

The Carbon Management Programme

Carbon management
challenges and
renewable energy
opportunities in the
UK water and waste
sectors





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Preface



Severn Trent understands that we must take responsibility for the environmental and social impacts of our business. Climate change, as the most important environmental issue facing the world today, is a high priority of our corporate responsibility programme. The carbon management scenario discussed in this report reveals that we face an important challenge in controlling our emissions going forward, whilst continuing to provide high quality environmental services.

Our renewable energy activities are an important part of our climate change mitigation programme. We will continue to encourage government to promote policies and instruments that are good for both the environment and for business growth, such as renewable energy generation. We will be exploring the opportunities for our two largest businesses – Severn Trent Water and Biffa Waste Services – to work together further to generate greater renewable energy. Together these businesses handle around 12%¹ of the UK's 'renewable carbon': biodegradable waste and sewage sludge that can be converted to valuable renewable energy.

Severn Trent is grateful for the support of the Carbon Trust in making this carbon management project possible.

Colin Matthews, Group Chief Executive, Severn Trent

¹ This figure excludes agricultural waste that remains within the agricultural sector



Climate change will have fundamental consequences for business performance and company valuation. Carbon dioxide emissions are one of the key causes of climate change and carbon management is increasingly becoming a strategic as well as an operational issue, impacting upon relationships with customers, shareholders and the community.

The Carbon Trust works with UK business and the public sector to help them cut their carbon emissions. An independent company set up by government to help the UK meet its climate change obligations, the Carbon Trust creates practical business-focused solutions to carbon emission reduction on energy efficiency, carbon management, and investment.

The Carbon Trust created its Carbon Management Programme to help organisations, such as Severn Trent, understand how carbon emissions and climate change will affect their business. Carbon management is a systematic approach that allows organisations to exploit the opportunities and mitigate the risks of climate change to support their core business strategy.

We have worked with Severn Trent to help develop business plans to reduce their carbon emissions both now and in the future. As a result of this work, Severn Trent has enhanced its understanding of climate change and the issues, risks and opportunities associated with cutting carbon emissions.

We are encouraged that the key findings and recommendations arising from the carbon management study have been so positively received by Severn Trent, and hope that other organisations will follow its example in taking action now to cut carbon emissions and mitigate climate change.

Tom Delay, CEO, the Carbon Trust

Executive summary

The group was concerned to quantify the increasing emissions that the waste and water sectors might face as environmental legislation is applied over the coming years.

Severn Trent Plc is a leading provider of water, waste and environmental services. Climate change is a high priority of the group's corporate responsibility programme, addressed through a twin-track approach that includes both mitigation and adaptation measures.

Background

In 2004 the group undertook a carbon management project, with the support of the Carbon Trust, which produced a scenario projecting the group's net UK greenhouse gas emissions to 2020. The group was concerned to quantify the increasing emissions that the waste and water sectors might face as environmental legislation is applied over the coming years. The group was also interested in examining opportunities for further renewable energy: the group currently generates around 5% of UK renewable electricity.

The scenario

The scenario described includes a number of central assumptions which are detailed and discussed in this report. It is projected that group emissions may increase by up to 25% to 2.3m tonnes of carbon dioxide equivalent per year (tCO₂e/yr) by 2020, above an average baseline of 1.8m tCO₂e/yr in the years 2000-2004. The key drivers of this increase include:

- Increased transport emissions from waste collection, due to increases in waste generated and increased collection of segregated waste streams
- Increased methane emissions from landfill sites
- Increased energy requirement for waste processing
- Increased energy requirement for wastewater treatment

Our action

In response to the scenario the group will be undertaking a number of steps to attempt to mitigate this potential increase in our net UK greenhouse gas emissions, these include:

- Utilising biodiesel in the fuel mix for our waste vehicle fleet and sponsoring research into more sustainable transport options for waste
- Further improving landfill gas capture to 80% by 2008
- Expanding our renewable energy generation activities where possible
- Further improving energy efficiency in the treatment and distribution of drinking water and the treatment of wastewater

Recommendations to government

To assist the group in controlling greenhouse gas emissions we recommend that government:

- Ensure that new water and waste legislation is more fully assessed for its broader environmental impact, through regulatory impact assessments
- Encourage alternative fuels through introducing a 'Renewable Transport Fuels Obligation' and provide additional support for research into these fuels
- Strengthen the investment case for renewables by making more detailed long term commitments regarding the Renewables Obligation
- Recycle 100% of Climate Change Levy revenues to climate change programmes, which could include supporting better adaptation to a changing climate
- Protect the recycling of biosolids to land as the most energy efficient and sustainable option

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Introduction

Severn Trent Plc is a leading provider of water, waste and environmental services. The group, which includes Severn Trent Water, Biffa and Severn Trent Laboratories generates revenues of £2.081 billion and employs more than 16,000 people across the UK, US and continental Europe. We aim to increase shareholder value by providing integrated solutions to environmental problems and by grasping the growth opportunities created by new legislation and new requirements in the private and public sectors.

Corporate responsibility

Severn Trent are amongst the leaders in the water and waste sectors in understanding and integrating sustainable development into our business practices, evidenced by the fact that for the last four years we have been ranked Utility Sector leader in the Dow Jones World Sustainability Index. We have publicly reported our environmental impacts since 1992 and publish an annual Corporate Responsibility Report on our website: www.severntrent.com/corporateresponsibility

Taking responsibility: a focus on climate change

Severn Trent plays a significant role in developing a better understanding of climate change mitigation and adaptation in the UK water and waste industries. We are a significant emitter: net greenhouse gas emissions from our UK sites, vehicles and electricity purchases totalled 2.02m tonnes of carbon dioxide equivalent (tCO₂e) in 2003/04, around 0.3% of UK emissions for the period.

To mitigate these emissions the group has successfully invested in a rapid expansion of renewable electricity generation across the group to a total capacity of 128MW in March 2005, generating approximately 5% of UK renewable electricity. Over recent years the group's growth strategy has been focused on the expansion of our waste business, Biffa Waste Services. Since 1999, despite acquiring less environmentally efficient businesses, Biffa have successfully reduced their normalised greenhouse emissions by 39%.

In terms of adaptation, both Severn Trent Water and Biffa have taken a lead within their sectors to understand and plan for the effects of a changing climate. Over the next century we expect drier summers, putting greater pressure on water resources, and wetter winters with increased periods of intense precipitation, putting pressure on our sewerage systems to provide adequate drainage. Beyond the immediately obvious, our detailed assessment has identified over 150 potential impacts (or climate 'hazards') including general impacts such as working conditions for employees, facilities management and transport.

The Carbon Management Project

This report arises from a Scenarios project that ran during 2004 funded by the Carbon Trust's Carbon Management Programme. Severn Trent was keen to consider setting a long term greenhouse gas reduction target, but to do so we needed to gain a better understanding of how our emissions profile might develop into the future. In particular we were aware that the requirements placed upon our water business to use more energy to clean drinking water and wastewater, and the changing nature of the UK waste market, are going to affect our ability to control emissions. Therefore we sought to quantify the likely impact of these obligations and market changes on our UK based businesses.

The scenario discussed in this report was built as part of the ongoing development of our in-house carbon flows model. The model, originally constructed in 2002, tracks flows of carbon into, through and out of our processes throughout our major businesses. We receive carbon in the form of solid and liquid wastes including sewage; we use energy throughout our businesses for the treatment and transport of water and waste, and we convert methane from our landfills and sewage treatment works into renewable energy.

The structure of the carbon flows model was assessed by Imperial College, London in 2002 and the data assumptions were tested and ratified by Entec in 2004 as part of this scenario project. We are able to use the carbon flows model to identify our most significant sources of emissions across the group, and focus our mitigation efforts on their reduction.



The challenge: an expected increase in greenhouse emissions

Baseline greenhouse gas emissions

The two largest companies within the Severn Trent Plc group, Severn Trent Water and Biffa, together account for 99% of the group's net UK greenhouse gas emissions. The average emission data for the four years, from April 2000 to March 2004, are presented in Table 1.

The data for the individual years in this baseline period, i.e. 2000/01 to 2003/04, are available but are not reported here as there are significant year-to-year variations. For example, the emissions from Biffa have been very variable over this period due to the acquisition of two major waste businesses and the subsequent work to improve environmental efficiencies. In addition there are inherent difficulties in calculating the production of methane in landfills.

Biffa currently accounts for approximately two thirds of the group's greenhouse gas emissions. By far the largest contributor is methane emissions from landfill sites. Methane is a greenhouse gas with a Global Warming Potential (GWP) of 21². The current methane emissions from the landfill sites are approximately 60,000 tonnes per year (t/yr), but this is equivalent to more than 1.2 million t/yr CO₂ emissions. The carbon dioxide (CO₂) emissions from the transport fleet used to collect waste are the second most significant source. Transport looks likely to become an even more significant source of emissions in the future.

The remaining one-third of the group's emissions originate from Severn Trent Water. The major emission sources currently are:

- CO₂ from the purchased electricity needed to pump clean water to customers
- CO₂ from the purchased electricity needed to treat wastewater to stringent standards before it is discharged to river
- Fugitive emissions of nitrous oxide (N₂O) from wastewater treatment

Emissions projections to 2020

Funded by the Carbon Trust's Carbon Management Programme, Severn Trent worked with consultants Entec to develop projections for the group's greenhouse gas emissions through to 2020. The aim was to improve Severn Trent's understanding of the:

- Trends in future emissions
- Magnitude of any projected increases or decreases
- Drivers for future emissions e.g. business growth, compliance with environmental legislation; and
- Priority areas to be addressed as part of the group's carbon management strategy

The net UK emissions projection for Severn Trent Plc, along with those for Severn Trent Water and Biffa, are presented in Table 3 (opposite). The results are based on a 'Business As Usual (BAU) with Policy Measures' scenario. This means that the projections are based on the normal business activity of the water and waste business. This includes changes due to planned business growth, UK population growth, normal asset replacement and refurbishment and energy efficiency measures. In addition, it assesses the likely impact of current and planned UK and EC policy measures and legislation for the sectors.

Table 2 presents a summary of where the main changes in emissions are projected to occur between now and 2019/20.

² The actual figure is now agreed by the Intergovernmental Panel on Climate Change to be 23, but this will not be applied in GHG calculations until the proposed second period of the Kyoto protocol from 2013

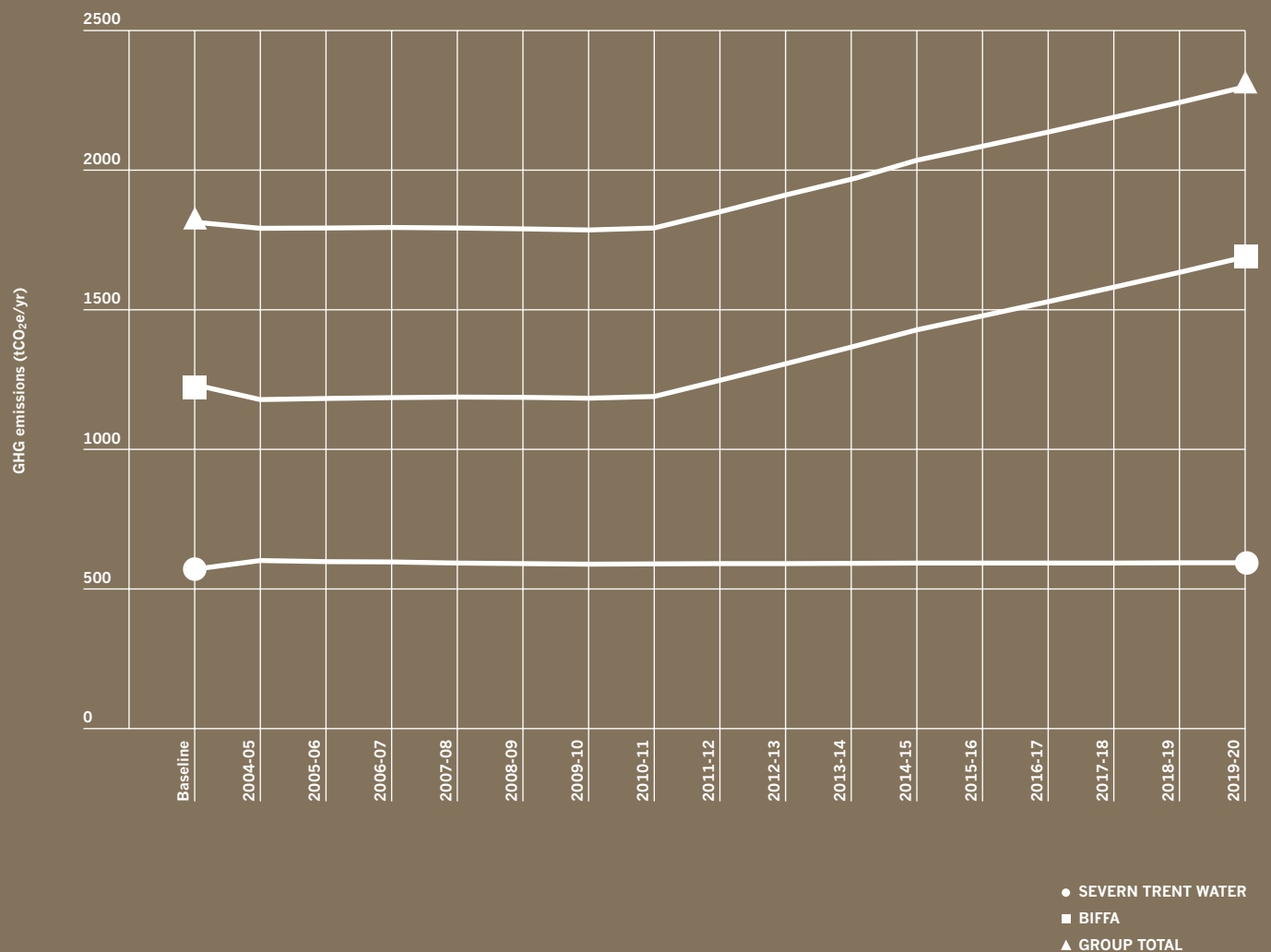
TABLE 1 Severn Trent annual net UK GHG emissions
From April 2000 to March 2004

Business unit	GHG average emissions (ktCO ₂ e/yr)	GHG emissions (% group total)
Severn Trent Water	571	31.5
Biffa	1,232	67.8
Other Group Companies	12	0.7
Group total	1,815	100.0

TABLE 2 Severn Trent changes in annual net UK GHG emissions
Baseline figure is an average of the period 2000/2001 to 2003/2004

Business area	Baseline GHG emissions (ktCO ₂ e/yr)	GHG emissions in 2019/20 (ktCO ₂ e/yr)	Change in emissions (ktCO ₂ e/yr)
Water Supply	231	238	7
Wastewater	332	361	29
Sludge	8	-6	-14
Severn Trent Water total	571	594	22
Waste Collection	74	451	377
Waste Processing	28	64	36
Landfill	1,130	1,176	46
Biffa total	1,232	1,691	459
Other Group Companies	12	16	4
Group total	1,815	2,301	485

TABLE 3 Severn Trent projected trend in annual net UK GHG emissions



These projections indicate that the group's greenhouse gas emissions may increase by more than 25% from the baseline by 2019/20. The main drivers for this increase are:

- Increased transport emissions from waste collection, due to both increases in the total quantity of waste generated and a shift to increased collection of segregated waste streams, e.g. kerbside collection of recyclables in addition to existing mixed domestic waste collection
- Increased methane emissions from landfill sites
- Increased energy requirement for waste processing due to increases in the total quantity of waste landfilled and the number of pre-treatment sites associated with the diversion of waste from landfill
- Increased energy requirement for wastewater treatment. Much of the increase is at the beginning of the period because the baseline period (April 2000 to March 2004) had below average rainfall and hence produced a lower volume of wastewater requiring treatment. The remainder of the increase is due to increased treatment to comply with the future environmental legislation, e.g. Water Framework Directive. This increase is not visible on Table 3 because of the offset of reduced net emissions from sewage sludge treatment, discussed below

The 'take off' in emissions growth within Biffa from 2011/12 is caused by the cumulative increase in landfill methane emissions and transport emissions driven by the assumed 3% annual waste growth (discussed in the following section) exceeding the rate of net emissions reduction through increased landfill methane capture and increasing renewables generation.

The greenhouse gas emissions associated with water supply are not projected to increase or decrease significantly. Energy use in the treatment of clean water is expected to continue to increase to meet tighter standards on disinfection. However, this increase is offset by projected improvements in pumping efficiency in the distribution of water to customers.

The emissions from sludge treatment are projected to provide a net benefit by 2020. The amount of methane released from sludge digestion will decrease because the percentage captured and use in CHP plants to generate renewable electricity will increase. This renewable electricity will displace fossil fuel derived electricity from the national grid and thus reduce its associated CO₂ emissions.

Discussion

Severn Trent Water

Water supply

The greenhouse gas emissions associated with water supply are projected to increase from the current baseline of 231 ktCO₂e/yr to 238 ktCO₂e/yr by 2019/20. This increase of 7 ktCO₂e/yr represents 1.4% of the projected increase (485 ktCO₂e/yr) in the total Severn Trent Plc emissions over the same period.

This increase is due to policy measures i.e. the need to install additional treatment (e.g. UV, membrane filtration) to meet tighter standards for disinfection and taste. The projected increase in energy consumption for treatment is 13% by 2010/11. This increase is partially offset by a projected 5% improvement in pumping efficiency in the water distribution network.

The total volume of water supplied is projected to remain fairly constant over this period. Water consumption by domestic users is projected to increase by 5-6%, but this is offset by a decrease in non-domestic consumption.

Wastewater

The greenhouse gas emissions associated with wastewater collection and treatment are projected to increase from the current baseline of 332 ktCO₂e/yr to 361 ktCO₂e/yr by 2019/20. This increase of 29 ktCO₂e/yr represents 6.0% of the projected increase (485 ktCO₂e/yr) in the Severn Trent Plc emissions over the same period.

Most of this increase (23 ktCO₂e/yr) is due to the fact that, on average, the baseline period (April 2000 to March 2004) was unusually dry. Therefore, average volumes of wastewater received were lower than normal.

Policy measures will increase emissions, as more energy intensive treatment processes will be employed to ensure compliance with the stringent standards dictated by the Water Framework Directive. It is projected that this will increase energy consumption by 10% by 2014/15. However, this increase is offset by:

- Reduction in total volume of wastewater treated
- Improvement in the energy efficiency of sewage treatment processes

Sludge

The greenhouse gas emissions associated with sludge treatment are projected to decrease from the current baseline of 8 ktCO₂e/yr to provide a net credit of -6 ktCO₂e/yr by 2019/20. This decrease of -14 ktCO₂e/yr reduces the total projected increase (485 ktCO₂e/yr) in the Severn Trent Plc emissions by 2.9%.

This decrease of -14 ktCO₂e/yr is due to business decisions to:

- Increase the percentage of methane that is captured and utilised from the current baseline of 98% to 99% by 2009/10; and
- Increase the percentage of methane utilised in CHP plant to generate electricity from the current baseline of 89% to 95% by 2005/06

The underlying benefit will actually be larger than this because it is projected that policy drivers, such as the Water Framework Directive, will increase the quantity of sludge requiring treatment by 20% between the baseline period and 2014/15. This in turn will increase the amount of methane from sludge digestion, which can be utilised for renewable energy generation.

However, there is also the important question of the security of the sludge, or bio-solids to land route. Whilst Severn Trent Water currently recycles bio-solids to land as the most effective and sustainable option in dealing with the material, the risk of legislation further restricting or closing this route remains. If this were to happen, it is likely Severn Trent Water would need to invest in substantial additional sludge drying capacity, resulting in an increase in greenhouse gas emissions. Whilst it is desirable to site sludge drying facilities alongside energy generation plants to make use of the waste heat produced, the distributed nature of sewage treatment facilities makes it difficult to fully exploit this synergy.

Data uncertainty

The key activity data for Severn Trent Water includes projections for population served and future demand (domestic, commercial and industrial) for clean water and wastewater provision. These numbers were generally those that have been used by the business as the basis of its planning for AMP4 and beyond.

There is clearly uncertainty associated with any future projections of demand, but this data should generally be regarded as robust.

The greenhouse gas emissions projections include assumptions that the energy efficiency of pumping, buildings and transport will improve by between 0.5% and 1% per annum, generally for the next 5 to 10 years. It is not considered that these assumptions are likely to change in a manner that would significantly affect the emissions projection. There are also projections that energy consumption will increase by approximately 10% due to pressures for increased treatment of both drinking water and wastewater. These projections were again based on assumptions made in the AMP4 business case and therefore should be also regarded as robust.

There are two key assumptions that could have a significant impact on the level of reported emissions, although they will not affect the trend going forwards. The first regards the assumption that 98% of all the methane generated in sludge digesters is captured and burnt. In practice this could be as low as 95%. There is clearly uncertainty in this data as capture efficiency is not routinely monitored as it very difficult to measure accurately and reliably. The difference between these two assumptions represents approximately 25-30 ktCO₂e/yr in greenhouse gas emissions.

The second area where there is significant uncertainty in the underlying data is on fugitive nitrous oxide emissions from wastewater treatment. This emission source cannot be monitored directly and so is calculated from published literature emission factors for nitrous oxide emission per head of population served. A 10% statistical variation

in these emission factors would affect greenhouse gas emissions for Severn Trent Water by approximately 15 ktCO₂e/yr.

Biffa**Waste collection**

The greenhouse gas emissions associated with waste collection are projected to increase from the current baseline of 74 ktCO₂e/yr to 451 ktCO₂e/yr by 2019/20. This increase of 377 ktCO₂e/yr represents 77.7% of the projected increase (485 ktCO₂e/yr) in the Severn Trent Plc emissions over the same period.

Business growth, in line with an average projected increase in UK waste volumes of 3% per annum, would increase the total volume of waste collected by approximately 50% by 2019/20. Thus, the business growth impact, were recycling rates to remain static, is to increase emissions by 37 ktCO₂e/yr, by 2019/20 compared with the current baseline. Biffa is currently focused on growing their share of the UK waste market organically, which would increase group greenhouse gas emissions but will not increase net emissions within the UK waste market. Such market share growth has not been factored into this model.

Policy measures are projected to increase emissions by 340 ktCO₂e/yr. In particular, the escalating targets for recovering value from municipal waste (UK Waste Strategy 2000) will increase transport associated with kerbside collection for recycling and composting schemes. The projection for the increased distance travelled as recycling rates increase is based on historical data trends. The effect of this projection is highly significant, with the average distance travelled per tonne of waste increasing from 12km in the baseline period to 58km by 2019/20.

Given the UK's low level of recycling the historic data trend may be misleading and it is recommended that the relationship between increased recycling and transport emissions is investigated further, especially as this is by far the single most significant factor affecting the

total group greenhouse gas emissions projection. Such an investigation could explore changes in transport levels in countries where recycling rates are higher than the UK, or seek to learn from major changes in the history of logistics in other UK industries such as food retailing or brewing.

The Environment Agency reports that in 2003/04 household waste produced in England was less than the previous year for the first time, although household waste in Wales continued to rise by 2%³. If waste growth occurred at a rate of 1.5% per year, rather than the 3% assumed for this scenario, then transport emissions would only grow by 272 ktCO₂e/yr by 2019/20 rather than 377 ktCO₂e/yr.

A potential decline in the rate of growth of waste per household over the period to 2020 needs to be offset against a growth in the number of households, which by 2021 is expected to be 14% higher than in 2001⁴.

There will be a potential offset of these transport emissions increases through:

- Continuous renewal and upgrading to more efficient vehicles
- Improved route planning
- Further driver training
- Introducing alternative fuels e.g. biofuels

Waste processing

The greenhouse gas emissions associated with waste processing are projected to increase from the current baseline of 28 ktCO₂e/yr to 64 ktCO₂e/yr by 2019/20. This increase of 36 ktCO₂e/yr represents 7.4% of the projected increase (485 ktCO₂e/yr) in the Severn Trent Plc emissions over the same period.

Policy measures will increase the volume of waste that goes for treatment, including:

- Recovery and recycling processes
- Pre-treatment prior to eventual landfill disposal
- New, non-landfill treatment and disposal routes

It is projected that this will increase greenhouse gas emissions by 23 ktCO₂e/yr by 2019/20.

These same policy measures will also increase the transport emissions directly associated with the treatment processes. This is projected to increase emissions by 9 ktCO₂e/yr by 2019/20.

Landfill

The greenhouse gas emissions associated with landfill operations are projected to increase from the current baseline of 1130 ktCO₂e/yr to 1176 ktCO₂e/yr by 2019/20. This increase of 46 ktCO₂e/yr represents 9.5% of the projected increase (485 ktCO₂e/yr) in the Severn Trent Plc emissions over the same period.

The total quantity of methane generated is projected to increase in line with the total quantity of waste deposited in Biffa owned and managed landfills. Thus, there is projected to be an increase in methane generation of approximately 70% by 2019/20, compared with the current baseline. This would increase greenhouse gas emissions by approximately 800-900 ktCO₂e/yr.

However, Biffa is planning both to reduce methane emissions and also to increase utilisation to generate greater renewable electricity in CHP plants or landfill gas engines. It is projected that:

- Methane collection efficiency will increase from an average of 68% in the baseline period, to 80% by 2010/11
- Available power generation capacity will increase from an average of 75MW in the baseline period, to 125MW by 2019/20. The renewable electricity generated will displace grid electricity derived from fossil fuels and therefore is credited with the CO₂ emissions avoided from that energy source. A proportion of biodegradable municipal waste diverted from landfills is assumed to be treated through a different technology such as anaerobic digestion, ultimately resulting in at least an equivalent level of renewable energy generation

³ Environment Agency: State of the Environment 2005

⁴ ODPM: Welsh Assembly government

These measures will offset the majority of the potential increase in greenhouse gas emissions, leaving a residual net increase of 46 ktCO₂e/yr by 2019/20.

The scenario assumes that Biffa's methane emissions will continue to rise over this period as landfills are assumed to produce significant quantities of methane for 15 years or more. However, recent evidence from Biffa's landfills suggests that the methane profile may be declining much faster, potentially reducing to as little as 25% of peak output within six years of closure. It is expected that the combined impact of the Animal By-Products Order (ABPO) and local authority biodegradable municipal waste diversion targets, driven by the Landfill Directive, will be to cause methane profiles to decline more quickly.

Data uncertainty

For Biffa the base data and assumptions that underpin the projections in waste collection are clearly the most significant. In general the activity data on future volumes of waste collected and treated should be regarded as having a significantly higher degree of uncertainty than the equivalent data for Severn Trent Water, in particular because of the detailed long term investment planning required in the water sector.

The projections are based on an underlying assumption that the volume of waste handled by Biffa will increase by 3% per annum for the foreseeable future. This level of growth would lead to an increase in emissions from waste collection transport alone of 37 ktCO₂e/yr.

The greatest and most significant area of uncertainty at present is associated with the link between increasing waste recovery and recycling rates and the transport emissions for the associated waste collection. At present it is assumed that there is a direct and linear link between increasing recycling targets and transport emissions. This results in a projected increase in emissions from this source of 340 ktCO₂e/yr by 2019/20.



The policy context

The UK government has a target to reduce carbon dioxide emissions by 20% below 1990 levels by 2010 and a long term goal to reduce carbon dioxide emissions by 60% by 2050. To support this reduction the government has produced an emissions scenario for the UK that identifies the following expected changes in emissions between 2005 and 2020⁵:

- Business sector: an increase of 1.8 MtC⁶
- Waste management: a reduction of 0.8 MtC

Extrapolating from our scenarios for Severn Trent Water and Biffa, this report suggests that both the water and waste sectors will see an increase in emissions over the period, with the waste sector seeing the more significant increase. As part of the current review of the climate change policy it would seem sensible to initiate a more substantial dialogue between different sectors of industry, as well as between industry and other sectors of society, to discuss where the required emissions reductions for the UK can be identified.

Regulatory impact assessment of water and waste policy

Severn Trent is a supporter of high environmental standards. For a number of years Biffa has led the waste industry in calling for a rapid escalation of the landfill tax to strengthen the business case for recycling. Biffa has been a strong advocate of recycling alliances and has introduced new mechanical and biological treatment (MBT) technologies to the UK to ensure that resources are not wasted through the mass burn incineration of unsorted wastes. Severn Trent Water has performed well against drinking and wastewater targets, delivering some of the greatest efficiencies in the UK water industry.

However, as this report shows, delivering excellent environmental performance in one area can have consequences in another, in this case increased greenhouse gases emissions. In this section we outline some of the actions that Severn Trent is taking to reduce emissions growth. There is also a clear role for policymakers. New water and waste legislation should be more fully assessed for its broader environmental impact, including greenhouse gas emissions. Where there is a substantial risk of increased emissions as a result of the new legislation, mitigating strategies should be put in place to assist companies in reducing emissions where possible. There are a number of areas, in particular renewable energy generation, where supporting mechanisms such as the Renewables Obligation (RO) enable waste and water companies to substantially reduce net emissions and should therefore be encouraged.

⁵ Climate Change Strategy Review
Consultation document, DEFRA, 2004

⁶ MtC=Million Tonnes of Carbon
One tonne of Carbon Dioxide contains
¹/₄ tonnes of Carbon

The 'renewable carbon' opportunity: offsetting increased emissions

Biffa Waste Services and Severn Trent Water between them manage 12% of the UK's 'renewable carbon'⁷: this being biodegradable waste and sewage sludge that can be digested or combusted to generate renewable energy. We call it 'renewable carbon' because of the important link between the responsible disposal of these biodegradable materials and the opportunity to generate renewable energy from materials which are already flowing through our economy. Renewable carbons are short cycle carbons, as opposed to the long cycle hydrocarbons associated with fossil derived fuels, the combustion of which is the principal source of man-made climate change.

The value of this important source of renewable energy is being overlooked in the current media debate, which pits the newer technologies of wind and tidal turbines against nuclear power generation. Severn Trent had an interest in the generation of 686 GWh of electricity in 2004/05, through the utilisation of landfill gas and anaerobic digestion of sewage sludge and biodegradable wastes. This equates to 5% of the UK's renewable electricity generation for 2005 and reduces the group's net greenhouse gas emissions by around 250 ktCO₂e.

In theory, if it was financially viable to do so, Severn Trent could capture all of the renewable carbon which flows through our operations for renewable energy generation. If this could be done we estimate that we could generate up to 1.8 TWh of electricity by 2010 and 2.7 TWh by 2020, assuming a more conservative waste growth scenario of 1.5% per annum, landfill diversion based on the Landfill Directive and using currently available technologies such as anaerobic digestion and combustion. New technologies such as gasification and pyrolysis could take this future potential generation figure higher.

Extrapolating from Severn Trent to the UK waste and water industries, the flows of renewable carbon through these industries, if captured for renewable electricity generation, could generate up to 14.5TWh by 2010, which would equate to 3.6% of UK electricity and 36% of the UK's required renewable electricity

generation in that year. These figures exclude the renewable energy potential of agricultural waste which remains in the agricultural sector. If just half of the 80 million tonnes of biodegradable agricultural waste⁸ generated each year could be captured and treated by anaerobic digestion⁹, an additional 13 TWh could be generated.

Our action

It is important that we maximise the efficiency of our current investments, particularly in landfill gas, and Biffa has worked hard to capture 70% of landfill gas by 2003/04 and has a target of capturing 80% by 2008. We will also continue to expand our renewables generation through installing generation engines at smaller landfill sites and through rotating different size generation sets around declining sites to exploit as much landfill gas as possible. In 2004/05 Severn Trent Water expanded its generation capacity by 26% to 27MW, capturing approximately 56% of the sewage sludge that flows through the business for renewables generation.

Over recent months, again with support from the Carbon Trust, Severn Trent has been exploring the opportunities for other renewable energy activities, including growing energy crops on our land. During the coming months Severn Trent intends to explore the opportunities for the treatment of biodegradable wastes and sewage sludge together, subject to an assessment of the regulatory context, in an attempt to further increase our renewable electricity generation. We will also be examining in detail the opportunity for further hydro generation and assessing the potential for wind generation where appropriate.

Policy recommendations

The Renewables Obligation (RO) has been an important tool in enabling the expansion of our renewable electricity generation through the support of Renewables Obligation Certificates (ROCs). In particular the recent expansion of Severn Trent Water's CHP programme and the expansion of Biffa's generation programme to smaller landfill sites could not have occurred

7 This figure excludes agricultural waste that remains within the agricultural sector

8 Future Perfect, Biffa Waste Services, Winter 2002/03

9 Assumed to be waste suitable for AD treatment. Calculated using DEFRA's AD conversion figure of 331KWh per tonne of biodegradable waste. Source: RPA, 2005

without the support of ROCs. The UK waste and water industries can make further substantial contributions towards the goal of 10% of electricity from renewable sources by 2010, but to do so we need the continued support of the RO.

When Biffa's Non-Fossil Fuel Obligation (NFFO) certified sites come out of the final NFFO programme these facilities will require substantial refurbishment and therefore the availability of ROCs support for these facilities is also vital. Furthermore, the more rapid decline in landfill gas, discussed above, also increases the risks faced by new investments in landfill gas facilities. Other costs associated with operating renewable electricity generation from landfill gas, such as rates, access to the electricity network and Pollution Prevention and Control (PPC) legislation, can also have a negative impact on likelihood to invest.

Biffa operates an anaerobic digestion (AD) plant for biodegradable wastes as part of its Private Finance Initiative contract with Leicester City Council and we would like to see this more sustainable option expanded as more waste is diverted from landfill.

The government can support further investment in this area by extending the commitment to support the technologies discussed in this report within the RO through to 2027. Offering additional grants to enable the agricultural sector to explore appropriate technologies for AD facilities in rural areas would also be of value.

The packaging of food in biodegradable containers greatly increases opportunities for the use of this food waste for renewable energy generation and should be substantially encouraged.

The combustion of sorted solid biomass wastes yields an energy output 76% higher than AD¹⁰ and therefore is an important route to generating further renewable energy. Current sorting technologies cannot viably achieve the 98% input purity threshold of biomass from waste materials required to attract ROCs. Therefore Severn Trent recommends that the biomass threshold for biomass to qualify for ROCs support should be reduced from 98% to 90% to allow for a faster expansion of waste biomass ahead of new waste sorting technologies coming to market.

Many of Biffa's landfill gas facilities produce excess heat which could be sold locally to meet business and domestic heating needs. However, the investment in pipelines to transport excess heat to users requires support to ensure that potential future lower natural gas prices do not undermine demand for heat from landfill gas. The government could consider a financial support scheme to enable better security of investment in distributing localised heat. The concept of a 'Renewable Heating Obligation' scheme could be of value here.

¹⁰ Source: RPA, 2005, quoting DEFRA statistics



Transport, waste growth and energy efficiency

Transport

Transport emissions form the largest proportion of the expected increase in group emissions to 2020. Transport is also the area of UK policy that is least well developed in terms of instruments to assist companies to reduce their greenhouse gas emissions.

Our action

Biffa, despite being a major landfill owner, has been a strong advocate of improving recycling rates. However, an increase in recycling, particularly in segregated collection, will result in an increase in the total distance travelled to collect, sort and deliver these materials for recycling or value recovery through renewable energy.

Biffa's fleet contains around 1650 trucks and recent acquisitions have increased the average age of trucks from 2.7 to 4 years. After each acquisition, Biffa moves quickly to remove the oldest and most polluting vehicles from its fleet. The entire fleet now runs on ultra-low sulphur diesel, and most of Biffa's workshops now have vehicles emissions monitors to ensure that trucks are run at optimal fuel efficiency.

In 2003/04 Biffa ran a successful biofuels trial, blending biodiesel into our standard fuel mix at 5%. Biffa has a target to utilise biodiesel in the fuel mix for half of its vehicles by April 2006. Severn Trent Water is also a significant fleet transport user and the group is considering how the two major businesses could work together to access supplies of new fuels such as biodiesel. At the group level there is a ceiling placed on company car emissions which excludes the most polluting vehicles from company car schemes.

Biffaward, the company's landfill tax credit scheme, is supporting the Sustainable Transport Resources and Waste (STRAW) project, which aims to think strategically about the scale and location of waste management and reprocessing infrastructure. In particular the project will consider the opportunity of employing rail, inland waterways and coastal options further.

Policy recommendations

For the group to be able to reduce emissions growth going forward, we propose that government consider introducing a 'Renewable Transport Fuels Obligation' and aim to increase biofuels use to 5% of UK road fuel provision by 2010. It is also important that government increase and improve the availability of funding for research and development of biofuels, and increase grants to encourage landowners to grow fuel crops, otherwise the UK will become a significant importer of biodiesel. By increasing the value of the duty differential for biodiesel and bioethanol to 30p, government could increase demand to create the necessary business case for growing these crops. By guaranteeing an extension of this duty for at least 10 years, government would improve certainty and encourage investment.

Waste growth

The scenario featured in this report assumes an annual increase in Biffa's waste handled of 3% per year, as discussed above, in line with UK waste growth projections. This has particular implications for both transport emissions and landfill gas emissions. The government's sustainable production and consumption strategy highlights the important objective of decoupling economic growth from resource use, which implies improved waste minimisation.

Our action

Both Biffa and Severn Trent Water are pursuing opportunities to operate processes on customer sites to treat and recycle materials and wastewater back into their customer's processes, moving further towards closed loop processes that reduce the amount of waste needing to be reprocessed off site.

Policy recommendations

Decoupling economic growth from resource use has been the focus of a number of government programmes, including Envirowise, to assist manufacturers in reducing the input of resources needed to make a product. In addition a number of companies have developed their own innovative strategies, shifting from selling products to selling the services of those products, whilst retaining ownership of the materials. Biffa has established relationships with a number of industries to encourage such companies to transport used products back for refurbishment, where it is environmentally efficient to do so. Government can encourage a further shift to efficient use of resources through introducing producer responsibility legislation beyond those sectors currently covered. Such an arrangement is facilitated by products being designed for disassembly and a commitment to eco-design could be further encouraged within industry.

Energy efficiency labelling on white goods is generally accepted to be improving public awareness and leading to more environmentally aware consumption choices. Introducing better labelling of the manufacturing resource efficiency of a product at the point of sale would enable aware consumers to extend their environmental choices further. Government can also, as always, go further in ensuring that public procurement at all levels includes an assessment of the resource efficiency of the supplier, to send industry a clear message that government is serious in this regard.

Energy efficiency**Our action**

Severn Trent Water are the largest energy user in the group, generating the majority of their emissions through imported electricity use. Severn Trent Water's normalised net emissions have remained relatively static over the last six years, as energy efficiency programmes have enabled them to improve water treatment standards whilst maintaining emissions at the same level. Severn Trent Water have prioritised

energy efficiency through a detailed programme of pump monitoring and replacement, working closely with suppliers to ensure that pumps selected are exactly suited for their workload. However, given the cost of electricity to the group and the large proportion of Severn Trent Water's greenhouse gas emissions that result from electricity use, there is a clear need to continually challenge ourselves to improve efficiency. Severn Trent Water are currently undertaking a detailed energy efficiency review, due to be completed by March 2006, to enable greater energy savings.

Policy recommendations

The UK water sector is a major electricity user, with significant greenhouse gas emissions. Currently water companies pay the full cost of the Climate Change Levy (CCL), a significant cost given the high level of electricity use in the industry. Whilst a significant proportion of revenues from the CCL goes to funding the Carbon Trust, we would propose that 100% of CCL revenue is hypothecated into climate change measures: either for mitigation, such as granting greater capital allowances for sectors such as water to improve their energy efficiency; or for adaptation, allocating funding to further research and preparation for a changing climate.

Severn Trent welcomes the proposed white certificate concept, allowing companies to trade energy efficiency gains achieved under the Energy End Use Efficiency and Energy Services Directive. However it needs to be clear how such a system might interact with efficiency targets placed upon water companies by the regulator, OFWAT.

It is important that the recycling of biosolids to land route remains open, protecting soil quality and ensuring that additional energy does not need to be expended in drying sludge prior to disposal.

Closing reflection

Each sector of UK society needs to bear an appropriate level of responsibility for reducing greenhouse gas emissions. Whilst Severn Trent Water and Biffa are prepared to contribute to reducing the UK's total emissions, it is clear that current water and waste policy is driving our emissions profile in the wrong direction. We hope that the policy proposals included in this report will be considered as an effective route to achieve high water quality, a greater proportion of UK waste recycled or composted, and the necessary control of greenhouse gas emissions.

We hope that this report, providing clear signposts to both industry and government regarding the likely future emissions of a water and waste company, demonstrates the value of the investment made through the Carbon Trust.

Invitation to respond

This report is intended as the next step in an ongoing dialogue with government, companies in the water and waste sectors, NGOs and socially responsible investors, to ensure that our industries fully understand their potential future emissions profiles.

We welcome your response to the scenario, our actions and the policy recommendations made.

Please email: **corporateresponsibility@stplc.com**

A selection of responses will be made available on our corporate responsibility website: www.severntrent.com/corporateresponsibility



**For more information about Severn Trent Plc and its businesses
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