Appeal Reference
APP/D0840/A/09/2113075/NWF)

Site at Rostowrack Farm and Land at Wheal Remfry, Goonvean and Parkandillick Dryers, St Dennis, St Austell, Cornwall

# Proof of Evidence on Need and Alternative Technologies of Simon Aumônier

On behalf of SITA Cornwall Limited

14th February 2010

# *1 INTRODUCTION AND QUALIFICATION*

1.1 My name is Simon Aumônier. I hold a Batchelor of Science combined honours degree in Biology and Geography from the University of Exeter and a Master of Science degree in Pollution and Environmental Control, gained from the University of Manchester and UMIST in 1988. I am a Partner at Environmental Resources Management Limited (ERM). I lead the company's Waste Management, Energy and Climate Change Team, directing ERM's waste management and climate change, energy & carbon footprinting practices.

1.2 I have over 20 years post-graduate experience in waste management and environmental protection, both in Government research & development and in consultancy. I am a Member of the Government's Sustainable Development Commission Panel.

1.3 In 2005/06, I led the development of *Practice Guidance for Local Authorities on Municipal Waste Management Strategies* for Defra, and I was a lead author of the *PPS 10 Companion Guide* (for ODPM now DCLG), also advising the Department on drafts of the PPS. As Programme Director for ERM's work under the Waste Implementation Programme (for the Local Authority Support Unit) I have worked with a substantial number of local authorities and regional bodies across the country on waste strategy, planning, project design and partnership projects.

1.4 I have directed a suite of need assessments for county and regional authorities including: the South East of England and the East of England Regional Assemblies; Essex, Oxfordshire and Kent County Councils; Southend and Thurrock Unitary Authorities; and jointly, East Sussex County Council and Brighton & Hove City Council.

1.5 Between 2005 and 2006, I directed two key studies for Defra that have influenced Government policy: *Carbon Balances and Energy Impacts of the Management of UK Waste Streams*; and the *Impact of Energy from Waste and Recycling Policy on UK Greenhouse Gas Emissions*. The aim of the first piece of research was to carry out a macro-level investigation of the source and scale of energy and greenhouse gas benefits and impacts associated with the management of waste streams arising in the UK. The study used a life cycle approach in determining the greenhouse gas and energy impacts associated with alternative waste disposal routes, and enabled the tracing of fossil and biogenic carbon throughout the waste management system. This work is extensively referenced in the Waste Strategy for England 2007. The second study involved a quantitative assessment of the implications of waste management policies on UK greenhouse gas emissions. The study quantified, for a range of scenarios, the likely effect of national-level recycling and landfill diversion targets on the UK greenhouse gas inventory.

1.6 I directed development of the Environment Agency's life cycle assessment waste management software tool, *WRATE* (Waste and Resources Assessment Tool for the Environment), which is described further in *Annex A*. The tool allows waste managers to describe and to compare current and hypothetical waste management scenarios to help them identify more environmentally preferable routes for the management of their wastes. The tool employs graphics to enable a user to examine individual emissions, for example carbon dioxide ($CO_2$) or a group of emissions such as a selection of water polluting substances. Impact assessment indices such as greenhouse warming are available in the tool, allowing users to estimate contributions to specific environmental impacts, such as global warming (in carbon dioxide equivalents ($CO_2e$)). ERM also provides training to *WRATE* licence holders on how to use the software and a helpdesk service on behalf of the Environment Agency.

1.7 I have acted as Expert Witness at a number of strategically important Public Inquiries into applications for waste management facilities for policy matters, need and environmental impacts. These include: the Surrey Waste Development Framework; East Sussex County Council and Brighton & Hove City Council Waste Local Plan; Wiltshire County Council Waste Local Plan; London Borough of Enfield's Carterhatch Lane Household Waste Recycling Centre; Regional Policy Guidance 9 (minerals and waste update); the London Plan; and a number of energy from waste (EfW) proposals: Riverside; Kidderminster; Hull; Ridham Dock; Glanford; and Ince Marshes.

1.8 Prior to joining ERM, I was Technical Director of Ecobalance UK and Senior Consultant at the Energy Technology Support Unit (ETSU, part of AEA Technology) providing project management and technical support on waste and renewable energy to both the Dti (subsequently DBERR and now BIS) and to the DoE / Environment Agency. At ETSU, I established and managed the

Environment Agency's Life Cycle Research programme for Waste Management. I am a founder member of the International Expert Group on Life Cycle Assessment for Waste Management. In 2008/09, I worked as part of the International Solid Waste Association's (ISWA's) Task Force on Greenhouse Gas Emissions and Waste Management to produce a 'white paper' to present at the Conference of the Parties to the Kyoto Protocol (COP) in Copenhagen.

1.9 *Table 1.1* and *Table 1.2* identify the documents to which I refer in my proof of evidence.

***Table 1.1 Core Documents referred to by Simon Aumônier***

| **Core Documents** | |
|---|---|
| **Title** | **Reference** |
| Planning Application Supporting Documents- Volume 1 | A1 |
| Planning Application Supporting Documents – Volume 2 | A2 |
| Planning Policy Statement 1: Delivering Sustainable Development, January 2005 (PPS 1) | E2 |
| Planning Policy Statement 1: Planning and Climate Change Supplement to Planning Policy Statement 1, December 2007 (PPS 1 Supplement) | E3 |
| Planning Policy Statement 10: Sustainable Waste Management, July 2005 (PPS 10) | E6 |
| Planning for Sustainable Waste Management, Companion Guide to PPS 10, 2006 (PPS 10 CG) | E7 |
| Waste Strategy for England 2007, May 2007 (WSE 2007) | F1 |
| European Union Waste Framework Directive (75/442/EEC amended 91/156, 91/692 and 96/350) | H1 |
| European Union Directive 2008/98/EC of the European Parliament and the Council of 19 November 2008 on Waste | H7 |
| Ince Marshes Inspector's report dated 3 October 2008 and Secretary of State's Decision Letter dated 11 August 2009. (PINS Ref: APP/20645/A/07/2059609) | I2 |

| Core Documents | |
|---|---|
| **Title** | **Reference** |
| Secretary of State's Decision Letter, dated 16 September 2008, for the application for consent to construct and operate an Energy from Waste CHP generating station at Runcorn, Cheshire | I6 |
| Fichtner Consulting Engineers 2010 'Cornwall Council Residual Waste Treatment Options Report' | O1 |

*Table 1.2* *Appendices referred to by Simon Aumônier*

| Annex | Reference |
|---|---|
| Description of *WRATE* | A |
| Tables and graphs referred to within proof of Simon Aumônier | B |
| Final Report – Cornwall Options Appraisal, ERM, March 2008 [from CD A2] | C |
| Final Report - Assessment of Number of Facilities, ERM, March 2008 [from CD A2] | D |
| SITA Cornwall – CERC Carbon Balance: *Final Report*, ERM, March 2008 [from CD A2] | E |
| Economies of Scale – Waste Management Optimisation Study, published by Defra, researched by AEA Technology, April 2007 (Waste Management Optimisation Study) | F |
| Defra. Commercial and Industrial Waste in England Statement of aims and actions 2009 | G |
| Defra, News Release, Changing the UK approach to the EU landfill diversion targets, 2 December 2009 | H |
| Defra, News Release, Text for communication on new consultation on definition of municipal waste and the future of the duty on 2-tier local authorities to produce joint municipal waste management strategies, | I |
| Defra, Waste Private Finance Initiative (PFI) – frequently asked questions (FAQs). October 2009 | J |
| Defra, News Release, £138m to help reduce landfill waste, 27 November 2008 | K |
| Independent external peer review of SITA Cornwall ERM WRATE modelling, RPS, February 2010 | L |

## 2 *OUTLINE OF PROOF OF EVIDENCE*

2.1 This Inquiry is considering the proposal made by SITA Cornwall Ltd in a Planning Application for an Energy from Waste facility (the Cornwall Energy Recovery Centre, or CERC) and the Appeal against refusal of this Planning Application (reference APP/D0840/A/09/2113075).

2.2 My Proof is concerned with the need for the proposed facility, the consideration of alternative technologies to the proposed facility, the energy efficiency of the proposed plant and the environmental benefits of the proposed facility.

2.3 My proof is structured as follows:

*Section 3* deals with the need for the proposed waste management facility;

*Section 4* considers an appraisal of different technologies that has been undertaken;

*Section 5* examines the environmental and economic consequences of developing different sized facilities to provide the required overall treatment capacity;

*Section 6* discuses the consequences of the proposals on greenhouse gas emissions; and

*Section 7* considers whether the proposed facility may be considered as a 'recovery facility' on the basis of its energy efficiency in accordance with the Waste Framework Directive.

## 3 *THE NEED FOR THE PROPOSED WASTE MANAGEMENT FACILITY*

3.1 In this section of my proof of evidence I explain the quantitative need for the proposal and the contribution that it will make to ensuring that the waste management needs of Cornwall can be met.

3.2 Currently, the only available method for the management of residual MW and C&I waste in Cornwall is landfill. However, landfill is at the bottom of the waste management hierarchy, being environmentally the least desirable way of managing waste. It cannot continue to be used to the same extent for this reason, as well as due to the lack of available voidspace, as I discuss below.

*Available Landfill Void*

3.3 There are currently three landfill sites in Cornwall: Lean Quarry Landfill operated by Viridor Waste Management; and United Mines and Connon Bridge landfills operated by SITA UK Ltd. The remaining available voidspace at the Lean Quarry landfill is contracted to a neighbouring authority (Plymouth) and is therefore not available for Cornwall's waste. The United Mines site is due to close in 2010 under the terms of its planning permission. The Connon Bridge landfill has approximately 1.2 million $m^3$ of remaining voidspace and, under its existing planning permission, this site will need to close by the end of 2014.

3.4 SITA is preparing an application for an extension to the Connon Bridge landfill. It is by no means certain that such an extension will be granted but, if planning permission is obtained, this would provide an additional

800,000m$^3$ of void at the site. SITA recognises that, as the only landfill available for the disposal of Cornwall's wastes, Connon Bridge is a precious asset. Therefore, it proposes that this site should be used only for the disposal of that residual MW and/or residual C&I waste that cannot be treated by the proposed CERC. Thus, the extension to Connon Bridge landfill is not an alternative to the CERC facility. Rather, it is a necessary complement, the use of which should be husbanded carefully.

3.5 I discuss later in my proof the quantitative need for the proposed EfW facility, in terms of the total capacity of the waste management infrastructure available for dealing with Cornwall's residual wastes, with or without the extension to the Connon Bridge landfill. However, notwithstanding the landfill capacity that may, or may not, be available in Cornwall in the future, there are other reasons why there is a need for the proposed EfW plant, which I set out below.

*Environmental and Waste Management Policy*

3.6 In pursuing the objectives of sustainable development through the UK sustainable development strategy, *Securing the Future*, waste management policy, in the Waste Strategy for England 2007 (WSE2007) and in PPS 10, demands progressively more diversion of waste from landfill. Policy seeks and requires that waste management be driven up the waste hierarchy - with disposal to landfill used as a last resort - and with the ultimate objective of recovering value from as much of the waste produced as possible. Policy does not place any limit on the diversion of waste from landfill, which has been confirmed in the Ince Marshes decision (CD I2). Indeed, the objective should be to landfill nothing other than rejects and residues from processes that precede landfill in the waste hierarchy.

3.7 UK policy is in line with, and responds to, the requirements specified under the EU Landfill Directive 99/31/EC (CD H2) to reduce waste and the dependency on landfill, in part to meet important climate change obligations. As a result, most products should be re-used or their materials recycled. Energy should be recovered from the remaining residual wastes where possible.

3.8 England's performance on waste recovery lags behind many other European countries, despite some progress having been made since the previous national waste strategy document, Waste Strategy 2000. Therefore, WSE2007 urges new investment in waste processing infrastructure to deal with MW, C&I waste and all other forms of waste.

3.9 National policy expectations are set out in WSE2007 and PPS 10. WSE2007 identifies specific targets for the MW and C&I waste streams.

3.10 The Government's key objectives are as follows:

i. to decouple waste growth from economic growth, with more emphasis on prevention and re-use;
ii. to exceed Landfill Directive diversion targets for biodegradable MW in 2010, 2013 and 2020;
iii. to increase diversion of non-municipal wastes from landfill;

iv. to secure the necessary investment in infrastructure to achieve these goals; and

v. to get the most environmental benefit from that investment through increased recycling of resources and recovery of energy from residual waste using a mix of technologies.

3.11 The targets set in WSE2007 are challenging. Recovery of MW: 53% by 2010; 67% by 2015; and 75% by 2020. C&I waste landfilled to fall by 20% by 2010 compared to 2004. Based on Cornwall Council's most recent projections [(1)] (see *Table 1* and *Table 3*), it is unlikely that the County will meet the 2010 recovery target and, without the CERC or a similar facility, it is very unlikely that it will meet the 2015 recovery target.

3.12 The timeline associated with these targets is important. They are milestones on the path towards a higher objective – diverting ever more waste from landfill – and not simply an end in themselves. This is confirmed by the statement in WSE2007 that the government intends to set a new national target for the reduction of C&I waste landfilled in 2010 with respect to 2005. WSE2007 also explains that the amount of waste landfilled is expected to fall by about 20% by 2010 compared with 2004, as a result of the policies that it sets out. As part of its stated aims, the summary to WSE2007 says that *"For a small amount of residual material, landfill will be necessary"*. The quantities of waste currently landfilled in Cornwall could not be described as small. Delay in commissioning recovery infrastructure would inevitably consign further waste to landfill, contrary to policy.

(1) Data provided to SITA by Paul Martin of Cornwall Council

3.13 WSE2007 is a core instrument for securing a radical change in the national network of sustainable waste management facilities to meet waste management and climate change obligations. Urgent investment in new waste management facilities is needed to increase recycling and the recovery of renewable energy to meet binding targets.

3.14 A range of measures, including: raising landfill tax; household financial incentives; capital allowances for CHP facilities; and tighter regulation, are shifting the emphasis in waste management towards recovery.

*Biodegradable Waste to Landfill*

3.15 The Landfill Directive requires a reduction in the amount of biodegradable municipal waste (BMW) that is disposed of to landfill. In order to ensure that the UK as a whole meets the targets it has been set, Government has allocated 'allowances' to each Waste Disposal Authority (WDA) which specify the maximum amount of BMW it may landfill each year. Each WDA's allowance reduces year by year. In the case of English WDA, allowances may be traded with other WDA under the terms of the Landfill Allowance Trading Scheme (LATS). WDA that invest, or have already invested, in alternative waste management facilities and which have an excess of landfill allowances may sell them to other authorities whereas those which have insufficient alternative treatment capacity need to purchase allowances or, alternatively, face a fine of £150 for every tonne of BMW that they landfill in excess of their allowance. The annual allowances allocated to Cornwall are listed in *Table 2*.

3.16 The Draft Regional Spatial Strategy for the South West 2006 – 2026 states:

at Section 7.4.2

> *Proposals for new waste management capacity should take into account the need to meet nationally set targets for recycling, and composting, recovery and disposal….*

and at Section 7.4.3

> *In addition, proposals should consider opportunities to provide treatment facilities for multiple waste streams and the need to accommodate new treatment technologies, including those offering recovery through Mechanical and Biological Treatment (MBT) and/or advanced energy conversion (waste to energy), to meet recovery targets.*

3.17 In addition to the paucity of local landfill capacity and the national and regional policy drivers, the increasing rate of Landfill Tax provides a significant incentive for waste generators, including local authorities, to use alternative treatment methods for residual waste. Landfill Tax for 'active wastes', which includes municipal and commercial and industrial wastes, is currently £40 per tonne and this will rise by £8 per tonne each year, reaching £72 per tonne by 2013. At this time, the total cost for landfill can therefore be expected to be of the order of £90 – £100 per tonne. This compares with an indicative price for EfW at the scale SITA proposes in Cornwall of £80 – £90 per tonne.

*Energy Recovery*

3.18 Recovering energy from waste which cannot be sensibly recycled is also an essential component of Government's energy policy. The provision of energy from waste (EfW) capacity has lagged well behind the expectations in WS2000, so active encouragement is now required. EfW is a source of renewable energy and gains policy support on these grounds as I explain in *Section 7* of my proof of evidence.

*Waste Arisings*

3.19 In order to determine the need for the proposed EfW facility, I have reviewed recent rates of waste generation in Cornwall and then forecast possible future waste arisings by modelling different scenarios. A previous assessment was reported in the Need Assessment published in March 2008 (1). However, that work was based on the MW arisings data for the year 2005/06 and so the opportunity has been taken to review more recent arisings data and to revise the predictions for future waste arisings. I will comment separately on anticipated MW and C&I waste arisings.

3.20 *Table 3* presents the actual arisings of MW in Cornwall since 2001/02 and these are also plotted graphically on *Figure 1*.

3.21 In the last two years, there has been a fall in MW arisings. This is almost certainly due at least in part to the recent recession, although waste statistics are notoriously volatile and cause and effect relationships are not well established. Consequently, it would be expected that, as the recession ends, there will be a return to growth in MW production or that future falls in MW arisings would certainly not be as great as seen over the past two years. There may also be an effect due to initiatives to encourage residents to

(1) Task 1: Need Assessment Report, ERM, March 2008. CD A2.

minimise the amount of waste that they generate, resulting in long-term MW arisings being relatively flat.

3.22 Given the uncertainties around future MW arisings, and taking account of both the short-term and longer term trends in arisings, I consider that future MW production will fall somewhere between two extremes, as follows: a return to growth rates of 2% per annum (ie somewhat less than the historic growth rate of approximately 3% per annum seen between 2001/02 and 2006/07); and an approximately constant rate of waste arisings (ie where any tendency for growth due to increased economic activity is offset by waste minimisation measures).

3.23 These two extremes are also plotted on *Figure 1*, together with the projected waste arisings resulting from the assumption that production of MW increases at 0.5% per annum, as predicted in WSE2007 and Cornwall Council's own projections up to 2020 (1).

3.24 In terms of C&I waste, the original Need Assessment work undertaken by ERM was based on the Environment Agency's C&I waste survey in 2002/03 and application of the assumed growth rates indicated in WSE2007 (equivalent to 0.98%pa). More recently, ADAS has undertaken a study into C&I waste arisings for the East of England Regional Assembly. This took the findings of a survey undertaken in the North West Region in 2006/07 and extrapolated the results to other regions, based on specific arisings of waste per employee for different standard industrial classifications (SICs). ADAS

(1) Data from Paul Martin, Cornwall Council – email to SITA, 6 January 2010.

also forecast regional arisings for 2020. For the SW Region, the ADAS estimate based on the 2006/07 survey is 14% less than the EA estimate for 2002/03, and its estimate for 2020 is approximately 1.2% higher than the 2006/07 estimate (ie it assumes less than 0.1%pa growth). Clearly, caution must be exercised when extrapolating data from one region of the UK to another because, although this extrapolation is based on waste arisings per employee for industries within a given sector, there will inevitably be regional differences in the character of businesses within a sector and hence their likely waste generation profiles. Nevertheless, this data set provides a useful comparison with that from the EA survey.

3.25 These findings have been applied to the data for Cornwall to develop likely lower bound ('best case') and upper bound ('worst case') scenarios for future C&I waste arisings, as shown in *Table 4* and plotted on *Figure 2*. The likely 'best case' is arisings of 444,000 tonnes in 2006/07 and zero growth in production. The likely worst case assumes the figures based on the EA 2002/03 survey and a growth of 1% per annum (which is virtually identical to the WSE2007 assumed growth rate).

3.26 Thus, under the most optimistic of the scenarios that I consider likely, arisings of MW will be approximately 314,000tpa in 2020 and arisings of C&I waste will be about 440,000tpa in the same year. Under less optimistic scenarios, the arisings of MW could reach 399,000tpa by 2020 and those of C&I waste 617,000tpa by the same year.

3.27 Having established the most likely lower and upper bounds to the arisings of MW and C&I wastes, I then looked at likely future recycling and composting rates in order to estimate the expected arisings of residual waste for both streams. Since the previous work, additional data are available which show the trend in recycling and composting performance. These indicate that Cornwall is approximately on target to meet the WSE2007 national target of 40% recycling/composting (of household waste) for 2010. For the purposes of determining the range of likely residual waste arisings, I have assumed that the 'best case' scenario will be that Cornwall achieves the WSE2007 targets and continues to achieve 50% recycling and composting beyond 2020. For simplicity of modelling, I have assumed that these targets are met for MW (rather than just household waste – the difference being insignificant compared with other assumptions). The likely 'worst case' scenario is assumed to be that recycling and composting levels off at 40% beyond 2010/11.

3.28 In the case of C&I waste, I have assumed that recycling occurs at the levels indicated in the RSS (ie 165,000tpa in 2010 and 180,000tpa in 2013). For the best case scenario, I have assumed recycling of C&I waste is 44% in 2020 and beyond. For the worst case, I have assumed that it is 190,000tpa in 2020 and beyond. I have used linear extrapolation for all intermediate years.

3.29 Based on these assumptions, the projected most likely 'best case' (lower bound) for future arisings of residual MW and C&I waste are as shown on *Figure 3*. Under these assumptions, the total amount of residual waste (after recycling and composting) in Cornwall that will need to be managed by 2020 will be approximately 406,000tpa, comprising approximately 157,000tpa of MW and 249,000tpa of C&I waste.

3.30 The projected most likely 'worst case' (or upper bound) for future arisings of residual MW and C&I waste are as shown on *Figure 4*. Under these assumptions, the total amount of residual waste (after recycling and composting) that will need to be managed by 2020 will be approximately 666,000tpa, comprising approximately 239,000tpa of MW and 427,000tpa of C&I waste.

3.31 Given this range of arisings for the two waste streams, SITA's proposal appears to me to be well judged in terms of its capacity to meet the need to manage residual MW and to divert it from landfill. It is sized appropriately to deliver what I understand to be the company's obligations under its contract with the Council.

3.32 However, there is likely to be a need for further capacity beyond SITA's proposal in order to deliver a more sustainable management solution than available currently for residual C&I waste. In what I consider to be the unlikely event of significant capacity becoming available at the EfW plant as a result of falling MW arisings or higher recycling rates, SITA's facility might contribute to addressing this need. I note below the prospect of imminent changes in the status of the C&I waste stream. Furthermore, Government policy, as expressed in the INEOS Chlor decision letter (CD I3) is that the sourcing of fuel is a commercial matter for the Company, such that a distinction between the two waste streams, notwithstanding any obligation that SITA has to the Council via its contract, is an artificial one in terms of need.

*Waste Disposal Capacity within Cornwall*

3.33 As indicated previously, there are currently two landfills in Cornwall catering for the management of all of its residual waste: United Mines; and Connon Bridge. The third landfill, Lean Quarry, is being used for disposal of waste from another authority. United Mines will cease operations in 2010 and, under its current planning permission, Connon Bridge will cease operations at the end of 2014. It is not expected that the CERC facility will be operational before 2014. Consequently, from approximately 2014 onwards, without the CERC, and assuming no extension to the Connon Bridge landfill planning permission, Cornwall will have no facility for treating or disposing of a total of between approximately 430,000 and 610,000 tonnes per annum of residual waste (including between approximately 173,000 tonnes and 212,000 tonnes of MW). Cornwall Council and waste producers in the county will then have no option other than to pay for the export of residual waste for management in other authorities, assuming such arrangements can be made.

3.34 Without an extension to the Connon Bridge landfill, under the 'best case' scenario, the proposed CERC will be able to treat all of the predicted arisings of residual MW and will have capacity for treating up to 83,000tpa, or approximately 33%, of Cornwall's residual C&I waste. Under the 'worst case' scenario, the proposed CERC will have the capacity to treat all of Cornwall's residual MW up to approximately 2021 and it will be able to treat approximately 75% of Cornwall's residual MW arisings in 2035. Under this scenario, it will have the capacity to treat diminishing quantities of residual C&I waste from the point at which it opens in 2014/15 (approximately 28,000tpa) until about 2021 when its input would be entirely MW. This is shown graphically on *Figure 3* and *Figure 4*.

3.35 Assuming that Connon Bridge landfill is granted planning permission for an additional 800,000m$^3$ of capacity, and to operate for a longer period, it would have a total remaining capacity of approximately 2.0 million m$^3$ when it reopens in October 2010. SITA's stated intention is that this capacity would be used for the disposal of MW during planned maintenance of the CERC, for the disposal of waste that cannot be treated by the CERC and for the disposal of MW and C&I waste in excess of that which can be handled by the CERC.

3.36 In his proof of evidence, John Scanlon presents the company's calculations of the lifetime of the Connon Bridge landfill, both with and without the CERC facility, based on the typical current rates at which SITA has disposed of waste at the United Mines landfill (300,000tpa). To determine the need for the CERC facility, I have considered the available landfill capacity in Cornwall to deal with the County's waste (MW and C&I waste). As discussed previously, the United Mines landfill is due to close in October 2010. From this date, Connon Bridge will be the only landfill in Cornwall able to accept the County's waste. I understand that, if necessary, Connon Bridge would be able to accept up to approximately 400,000tpa of waste, rather than the 300,000tpa that it currently receives, and as considered by John Scanlon. However, total estimated residual waste arisings are between 450,000tpa and

600,000tpa up to 2014, and it is unlikely that Connon Bridge alone could serve the County's needs until the CERC becomes operational.

3.37 Under the assumed 'best case' scenario, if it was to take all of Cornwall's residual MW and C&I waste, the extended Connon Bridge landfill would have sufficient capacity for the disposal of all of Cornwall's residual waste up to approximately March 2015. Under the assumed worst case scenario, Connon Bridge landfill will not provide sufficient capacity for the disposal of Cornwall's residual waste beyond approximately March 2014, which is prior to commencement of operations of the proposed CERC. This is demonstrated graphically by *Figure 5* and the supporting data are presented in *Table 5*.

3.38 However, if all of the residual MW was to be landfilled, Cornwall Council would exceed its LATS allowances and would therefore need to purchase allowances from other WDA, or risk being fined £150 per tonne of biodegradable waste for exceeding its allowance. In 2008/09, Cornwall County Council landfilled 109% of its allocation, the only WDA in the South West to exceed its allocation, and it had an allowance deficit of 11,714 tonnes for the year (1). This deficit is likely to continue to rise year on year because the Council's LATS allowance decreases in line with national targets (refer to *Table 2*). Cornwall's LATS allowance for 2009/10, for example, is 110,554 tonnes of BMW whereas estimated arisings of BMW (amount of residual municipal waste multiplied by the proportion of BMW in the waste – typically about 66%) that will require disposal are likely to be between 124,460 tonnes

(1) Report on the Landfill Allowances and Trading Scheme 2008/09, Environment Agency, November 2009.

and 126,950 tonnes based on the best and worst case scenarios described previously. This is equivalent to a deficit of between approximately 13,900 tonnes and 16,400 tonnes of BMW.

*Conclusions Regarding Need for Waste Management Capacity offered by CERC*

3.39 It is apparent from these simple projections and calculations that there is a pressing need for an alternative to landfill for the management of Cornwall's residual MW. The proposed CERC facility will meet this need – in whole if measures to minimise waste generation and maximise waste recycling and composting are effective - or at least to a large extent even if waste arisings continue to grow and waste recycling and composting is not quite so effective. The need for capacity for residual C&I waste remains unaddressed.

3.40 There a demonstrated need both for the CERC and for the extension to the Connon Bridge landfill in order to provide sufficient capacity for the treatment of Cornwall's residual wastes. Connon Bridge cannot provide anything other than a very short-term alternative to CERC.

3.41 If the local schemes for recycling and composting MW out-perform expectations, then less residual MW will be sent to the CERC, with the remaining capacity being used to treat more than the anticipated amount of C&I waste. In this way, the CERC will not hamper or compete with recycling and composting of MW. On the contrary, it will compete with landfill or other forms of out-of-County treatment for the remaining residual C&I waste.

3.42 Realistically, there is no in-County alternative to CERC for the residual waste treatment capacity that is required. It is estimated that it would take a minimum of 9 years to develop a new strategy for Cornwall, and to identify and then to procure and put through planning an alternative facility, in other words to get to the stage to which the CERC has progressed to date. It would then take a further three to four years to construct and to commission the facility before it could be fully operational. During this period, Cornwall would need to rely on out-of-County facilities for the management of all of its residual MW and C&I waste. Although it is possible that some recovery capacity could be found elsewhere, there is unlikely to be sufficient surplus to manage more than a fraction of the waste that would be exported, and the remainder would be consigned to landfill. As I observe above, this is contrary to policy. It is difficult to see how this situation could in any way be seen as consistent with the obligations placed on the Waste Planning Authority in PPS 10.

3.43 The latest Defra statement on C&I waste states that landfill should be the home of last resort for waste, in line with the waste hierarchy. The statement includes the aim of increasing the proportion of the waste that does arise which is productively re-used, recycled or recovered. It also re-iterates the obligation on local authorities in PPS 10 to ensure (in their role as planning authorities) that there is a suitable network of facilities for the recovery and, where necessary, disposal of all types of waste [(1)].

(1) Defra. Commercial and Industrial Waste in England Statement of aims and actions 2009. Page 9. See *Annex G*.

3.44 For some time, commentators have speculated about the need for the definition of MW to be brought into line with practice elsewhere in Europe in order to satisfy the European Commission that the UK has properly implemented the Landfill Directive. On 2 December 2009, Defra announced its intention to change the definition to include a significant proportion of C&I waste [(1)]. Subsequently, it has announced that the consultation will take place later this year [(1)].

3.45 Given the expected timeline, I will comment on the latest state of affairs regarding these changes in my oral evidence to the inquiry. Nevertheless, at the time of writing is appears that in practice the change will mean that the amount of waste counted as MW will increase significantly. Changing the way MW is counted will mean amending the baseline on which the landfill diversion targets were set, and thus the 2010, 2013 and 2020 diversion targets for the UK. There will need to be a mechanism or mechanisms to ensure that a greater quantity of C&I waste is diverted from landfill than is the case at the present. Although Defra has stated this will not be through a further obligation, through LATS, on the WDA, the result will be a requirement for additional capacity to divert wastes produced in Cornwall beyond that currently envisaged by the Council. The requirement will be matched by an appropriate instrument, such that it cannot be ignored by waste producers or those responsible for providing for an adequate network of waste management facilities.

(1) http://www.defra.gov.uk/environment/waste/strategy/legislation/landfill/targets.htm. Accessed 2/2/10. See *Annex H*

3.46 One such mechanism is a restriction on the type of waste that can be sent to landfill, or a 'landfill ban'. The Government has conducted research on this instrument for diverting a greater proportion of waste from landfill, and intends to consult on the issue in 2010 (2) (3). Any such restriction would add to the pressure to provide non-landfill waste management infrastructure in Cornwall.

*Renewable Energy Need*

3.47 There is a similarly pressing need for renewable and low-carbon energy supply systems as there is for waste management infrastructure. The Government's UK Renewable Energy Strategy, issued by the Department for Energy and Climate Change in July 2009, lays out plans to meet the legally binding UK target of producing 15% of the UK's energy from renewable sources by 2020. The target is a seven-fold increase over 2008 levels, the most challenging of any EU Member State, and is described by the Department itself as "*very ambitious*" (4) (5). As I observe in paragraph 7.12 the draft Draft Overarching National Policy Statement for Energy (NPS EN-1) makes clear the significant need for new, major energy generating infrastructure and advises the Infrastructure Planning Commission that it should start its assessment on the basis that need has been demonstrated.

(1) http://www.defra.gov.uk/Environment/waste/localauth/lats/documents/consult-def-municipal-waste.pdf. Accessed 2/2/10. See *Annex I*.
(2) As originally suggested in CD F1, for example, in Summary, Effective Regulation, Para xix, Page 5.
(3) Defra. Commercial and Industrial Waste in England Statement of aims and actions 2009. Page 25. See *Annex G*.
(4) DECC. The UK Renewable Energy Strategy, Executive Summary, Page 8.
(5) http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/res/res.aspx. Accessed 2/2/10.

3.48 Planning Policy Statement 22: Renewable Energy (PPS 22) [1] stated the Government's aims of cutting carbon dioxide emissions by 60% by 2050 and making 'real progress' towards this target by 2020. It recognises that:

*"The development of renewable energy, alongside improvements in energy efficiency and the development of combined heat and power, will make a vital contribution to these aims."*

and:

*"Increased development of renewable energy resources is vital to facilitating the delivery of the Government's commitments on both climate change and renewable energy. Positive planning which facilitates renewable energy developments can contribute to all four elements of the Government's sustainable development strategy."*

As a renewable energy facility, offering substantial greenhouse gas reductions, the proposed CERC would contribute significantly to achieving these objectives, and meeting the specific needs of Cornwall in this regard. I amplify on this point below, and in subsequent sections of my Proof of Evidence.

3.49 In its glossary, the Planning Policy Statement 1 Supplement on Climate Change (CD E3) defines renewable energy and low-carbon energy in order to clarify what are supplies of these technologies so that they may benefit from the support provided elsewhere in the PPS, for example in paragraphs 13, 19, 20 and 40. EfW is defined as a renewable energy, whilst CHP is defined as a low-carbon energy. Therefore, SITA's proposals should receive the support

(1) CD E13

required by the PPS, not least at Paragraph 40 where it is stated that "*An applicant for planning permission to develop a proposal that will contribute to the delivery of the Key Planning Objectives set out in this PPS should expect expeditious and sympathetic handling of the planning application.*"

3.50 The draft RSS notes that development of renewable energy sources in the region is a major challenge for the region as, when it was prepared [(1)], only about 3% of the of the region's electricity requirements were generated from renewable sources compared with the national target of 20% by 2020. In order to reduce the region's ecological footprint, the RSS has a stated aim of meeting national targets relating to renewable energy. It also notes that by producing more of the energy that the County uses from renewable sources, its 'carbon footprint' can be reduced and that producing energy from a range of renewable resources will contribute to resilience of supply.

3.51 The RSS envisages that the renewable energy targets are likely to be met through a mixture of technologies dispersed throughout the region.

3.52 Delivering sustainable waste management and renewable energy infrastructure will require the diversion of greater quantities of waste from landfill, a demand which will be matched by the market as the Landfill Tax brings landfill gate fees into line with those of other management routes. The CERC will provide a significant and deliverable contribution to both needs, and will deliver the environmental benefits that alternative management routes offer and that are sought by national policy.

(1) Consultation draft of RSS was published in June 2006.

3.53 The need for new waste management infrastructure, nationally and locally, is urgent. The need for renewable and low-carbon energy supply systems is equally pressing. CERC offers a deliverable and significant contribution to meeting both these needs. In the nature of the technology employed and in its scale, the proposal will provide the environmental benefits of management further up the waste hierarchy compared with the present arrangements, including the reduction of carbon emissions as I discuss in *Section 6*.

3.54 Current policy on need is indicated in the Secretary of State's decision letter on Ince Marshes (CD I2), wherein the Secretary of State says, in relation to a competing proposal to Ince Marshes in the North West:

"*The Government's policy on energy is set out in the Energy White Paper 'Meeting the Energy Challenge May 2007 and includes the view that a diverse mix of energy technologies, including energy from waste generation, will be required to combat climate change and provide secure, clean and affordable energy. The market brings forward proposals to meet the needs of those policies, which then need to be considered on their individual merits. While the INEOS Chlor energy from waste proposal at Runcorn, referred to at the [Ince Marshes] inquiry was granted consent by the Secretary of State on 16 September 2008, there can be no guarantee that the waste facility will be constructed or that other prospective energy from waste facilities will be approved and constructed. At the same time the Secretary of State notes that neither waste nor energy policy places a rigid cap on the development of waste management capacity.*"

3.55 In effect, there is no need to demonstrate a quantitative need at the local level given the step change required in waste management and in energy supply.

Bringing forward planning applications, and constructing and operating facilities where these applications are successful, is a commercial matter for the industry, in this case for SITA, responding to its contract with the WDA.

## *4 APPRAISAL OF DIFFERENT TECHNOLOGY OPTIONS*

4.1 In this section of my Proof of Evidence, I present the results of an appraisal undertaken by ERM to determine the most preferable means of handling residual waste in Cornwall. The full report is presented as *Annex C* to my Proof. I intend to present here a summary of the work undertaken and of the main findings.

4.2 The options appraisal demonstrates the advantages and disadvantages of various technology options, and indicates the contribution that SITA's proposal can make to sustainable development, consistent with the first Key Planning Objective of PPS 10. The options appraisal is not intended to be exhaustive, nor to prove conclusively which is the best. This would require a degree of subjective judgement upon which there is quite reasonably a plurality of opinion, as no doubt the Inquiry will amply demonstrate. There is no policy requirement to identify or to pursue a preferred technology, and the Council has, in its contract with SITA, and in the Waste Local Plan, itself selected a centralised EfW facility for the delivery of its MW management needs.

4.3 Government indicated, in consulting on changes to the decision making principles in WS2000, which included the concept of the 'Best Practicable Environmental Option' (BPEO), that an optimal solution was all too difficult to prove and all too easy to attack. The BPEO, and its constituent concepts of 'regional self sufficiency' and the 'proximity principle' were abandoned as policy constructs in favour of a more practical set of decision making principles and key planning objectives.

4.4 Decisions elsewhere indicate that technology choice is a matter for policy, not for the consideration of individual planning applications (1). Policy, as set out by the Secretary of State in WSE2007 (2) (CD F1) and the Ince Marshes decision letter (CD I2), takes the view that a diverse mix of technologies will be required to provide secure, clean and affordable supply, a view also stated in the decision on INEOS Chlor (CD I3). In WSE2007, Government "*…does not generally think it appropriate to express a preference for one technology over another, since local circumstances differ so much.*" (3). It is for the market to bring forward proposals, choice of technology being a commercial matter for SITA.

4.5 Nevertheless, although Government is equivocal about the choice of recovery technology, Defra stated in October 2009 that "*As set out in the WSE2007 and the Energy White Paper, Government supports the use of incineration with energy recovery, for the treatment of residual waste that cannot be safely or practically recycled or composted.*" (4) Furthermore, EfW continues to be selected by authorities in Outline Business Cases for PFI credits approved by Defra, and in on-going MW contract procurements, tenderers offering EfW are in the final stages of bidding, or at the preferred bidder stage, for example in Buckinghamshire, Hertfordshire, Milton Keynes & Northamptonshire, Norfolk and Oxfordshire. EfW is used widely elsewhere in Europe, and the

(1) Wadlow Farm, Six Mile Bottom Road, West Wratting, Cambridgeshire. 26 August 2009. Paragraph 12.12. Appeal reference: APP/W0530/A/07/2059471.
(2) See, for example, CD F1, Summary, Objectives and Targets, Paragraph ix, Page 3.
(3) CD F1, paragraph 27, page 79.
(4) Defra, Waste Private Finance Initiative (PFI) – frequently asked questions (FAQs). October 2009. Page 10. See *Annex J*.

evidence is that a vigorous EfW policy is compatible with high recycling rates [(1)].

*Technical options that were considered*

4.6 Seven scenarios were chosen for this appraisal, each representing a possible option for the management of residual waste after extensive recycling and composting have been carried out. The scenarios were as follows:

1. Do Nothing;
2. EfW without heat recovery;
3. EfW with heat recovery (ie combined heat and power - CHP);
4. Mechanical biological treatment (MBT) with anaerobic digestion (AD);
5. MBT with on-site gasification;
6. Autoclave with gasification; and
7. MBT with off-site burning of refuse derived fuel (RDF).

4.7 The 'do nothing' option was included to act as a baseline or 'benchmark' against which the other scenarios could be compared. In practice, as this scenario involves the continued disposal of residual waste to landfill, it is not a practical option given policy imperatives and the lack of landfill voidspace, as I discussed previously in *Section 3* of my Proof of Evidence.

4.8 The two scenarios employing EfW were chosen to demonstrate how EfW technology performs generally and the difference that heat recovery can make.

(1) CD F1, Box 5.2 and paragraph 23, page 78.

4.9 Three MBT options were included in the assessment. Two scenarios modelled MBT producing a refuse derived fuel (RDF): in one scenario this is assumed to be gasified on-site; and in another it is sent off-site for combustion. The third MBT scenario assumes preparation of the waste for subsequent anaerobic digestion.

4.10 The final scenario that was modelled replaces MBT with autoclaving the residual waste, prior to gasifying the output on-site.

4.11 The scenarios that were modelled represent a reasonable range of possible technologies that could be considered for dealing with Cornwall's residual waste following extensive recycling and composting. They are not intended to be exhaustive. Pyrolysis was not included in the scenarios because it is not currently a method used for treating mixed residual MW in the UK. Moreover, the processes offering 'gasification' typically offer a process that combines pyrolysis and gasification, so the distinction between the operations becomes blurred. I consider that pyrolysis technology, if developed, could realistically only replace the gasification step for RDF/fluff, and that modelling gasification will also give an indication of how a pyrolysis system might perform.

*Assessment Criteria*

4.12 The scenarios were each assessed against eleven criteria: six environmental criteria (abiotic resource depletion, global warming, human toxicity, freshwater aquatic ecotoxicity, acidification and eutrophication); transport amenity; cost; deliverability; employment; and compliance with policy. The six environmental criteria are the default criteria used by the Environment Agency's Life Cycle Assessment (LCA) tool WRATE, which I describe in more detail in *paragraphs 4.11* and *4.12*. The other five criteria were selected by ERM, based on our experience of the key factors affecting the choice of waste management facilities by local authorities.

4.13 The Waste and Resources Assessment Tool for the Environment (WRATE) life LCA software was used to compare the environmental performance of the different technology options. WRATE was specifically developed for comparing different management systems treating MW. The model is a software tool developed for, and commercially available from, the Environment Agency. Defra encourages local authorities and the waste management industry to use WRATE for determining environmental impacts of different waste management systems, for example in the submission of business cases for PFI funding, as in the case of Milton Keynes and Northamptonshire (1) (2) (3) . There are other LCA tools and methods for technology options appraisal, but I consider that none offer the same policy support, range of waste technologies that is provided by WRATE, or have the level of sophistication of technical development or peer review.

4.14 WRATE calculates potential impacts stemming from all stages in the management and processing of MW. These impacts include waste collection, transport, treatment and disposal activities, taking account of the associated infrastructure, together with the avoided burdens associated with materials

(1) For example, CD F1 paragraph 29, page 79.
(2) Defra, Waste Private Finance Initiative (PFI) – frequently asked questions (FAQs). October 2009. Page 10. See *Annex J*.
(3) http://www.defra.gov.uk/news/2008/081127b.htm. Accessed 12 February 2010. See *Annex K*.

recycling and energy recovery (eg energy from fossil fuels, mining for iron ore). WRATE's process data have been audited by a combination of Environment Agency staff and members of academia, so its results have an added degree of authority. Further information about WRATE is provided in *Annex A* and the full report of the study included as *Annex C* to my Proof of Evidence. The assessment has been subject to independent peer review, and the peer review report is provided as *Annex L* to my Proof.

4.15 The WRATE software models waste management scenarios in a given year. For the purposes of this work, the year chosen was 2020, the year of the last and most stringent diversion targets under the Landfill Directive.

4.16 The waste arisings and the recycling and composting rates in 2020 were taken from the Need Assessment report prepared by ERM [1]. The key data for this study are presented in *Table 6*. As I discussed previously, when considering the need for the CERC facility, I have reviewed the likely future waste arisings based on the most recent data and this has resulted in slightly different estimates from those used when the Need Assessment report was prepared. However, I consider that the differences are not sufficient materially to affect the outcome of the assessment of different technologies.

4.17 The impact on transport amenity was assessed by determining the total tonne-kilometres that waste would need to be hauled. One tonne-kilometre is the movement of one tonne of material a distance of one kilometre, so a lorry transporting 20 tonnes of waste 15 kilometres will accrue 300 tonne-kilometres

(1) Task 1: Need Assessment Report, ERM, February 2008. CD A2.

of haulage. This measurement is used as a proxy for such aspects as congestion, noise, and local air pollution (such as generation of dust).

4.18 The likely deliverability of the scenarios was assessed in terms of: capability (how well the plant would be able to handle the waste); planning (assessment of the likely opposition to gaining planning permission); and markets (whether there will be markets for the outputs from the technologies).

4.19 The other assessment criteria were: the relative costs of the waste management scenarios; the levels of direct employment likely to be generated by the technologies; and their relative compliance with policies, focusing on landfill diversion and the waste hierarchy.

*Modelling Assumptions*

4.20 For the purposes of the modelling, it was assumed that the residual waste treatment facility will handle 240,000 tonnes of residual waste per annum, encompassing nearly all the residual MW generated in Cornwall (180,000 tonnes), with the balance made up by some of the residual C&I waste arisings, with the rest continuing to go to landfill (or other processes outside the scope of the modelling).

4.21 The recycling and composting undertaken on waste segregated at the kerbside was assumed to be the same for all seven scenarios, and hence would not affect their relative performance. Therefore, all the scenarios start with the 240,000 tonnes of residual waste, and only the management of that waste was modelled using WRATE.

4.22 The waste compositions used for the study were derived from the starting composition of MW taken from the 2002 WRAP study (1). The composition of the residual waste was determined by estimating how much of the different recyclate streams might be diverted by 2020, in order to hit the 2020 target level of 50% for household waste, which corresponds to 47.4% for MW. The recycling and composting rates achieved for the different material types are summarised in *Table 7*.

4.23 The same basic process was followed for C&I waste. The composition of waste arisings was taken from Environment Agency's Commercial and Industrial Waste Survey 2002/03 (2). Some adjustments to waste fractions had to be made, so that WRATE could model the C&I waste. Specific details are provided in the full report. As with MW, recyclable and compostable fractions were then diverted until the overall diversion rate reached the 2020 target. The remaining waste was split between the residual waste treatment processes and C&I waste landfill.

4.24 The final composition of the waste modelled is depicted in *Figure 6*. The largest fractions are organic waste (21.4%), non-combustibles (17.1%), paper and card (13.9%) and combustibles (8.5%).

(1) The analysis of household waste composition and factors driving waste increases, WRAP, December 2002.
(2) http://www.environment-agency.gov.uk/subjects/waste/1031954/315439/923299/1071046/?version=1&lang=_e

*Environmental Impact*

4.25 The results from the WRATE modelling are presented in *Table 8*. The figures indicate the environmental impacts associated with the scenarios, so the larger the number, the more significant the impact.

4.26 A number of the scenarios have *negative* scores. These indicate that the scenarios have a net beneficial effect on the environment, and arise from such activities as recycling materials (thereby avoiding the impacts of extracting new raw materials and purifying them) and recovering energy (thereby avoiding the extraction and combustion of, for example, coal and natural gas).

4.27 More information detailed information about the results of the WRATE modelling of each scenario is presented in the full report. This demonstrates, for example, that the recycling operations make contributions to the overall *benefits* of each of the scenarios while, in general (although not always), if a scenario includes an element of landfill this will add to the overall impact of the scenario.

4.28 The 'Do Nothing' scenario scores badly for nearly all of the criteria assessed by WRATE. In contrast, autoclaving with gasification performs very well, and is most preferred for four of the six criteria. The chief reason for this is the benefits that accrue from recycling glass, metals and plastics (for the latter, over the alternative of, for example, burning them). However, I do have some reservations about whether the level of recycling and quality of separation will be high enough to deliver the high quality recyclates assumed in WRATE. The plastic output from autoclaving is deformed and can be difficult to sort into polymers. Furthermore, contrary items in the bottles in the autoclave may be encapsulated during the deformation process, trapping various contaminants within the plastic. WRATE assumes that the plastics are of the same high quality as those obtained via source-separated collection programmes, and this is unlikely to be the case. The implications of this were examined by undertaking a sensitivity analysis as I will describe later.

4.29 The second best option from the WRATE assessment was EfW with CHP. This was found to be consistently better than the EfW scenario (the next best after that), because of the additional benefit afforded by heat recovery. Approximately equal with the EfW only plant were the two MBT scenarios that generate RDF, either for gasification on site or combustion off-site. The seventh scenario, MBT with anaerobic digestion, was generally ranked last of the alternative scenarios, reflecting the large amount of material that is still sent to landfill.

*Transport Amenity*

4.30 When considering potential transport impacts associated with a new waste management facility, it is appropriate to compare the impacts against the existing situation; in this case the baseline or 'Do Nothing' scenario, to determine the extent of change from the default situation. In undertaking the assessment, it was therefore assumed that all of the scenarios will incur the same impacts transporting the waste to the principal treatment facility, so the assessment looked at the onward transport of products and residues from that site. As I explained previously, the total amount of waste freight was taken to be an appropriate proxy for transport amenity, on the assumption that amenity is broadly proportional to the waste residues moved, measured in tonne-kilometres. The tonnages of residues moved for each scenario were provided by the WRATE modelling, and an estimate was made as to whether the waste residues and recovered fractions will be moved locally (25 km), sub-regionally (100 km) or regionally (250 km). This estimation was undertaken taking into account the anticipated availability of facilities to accept the recovered materials.

4.31 The two EfW scenarios are most preferred from a transportation point of view, as the onward movements of ferrous metal and bottom ash are expected to be local, with the non-ferrous sub-regional and the remaining fly ash taken further away for landfilling. The next best option is MBT with on-site gasification. Once again, the bulk of the incoming waste is disposed on site (by combustion), but this time both ferrous and non-ferrous metals are recovered, and some material is still sent to landfill. Autoclaving is the next most preferred scenario, with a similar transport footprint to the MBT processes, except that more materials (glass and plastics) are sent to reprocessors for recycling. MBT with off-site burning of RDF and MBT with AD are least preferred for transport, since both have significant volumes of residual waste that have to be moved off-site again (either to the RDF plant or the landfill). The Do Nothing scenario performs even more poorly, because the rapid exhaustion and closure of local landfills will force the transportation of the waste quite some distance out of the county.

*Cost*

4.32 The cost data presented in Annex A of WSE2007 were used as a basis for the assessment of the costs associated with the different technology options. The assumptions made when estimating the costs associated with those technologies not explicitly listed in Annex A of the WSE2007 are detailed in the full report.

4.33 When comparing the costs of the different options, the prevailing rate of landfill tax was assumed which, at the time was £24 per tonne. It should be noted that landfill tax will continue rising steeply, which will make any scenario which includes much landfilling look less and less attractive in future years.

4.34 Two of the scenarios fail to meet the landfill diversion targets so, in calculating the overall costs, LATS fines were included at the rate of £150 per tonne. Depending on their availability, it may be possible to purchase LATS allowances from other authorities at a price lower than £150/t, but for the purpose of the modelling it was assumed that this is not possible.

4.35 The costs for each scenario are presented in *Table 9*. The lowest cost scenario was EfW without heat recovery. The assumption concerning the additional gate fee of an EfW facility incorporating heat recovery is responsible for the slightly higher cost of that scenario. It should be noted that it may also be that the CHP plant could command a lower gate fee, because of the extra income from the heat energy. For both the EfW scenarios, the low total cost is a result of the relatively low gate fees for the tonnage being handled, and the small amount of material subsequently requiring landfill. For the modelling, it was assumed that the landfill tax rate for active waste will be paid, although it may be possible to pay only the inert waste rate of £2/t. Whether or not this is possible does not make a material difference to the overall costs, which are dominated by the gate fee.

4.36 MBT with AD was found to be the most expensive option (even higher than doing nothing) because the process is inefficient at treating the waste, with the result that a large amount of BMW is sent to landfill. This increases the landfill tax payable and also results in a large LATS fine. These two aspects make this scenario significantly more expensive than the alternatives.

4.37 The costs of the other scenarios fall between the costs of EfW and MBT with AD. The different combinations of gate fees, tonnages sent to landfill and (for the Do Nothing scenario) LATS fines result in generally similar total costs although the MBT scenario with offsite burning of RDF has a relatively high cost because of the assumed RDF burner gate fee.

*Deliverability*

4.38 In determining the likely deliverability of each of the different technology options, three aspects were considered: capability of the technology to handle the waste input; likelihood of gaining planning permission; and whether outlets for the outputs from the processes can be found. All these matters are implicitly considered by the financial institutions when they consider supporting a proposed development.

4.39 In theory, all the proposed scenarios should be capable of handling the proposed waste input because only plausible technologies were included in the assessment. However, in practice, some technologies are more completely proven than others, as demonstrated, for example, by number of full-scale operational plants in the UK (or Europe),their length of operation and the level of development of markets for outputs.

4.40 In terms of obtaining planning permission, any facility is likely to face a challenge from local pressure groups, regardless of the technology employed, but it is also true that some technologies are less publicly accepted than others, whether for scientific or emotional reasons.

4.41 The more sophisticated separation technologies generate a number of potential product streams. On the one hand, these can be financially and environmentally beneficial if markets can be readily found. On the other, they become financial and environmental liabilities if no, or unreliable, outlets are found. At worst, landfilling these outputs can lead to failure in achieving LATS targets, with all the associated implications.

4.42 A relative assessment of each of the technologies against these three aspects of deliverability was undertaken. The results of this are copied in *Table 10* and further detail may be found in the full report. It can be seen that EfW without heat recovery was determined as being the most deliverable of the options followed (equally) by EfW with heat recovery, landfill ('do nothing'), MBT with AD and MBT with off-site burning of RDF. Autoclaving with on-site gasification was assessed as being the least deliverable, due largely to the lack of full-scale commercial experience of these technologies in treating waste in the UK.

*Employment*

4.43 The creation of jobs is seen as a positive benefit of a new waste management facility. Approximate figures for the numbers of skilled and unskilled jobs associated with different types of waste management facility and for different throughputs were taken from a previous study [(1)]. For options that involve two processes, such as MBT with AD, the employment requirements of each were simply added to estimate the total number of staff required.

4.44 The estimated total numbers of employees required for the different scenarios are presented in *Table 11*. The combined 'unskilled equivalent' figure for each scenario is based on the estimation that each skilled job is equivalent to three unskilled jobs. This figure, and the data in general, are necessarily approximations, but they provide an indication of the number of jobs that might be created.

4.45 From this approach, it can be seen that the largest number of jobs is associated with the MBT plus RDF scenarios. However, the figures include the additional staff required to man the gasifier/combustion plant which, if on-site, might share some staff with the MBT plant and, if off-site, could already exist, and might well be outside the County so the employment benefit might not be felt locally. The autoclaving scenario is the next biggest employer, again with staff required to man two operations. After autoclaving comes

(1) Appendix 4 of SWRA BPEO Report June 2003.

MBT with AD, and then the EfW scenarios, which create the smallest number of additional jobs, except for the 'Do Nothing' scenario.

*Compliance with Policy*

4.46 Compliance with policy was judged on whether the scenarios meet the landfill diversion requirements of the Landfill Directive, and by how well they accord with the waste management hierarchy.

4.47 By 2020, Cornwall will only be able to send a maximum of 51,526 tonnes of BMW to landfill. The WRATE software models environmental impacts via mass balances on each waste fraction, so it is also able to report on the approximate amount of biodegradable waste sent to landfill. Figures for the seven scenarios are presented in *Table 12.*

4.48 The figures presented in this table are total biodegradable waste landfilled, and include both municipal and C&I waste. However, the model assumed waste input is 75% MW, and inspection of the two residual waste compositions (MW and C&I waste) suggests that the MW also has a higher biodegradable content. The net result is that 78% of the biodegradability of the residual waste feedstock is of MW origin. The conclusion is that the Do Nothing and the MBT with AD scenarios will send approximately 98,000tpa and 84,000tpa of BMW to landfill, and that both will therefore fail to meet the Landfill Directive requirements.

4.49 The waste hierarchy states that, having minimised waste arisings and reused waste where possible, the next best thing to do is to recycle and to compost, and then to digest anaerobically the waste. After this, energy recovery is preferable to landfilling. Compliance with this hierarchy was assessed by assigning a score between one (good) and four (bad) to the different ways of managing waste. Thus, recycling and composting score one, AD scores two, recovery scores three and landfill scores four. The scores were then scaled by the weight of waste treated by each method, and totalled to give an overall hierarchy score, in which low scores are better. The results of this process are presented in *Table 13*.

4.50 This process showed that three of the six scenarios score similarly well when judged against the waste hierarchy. The two EfW scenarios perform the best, because of the recycling and small amount of residual waste sent to landfill. Autoclaving is a close third, because of its combination of recycling and recovery, but it scores less well because of the amount of waste still sent to landfill. At the other end of the scale, MBT with AD still sends a lot of waste to landfill, so is the least preferred option with the exception of the Do Nothing scenario. The two other MBT options were rated between the two extremes.

*Overall Results*

4.51 None of the options is most preferred for all of the criteria used in the assessment. Some form of balancing of impacts must therefore be undertaken to determine the most preferred scenario. Firstly, it can be seen that the Do Nothing and MBT with AD scenarios generally perform poorly, and, in particular, fail to meet LATS diversion targets. For these reasons, they were disregarded from further consideration.

4.52 The EfW scenario with heat recovery outperforms or matches EfW without heat recovery for nearly all the criteria, with the exceptions of cost and deliverability. Therefore, if EfW is the preferred overall option, it makes sense to build in heat recovery, if at all possible.

4.53 Of the three remaining scenarios, the autoclave option performs very well for most of the environmental criteria, whereas the MBT options tend to get predominantly intermediate rankings. Neither of these last two scenarios appears to perform as well as the autoclaving or CHP options, which therefore emerge as the preferred alternatives. This analysis leaves us with two scenarios as possible preferred options: EfW with heat recovery (CHP); and autoclaving with gasification.

4.54 There are pros and cons to both scenarios, but it is clear that, while autoclave with gasification performs slightly better on the environmental criteria, EfW with CHP performs significantly better for almost everything else. If equal weighting were given to the environment (as a whole), transport, cost, deliverability, employment, LATS and waste hierarchy, EfW with CHP would be preferred. Such an analysis may over-emphasise the non-environmental criteria, but even giving the environment a small weighting advantage over the other criteria is still likely to leave EfW with heat recovery more preferred. Moreover, the most important of the criteria is deliverability, and there remains a real question over whether autoclaves can deliver in practice the excellent performance that process modelling suggests they can achieve.

4.55 My conclusion from this analysis is that the most preferred means of handling the residual MW and C&I waste predicted to arise in Cornwall in the future is by means of an EfW plant, with heat recovery.

*Sensitivity Analysis*

4.56 In order to test the results of the assessment, two sensitivity analyses were undertaken.

4.57 An assumption made in undertaking the initial assessment was that the plastic recovered from the autoclave is fit for recycling as either mixed dense plastics (for the dense plastic waste) or LLDPE and mixed agricultural films (for the films). If this is not the case, and the plastics must be landfilled instead, the performance of the autoclave scenario is significantly changed, in particular for the environmental criteria. EfW with CHP, rather than autoclaving, then becomes the most preferred option for global warming, while the MBT with AD and MBT with on-site gasification become most preferred in terms of acidification and eutrophication, respectively. The reduced amount of transport associated with finding a market for the plastics does provide a small improvement but, overall, the margin by which the EfW with CHP scenario is more preferred becomes much wider, while the autoclave becomes on a par with the MBT+RDF scenarios.

4.58 In the original analysis, it was assumed that there would be a gate fee associated with the burning of RDF. However, it is not clear whether a waste contractor would have to pay a third party burner to accept its RDF, whether that RDF would be revenue neutral, or whether the contractor might receive some money. Changing the RDF to revenue neutral makes this scenario the third most preferred on cost grounds (behind the two thermal processes), instead of sixth, but still does not make a significant difference to the overall assessment.

*Conclusions*

4.59 Based on the comparison of the seven different technical options against the eleven assessment criteria, two scenarios generally stood out as being preferred over the alternatives: EfW with heat recovery and autoclaving with a gasifier to treat the fluff produced.

4.60 These two options were subjected to a more detailed comparison. Looking at their relative performance, the autoclave is generally rated slightly better for the environmental criteria, while the EfW with CHP plant performs significantly better for almost everything else. If the environment were the only matter of concern, it would probably be concluded that the autoclave is the best option. However, matters such as cost and transport amenity are also very important, and, arguably, the single most important criteria is deliverability, since a plant that does not deliver the diversion from landfill is a failure and will not secure the benefits that have been ascribed to it. While the autoclave plant appears to be a good option, it is a largely unproven technology for handling MW at this scale, so raising finance in the first place may be an issue. It is not a certainty that the plant will be able to operate routinely without unexpected downtimes, and, finally, there may be issues finding markets for all its outputs.

4.61 Taking all these points into consideration, my conclusion is that the most preferred means of handling the residual MW and C&I waste predicted to arise in Cornwall in the future is by means of an EfW plant with heat recovery.

4.62 I note that Fichtner Consulting Engineers Ltd have also undertaken an assessment on behalf of Cornwall County Council to review the potential of some of the proposed alternatives for dealing with MW which would otherwise go directly to landfill (CD 01). Specifically, their study investigated three potential technologies: gasification, based on the Energos technology with appropriate pre-treatment; a combination of autoclave, sorting, anaerobic digestion and composting; and gasification using Stein gasification technology with appropriate pre-treatment. All three technology options were considered for either a single central site located at Rostowrack Farm or three smaller sites located across Cornwall. The assessment considered estimated capital cost, estimated operating costs, planning risk, reference facilities, reliability of technology, flexibility of technology, compliance with the Waste Local Plan, end product liability and transportation issues. As a reference, for comparison of these alternative solutions, Fichtner used conventional energy from waste facility as being offered by SITA.

4.63 The overall conclusion of Fichtner's study, as presented in their final report (1) is that 'a central energy-from-waste plant' is the preferred option. In other words, they deemed the solution being proposed by SITA to be better than the three alternative technologies that were considered. Fichtner scored each of the technologies against the twelve different assessment criteria and then

(1) Core Document O1

determined the overall performance by comparing both the average score for each for each option and also the average ranking. Using both the average score method and the average ranking method, conventional EfW was the clearly preferred option. Sensitivity assessments undertaken by Fichtner confirmed that the ranking is robust to different weightings of the criteria, with the preferred option of conventional EfW remaining top or second 'under all reasonable permutations'.

## *5 ECONOMIC AND ENVIRONMENTAL BENEFITS OF THE SCALE OF THE PROPOSAL*

5.1 This section of my proof describes the results of an appraisal undertaken to compare the environmental and economic performance of using different sized facilities to provide the overall treatment capacity provided by the proposed EfW facility. I present the results of modelling the relative impact of providing one or more separate energy from waste (EfW) facilities to provide the overall treatment capacity of the proposed facility. The full report is presented as *Annex D* to my Proof of Evidence. I intend to present here a summary of the work undertaken and the main findings.

5.2 As with the options appraisal I describe in *Section 4*, there is no policy requirement to investigate the relative advantages and disadvantages of centralised or decentralised facilities for managing waste. SITA's proposals are to deliver the requirements of its contract with the WDA, and a single, centralised facility is consistent with the Waste Local Plan. However, this appraisal serves to demonstrate the trade-off between the economies of scale of a larger plant and the reduced waste transport distances associated with smaller facilities. In this section, I look at EfW only. I have not considered the economies of scale of other technologies, which might be different.

5.3 I do not comment here on the merits of the site, other than by virtue of its centrality and scale. Neither do I comment on the specific merits of alternative sites, since the assessment relies upon indicative, rather than proposed, locations for smaller, decentralised plant. Nevertheless, I observe that in the INEOS Chlor decision, with respect to management of wastes close to the point of arising and the sourcing of waste, the Secretary of State considered that the location of waste treatment facilities is a matter for the respective waste disposal authorities to decide (CD I3). With respect to renewable energy proposals, policy requires that planning authorities should "*Not…question the energy justification for why a proposal for such development must be sited in a particular location*." (1)

5.4 Three possible options for providing the total 240,00tpa treatment capacity of the proposed plant were compared:

1. one centralised facility of the capacity planned for Rostrowrack;
2. two facilities each of 120,000tpa capacity – located at United Mines and Connon Bridge; and
3. five facilities each of 48,000tpa capacity distributed around the County.

5.5 These three scenarios represent a reasonable range of possible options for the number, and hence sizes, of facility that could be considered for dealing with the total volume of Cornwall's residual waste following recycling and composting.

5.6 In each case, it was assumed that the facilities will accept mainly MW, with additional C&I waste used to make up any capacity shortfall.

*Assessment Criteria*

5.7 These scenarios were each assessed against four criteria: environmental impact; transport amenity; cost; and deliverability and risk. The

(1) CD E3, Para 20.

environmental impact assessment comprised consideration of five separate assessment criteria: global warming; resource depletion; human toxicity; acidification; and eutrophication. These are all default criteria used by the Environment Agency's Life Cycle Assessment (LCA) tool WRATE, which I described briefly in *Section 4*. Further information about WRATE is provided in the full report included as *Annex D* to my Proof. The impact on transport amenity and the deliverability of the scenarios were assessed as I described in *Section 4*.

*Modelling Assumptions*

5.8 As with the appraisal of different technical options, which I described in *Section 4* of my Proof, the modelling was undertaken for the year 2020, as this is the year of the last and most stringent diversion targets under the Landfill Directive. As I explained in *Section 4*, waste arisings and the recycling and composting rates in 2020 were taken from the Need Assessment report prepared by ERM (1).

5.9 Also drawn from the Need Assessment report, the residual waste treatment facility or facilities were anticipated to handle a total of 240,000tpa, encompassing nearly all the residual MW (180,000 tonnes), with the balance made up by some of the residual C&I waste, while the rest continues to go to landfill (or other processes outside the scope of this study).

5.10 The composition of the waste to be treated was determined as I described in Section 4.

(1) Task 1: Needs Assessment Report, ERM, February 2008

5.11 There is a relationship between the size of a facility and energy recovery efficiency, owing to thermal losses, plant energy demands (which tend to be largely independent of plant scale) and efficiencies of electricity conversion. The electrical outputs for different sized facilities were taken from a previous report for Defra by AEAT (1) as summarised in *Table 14*, together with that for the EfW facility at Chineham, which is a modern facility and the reference EfW plant within the WRATE model. These data were extrapolated to estimate the output for the different sized facilities considered in this study as listed in *Table 15*.

5.12 These results were used to generate customised EfW models in WRATE to scale the energy outputs from the basic WRATE Chineham model. The original EfW model was further customised by allowing it to accept the combined MW and C&I waste fractions.

5.13 WSP undertook detailed modelling of the transport associated with the three scenarios in order to assess the transport amenity impacts and to provide inputs to the WRATE modelling of environmental impacts. Jeremy Penfold describes the modelling of transport distance in his Proof of Evidence.

5.14 Using the combined waste composition, the EfW efficiency profiles and the travel distances determined by WSP, the three scenarios were modelled in WRATE for the year 2020. The modelling took into account: first level burdens (the direct use of resources and all emissions associated with the operation of the facilities); second level burdens (such as those associated with the construction and ultimate demolition of the facilities); and avoided burdens due to materials and energy displacement (for example, generating electricity reduces the need for coal and gas-fired electricity generation, or recycling ferrous metal reduces the need to extract iron ore and refine it).

*Environmental Impact*

5.15 The results from the WRATE modelling are presented in *Table 16*. The figures indicate the environmental impacts associated with the scenarios, so the larger the number, the more significant the impact. A number of the scenarios have *negative* scores. These indicate that the scenarios have a net beneficial effect on the environment, and arise from such activities as recycling materials (thereby avoiding the impacts of extracting new raw materials and purifying them) and recovering energy (thereby avoiding the extraction and combustion of, for example, coal and natural gas).

5.16 Given that the 'mass balance' is the same for each scenario, the negative impact due to landfill and the benefit due to ferrous recycling, for example, is also identical for each scenario. Hence, the only differentiators between the scenarios were the impacts from transportation and the operation of the EfW facilities themselves. In all cases, the impact of transport operations reported by WRATE is not significant compared to that of the EfW plant(s).

5.17 The results show that, for each of the environmental criteria, the impacts are smallest, and the benefits are the largest for Scenario 1, the single incinerator.

(1) From Table 5.1 of draft final report, An Assessment of costs an environmental impacts of single and multiple facilities,

5.18 One way of comparing the relative significance of the different environmental impacts is to express the impacts relative to the annual impact of a typical EU citizen. For example, one year in the life of a typical EU citizen reduces the earth's resources by an amount estimated to be equivalent to 38.76 kg of antimony. The first scenario, with a single plant, saves 977,900 kg of antimony per year, so this is equivalent to saving the impacts associated with 25,227 EU citizens. On this basis, and assuming that each of the impacts is equally important, the largest contribution is the offset in resource depletion, for which Scenario 1 delivers the greatest savings. Totalling the scores for the various impacts is one way of combining the environmental assessments into a single score, implicitly giving an equal weighting to each criterion, as shown in *Table 17*. Even if a different set of weighting factors is applied, Scenario 1 is still the most preferred.

*Transport Amenity Impacts*

5.19 As I explained above, WSP undertook detailed modelling of the transport associated with the three scenarios. The detailed method together with the results of this modelling and a commentary on the findings are presented *Annex A* of the full report.

5.20 The daily laden mileages calculated for the three scenarios are shown in *Table 18*, and are converted into annual kilometres by multiplying by 260 (approximate working days per year) and 1.609 (to convert miles to kilometres).

AEA Energy and Environment, May 2007.

5.21 The modelling shows that the least impact due to transport occurs for the two plant scenario and that the one plant option has the greatest impact. It would be expected that increasing the number of plants would decrease the overall transport mileage, because the average distance to the nearest facility is reduced. The results show that this is true in moving from one to two plants, but there is a small increase in mileages moving from two to five plants. This is caused by fixing the locations of the five sites, and stipulating that the throughputs of the five sites must be the same. The result is that some waste has to be hauled an extra distance, to the more remote locations, to balance the throughputs, so that, overall, it is marginally better to have two plants than either one or five.

5.22 The modelling did not include the traffic impacts associated with site preparation, construction and ultimate demolition. In this respect, it is likely that the single-plant will benefit from economies, and that traffic movements associated with these phases will be fewer for the single plant than for the two-plant or five-plant scenarios. Quantifying these differences is difficult and was not attempted.

*Cost*

5.23 In terms of capital costs, there are considerable economies of scale associated with the construction of a single, large facility (estimated at £117 million), in comparison with two smaller or, in particular, five much smaller facilities (£135 million and £223 million, respectively).

5.24 Total operating costs per plant are markedly higher for a 240ktpa facility in comparison to the 120ktpa or 48kpta plants, as would be expected. However, when the operating costs for all the plants in each scenario are summed, the single plant is the least expensive. The revenues from ash and metal recycling are included in the operating costs. However, the amounts of revenue from these activities are likely to remain relatively constant regardless of the number of plant.

5.25 *Table 15* showed how the relative efficiency per plant decreases with decreasing plant size. This means that electricity generated from each of the scenarios, and hence total annual revenue, decreases with an increasing number of facilities.

5.26 The two sets of costs were combined into total annual costs (ignoring depreciation effects) by scaling the capital costs by the lifetimes of the plants (25 years) and adding the operating costs and revenues. The results are presented in *Table 19*.

5.27 These results show that a single, large facility is considerably less expensive than the other options. The five-plant scenario is over twice the cost of the single plant, while the two-plant scenario would cost over 20% more than one plant.

*Deliverability and Risk*

5.28 The main risks associated with delivering new waste management facilities are: their track record in managing waste and ability to deliver a dependable waste management service; the need to find outlets for outputs from the processes; potential delays in obtaining planning permission and a waste management licence/PPC permit; and how the above uncertainties may affect the ability to raise finance for the project.

5.29 I discussed the deliverability of different technologies in *Section 4* of my Proof. As all three scenarios in this assessment use EfW technology, track record is not a factor that will distinguish between them. However, the proposed capacity of the facilities will make a difference to deliverability. Energy from waste plants are shown to work at their most efficient at sizes in excess of 100,000tpa, as I discussed at *paragraph 5.10*. This suggests that a single 240,000tpa plant or two 120,000 tpa plants would be entirely feasible, but that five 48,000tpa plants would run into difficulties through operating at a sub-optimal scale. There is one energy from waste plant in the UK with a smaller capacity, the 26,000tpa plant at Lerwick in the Shetland Isles, but this is very much the exception, and its size is a function of its island location.

5.30 The modelling performed for this study indicated that each scenario would generate the same amounts of the same outputs (ferrous metal, bottom ash and air pollution control residues). This suggests that finding outlets for these outputs is not a determining factor in the assessment of deliverability.

5.31 The ability of obtaining planning permission for the three scenarios could be a major differentiator between them. For one facility, the planning and permitting procedures must only be completed once. The plant would be larger than in the alternative scenarios, so it can be expected to influence a larger surrounding area than any one of the plants in the other scenarios. However, there is only one plant and one process to be completed successfully in order to deliver the contracted waste management service.

5.32 For the two-plant and five-plant scenarios, the smaller size of the proposed facilities might conceivably be more acceptable to the public. However, if people are to protest about a facility, it is, generally speaking, less to do with the size of it, and more to do with its proximity. Two locations means two sets of residents that will be affected, and five locations will be worse still. For this reason, I consider that planning risks will increase with the increasing number of plants. Both facilities in the two-plant scenario, and all five facilities, in the five-plant scenario, must successfully complete the planning process in order for the contracted waste management service to be delivered.

5.33 For the PPC permits, many of the issues that might arise, such as controls on emissions to air and groundwater, will be consistent for each of the multiple plants. The impact assessment within the permit applications would need to consider local receptors that may be impacted by emissions, which will be different for each site, thereby requiring multiple impact assessments. Overall, it is not expected that there will be much difference in likelihood of gaining PPC permit(s) for the three scenarios, although it can be expected that applying for one permit will be significantly more straightforward than two or five permits.

5.34 In deciding whether to finance such large capital projects, banks and investors consider all of the above matters. They will want to be fairly sure that: the money spent preparing the plans will not be wasted and that permission will be granted to build the plants; that the plants will operate as designed; and that outlets will be available for their products. Apart from planning, the ability to operate five small plants is probably the biggest concern.

5.35 The assessment of deliverability and risks is necessarily more qualitative than the other criteria that have been used in this assessment. However, in conclusion, I am of the opinion that the deliverability will decrease with an increasing number of plants, primarily because of the issues associated with gaining multiple planning permissions, where dilute and disperse is not a valid concept. Similarly, I also consider that the small capacity of individual plants in the five plant scenario would be a high risk given the inherent inefficiency of plants of such a small size.

*Overall Conclusions*

5.36 The overall findings from the assessment of the impacts of installing and operating one, two or five energy from waste facilities to treat projected residual waste arisings (largely MW, with some C&I waste), in Cornwall using the four assessment criteria are summarised in *Table 20*.

5.37 The relative importance of the different criteria are sometimes weighted in an options appraisal, because some criteria are more important than others, and because different scenarios typically perform differently according to the criterion being examined. However, from *Table 20*, it can be seen that, for three of the four criteria, a single EfW plant is the preferred option. Only in the case of transport amenity impacts is this order of preference different. In order to perform any weighting study, it is first necessary to present the results on a consistent basis. One way to do this is to normalise the results, relative to the best performing scenario for each criterion. In *Table 21*, the results for each criterion are scaled relative to the best result, which is given a score of 100%.

5.38 *Table 22* presents two weighting sets. In the first weighting set, the four criteria are ranked equally important (all with a weighting of 25%). The one plant scenario gets the highest overall score and is therefore the most preferred. In the second weighting set, the importance of transport amenity is increased at the expense of the other criteria, until the one-plant scenario is no longer the most preferred.

5.39 The single-plant scenario is no longer *most* preferred when transport amenity is given a weighting of 72.4%, and the other criteria 9.2% each. In other words, transport would need to be almost eight times more important than the other criteria in order for the single-plant scenario not to be the most preferred. I consider that this is giving transport far more significance than can possibly be justified. Moreover, as I explained above, traffic movements associated with site preparation, construction and demolition have been disregarded, but are anticipated to favour the single-plant scenario over the alternatives.

5.40 Taking these considerations into account, I conclude that the best means of treating the residual waste by EfW is through the use of a single large facility.

## 6 *CARBON BALANCE OF THE PROPOSAL*

6.1 This section of my Proof of Evidence, I discuss the carbon balance of the proposed CERC during the construction and operational phases of the plant. My evidence is based on a previous carbon balance assessment undertaken by ERM. The full report is presented as *Annex E* to my Proof. I intend to present here a summary of the work undertaken and the main findings.

*Background*

6.2 The debate on climate change has shifted from whether we need to act to how much we need to do by when, and the economic implications of doing so. The Government has introduced a strong legal framework for tackling climate change through the Climate Change Bill. The Bill has committed the UK to a 2050 target of reducing carbon dioxide emissions by at least 60%. In response to consultation on the Bill, the Government is now considering making this target even higher.

6.3 The Climate Change Bill also includes an interim target of reducing carbon dioxide emissions by 26-32% by 2020 against a 1990 baseline. There will be five-year 'carbon budgets', set in advance, which will aim to limit total emissions over the period. The first will run from 2008 to 2012, and the Government will set the budgets for at least three periods, or 15 years, ahead. Once set, the budgets can only be changed with the agreement of parliament and following the advice of the committee.

6.4 The PPS 1 Supplement on Climate Change (CD E3) promotes the delivery of decentralised and renewable or low-carbon energy. Within its glossary, CHP is explicitly recognised to deliver improved fuel efficiency and energy from waste technologies identified as forming part of renewable and low-carbon energy supply systems.

6.5 Local planning authorities are encouraged to provide a policy framework *to promote and not restrict renewable and low-carbon energy and supporting infrastructure* (paragraph 19, CD E3). The application would make a significant contribution to the waste management infrastructure required within Cornwall, and in such a way as to contribute to the reduction of carbon emissions.

6.6 The overall objective of Government policy on waste, expressed through both PPS 10 and WSE2007 is to protect human health and the environment by producing less waste and by using it as a resource wherever possible.

6.7 Box 1.2 of WSE2007 identifies that "*Methane emissions from (biodegradable waste in) landfill account for 40% of all UK methane emissions and 3% of all UK greenhouse gas emissions. (Methane is 23 times as damaging a greenhouse gas as carbon dioxide).*"

6.8 Through more sustainable waste management, moving the management of waste up the waste hierarchy and only using disposal as a last resort, the Government aims to break the link between economic growth and the environmental impact of waste.

*Scope and General Approach of the Carbon Balance Assessment*

6.9 As well as looking at the carbon impacts of the proposed CERC, for comparison purposes, a do-nothing scenario was also examined whereby it was assumed that waste disposal continues at Connon Bridge landfill until its capacity is exhausted around the year 2012. Thereafter, it was assumed the waste will be transported out-of-County. As the actual disposal site is not certain at this stage, an estimate was made about the distance the waste would travel.

6.10 The general methods outlined by the Intergovernmental Panel on Climate Change (IPCC) in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, specifically Volume 5 of the Guidelines which pertains to the waste sector, were used when undertaking the carbon balance assessment.

6.11 The assessment evaluated the greenhouse gases (GHGs) relevant to the operation of an EfW plant and a landfill, mainly carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$). There are three other GHGs addressed in the Kyoto Protocol, ie sulphur hexafluoride ($SF_6$), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). However, these were not included in the assessment as they are not normally associated on a significant scale with waste incineration and landfill. The carbon balance is calculated based on known carbon emission factors, expressed in the unit of $CO_2$ equivalent ($CO_2$-eq). The GHGs evaluated are frequently summed as $CO_2$-eq by taking into account their respective global warming potentials (GWPs). The GWP is a relative scale for measuring how much of a given mass of GHG is estimated to contribute to global warming. By definition, $CO_2$ has a GWP of 1. The GWP for $CH_4$ is 21 and that for $N_2O$ is 310 (1). These GWPs are based on the values published by the Intergovernmental Panel on Climate Change (IPCC) in its Second Assessment Report (1995). Revised GWP values have since been published in the Third Assessment Report (2001) but current United Nations Framework Convention on Climate Change (UNFCCC) Guidelines on Reporting and Review, adopted before the publication of the Third Assessment Report, require emission estimates to be based on the values from the Second Assessment Report.

6.12 Where site-specific emission factors were available, or could be calculated from project data, these were used in place of default IPCC emission factors. Other sources of emission factors were also used where appropriate.

*Construction Phase Method*

6.13 The GHG emissions associated with construction of the CERC were estimated using the carbon calculator developed by the Environment Agency (EA) (1) to calculate the embodied $CO_2$-eq of materials consumed, plus the $CO_2$-eq associated with their transportation. This also considers emissions from personal travel, site energy use and waste management. The EA carbon calculator incorporates default carbon emissions factors, and these have been retained for the carbon balance calculations.

6.14 The calculated emissions include those associated with mobilisation, such as from the transportation of construction materials from the source to the site, as

(1) Guidelines to Defra's GHG Conversion Factors for Company Reporting (2007).

well as transportation of construction personnel, using different modes of transport. They also include process emissions arising from the embodied $CO_2$-eq of the different construction materials, emissions from the disposal of site-derived waste and emissions from the energy used during construction activities.

6.15 Details of the method used to calculate the GHG emissions during the construction, together with the assumptions that were made regarding the amounts of the different materials used in the construction are presented in the full report included as *Annex E* to my Proof of Evidence. At this stage in the CERC project, the quantities of the different construction materials and the sources of these materials can not be defined. The amounts of construction materials are therefore estimates, and the related GHG emissions of the construction phase are necessarily indicative values.

*Operational Phase Method*

6.16 The majority of potential GHG emissions will arise through the operational phase of the CERC project. As I explained at *paragraph 6.9*, for baseline comparison purposes, a GHG assessment was also carried out for a 'do nothing' scenario based on waste being landfilled at Connon Bridge until its capacity is exhausted, whereafter the waste would then have to be diverted out-of-County to an appropriate management facility, if one could be found.

6.17 Mobilisation emissions, associated with transportation of waste directly to the treatment facility (CERC or Connon Bridge landfill), or via any intermediate

(1) http://www.environment-agency.gov.uk/business/444304/502508/1506471/1506565/1508048/1883907/?lang=_e

steps such as waste transfer stations (WTS) were calculated. Untreated waste collected by waste collection authorities (WCA [now the waste collection authority]) from households was assumed to be taken to a WTS using a refuse collection vehicle. After compaction at the WTS, the waste is assumed to be taken by a lorry to the treatment facility. Mobilisation emissions also include emissions from delivery of residues from the waste treatment facility to ultimate disposal or recovery sites using a lorry. The main GHG from combustion of vehicle fuels is fossil-derived $CO_2$, with some small amounts of $N_2O$. Further details of the calculation of emissions associated with mobilisation, including assumptions about transport distances and types of vehicle, are presented in the full report.

6.18 Process emissions include GHG emissions derived directly from the processing of the waste itself, and indirectly from the fuel used to enable the treatment process to take place prior to disposal of any residue. For instance, this includes $CO_2$ releases from the incineration of waste containing fossil carbon (eg plastics) in the CERC. Some very small amounts of $N_2O$ and $CH_4$ will also be generated during the incineration of waste. Process emissions also arise from decomposition of biodegradable material in the landfill. However, decomposition of organic materials derived from biomass materials (eg wood) are not included in the GHG totals, because the carbon is of biogenic (non-fossil) origin. In accordance with the IPCC guidelines, these $CO_2$ emissions from biogenic sources are not included in the carbon balance assessment, as the emissions are considered to be part of the short-term carbon cycle and therefore equilibrium is reached between carbon taken from, and released back to, the atmosphere.

6.19 There are also GHG emissions associated with the ultimate management or disposal of the residual waste from the treatment process. For example, this may be $CO_2$ released to the atmosphere from processing aluminium for secondary production of that metal.

6.20 A waste treatment process may generate useful energy in the form of electricity and heat. Emissions are avoided as useful energy displaces the generation of electricity or heat elsewhere from fossil fuels and reusing recycled materials displaces the primary production of materials from virgin resources and its associated GHG impacts. For example, the electricity exported from the CERC would be used to displace electricity from the national grid. Another example is the recovery of aluminium from the residues produced by the incineration process, which would displace primary metal production from raw materials.

6.21 Further detail on the methods used to calculate the process emissions during the operational phase, including assumptions about the waste composition and other parameters, such as emission factors, are presented in the full report included as *Annex E* to my Proof of Evidence.

*Findings*

6.22 The total estimated emissions of GHGs from the construction of the CERC are approximately 54,000 tonnes $CO_2$-eq. A breakdown of the source of these emissions is shown in *Table 23*. As I mentioned previously, these figures should be regarded as being indicative at this stage, given the uncertainties in terms of actual quantities and exact sources of the different materials that will be used to construct the CERC.

6.23 The carbon balance for the operation of CERC and the alternative 'do nothing' (ie continue with landfill) scenario is presented in *Table 24.*

6.24 There is a net benefit to the environment of avoided emissions of approximately 37,000 tonnes $CO_2$-eq per year for the CERC. Based on the assumptions used in the modelling, this means that significantly more carbon emissions will be avoided than will be generated when waste is processed at CERC. This is consistent with the PPS 1 Supplement definition of energy from waste as a source of renewable energy. Assuming that the CERC operates for 30 years and the assumptions remain constant, the facility could avoid the release of 1.1 million tonnes $CO_2$-eq during its operational lifetime.

6.25 The carbon balance derived by the method I have just described is comparable with the figure obtained as part of the WRATE modelling that I described in *Section 5* of my Proof of Evidence when considering the impact of having different numbers of facilities. In that case, WRATE calculated a net benefit (for one EfW facility) of approximately 33,000 tonnes $CO_2$-eq per year for the CERC compared with the landfill alternative. This is a difference of c.12% in the calculated net benefit which, given the different methods of calculation and different assumptions, I consider a reasonable correlation.

6.26 Similarly, emissions for the do nothing scenario, as calculated by WRATE, amount to approximately 46,000 tonnes $CO_2$-eq per year (see *Table 8*) which is within 7% of the figure of approximately 49,000 tonnes $CO_2$-eq per year derived by the method described here. Again, I consider this to be a good correlation given the different methods applied.

*Conclusions*

6.27 The CERC project offers a benefit of net avoided $CO_2$-eq emissions of approximately 85,700 tonnes per year when compared to the do-nothing scenario of landfilling (within Cornwall). This figure is derived by adding the offset emissions from the CERC (36,611 tonnes $CO_2$-eq) to the savings produced by not landfilling (49,070 tonnes $CO_2$-eq). The benefit of the CERC in terms of net avoided GHG emissions, is even greater (approximately 97,600 tonnes $CO_2$-eq per year) following closure of the Connon Bridge landfill, when it is assumed that the alternative to CERC would be for all waste to be transported out-of-County for landfilling.

6.28 Over the lifetime of the facility, the CERC has the potential to avoid the release of over 1 million tonnes of $CO_2$-eq. Compared with landfilling waste outside of Cornwall, this would result in net savings in GHG emissions of nearly 3 million tonnes $CO_2$-eq.

## 7 CLASSIFICATION OF THE CERC AS A RECOVERY FACILITY

7.1 In this section of my Proof of Evidence, I discuss the efficiency of the proposed CERC plant in terms of its energy balance, and its classification as a 'recovery facility', with the policy support that warrants, rather than as a 'disposal facility'.

*Energy Recovery within the Waste Hierarchy*

7.2 PPS 10, in its fourth Key Planning Objective, requires all planning authorities to prepare and to deliver planning strategies that: "*…help secure the recovery or disposal of waste without endangering human health and without harming the environment, and enable waste to be disposed of in one of the nearest appropriate installations;*".

7.3 The distinction made between recovery and disposal in national policy is for good reason. The benefits of recovering value from waste more than counterbalance the disbenefits of transport over some reasonable distance. However, when waste is to be disposed of, these disbenefits are not counterbalanced, and therefore it is imperative that disposal occurs in an appropriate facility as close to the point of arising as possible.

7.4 The Waste Framework Directive of 2006 (2006/12/EC) defined recovery and requires Member States, through the waste hierarchy, to take appropriate measures to encourage recovery through, *inter alia*, the use of waste as a source of energy. This waste hierarchy is directly transposed in England and

Wales by means of section 44A of the Environmental Protection Act 1990 and paragraphs 4 and 5 of Schedule 2A to that Act.

7.5 The Waste Framework Directive also defined disposal (1), which it places at the bottom of the waste hierarchy. It is quite distinct from recovery. In requiring Member States to establish a network of disposal installations, the Directive also states that this network must enable waste to be disposed of in one of the nearest appropriate installations (2). Thus, in relation to disposal, the proximity of the management facility has considerable weight. For recovery, proximity is of lesser significance, because the environmental benefits secured outweigh considerably those disbenefits of transport. The text of PPS 10's fourth Key Planning Objective quite deliberately reflects the wording of the Waste Framework Directive.

7.6 Consequently, disposal of Cornwall's waste to landfill out of County is contrary to policy because of the transport that is entailed. Jeremy Penfold addresses the scale of the transport implications of exporting waste from Cornwall that would be committed in the absence of the CERC in his proof of evidence. By contrast, transport of waste to the CERC is accepted by policy, and the movements would be within the County in any case.

*Waste Policy*

7.7 National policy explicitly sets an objective of obtaining environmental benefit through the recovery of energy from residual waste, and sets targets for the

(1) Ibid, Article 1
(2) Ibid, Article 5

recovery of MW [1]. The national waste strategy also makes clear the link between energy from waste and energy policy: *"Recovering energy from waste (EfW) which cannot sensibly be recycled is an essential component of a well-balanced energy policy."* [1] The Government's Energy White Paper, published in May 2007, places energy from waste in a wider energy policy context.

7.8 Energy from waste is defined as a renewable energy in the PPS 1 Supplement on Planning and Climate Change. Local authorities are charged in the Supplement with providing a framework that promotes and encourages renewable energy generation. Their policies should be designed to promote and not restrict such infrastructure. Paragraph 40 of the Supplement states that "*An applicant for planning permission to develop a proposal that will contribute to the delivery of the Key Planning Objectives set out in this PPS should expect expeditious and sympathetic handling of the planning application.*"

7.9 A number of draft national policy statements (NPS) have been published for consultation. The two that are relevant to this Inquiry are:

- Draft Overarching National Policy Statement for Energy, November 2009 (draft NPS EN-1); and
- Draft National Policy Statement for Renewable Energy Infrastructure, November 2009 (draft NPS EN-3).

7.10 Both NPS are considered to be helpful to local planning authorities and "*may also be a material consideration in decision making on applications that fall under the Town and Country Planning Act 1990 (as amended). Where relevant,*

(1) Defra, Waste Strategy for England 2007, Executive Summary, page 11

*decision makers of such applications in England should apply the policy and guidance in this NPS as far as practicable*". (1)

7.11 The draft NPS EN-1 makes clear the significant need for new, major energy generating infrastructure and advises the IPC that it should start its assessment on the basis that need has been demonstrated. Further, the IPC is not required to consider the relative advantages of one technology over another. This policy is aimed at security of energy supply, provided through a diverse range of generating technologies.

7.12 Draft NPS EN-1 presents five objectives for the power generation industry to assist in delivery of the Government's climate change plan.

1. To help deliver the UK's obligation to reduce greenhouse gas emissions by 80% by 2050 and work to the carbon budgets stemming from the Climate Change Act 2008, within the context of the EU Emissions Trading System.
2. To ensure that investment provides security of energy supply through a diverse and reliable mix of fuels and low carbon technologies – renewables, nuclear and fossil fuel plants fitted with carbon capture and storage.
3. To further ensure that investment delivers an electricity grid with greater capacity and the ability to manage larger fluctuations in supply and demand.
4. To support the elimination of fuel poverty and protect the vulnerable through ensuring energy infrastructure is delivered in a cost effective way that keeps energy bills as low as possible.

(1) Defra, Waste Strategy for England 2007, Executive Summary, page 15

5. To contribute to sustainable development by seeking energy infrastructure development that helps reduce climate change while also minimising negative impacts on the local environment.

7.13 Draft NPS EN-3 states that electricity generation from renewable energy sources is an important element in the Government's transition to a low-carbon economy.

7.14 As I have already discussed (at paragraph 3.15), the draft RSS acknowledges the need to meet national targets for recovery as well as recycling and composting and states that proposals should consider opportunities to provide facilities for treating multiple waste streams and for waste to energy facilities to help meet recovery targets.

*The CERC as a Recovery Facility*

7.15 The revised Waste Framework Directive (2008/98/EC) (WFD 2008) clarifies the definition of 'recovery' as applied to EfW facilities. Specifically, it provides a distinction between the concepts of 'recovery' and 'disposal' based on difference in environmental impact through the substitution of natural resources in the economy and recognising the potential benefits to the environment and human health of using waste as a resource. The distinction between whether the waste is being used principally as a fuel to generate energy, a recovery operation (classified as 'R1' under WFD 2008), and whether the incineration of the waste constitutes a disposal operation ('D10' under WFD 2008) depends on the efficiency of the plant in converting the input

(1) Draft NPS EN-1, paragraph 1.2.1 and draft NPS EN-3, paragraph 1.2.4, both November 2009, DECC.

waste into electrical and heat energy. WFD 2008 includes a formula for determining whether an EfW plant can be regarded as being 'energy-efficient' and hence classified as a 'recovery' facility. This is known as the 'R1' calculation.

7.16 Under the requirements of WFD 2008, an EfW facility permitted after 31 December 2008 must have an energy efficiency of at least 0.65 to be regarded as a recovery facility, where energy efficiency is defined as:

**Energy efficiency = (Ep - (Ef + Ei))/(0.97 × (Ew + Ef))**

Where:

**Ep** means annual energy produced as heat or electricity calculated with energy in the form of electricity being multiplied by 2.6 and heat produced for commercial use multiplied by 1.1 (in units of GJ/year);

**Ef** means annual energy input to the system from fuels contributing to the production of steam (GJ/year);

**Ew** means annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year);

**Ei** means annual energy imported excluding Ew and Ef (GJ/year); and

0.97 is a factor accounting for energy losses due to bottom ash and radiation.

7.17 The European Commission proposes to develop guidelines on some aspects of R1 and its associated formula. Pending the development of such guidelines, advice from the Environment Agency is that the R1 formula should be applied on the basis of plant design figures to avoid any complications due to occasional operational variability. The Environment Agency further advises that the term Ep should be taken to mean the energy (as heat and/or electricity) made available to users, but the Agency accepts the Commission's explanation that the electricity used by the operator in flue gas cleaning systems is to be taken as being made available to users and included within the term Ep (1).

7.18 The UK has until 12 December 2010 to implement WFD 2008 and Defra is currently consulting on transposition of WFD 2008 into UK law although the R1 formula and the recovery/disposal distinction is not part of the Stage One consultation. I do not expect any significant variation from the R1 formula will be used in the UK for determining whether an EfW facility may be regarded as a recovery operation.

7.19 The data required for determining the proposed plant's efficiency, in accordance with the R1 calculation are as follows (2) :

Electrical Energy Generated = 154,729 MWh/yr [A]

This is equivalent to 557,024 GJ/yr ([A] x 3.6) [B]

Heat Energy Generated = 18,800 MWh/yr [C]

This is equivalent to 67,680 GJ/yr ([C] x 3.6) [D]

Thus total energy produced, Ep =

2.6 x [B] + 1.1 x [D] = 1,522,711 GJ/yr [Ep]

(1) Stage One Consultation on the transposition of the revised Waste Framework Directive (Directive 2008/98/EC), Department for Environment, Food and Rural Affairs and the Welsh Assembly Government, July 2009

(2) Data taken from Environmental Permit Application submitted to the Environment Agency July 2008. Reference EA/EPR/GP3433GH/A001.

Energy used to raise steam = 5,330 GJ/yr [Ef]

Waste Throughput 240,000 tpa [F]

Calorific Value of Waste: 9.8 MJ/kg [G]

Energy content of incoming waste, Ew =

[F] x [G] = 2,352,000 GJ/yr [Ew]

Electricity Imported = 650 MWh/yr [H]

This is equivalent to 2,340 GJ/yr 9[H] x 3.6) [I]

Energy used to heat boilers = 5,330 GJ/yr [J]

Total Imported Energy = 2.6 x [I] + [J] = 11,414 GJ/yr [Ei]

7.20 Hence the plant's energy efficiency is determined as:

**1,522,711 – (5,330 + 11,414) / 0.97 x (2,352,000 + 5,330) = 65.9%**

This is in excess of the 65% target set by the WFD and hence the plant will be regarded as a recovery facility.

7.21 The above calculation is based on the export of heat to Goonvean only. I understand that it is likely that heat will also be exported to Imerys, and that evidence will be presented to the Inquiry to that effect.. If this occurs, the electrical energy generated will fall slightly, to 150,564 MWh/year, but the heat energy generated will rise to 35,800 MWh/year. The net result will be an overall energy efficiency of 67.1%.

*Conclusion*

7.22 CERC will recover energy from Cornwall's residual waste, thereby providing a valuable source of renewable energy. The predicted efficiency of the plant is above the threshold set out in WFD 2008, and it will be classified as a recovery facility, thereby helping Cornwall to meet its recovery targets, and its contribution to national policy.