

Energy and Atmosphere

The burning of fossil fuels to generate electricity and to power transport vehicles results in the release of gases to the environment. For this reason energy, transport and emissions to atmosphere are considered together in this report. Information on global warming and climate change is presented in the Emissions to Atmosphere section of this report.

Case Study

Combined Heat and Power Systems

Our Combined Heat and Power (CHP) units use biogas, a by-product of sludge digestion, as engine fuel. The engine turns a generator that produces electricity, used to operate our electrical plant.

Due to the nature of our business we have a large energy requirement and related cost. In order to reduce our reliance on fossil fuel derived electricity imported from the grid, we increased our number of CHP units.

An additional output from a CHP unit is the heat given off by the engine. We capture this heat and use it to assist in maintaining the correct temperature of sludge digestion plant.

In 2003 we awarded contracts for the installation of new CHP units on four of our sites, bringing our total number of CHP units to six. These four new units came on-line during 2004. When fully operational, the annual electricity generated from all six units will be about 13,000 MWh. Any electricity not used

on site will be fed into the electricity grid for sale as renewable energy.

Our increased CHP capacity has several advantages:

- Reduced demand of electricity from the local grid
- Reduced greenhouse gas emissions through reduced demand of non-renewable derived electricity
- Income derived from the generated electricity fed back to the grid
- Electricity generated from CHP units is exempt from the Climate Change Levy. (This levy is explained further in the Emissions to Atmosphere section)

Due to the benefits gained from CHP units, we carried out initial investigations into the potential for developing CHP plants at additional sites.

Energy use by the UK water and wastewater industry was over 8,000 gigawatt hours in 2003-2004

We used 424,366 megawatt (million watt) hours of energy to provide customers with drinking water, treat customers' wastewater and for our own office use in 2004

In water supply operations we used 151,111 megawatt hours of electricity and 190 megawatt hours of gas

In wastewater treatment operations we used 247,015 megawatt hours of electricity and 17,386 megawatt hours of grid supplied gas



Inspecting part of the Combined Heat and Power plant at Goddards Green in Sussex

Our core business is the supply of drinking water and the treatment of wastewater. The greater the demand for these processes, the greater the energy requirement to meet these demands. As future wholesale electricity prices are expected to continue to rise between now and 2007, greater energy requirements will mean even greater costs so, even if we kept our electricity demand the same, our costs will increase. The electricity we buy from the local supply grid is generated from a mix of different fossil fuels.

Key Performance

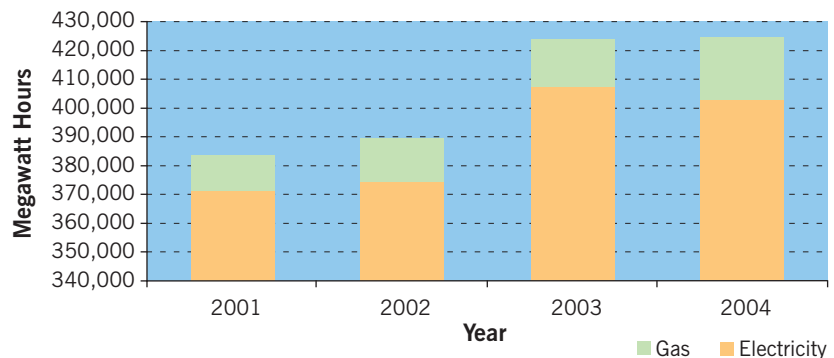
- We achieved an electricity saving of 1,178 megawatt hours over 2004
- We generated a total of 4,009 megawatt hours of CHP electricity in 2004
- Of the total electricity we generated, 3,059 megawatt hours was used on our sites in 2004
- We exported 950 megawatt hours of renewable generated electricity to the grid in 2004

Energy Demand

Accurate monitoring of energy used on our sites and the flows passing through these sites helps us to identify where we can further improve site operational energy efficiency. We currently have detailed energy consumption and flow data for 62 wastewater sites and 75 water supply sites. This information has enabled us to reduce energy demands – and costs – on a number of our sites by highlighting areas of the process that can be improved and made more energy efficient. Improvements on a number of our sites meant that we reduced our electricity demand by 1,178 megawatt hours over the 2004 financial year.

Following the rise in 2003, our total energy demand has remained about the same for 2004, with a decrease in electricity consumption, but an increase in gas consumption. The decrease in electricity consumption was in part due to our energy efficiency initiatives.

Fixed Sites Energy Consumption



Alternative Technology

Low head hydropower water turbines can be used to recover energy lost by water falling from a height. We identified a number of our wastewater treatment works and reservoirs where we could use this technology and further enhance our energy efficiency. We will carry out

further work over the next year to determine the financial viability of this option at our sites.

Following a feasibility study into the potential for installing large-scale wind turbines on our sites, we identified a strong business case for development at three sites. We are currently finalising tender documents for the design, build, operation and maintenance of these turbines.

In collaboration with other water companies and organisations from England, Northern Ireland and the Republic of Ireland, we carried out a study on the suitability of sustainable treatment technologies and renewable energy at small wastewater treatment facilities. This study concluded that a number of options were available. Specific site assessments are necessary to determine our most appropriate options.

2004-2005 Target	2004-2005 Progress	2005-2006 Target
Energy		
Carry out water and wastewater works optimisation to save 400 megawatt hours.	Achieved power saving of 1,178 megawatt hours.	Investigate minimisation of energy consumption in wastewater operations.
Deliver four new biogas fuelled combined heat and power electricity generation systems.	Four new CHP systems installed and brought on line during 2004.	Reduce imports of brown electricity (fossil-fuel generated) via delivery of CHP.

KEY: Target met In progress Target not met

Key Performance

- **56.7% of biogas we generated was used as a source of fuel for boilers producing heat in digesters and dryers and as a fuel for Combined Heat and Power (CHP) units during 2004**
- **Odour complaints have fallen by 16% in 2004, compared with 2003**

Odour Control

Following a High Court ruling in May 2003 relating to wastewater treatment and odour, the Department of Environment, Food and Rural Affairs (Defra) announced the development of a Code of Practice to address the issue of odour from sewage treatment works. A Consultation on the draft Code of Practice on Odour Nuisance from Sewage Treatment Works was published in December 2004. The final document is yet to be issued by Defra.

Odour emissions will occasionally happen when an odour control plant develops a problem or an operational issue on site occurs. We monitor odour complaints from our customers and seek to determine the most effective methods of managing our odour control issues.

In September 2004, work commenced on a framework contract to look after and maintain a number of our odour control plants. In addition, Ofwat approved funding of £10.9 million to enable us to address difficulties we have been experiencing with seven of our large odour control plants.

Biogas Production and Use

During 2004 we monitored the amount of gas produced from the digestion process on our sites. We used 56.7% of this gas by-product as fuel for boilers, dryers and CHP units. The remainder was flared off (burnt) via flare stacks. This is flared off as we are currently unable to use it. One unit of methane has a global warming potential of 23 units of carbon dioxide. Flaring off this gas means that we are releasing carbon dioxide instead of methane, and further reducing our potential impact on global warming.



A methane gas holder at Worthing Wastewater Treatment Works

Odour is a specific issue associated with the wastewater treatment process. Very low concentrations of hydrogen sulphide gas are detectable by a characteristic bad egg smell. The purpose of our odour treatment plants is to deal with this gas

Our wastewater treatment processes generate a flammable gas by-product, which is known as biogas

A waste product of burning any carbon-based fuel is carbon dioxide gas. This is considered to be one of the key greenhouse gases

In the 10,000 years before industrialisation, carbon dioxide levels appear to have varied by less than 10% globally. In the 200 years since 1800 concentration levels of the three main greenhouse gases (carbon dioxide, methane and nitrous oxide) have all risen by over 30%

2004-2005 Target	2004-2005 Progress	2005-2006 Target
Air		
Develop periodic controlled programme for the maintenance of odour control units to ensure efficient and effective operation.	Information on odour control units has been gathered and will be implemented into a controlled maintenance programme during 2005-2006. ✓	Develop odour management guidance to specific timescale criteria for responding to customers.

KEY: Target met ✓ In progress ✓ Target not met ✗

Climate change has serious global implications for economies, societies and the environment. The UK Climate Impacts Programme (UKCIP) provides detailed information to help organisations prepare for climate change.

Climate Change

Natural greenhouse gas emissions maintain the atmosphere of the Earth at a global average temperature of 15°C. Without this natural greenhouse effect, the average global surface temperature of the Earth would be -18°C. Additional man-made emissions of greenhouse gases increase this natural effect. It is this additional increase to which global warming and climate change are attributed.

The main greenhouse gases attributed to climate change are carbon dioxide, methane and nitrous oxides. The burning of fossil fuel is one of the main sources of these greenhouse gases.

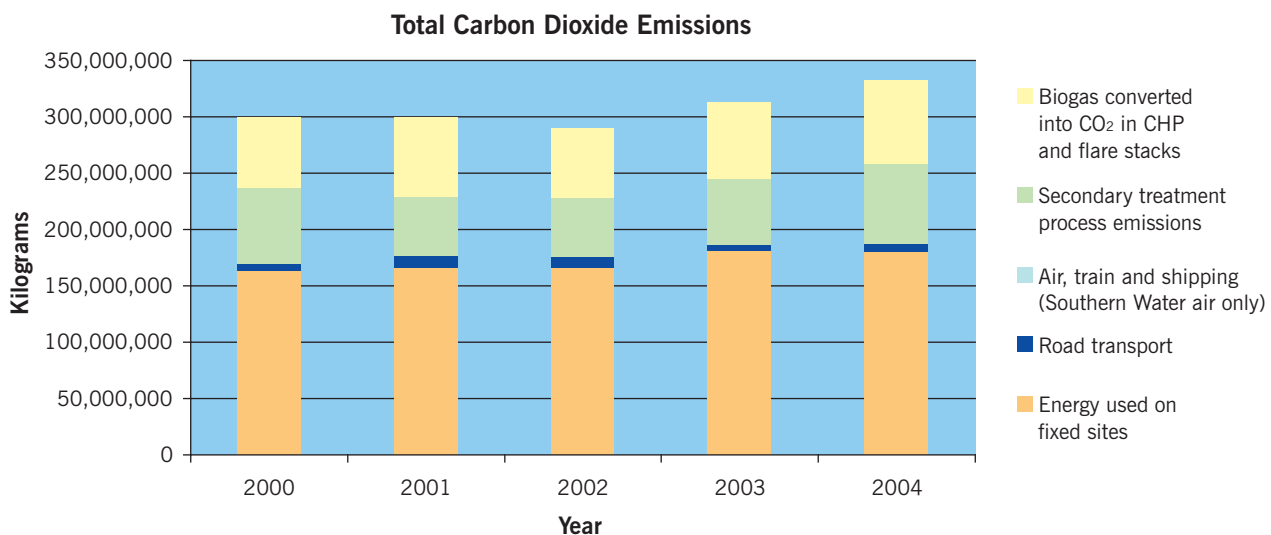
In February 2004, the 1997 Kyoto Protocol became binding for all countries that signed up to it. The goal of the protocol is for industrialised countries to reduce greenhouse gas emissions to 5.2% below 1990 levels between 2008 and 2012. The European Union states must also collectively reduce their emissions by 8% during the same period.

As of April 2001, the Climate Change Levy (CCL) was introduced in the UK as an economic instrument to assist in meeting the Kyoto Protocol targets. The CCL affects all non-domestic consumers of energy. It is a flat rate charge on each unit of energy consumed.

Energy exempt from this CCL charge includes that from CHP and forms of renewable energy.

UK water and wastewater companies met with Water UK and their research body (UKWIR) to develop a method to calculate industry greenhouse gas emissions across the industry. This methodology should be available to all the UK water and wastewater companies during 2005.

We have slightly increased our carbon dioxide emissions in all areas, with a small reduction in energy used on fixed sites. Our decreased electricity consumption and increase in our CHP capacity has contributed to this reduction.



We monitor our fuel consumption for fleet vehicles via our fuel provider. We monitor annual mileage of all our company vehicles. If excessive mileage is recorded, individual vehicle users are contacted to determine the mileage pattern is correct. We monitor other mileage, on private vehicles, via expenses issued through our payroll department.

Key Performance

- Our average fleet incident rate over 2004 was 26%

Fuel Usage and Alternatives

The European Union (EU) has been setting increasingly tighter emission regulations on cars and light commercial vehicles. The current requirement is for all new engines to meet the Euro 4 regulations. These relate to limits set for emissions of nitrous oxides, carbon monoxide, hydrocarbons and particulate matter. All new vehicles that we lease must meet the Euro 4 emission regulations. To ensure all our vehicles are safe and remain within all relevant regulations, we carry out regular servicing and inspections. We conduct monthly reviews to ensure any service issues are rectified as soon as possible.

Liquefied Petroleum Gas (LPG) is used to fuel modified petrol engines. LPG is a butane or propane gas, which emits lower levels of harmful emissions than petrol. We looked at the use of LPG-petrol fuelled vehicles for our commercial fleet on a number of occasions in the past and found it was not a viable option. However, the 2005 Chancellor's budget has made a number of tax concessions to the fuel duty imposed on LPG. We are currently preparing a further report on the use and viability of using LPG as a fuel for our commercial fleet of vehicles.

We are currently assisting Hampshire County Council in trials on a hybrid car (conventionally fuelled engine, assisted by on-board batteries).

Vehicle Accidents

The RAC currently quote that 65% of all corporately driven vehicles in the UK are involved in some form of crash every 12 months. During 2004, 246 of our vehicles were involved in some form of incident. This is equivalent to 26% of our vehicle fleet, well below the UK average. To maintain responsible driving, we have developed a Driver's Handbook covering safe vehicle and road use. To enhance driver awareness we have carried out the following:

- Specific training in towing of trailers and use of cranes on vehicles
- Awareness of hazardous substances


At the end of March 2005 our vehicle fleet consisted of:

- 319 cars
- 612 commercial vehicles
- 11 heavy goods vehicles
- 22 plant vehicles (including tractors)

"Fleet sector crashes:

- 65% of all corporately driven vehicles are involved in a crash every 12 months"

RAC, 22nd February 2005

2004-2005 Target	2004-2005 Progress	2005-2006 Target
Transport		
Continue to assess the benefits of alternative fuels.	Trial of a hybrid vehicle has commenced and we are reviewing liquid petroleum gas as a fuel option. 	Assess the benefits of alternative fuel-powered vehicles.

KEY: Target met  In progress  Target not met 