Innovative electricity system balancing tool helps keep Britain's lights on

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A new cutting-edge tool developed in collaboration with researchers from the University of Strathclyde is helping to revolutionize the real-time balancing of Britain's electricity network.

Energy experts at the University teamed up with the Electricity System Operator (ESO) to design an optimization tool that paves the way for net-zero electricity system operation in Great Britain. It enables the control room to make better use of the most economic service providers, including fast-response batteries.

System balancing

To maintain a balance between electricity generation and demand, the ESO operates an hour-ahead market known as the Balancing Mechanism (BM). The first phase of the Open Balancing Platform (OBP), developed as part of the ESO's existing program of operational improvement, is supporting transformation of system balancing by allowing control room engineers to send instructions to hundreds of balancing units in each battery and small BM unit (BMU) zone across Britain at the touch of a single button.

In the past, balancing electricity generation and demand involved sending dispatch instructions to several large generators. Greater numbers of smaller generators including fast-response batteries are participating increasingly in the BM market. The addition of these assets brings about potential cost savings, but also an increased number of dispatch instructions and greater complexity.

Strathclyde developed an early-stage proof of concept within the MDI (Modernized Dispatch Instructor) project, a collaboration with ESO which helped identify the system requirements and form a view on the approach to bulk dispatch optimization. Building on Strathclyde research, a mathematical optimization tool, referred to as the Bulk Dispatch Optimizer (BDO) has been created for control room engineers. It became operational in the Electricity National Control Center (ENCC) in December 2023.

The ENCC is Great Britain's central hub for operation of the national electricity system, moving electricity around the country from where it's generated to where it's used and ensuring that supply and demand are balanced minute-by-minute.

Single button

Bulk dispatch gives control room users a proposed set of optimized instructions based on the lowest cost solution, subject to BMU constraints. Previously, engineers had to manually instruct each action on each unit and check BM rule compliance. With bulk dispatch, instructions can be sent at the press of a single button, significantly reducing the number of manual instructions and time taken to instruct small BMUs and batteries, ultimately optimizing network balancing and delivering value for consumers.

Dr. Waqquas Bukhsh, a specialist in Power Systems Optimization, led Strathclyde's input to the project. He said, "The variability of wind and solar power mean that the system operator needs to be much more agile than in the past. However, they also now have many more options for how to balance the system, including using batteries that have come down massively in cost in the last few years.

"The trick is knowing how to make best use of all the different options. That's what our mathematical expertise has been able to do. This tool will benefit every electricity user in the country, aiming to drive value for consumers by reducing costs and enabling net-zero carbon operability."

Professor Keith Bell, Scottish Power Professor Future Systems at Strathclyde, a long-standing collaborator with the ESO, said, "The go-live of this tool at the national electricity system control center is a major milestone. It's fantastic to witness our academic research making a real

impact, building on many years of close engagement with the electricity industry on the challenges in migrating to a zero-carbon energy system."

Craig Dyke, Director of System Operations, ESO, said, "Release 1 of the Open Balancing Platform is a huge step forward for the sector and provides an essential foundation to making improved use of available low carbon energy. The University of Strathclyde was a key contributor, having developed a prototype for BDO as part of an innovation project, and providing guidance on further development towards production.

"The university brought a unique ability to translate mathematical concepts to the practical challenges of power system operation."

Provided by University of Strathclyde, Glasgow

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