limits of variables that can have a range of values. How much electricity a wind turbine produces, for example, varies according to wind speed, but each turbine has a maximum possible output.

By pinpointing the inequality variables with the biggest impact and ignoring the rest, the researchers were able to produce accurate results more quickly.

Using these findings, Anjos and his colleagues developed a new, efficient UC formulation to optimize grid operations. It promises not only to cut electricity costs today but also to manage the increasingly complex grid of the future, as more and more renewable energy sources get added to the mix.

Partners: Mprime - the Canadian Network of Centres of Excellence for the Mathematical Sciences

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