

THE MATHEMATICS OF ELECTRICITY STORAGE

TakeAIM Winner 2013:
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The UK electricity market is complex, dynamic and often controversial. Meeting our energy needs while moving towards greener fuels is one of the biggest challenges facing us today. Innovation is everywhere, from wind farms and solar panels to smart meters and electric vehicles, but an energy supply that's affordable, reliable and sustainable is yet to be achieved. My research uses mathematical modelling to explore how different technologies could be used in conjunction to supply power reliably and sustainably, while keeping prices for consumers low.

For instance although wind farms produce renewable power, they often go unused when the grid cannot handle the variable, unpredictable power they produce. Electricity storage technologies such as CAES (compressed air in underground salt caverns) can store power during high winds and release it during peak demand, potentially alleviating this problem. With my research we address questions such as 'How would electricity storage operate in the market?', 'How could it be financially viable?' and 'Where on the network should stores be located to prevent surges or blackouts?'.

By modelling the system as a whole rather than focusing on each individual component, we can understand how changes to different parts of the energy system would impact consumers, investors and overall carbon emissions. Our unique approach will offer insights into how electricity storage could benefit both consumers and the environment, and motivate investment for further storage technology research and development. Ultimately this research will contribute to making a low carbon future an affordable reality.

Competition sponsors:



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MATHEMATICS**

The use of mathematics has profound consequences in all walks of life, but the opportunities that it opens up often go unrecognised or underexploited. The Industrial Mathematics KTN, enabled by the generous sponsorship of six leading corporate partners, ran the third annual TakeAIM competition in 2013 to make visible the crucial role that mathematics will increasingly play in all aspects of our lives. The competition was open to all undergraduate and postgraduate students working in the mathematical sciences. Authors of the best two entries each received a MacBook Air as their prize, with additional prizes being awarded to two runners-up.