Technology Strategy Board
Driving Innovation

Innovation **results**

AN R&D CASE STUDY #025

Maximising wind energy to power homes

The project successfully demonstrated an energy demand-management system to maximise the use of wind-generated electricity in real-life situations.

The need

To help reduce carbon emissions, the Government requires 30% of electricity to be generated from renewable sources by 2020, an increase of from 5.5% on 2008 levels. Wind energy will make up a substantial part of this renewable energy. However, the amount of electricity generated from wind farms depends on the strength and quantity of wind, which cannot be predicted. In addition, the electricity distribution system cannot store electricity and generation has to match demand from consumers at all times. Demand-side management is a method that can be used to optimise the demand for electricity and its production from wind.

The results

The project partners, led by Senergy Econnect, developed and tested a prototype, web-based, demand-management system, 'Demand for Wind' (www.demandforwind.co.uk), which aims to optimise the amount of wind-generated electricity used in domestic homes.

The system changes the timing of domestic electricity demand by switching equipment on when wind energy is available. It also allows switching from gas to electricity for heating, thus exploiting renewable energy that might otherwise not have been produced (ie wind turbines switched off) or sold at a lower price because of surplus capacity. Trials in 11 homes across the UK tested the system's two-way communication, collected high-resolution electricity consumption data and optimised the load control software.

Although the system tested is at an early stage, the trials demonstrated that the scheme is feasible with existing technology. Analysis of the collected data confirmed the significant potential for demand-side management in the residential sector.

The trial data, together with computer modelling, indicate that given a surplus in wind generated electricity for 20% of the time, the demand management system could shift about 10% of heating requirements to wind energy without any impact on the consumer.

This implies an annual reduction in non-renewable energy consumption of about 550 kWh per household, corresponding to 105 kg of CO_2 per household (if wind energy replaces gas) or a reduction in domestic CO_2 emissions of about 4%.

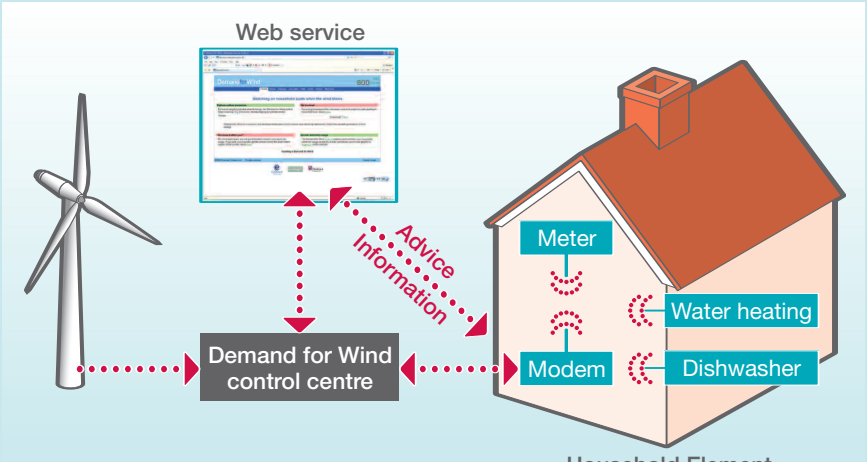
Demand-side management

Demand-side management involves actions that influence the amount or patterns of use to better match electricity production and consumption. The aim is to maintain a smooth flow of electricity, avoiding 'peaks' and 'troughs' in supply and demand.

How does Demand for Wind work?

Electricity monitoring data captured by the Household Element are submitted every minute to the web service (a secure interface for Internet communication with the households). The web service saves the data in the database and returns control signals, which in turn operate the controllable loads. The 'brain' of the system is the Demand for Wind control centre (see schematic diagram), which contains the software that determines whether controllable loads should come on or not; it makes this assessment based on information about wind generation and data stored in the database.

The web service gives users information on their electricity consumption and generation, enabling them to understand their usage patterns; it also offers a quick way to customise certain load-control parameters.



Schematic of Demand for Wind concept

Future activities

The website service and control centre will continue to gather data and intelligence. Feedback from trial participants on what level of control is acceptable will feed into plans for further development. Commercial opportunities include:

- Tailoring the system for energy saving purposes.
- Applying the system in markets with a higher penetration of wind energy than that in the UK.

HOW THE TECHNOLOGY STRATEGY BOARD MADE A DIFFERENCE:

'The Demand for Wind system maximises the value of wind energy, thus helping to reduce carbon emissions.'

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Project partners
Senergy Econnect Limited
Good Energy Limited
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£140,800

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£281,600

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