

29 February 2016

The Institution of Civil Engineers
1 Great George St
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RE: National Needs Assessment- Call for Evidence

Open Energi, National Grid and Cardiff University welcome the opportunity to contribute to the National Needs Assessment (NNA) Call for Evidence, in its support for the National Infrastructure Assessment.

The National Infrastructure Commission (NIC) has named future-proofing UK energy infrastructure in its priorities with specific attention to the role of energy storage and demand side response technology and the stated aim of 'reducing the long-term need for investing in a surplus of back-up power stations and unnecessary network reinforcements'. Given these defined priorities, Open Energi, National Grid and Cardiff University are submitting the jointly published research paper 'Power System Frequency Response from the Control of Bitumen Tanks', attached in annex to this letter. Published in 2015, the paper is the result of ongoing collaborative research by Open Energi, National Grid and Cardiff University and looks at the feasibility of demand side response to provide a significant share of frequency balancing services. Key highlights from the report are noted below, with reference to the specific questions of the NNA.

Q: What new and emerging technologies and disruptive trends should we consider in producing this assessment?

Dynamic Demand is a Demand Response service unique to Open Energi that reacts instantaneously to second-by-second changes in the balance between supply and demand on the grid. Keeping power grid frequency in balance doesn't necessarily require expensive, fast-responding power plants or utility-scale batteries. With the right technology, the same job can be done with supermarket refrigerators, or water pumps, or even tanks of bitumen. Before it's turned into roads, bitumen must be kept in enormous tanks at temperatures of about 150 degrees Celsius, a task that requires an immense amount of electricity. But this enormous electrical load also comes with "a huge amount of thermal inertia- the tanks stay hot for a long time without electricity, losing only about 1.5 degrees Celsius over half an hour of being turned off- creating a grid resource for Open Energi's targeted grid service: fast-responding, short-duration dynamic frequency response for UK grid operator National Grid. Frequency response in the UK has traditionally been done by large power plants that ramp generation up and down; an inefficient way to react to quick grid frequency changes, particularly those that can arise with more and more intermittent wind and solar power coming onto the grid. The attached study demonstrates the ability to deliver full response from field-tested bitumen tanks within 2 seconds, compared to 5 to 10 seconds for a thermal generator. Compared to the inefficient and greenhouse-gas-intensive method of quickly ramping power plants up and down, demand-side flexibility is essentially carbon-free.

Q: In what areas can demand management or other forms of behavioural change make a significant impact?

Research published by Open Energi, National Grid and Cardiff University, attached in annex to this letter, evidences the potential of demand side response (DSR) technology meeting the UK's crucial grid balancing requirements faster than a conventional power station.

Bitumen tanks equipped with Dynamic Demand were used in combination with National Grid's model of the GB transmission system to investigate the capability of industrial heating loads to provide frequency response to the power system. The conclusion is that Dynamic Demand deployed at scale is able to contribute to the grid frequency control in a manner similar to, and, crucially, faster than that provided by traditional peaking power generation. Field tests showed that full response could be provided in less than two seconds, as compared to 5 – 10 seconds for a thermal generator. Large scale deployment of Dynamic Demand will reduce the reliance on frequency-sensitive generators and ensure that the grid stays balanced in a cost-effective, sustainable and secure manner. The research findings are central to National Grid's Power Responsive campaign, which aims to increase DSR participation in the balancing services market by 2020, making DSR one of the major means for delivering frequency response. The research simulations help to shape National Grid's understanding of DSR as a replacement for frequency-sensitive generation and will be used when they are planning their requirements for grid network operation in the future – with huge impacts on the future of our energy mix. Open Energi is already working with some of Britain's largest organisations including Aggregate Industries, United Utilities and Sainsbury's to deliver this service to the grid, using its Dynamic Demand technology.

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