

science summary



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Resource use in the Environment Agency: the energy efficiency of pumping stations and their associated infrastructure

Science Summary SC070017

Climate change is one of the top priorities for the Government, with a national target to cut CO₂ emissions by 60% by 2050. The UK Government set out its policy to deliver a secure, low carbon energy mix for the UK in May 2007 when it published its Energy White Paper 'Meeting the Energy Challenge'. The White Paper announced specific measures that will ensure individuals, businesses and Government reduce their carbon emissions and save energy.

A key announcement is the implementation of a mandatory national scheme, the 'Carbon Reduction Commitment' (CRC), which could come into force in January 2010. The CRC requires reductions in CO₂ emissions to be real – i.e. you cannot use offsetting or buying green electricity as a substitute for absolute energy use savings. Therefore the Environment Agency has to clearly understand where real energy-savings and reductions in CO₂ emissions can be delivered across the organisation.

In 2006/07, the Environment Agency produced 62, 207 tonnes of CO₂ emissions, of which 56.7% is attributed to electricity usage. The largest consumer of electricity within the organisation is pumping stations – accounting for two-thirds of electricity use and 35% of total CO₂ emissions. We have set a target to reduce our carbon emissions by 15% by March 2010 and by 30% by March 2012.

This study is our first step towards reducing carbon emissions from our pumping stations. It is a detailed analysis of energy use and carbon emissions at a sample of eight pumping stations completed between December 2007 and February 2008. The study assesses what carbon reduction measures are available, through more efficient use of energy or use of different technology, and how much the measures will cost. It also demonstrates a method of benchmarking, in which the performance of pumping stations can be compared in terms of how much carbon they emit per unit of water pumped.

One pumping station was selected from each of the eight Environment Agency regions in England and Wales. The eight selected stations were: Crossens, Kennet, Foss, West Sedgemoor, Union, Thamesmead Lake Four, Gronant and Highbridge. They represent a range of ages and sizes, from large manned stations with up to 17 pumps, to very small, unmanned stations with just three pumps. They include examples of the three main pumping station functions – land drainage, flood protection and water transfer.

At each station, information was collated to study the performance of each pump, using direct measurement of flow rates and energy use, and referring to data provided by the manufacturers. We also examined how the pumps are managed, including all their associated machinery and infrastructure plus how the pumping stations are heated and lit.

The combined electrical consumption of the eight pumping stations was 3,134,281 kWh in 2007. Together, they emitted 1,725 tonnes of CO₂, including diesel fuel.

We recommend a range of energy saving measures at each pumping station. These include the following:

- Reduce the height through which the pumps lift water (the pumping head), by altering the water levels.
- Use the most efficient pumps in preference to less efficient ones at each site.
- Improve heating systems, by installing heat pump technology or small and easily controlled radiant heaters.
- Upgrade to more efficient lighting.
- Turn down heating set points, switch off lights and close external doors when not in use.
- Use wind power to generate electricity.

By implementing the energy-saving measures recommended in this study, a potential 255 tonnes of CO₂ per year could be saved, representing 14.8% of the

total emissions from these stations. The costs of these measures will be recouped in energy savings, although the payback periods range from immediate to 10 years, depending on the initial investment.

If similar energy saving measures were available across all the Environment Agency's pumping stations, this would represent substantial progress towards meeting our carbon reduction targets. But currently there are some 2000 pumping stations and a sample of eight is not large enough to provide confidence that it is representative. We recommend that a similar analysis is carried out over a larger sample of stations.

We also recommend further research on our benchmarking measures for pumping stations, to see whether or not they are suitable to be applied as standard at all pumping stations.

Many of the pumps examined in this study are decades old. Often, good performance data are not available, and their design makes it very difficult to measure their power consumption or flow rate. Also, at some sample pumping stations, it was difficult to identify how much electricity was being used by which facilities. We recommend that systems are put into place to gather and collate pump performance data, and to systematically collect half-hourly, sub-metered electrical consumption data, where possible. These measures will greatly help our efforts to improve energy efficiency at pumping stations, by showing how much energy is being used and where there is potential to improve efficiency.

The results of this study will be used by the Environment Agency's Internal Environmental Management Teams and Regional MEICA Engineers to co-ordinate and prioritise activities and actions to meet the carbon reduction targets.

This summary relates to information from Science Project SC070017, reported in detail in the following report:

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