

Energy Management Strategy 2011 – 2020

Document Management No.	
Author	
Date Written	
Date Ratified	
Date for Review	
Version No.	1
Managers Handbook Reference	



South Yorkshire
Fire & Rescue
WORKING FOR A SAFER
SOUTH YORKSHIRE

Energy Management Strategy 2011 - 2020

Contents

Title	Page No
Part A – Setting the Scene	3
Introduction	3
Energy Management Strategy	4
Carbon Reduction Commitment – Energy Efficiency Scheme (CRC)	5
Resources	6
Hierarchy of Actions	6
Calculate	6
Avoid	7
Reduce	7
Offset	7
Cost	8
Part B - Objectives	
Generally	10
Energy Procurement	11
Renewable Energy – the story so far	13
Renewable Energy – the work in progress	13
Renewable Energy – the cost to go forward	14
Carbon Reduction	15
Management of Energy Consumption	17
New Build and Refurbishment of Property	19
Offsetting	19
Part C	21
Action Plan	21

Part A – Setting the Scene

INTRODUCTION

1. In 2002, as part of the drive for energy accreditation, South Yorkshire Fire and Rescue (SYFR) published its first Energy Policy. It was a simple statement of commitment to manage the energy used by the organisation and to report on progress.
2. In 2007, the Authority approved and published an Environmental Policy and a Declaration of Commitment to 'improve our corporate environmental performance', and in 2009 the Authority approved the implementation of an Environmental Management System (EMS). This strategy aims to address the commitment to manage energy that is inherent in these documents.
3. The 2002, Energy Policy has been superseded by a wider ranging Environmental Policy and this strategy has been developed in light of the legislation, an even greater urgency in the requirement to reduce energy consumption and greenhouse gases,¹ and to mitigate the ever increasing cost of energy. The strategy is primarily property based as required by Action Point 2 of the Property Asset Management Plan (PAMP), (develop a strategic approach to energy use and emissions), and because the current legislation 'leans' towards energy consumption management in buildings. The bulk of the advice from government sources and other organisations such as, the Carbon Trust is property asset orientated. This strategy also links to the Environmental Management System and, as with the EMS, this strategy only covers SYFR premises and day to day operations at those premises and excludes operational activities due to the varied nature and unpredictability of these events.
4. **Transport related energy control is also excluded and will be specifically addressed elsewhere.**
5. In order to understand how well we are doing in relation to other organisations it is important that the results of the implementation of the Energy Management Strategy be measured and tangible. To this end, the methodology for energy management will comply with the requirements of BS EN 16001:2009 – Energy Management Systems.

¹ The Kyoto Protocol identified six greenhouse gases, all of which were included in both SYFR carbon footprint assessments. The gases are carbon dioxide [CO₂]; methane [CH₄]; nitrous oxide [N₂O]; hydrofluorocarbons [HFCs]; perfluorocarbons [PFCs] and sulphur hexafluoride [SF₆].

ENERGY MANAGEMENT STRATEGY

6. When compared to other organisations such as, Sheffield City Council (463m kWh in 2005 [Cabinet report of 13 Sept 2006]), or Rotherham Metropolitan Borough Council (461m kWh [Environmental Statement 2008]), SYFR is not considered a large energy user (see table below), and the Authority had committed to reducing the greenhouse gases its activities produce before the legislation came in to force, but the legislation has increased the need to quantify, target and record the reduction. The ever increasing costs of energy make it imperative.

Estimated Energy requirement for 2010/2011		
Electricity [kWh]	Gas [kWh]	Total kWh
6,800,906 ²	4,373,732 ³	11,174,638

7. The Climate Change Act 2008, set legally binding emission reduction targets for 2020 and 2050 (34% and 80% respectively base-lined on the UK emissions rate for 1990). Directive 2009/ 28/EC of the European Parliament and of The Council, The Renewable Energy Directive, centres around a legally-binding European target for 20% of all energy types - electricity, heat and transport fuels - to come from renewable sources by 2020. It is expected that the bulk of this target will come from electricity generation, but for the first time heat from renewable sources is included in legislation. The Directive became European law on 5 June 2009. SYFR as a local government organisation, is bound by this legislation.
8. The time line for achieving the legal targets has been set and the overall strategy will be to meet the target of 20% of energy (2,234,928kWh based on 2010/2011 estimates) from renewable sources and a 34% reduction in greenhouse gases by 2020. A further strategy will be required to manage the reduction in greenhouse gases to 2050.
9. SYFR has no data for its carbon footprint in 1990, which is the baseline data established by the 2008 Act. The first exercise to measure SYFR greenhouse gases produced by its actions took place in 2008. There is no way of knowing if the total tonnage would have been higher or lower and there are arguments which could be made either way. Therefore, the baseline for all targets and calculations in the strategy will be the 2008 Carbon Footprint Assessment.
10. It should be noted that the targets measure different outcomes and while they are related in that energy from renewable sources should reduce greenhouse gases the relationship needs to be investigated. For example, Department for Environment, Food and Rural Affairs (DEFRA) emission factors for 2010 state that each kWh of natural gas produces 0.18523kg of carbon while each kWh of electricity produces 0.54160kg, almost three times as much. Therefore, reducing electrical usage or providing on site electrical generation will have a much greater impact on the reduction in greenhouse gases.
11. Additionally, the Government has a stated ambition that all new non domestic buildings should be 'zero carbon' from 2019, with the public sector leading the way from 2018, and changes to the Building Regulations, Part L, are the first step towards achieving this ambition. It can be expected that further amendments and regulations will be introduced to speed this agenda forward.

² SYFR currently pays an average of 8.1p/kWh for electricity.

³ SYFR currently pays an average of 2.5p/kWh for natural gas

12. In order to provide a framework for achieving the objectives laid down by the Environmental Policy, and ensure it meets the requirements of legislation relating to energy and climate change, SYFR will publish this Energy Management Strategy.
13. This Strategy will:
 - Provide a template to achieve targets outlined in the first milestone date of 2020
 - Set targets for sourcing energy from renewable and fossil fuels
 - Address sustainability issues for new build and refurbishment projects, based on the independent advice already provided and best practice going forward, and will set down targets for the installation of renewable technologies on existing properties
 - Set out the requirement for Automatic Monitoring and Targeting (AM&T) of energy use through remote meter reading and set down targets for reduction in energy use
 - Examine the need for offsetting and provide guidance as to when it is appropriate for the Authority to purchase carbon credits
 - Be the basis for an action plan, which will set down the time scales for achieving the objectives
 - Be regularly reviewed and approved by the Authority

CARBON REDUCTION COMMITMENT (CRC) - ENERGY EFFICIENCY SCHEME

14. The CRC Energy Efficiency Scheme was introduced to encourage large users of electricity to reduce their consumption. The scheme is based on electrical energy consumption from half-hourly metered sites and the thresholds are:
 - over 6,000MWh (6,000,000kWh) for full participation
 - 3,000MWh (3,000,000kWh) to 6,000MWh, make an information disclosure stating consumption
 - below 3,000MWh, make a disclosure without any stating consumption
15. In simple terms organisations that are required to participate fully in CRC will need to buy sufficient carbon allowances at the beginning of the year to cover their total carbon emissions for that year, and surrender them at the end of the year. If they buy too few they will have to buy more on the market through a cap-and-trade system which is to be introduced, or when they have a surplus they may sell them on the market. The Government will be publishing a league table to show which participants have lowered their carbon emission by the most and initially, the best performing organisations were to get a rebate as a reward.
16. Following the Comprehensive Spending Review in October 2010, the legislation around CRC is under review and will be monitored for any changes which affect SYFR. However, the Government has announced its intention to change the scheme from a self-financing one, where good performers would be rewarded and poor performers financially penalised, to one where all monies collected under the scheme would be kept by the Government. It is expected the changes will be implemented on 1 April 2011.
17. SYFR has had to make a disclosure under the scheme as we have 3 half-hourly meters, but our consumption from these meters is less than 3,000MWh (estimated at 1,919MWh [1,919,000kWh] for 2010/2011), so no further information is required at this time (CRC Registration Number CRC4609708).

RESOURCES

18. The organisation has published its intention through its Environmental Policy and Declaration of Commitment.

The Environmental Policy sets the objectives to:

'T4 – Improve energy efficiency

T5 – Increase the use of energy from renewable sources.'

The Declaration of Commitment states:

'Energy

SYFR contributes to global climate change by producing 'greenhouse' gases from a range of activities. The Service will:-

- ***Identify and (where possible) quantify emissions, establish targets and implement actions to achieve reductions.***
- ***Encourage energy efficiency and support the use (where possible) of renewable energy generation.'***

19. To achieve these objectives and the legislative requirements will involve active energy and carbon management initiatives.
20. The gathering, analysing and sharing of information is an essential part of active energy management together with the proactive management of energy using equipment and the selection and installation of renewable energy technology both in new buildings and as part of renovation and upgrading works.
21. The implementation of the Energy Management Strategy commits the Authority to providing sufficient resources to achieve the objectives and targets required by the legislation, this document, the Environmental Policy and the Declaration of Commitment and as set down by the Authority from time to time.

HIERARCHY OF ACTIONS

22. The Department of Energy and Climate Change (DECC) has set out guidance that includes a recommended hierarchy for actions to reduce an organisations carbon footprint by controlling the energy it uses. The hierarchy is: calculate, avoid, reduce, offset.

Calculate

23. SYFR calculated its base line carbon footprint, and this was published in 2008. A new carbon footprint has recently been calculated for financial year 2009/10 and it was published in January 2011⁴. A spend to save initiative to provide automatic meter reading to all sites has been submitted and approved to aid the capture and calculation of energy usage and to assist with target setting and monitoring.

⁴ Reported to the Fire Authority 31 January 2011

Avoid

24. SYFR has already put in place some measures to avoid energy use with, for example, the introduction of a Building and Energy Management System (BeMS) to control heating plant across most sites centrally, campaigns to get lights and unused equipment turned off and the installation of eco-buttons on computers. These and many others such initiatives brought about through the Environmental Forum, confirm the Authorities commitment to avoid using energy that it does not need. However, further work is required to ensure a culture shift towards energy efficiency continues to be embedded throughout the organisation.

Reduce

25. The adoption of a sustainable strategy for all new build and major refurbishment projects demonstrates the Authorities commitment to reducing the amount of energy it uses. The new fire stations at Dearne, Cudworth and Penistone are the first to be built in line with the strategy and the construction methods employed, the materials and equipment used and the renewable technologies installed all work together to provide energy efficient buildings with relatively low carbon footprints. The introduction of Voltage Optimisation at Rotherham has reduced electrical consumption by 10 – 15% and other sites are being investigated.
26. However, further reductions can be achieved by:
- continuing to educate staff in energy reduction and management initiatives which is a low cost/no cost solution. It has been suggested by the Carbon Trust that (initially) up to a 10% reduction can be achieved but, this tends to fall back in time without continuous promotion
 - re-commissioning existing building systems and improving maintenance regimes to ensure optimum efficiency of plant and equipment which depending on the level of the equipment may achieve a 5 to 10% improvement
 - up-grade lighting systems replacing old light tubes with much more efficient units which could save up to 25% of lighting consumption
 - improving insulation to building fabrics
 - improving air tightness of building fabrics
 - investing in energy efficient technologies and renewable energy generation on existing sites

Offset

27. There will always be a need for energy and it will be highly unlikely that SYFR ever achieves a Carbon Neutral state, but by offsetting the remaining emissions that cannot be reduced or avoided, the full effects of the organisations carbon generation can be mitigated. The Government advice is that organisations are urged to follow the above hierarchy and only use of offsetting where emissions are currently unavoidable. Offsetting should never be the first choice; it is purely a cost to the organisation without any direct benefit from energy saved in any terms. (Offsetting is the purchasing of carbon credits to fund carbon reduction schemes in other parts of the world. Assured credits are created through a regulated mechanism to ensure that emissions savings as a result of funding through credits are additional and permanent. Offsetting is part of a global solution).

COST

28. It is inevitable that there will be costs to the implementation of the Energy Management Strategy. However, there will also be long-term benefits in terms of energy efficiency and carbon reduction.

28. **There has been no allowance made within the costings shown for any possible grant assistance which may be available. Should SYFR decide to proceed with any of the proposals, investigations into the availability and implications of grant assistance will be carried out at the time works are authorised. Similarly no account has been taken of any revenue savings through lower cost energy due to on-site production**

29. One of the key recommendations in an Office of Government Commerce (OGC) report is that departments:

“should initially prioritise investment in:

- *improved energy performance data through the installation of half-hourly metering equipment in core buildings, this would inform and enhance a programme of;*
- *energy efficiency measures with a payback of less than 5 years – these are likely to include a combination of ‘easy win’ policies and incentives to promote staff and FM provider participation, recalibration of building systems as well as low level investment in voltage optimisation, power correction equipment and low energy lamps and insulation measures”⁵*

30. Initially these are the areas in which SYFR should concentrate its activities and the Action Plan will reflect this. However, it must be remembered that the long term objectives have been set (by the legislation), over a forty-year period, therefore any financial requirement arising from the strategy must consider whole life costing and extended payback periods as a norm. Any capital investment and the business case for any renewable technology needs to include the expected payback period, the expected annual return on investment and the expected reduction in greenhouse gas emissions. Each project will need to be costed individually and reported as part of the Capital Programme or Spend-to-Save initiatives.

In reality this could mean that any technology which pays back in 10 years or less and has a return on investment that is more than twice the interest rate at the time of the proposal should be considered (provided always that there is an intention to occupy the proposed site of the works for longer than the payback period).

31. An indication of the estimated cost and outputs of typical renewable technology installations is shown below. The costs are based on SYFR experiences at Dearne and Cudworth new fire stations and on information gathered from Government Web sites.

⁵ Energy Efficiency Measures in the Government Civil Estate. Scoping Study. August 2009. OGC – Key Recommendation 2

Renewable Technology						
Technology	Power generated	Capital outlay	Feed in tariff (Where applicable)	Annual Return on investment	Estimated carbon saving per year	Estimated payback
Solar Hot water	450kWh/m ² /year	£2,000/m ²	Not yet available	8 -12%	200kgC/m ²	5 years
Wind turbines	Depends on size of turbine but based on 15kW	£70-80K	26.7p/kWh	3 – 5%	10.8 tonnes	15 years (based on unusual ground conditions)
Ground source heat pumps 80kW	163,800kWh	£200k	Not yet available	4 -6%	53.6 tonnes	13 years
Photovoltaic panels	100kWh/m ² /year	£4,500/m ²	41.3p/kWh (retro fit) 36.1p/kWh (new build)	5-7%%	3.5 tonnes	10 Years

32. However, each of these technologies needs to be examined in relation to whole life costs, where the total estimated energy production for 20 years is balanced against the total estimated cost for the purchase, repair, maintenance, dismantling, removal and safe disposal over the same period (all at present day rates), and including allowances for any feed-in tariffs.

Example 1 – Proposed wind turbine
<p>The proposed wind turbine for Dearne Community Fire Station when first investigated had an estimated total installed cost of £52,005.00, the estimated annual yield was 23,554kWh, providing an estimated lifetime revenue of £246,070.00 over 25 years.</p> <p>The estimated repair and maintenance cost for the 25-year period were £15,000 and the decommissioning and disposal costs were £5,000.00, therefore the total estimated whole life cost was £72K.</p> <p>This gives a simple payback of 7.3 years and a return on investment over the life of the unit as 13.6% per year which makes the project viable.</p> <p>The costing was revised and the predicted output changed as the project was developed, the construction cost (excluding repair and maintenance etc.) increased to £84,241.79 and the predicted yield fell to between 15,000 to 20,000kWh reducing the lifetime revenue to £138,000 over 20 years.</p> <p>Assuming similar whole life costs of £17,000.00 the payback has extended to 14.7 years and the return on investment is reduced to 3.6% per year which makes the project less viable compared with other options.</p>

Part B – Objectives

GENERALLY

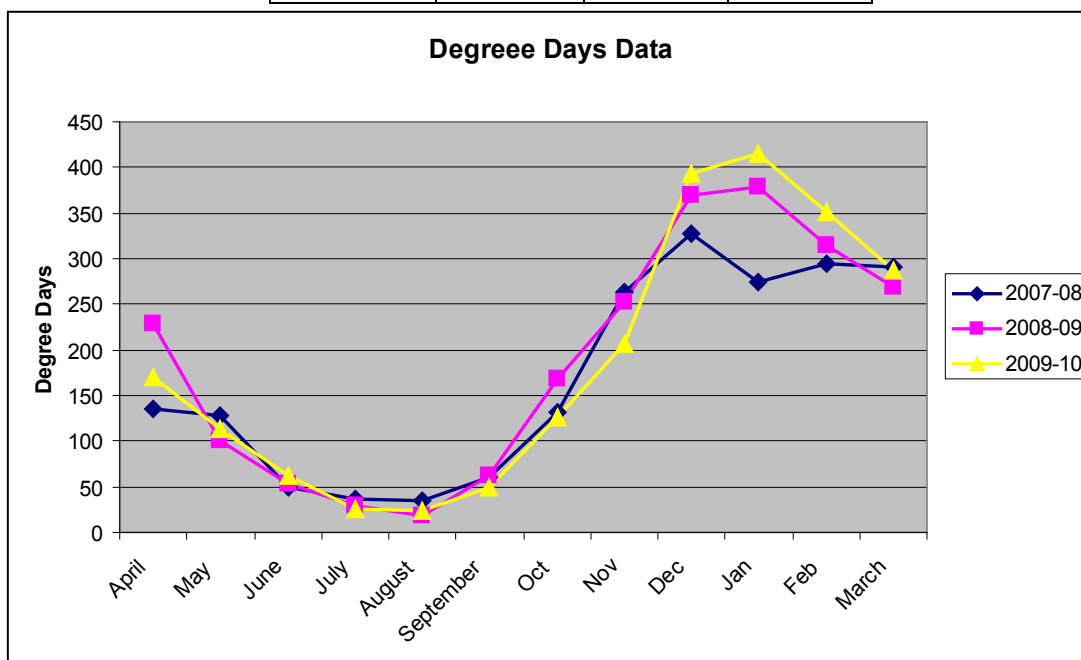
33. The objectives this strategy must achieve are set out in the legislation previously stated and the Authorities own Environmental Policy and Declaration of Commitment (see above).
34. The overall objective for emissions reduction, based on the 2008 Carbon Footprint Assessment, in line with The Climate Change Act 2008, is to:
- reduce the Services' carbon footprint by 34% by 2020
 - reduce the Services' carbon footprint by at least 80% by 2050
35. Initial SYFR targets for a reduction in greenhouse gas
- 2010 - 10% reduction on 2008 base line and,
 - 2012 - a further 10% reduction on 2010,
- have been previously agreed. However, longer term objectives need to be set.
- (The carbon footprint for SYFR was re-calculated October 2010 and unfortunately shows that the total carbon produced by the organisations activities had increased by around 6% making the target that much more challenging. The reasons for the increase are being investigated but initial findings indicate that electrical usage at Eyre Street is one major contributing factor and the severe winter weather was another, see below).
36. The initial objective for renewable energy is to achieve the 20% requirement by 2020 with ongoing objectives to match EU and Governmental aspirations, as they are made public.

Example 2 – Weather effects

Weather will always affect energy usage, gas for heating when it's cold and electricity for cooling when it's hot. For convenience local air temperatures can be accessed as degree-day values. A degree-day is a single number that quantifies how hot or cold the weather has been for a certain region over a month. **The colder the weather in a given month the higher the degree-day value.** This number helps account for the effect of weather on energy consumption (for example – it allows you to take account of the weather when you compare your energy usage from one year to the next).

The winter degree-day data for the East Pennines region (within which Sheffield is located) between 2007 and 2010 is shown below and demonstrate how the colder weather in the winters of 2008-09 and 2009-10 have resulted in higher degree days, and thereby greater heating requirement, during this period compared to 2007-08.

	2007-08	2008-09	2009-10
April	135	229	171
May	128	100	113
June	49	53	63
July	36	29	25
August	35	19	24
September	60	63	50
Oct	131	169	126
Nov	263	252	207
Dec	328	370	394
Jan	275	378	416
Feb	295	315	352
March	291	268	287
	2026	2245	2228



ENERGY PROCUREMENT

37. Currently, in line with previous Authority approval (pre 1995) and current government guidelines, SYFR buys all its energy through the Yorkshire Purchasing Organisation (YPO) framework agreements. This enables SYFR access to the bulk buying power that YPO commands and ensures the relatively small amount of energy we use is procured at the same rates as major users. Again, in line with previous approvals, green energy is procured for just two sites, Rotherham and Eyre Street, and this equates to around 10% of total electrical energy use (only sites with half-hourly meters are allowed to purchase energy from renewable sources).
38. However, it should be noted that due to the DEFRA methodology for calculating carbon associated with electricity there is no additional allowance for 'green' energy procured from suppliers in this manner. Therefore, this option will have no impact on the reduction of the organisations carbon footprint (objective 2).

39. Electrical energy provided from renewable resources is more expensive than that provided from fossil fuel generation, but it is free from Climate Change Levy (CCL), which mitigates some of the additional cost. Currently there is no renewable alternative for gas, both the natural gas and liquid propane used to heat our premises are carbon based.

To move forward, the long-term objective of the Authority must be to reduce, as far as possible, the reliance on fossil fuel based energy and move towards energy generated from renewable sources, either on or off site.

40. The introduction of feed in tariffs for site-generated electricity and the recent changes to the Law that now allow Local Authorities to sell any such generated power back to the utility companies has had a major impact on the pay back for renewable technologies. The tariff differs for each type of generation but is currently 3 to 4 times the value per kWh of the cost of that purchased from the utility supplier. This is in addition to the use of the free electricity generated.
41. These changes mean that the retrofitting of technologies such as, photovoltaic solar panels and wind turbines are much more attractive propositions. Tariff levels will be reviewed in 2013. Additionally from April 2011 the government intends to introduce a Renewable Heat Incentive (RHI) which will apply the principles of feed in tariffs to renewable heating schemes, such as ground source heat pumps and solar hot water systems, but it is not yet known if existing installations will be eligible.
42. The percentage of renewable energy required in the table below includes both electricity and heat producing technologies.

Energy Procurement						
Objective 1 – Achieve 20% of supply from Renewable Energy sources by 2020						
Energy	Target Year					
	2010	2012	2014	2016	2018	2020
Renewable energy %	1.61% Existing	2.5%	5%	10%	15%	20%
Renewable energy in kWh (based on 2011 estimates)	180,193	279,366	558,732	1,117,464	1,676,196	2,234,928
Assuming objective 3 achieved	/	229,080	424,636	782,225	1,039,240	1,340,960

43. The strategy will set targets (as a percentage of its total usage [kWh]), for the amount of on or off site green energy the Authority needs to develop to achieve objective 1. The profile is on a simple linear basis assuming an increase of 2.5% per year. **It has been assumed throughout this strategy document, that the property portfolio remains constant i.e. no building closures or relocations.**

Renewable Energy – the story so far

44. SYFR started installing sustainability features and renewable energy technology in 2003 with the installation of a solar hot water system and rainwater harvesting at the new Doncaster Fire Station. This was followed by similar installations on the vehicle workshop extension at Rotherham and rainwater harvesting at Eyre Street. Both Dearne and Cudworth fire stations were designed to achieve a Building Research Establishment Environmental Assessment Method (BREEAM) rating of excellent in line with the Department for Communities and Local Government (DCLG) publication 'Achieving Design Quality in Fire and Rescue Service Buildings' (December 2007).

Example 3 – Dearne Community Fire Station

The design of the new Dearne Community Fire Station included a requirement for renewable technologies to reduce energy consumption and improve the carbon footprint of the property. The technologies included are a Ground Source Heat Pump (GSHP), which is used for both heating and cooling systems, solar hot water panels and rainwater harvesting.

The GSHP provides an estimated annual contribution of 145,328kWh of heating and 95,400kWh of cooling and uses an estimated 76,923kWh of electricity to run. This is a net gain of 163,805kWh per year (a net saving of 53,630kg of CO₂ over gas heating/electric cooling). There is also 8.49 square meters of solar hot water panel which is estimated to provide a further 4,097kWh of heat per annum. Therefore, the current on site generation is equivalent to 167,902kWh, saving around £14,750.00 per year at current prices.

The additional estimated cost to the project for this renewable technology (as identified in the Authority report of 16 March 2009), was £242,000.00. There had been Authority approval to include a wind turbine on this site. However, as the project progressed it became evident that due to increases in construction related cost and decreases in projected output this would not be a cost effective solution. (see example 1).

The proposed wind turbine had an estimated cost of £76,774 and was expected to generate between 15,000 and 20,000kWh per year. Had this technology been included in the project the total (estimated) cost would have been £320,774 to produce (an estimated) 185,402kWh of renewable energy each year.

45. SYFR has solar hot water on three other sites which produce a similar amount of hot water to Dearne saving a further 12,291kWh.
46. Currently SYFR total onsite renewable energy provision is estimated to be 180,193kWh, or 1.61% of total energy requirement.
47. In addition to the above since 2002 major refurbishment projects at fire stations, such as Thorne and Adwick, or replacement of roof coverings such as Lowedges and Mansfield Road, have always included some element of sustainability in accordance with the latest building regulations in place at the time of the works and in accordance with our sustainability strategy.

Renewable Energy – work in progress

48. Provision for energy saving technologies have been included in projects that have been completed over the last few years and there are several projects currently being implemented/planned that will have a positive impact on both energy use and carbon reduction and which form the basis for the initial action plan:

- The provision of remote meter reading facilities on all sites at an estimated cost of £42,000 should provide more accurate real time readings and will help target high energy using sites. The Carbon Trust estimate that between 3 and 5% of total energy use can be saved through monitoring and targeting energy use
- The provision of voltage optimisation and regulation equipment for Eyre Street and the Training and Development Centre (TDC) at an estimated cost of £55,000 should reduce the electrical consumption at both sites by around 10%
- A project to rewire Lowedges fire station will include energy saving light fittings and additional passive controllers where practicable including provision for electrically operated water saving technologies such as sensor taps
- Investigation into solar photovoltaic panels is on going (see example)
- Provision for solar hot water panels included in roof recovering projects and in domestic hot water calorifier replacement.

Example 4 – Solar Photovoltaic Panels

Currently there are suppliers of Solar Photovoltaic (PV) who are willing to install and maintain PV systems provided they receive the feed in tariff. The host site has the benefit of the free electricity and the carbon reduction.

These schemes are being investigated by the Office of Government Commerce (OGC), with a view to providing a best value solution for the civil estate. SYFR has registered an interest with OGC and should receive any information when it is published.

In the meantime, a free survey of the whole estate has been carried out identifying 12 SYFR sites which are suitable, due to their size, location and orientation, for renewable electricity generation using PV panels. From the information provided in the proposal (and subject to a structural survey of the proposed locations), each site would have approximately 50 panels producing an average of 8,400kWh per year, a total of 100,770kWh.

The cost, should SYFR choose to fund the scheme, is around £42,000 per site and each site would save around 3,500kg of carbon per year.

There are also joint venture schemes available where the feed in tariffs would be shared in proportion to the investment by each party.

There are however, non-energy related issues that need to be considered in these schemes, such as the effect on a future building value or the ability to redevelop sites.

Renewable Energy – the cost to go forward

49. In the past few years some Government grants have been available to help with the purchase and installation of renewable technology. However, acceptance of the grant generally precluded the recipient from participation in the feed in tariff scheme. The availability and implications of Government grants should be investigated as part of the whole life costing exercise to be carried out as part of the initial cost implication and be included in the business plan for the provision of any renewable energy technology.

50. If the costs shown in Example 3 were to be extrapolated (£320,774/185402kWh = £1.73/kWh), the additional 99,173kWh required from renewable sources by 2012 would require an investment of £171,600 and the 2020 target of 2,054,735kWh would require **£3,554,700.00** (excluding any possible environmental grants and any positive benefits from objective 3 energy reduction measures) to retrofit the technology to the whole estate. These estimated figures do not take account of any reductions in energy use which may be achieved by other measures which would reduce the total kWh requirement and therefore the 20% kWh target.
51. The additional cost of moving to green electrical energy purchased solely from the utility company is estimated to be (using present day figures) £0.02/kWh. It can be seen from the table below, that by 2020 it is estimated that 2,234,928kWh of energy will be required from renewable sources. Should the authority elect to achieve this objective through purchasing green electricity it would equate to an increase of £44,700 at present day rates, but as stated above, this would have no impact on Objective 2.

Potential Impact of PV on Objective 1		
	2012	2020
Energy generation required to meet target	279,366kWh	2,234,928kWh
Energy generated from PV (12 sites)	100,770kWh	100,770kWh
Existing Generation	180,193kWh	1,953,965kWh
Gap	+ 1,597kWh	

52. If the solar voltaic option proves to be viable and acceptable to meet the 2020 gap additional investment will be required. The renewable technology employed at Dearne produces an estimated 167,902kWh/year at a capital cost of £242,000.00 (not whole life cost). To meet the gap would require 11.6 typical Dearne schemes at an estimated present day cost of **£2,816,283** (excluding any possible environmental grants and any positive benefits from objective 3 energy reduction measures).
53. The balance between retrofitting technology and buying green energy needs to be considered in light of the DEFRA methodology for calculating carbon emissions and the need to reduce the carbon footprint. The legislative targets will be difficult and expensive to achieve and it is also likely that further targets will be set from time to time by both the EU and central Government. None of the above can provide a single solution and a combination of the various technologies and techniques will be required to ensure that SYFR achieves the legislative targets. Additionally it is highly likely that the cost of energy will continue to rise and therefore the earlier SYFR makes investments in this area the greater the revenue and carbon saving will be over time.

CARBON REDUCTION

54. **This strategy deals with SYFR built environment because that is the inclination of the current legislation.** Successful building energy management should lead to a reduction in the carbon footprint of the organisation. However, this will not be enough to achieve the targets set out by the legislation.

Carbon reduction								
Objective 2 – Achieve a reduction of 34% in carbon footprint by 2020								
Target Year								
	2008	2010	2012	2014	2016	2018	2020	2050
Cumulative carbon reduction %	base	10	20	24	27	30	34	80
Carbon reduction tonnes	0	487	439	197	188	107	104	2095
Cumulative reduction in tonnes		487	536	1174	1316	1462	1657	3898
Estimated target total carbon produced		4386	3947	3750	3562	3455	3352	975
Carbon shortfall (tonnes) assuming Objective 1 is met and solely electricity		785*	385	871	711	554	465	N/A
Actual	4,873	[5,171] ⁶	* based on 2010 carbon footprint assessment figures					

55. Should SYFR achieve the targets set out in objective 1, and assuming the reduction was solely due to reduction in electricity use, 1,210.4 tonnes of carbon would be saved of the 1,657 required, a gap of 465 tonnes. The table below gives guidance to the levels of carbon reduction required to comply with the legislation and the Government is currently discussing the possibility of introducing a further target of 60% by 2034 (or 2037 as yet to be confirmed).
56. The gap of 465 tonnes of carbon (equivalent to 8.9% of 2010 levels) would have to be closed by implementing CO₂ reduction schemes in other areas such as transport or by offsetting.
57. The 2008 Carbon Footprint Assessment identified that fleet vehicle use, business travel and employee commuting (not normally reported by other organisations), (all areas outside the scope of this strategy), accounted for 49% of the total SYFR footprint. This has reduced to 45% in the 2010 assessment. As evidenced in the review of progress on environmental initiatives⁷, carbon reduction schemes such as the cycle to work scheme and the green travel plan have been introduced to assist with attaining this objective, both have been successful in the first instance and continuation of these and other initiatives should ensure that the closing of the gap is achievable.
58. Further initiatives are required aimed at changing the culture of the organisation to one where carbon issues are considered in all aspects of the organisation from procurement to transport and fire prevention.

⁶ This figure is based on the Carbon Footprint calculation carried out in Oct 2010 and reported to the Authority in January 2011.

⁷ FRA Report – Progress Review on Environmental Initiatives - June 2010

MANAGEMENT OF ENERGY CONSUMPTION

59. In line with current best practice, this strategy will set out the requirement for Automatic Monitoring and Targeting (AM&T) of energy use through remote meter reading and lay down objectives and targets for reduction in energy use. It is recognised that compared with many other organisations SYFR is not a high energy user, but energy will always be required to enable the organisation to fulfil its role in the community. However, a 5% year on year reduction in energy use (total kWh) would achieve a 40% total reduction in energy over 10 years. In practice it is unlikely that this level of reduction could be maintained and OGC recommend a target of 20 to 30% over a 5 to 8 year period.

Energy Consumption								
Objective 3 – Achieve a year on year reduction in total energy usage (kWh).								
5% year on year reduction	2011	2012	2013	2014	2015	2016	2018	2020
Total % reduction on baseline	16%	18%	21%	24%	27%	30%	38%	40%

60. There is no legislation around energy reduction only around carbon reduction, but they are intrinsically linked. These targets are therefore aspirational and while every effort will be made to reduce energy consumption, it should be noted that the introduction of new electrical equipment and plant may have an adverse effect if it is not fully controlled (see example 5).
61. Current energy monitoring procedures are based around monthly manual meter reading and annual reconciliation which prevents close monitoring of energy usage and early identification of problem areas. In 2010, approval was given for the installation of automatic meter reading to all electric, gas and water meters throughout the service. This will allow the measuring and monitoring of energy consumption in detail to identify and more effectively target the high energy using sites in order that early remedial action can be taken. Energy generated on site will also be measured to provide evidence of alignment with the Environmental Policy. The information gathered will identify the areas of both high and low energy use and allow best practice to be rolled out to poor performing sites.

Example 5 – Eyre Street electrical consumption
<p>The move of Headquarters from Wellington Street to Eyre Street had an unexpected effect on the electricity costs to the organisation.</p> <ul style="list-style-type: none"> • Eyre Street is a building which has a much smaller floor area, about one third the size of Wellington Street. • Eyre Street is a building which has been designed to be energy efficient, complying to the latest building regulations and to BREEAM 'very good' standard, Wellington Street had been designed some twenty years earlier when energy conservation was not so important. • Eyre Street has sophisticated computerised lighting controls while Wellington Street had light switches. • Eyre Street has building and energy management system to control the chilled beam heating and cooling ventilation system, Wellington Street generally had natural cooling and ventilation via operable windows and the heating was either on or off • Eyre Street has a centralised fully air conditioned computer suite whereas Wellington Street had several server rooms with individual air conditioning units.

Wellington Street was a building of odd shaped cellular offices which could be dark and 'airless' and Eyre Street is a sophisticated open plan office, which is light and airy and conducive to good working; but it uses about three times more electricity than Wellington Street required.

The reason is simply the massive amount of energy using plant and equipment required on site at Eyre Street to maintain the sophisticated light and airy space. In spite of the energy efficient design and the provision of new energy efficient office equipment throughout the building, the sheer quantity has negated all of the planned efficiency.

62. SYFR (and its heating contractors) currently use the BeMS to set the temperatures and to record and act on alarms that the system generates, improved management control of the BeMS would give greater internal control of heating and cooling remote sites which, together with:

- improved maintenance of existing plant and equipment to ensure it is working at optimum efficiency,
- checking and re-commissioning heating and cooling systems,
- replacing light emitters with more efficient ones,
- improved building insulation,
- improved air tightness,

are all relatively low cost options which could have high impact on energy usage and thereby the carbon emissions of the organisation. These actions may be achievable by alteration to the existing maintenance contracts to include some form of energy saving incentive for the contractors providing the maintenance service.

63. Education of the workforce leading to a change of culture with regard to embedding energy efficiency as a 'way of life' has to be an aspiration of the strategy, backed by continuous energy saving messages and advice from the Corporate Board. Again this is a relatively low cost initiative.

64. Provision of Voltage Optimisation and Regulation equipment on high energy use sites will reduce consumption by around 10%. The cost of such an installation is between £40K and £50K depending on size and the payback is between 3 and 5 years. One has been installed at Rotherham and early indications are that it will save between 12 and 15% of electricity consumption.

65. Provision for connection to the district heating scheme was made during the construction of Eyre Street as a way for future proofing. There is an understanding with the operator that when the heating main system is extended to provide heating for the new market building on The Moor, Eyre Street will also be added. While this may not reduce the energy consumed by the building (in terms of kWh) it will substantially reduce the carbon footprint.

66. One of the major difficulties surrounding the reduction of energy consumption is the age of SYFR building stock, with the exception of Eyre Street and the three new fire stations most stock is over 40 years old and, while energy efficiency has been considered in all refurbishment work carried out over the last 10 years, the bulk of the estate is in need of investment in energy reducing technologies. Provision of long term individual station improvement plans to highlight the potential for energy saving and carbon reduction initiatives should be introduced as part of the building condition survey process.

NEW BUILD AND REFURBISHMENT OF PROPERTY

New Build and Refurbishment Projects

Objective 4 – Provide carbon and energy efficient premises which include a measure of on site renewable energy generation where practicable

Ensure energy efficiency and sustainability remains core to all new build and major refurbishment projects. Ensure all construction projects comply with current climate and carbon reduction legislation, the approved strategy, government guidelines and best practice, and that they include measure to meet objective 1, 2 and 3 targets.

67. Previously energy efficiency had been considered in all refurbishment projects carried out in the last ten years. However, it was realised that the approach was somewhat ad-hoc and, subject to financial constraints. The process was in need of structure.
68. In 2009, following an independent report by experts in the field, SYFR adopted a strategy for sustainable construction. The strategy was aimed at new build and major refurbishment projects and was based on the principles of reducing the need for energy and water use through the construction methodology, the selection of energy efficient plant and equipment and the installation of renewable energy and water recycling technologies.
69. Since the introduction of the strategy there has been increased legislation and guidance relating to construction methodology and plant selection in the form of amendments to Parts L and G of the Building Regulations 2000. The Government has stated its intention that all newly constructed non-domestic buildings will be 'zero carbon' by 2019 and that the public sector will lead the way by achieving 'zero carbon' buildings by 2018. Additionally the introduction of feed in tariffs for site generated electricity has had an impact on the payback for renewable technologies and some of the conclusion in the strategy may need to be re-examined in light of these changes.

However, the principles remain the same, new build and refurbishment projects need to include energy efficiency and sustainability as a core ingredient to be considered at the design stage and not as a bolt on requirement.

70. The cost associated with achieving this objective will be outlined separately for each project as it occurs together with alternative solutions where practicable. This will take the form of the extra over cost to achieve neutrality above that required to comply with legislation. The Authority will be able to approve or reject the additional cost.

OFFSETTING

71. There will always be a need for energy and it will be highly unlikely that SYFR ever achieves a carbon neutral state, but by offsetting the remaining emissions that cannot be reduced or avoided, the full effects of the organisations carbon generation can be mitigated. Government advice is that organisations only use offsetting where emissions are currently unavoidable. Offsetting should never be the first choice; it is purely a cost to the organisation without any direct benefit from energy saved in any terms. (Offsetting is the purchasing of carbon credits to fund carbon reduction schemes in other parts of the world [there are no approved schemes in the UK]. Assured credits are created through a regulated mechanism to ensure that emissions savings as a result of funding through credits are additional and permanent. Offsetting is part of a global solution).

72. As stated above there is a potential shortfall of around 465 tonnes of carbon if objective 1 is achieved. If no other carbon reduction scheme were initiated, this carbon could be offset. The purchase of the carbon credit for offsetting is not linked to the cost of carbon in the CRC scheme but is traded separately. The scheme would have to be a Government approved one and could cost between £7/tonne and £15/tonne depending on the choice of scheme. **To cover the 465 gap would incur an annual cost of between £3,300 and £7,000 at current rates.**

Part C

ACTION PLAN

73. The advice from the OGC report (previously mentioned) is that the initial investment in any energy management strategy should be in information gathering technology (in the form of half hourly meters and interpretive software), so as to understand the organisations energy profile (action point 1). **The report further advises that small schemes on a large number of sites will have the highest overall impact and schemes with payback of less than five years should be actively pursued.**
74. The key recommendation specifically include; lighting upgrade (action point 2), re-commissioning plant and equipment (action point 3), improved insulation and air tightness (action point 9) and Voltage Optimisation. There are currently three sites within the property portfolio which have half hourly (code 5) electricity meters due to the site demand. These are Rotherham, Eyre Street and TDC. Rotherham has had voltage optimisation successfully installed and similar schemes are proposed for the two remaining high demand sites (action points 4 and 5).
75. The guidance from the carbon trust supports the active measuring and management of energy and suggests that the education and training of staff in energy saving initiatives (action point 6) could save as much as 10% of the total energy consumption. However, due to the nature of the organisation and its building stock it is believed that this level is overly ambitious and it is expected that between 3% and 5% would be achievable.
76. The possibility of free photovoltaic panels (action point 7) is discussed above (example 4) and is a way forward which has several funding options from £0 up to the full £500,000 for a full installation and, in financial terms, the level of return on the investment is proportional to the investment. Whichever funding option is used the electricity generated and the CO₂ savings are the same and would belong to the organisation. Feed in tariff (FiT) allowances have been included in the estimated annual cost savings.
77. Due to the general age of the property and for the longer term individual plans for each site are required to ensure that any funding is spent in ways that have the best impact on energy reduction, renewable energy generation and carbon savings (action point 8).
78. **As an alternative to the OGC advice the organisation may choose to invest in upgrading the worst performing property.** The 2010 carbon footprint assessment identified individual sites which were performing poorly in regard to carbon produced by the level of gas and electricity usage. The four worst performing sites are Eyre Street, Tankersley, TDC and Brampton Bierlow (Brampton has since closed due to the opening of new fire stations). Should the organisation wish to concentrate the funding on these sites the estimated projected cost and results are shown below. (It will be noted that some of the general AP's are included as part of the individual property AP's).

General Action Points

No	Description	Estimated Cost	Estimated saving in kWh	Estimated annual cost savings	Estimated saving in tonnes CO ₂
AP 1	The provision of remote meter reading facilities on all sites to allow accuracy greater scope for targeting high energy using sites. Assumed 3% improvement (This work is already being programmed)	£42,500	335,000	£19,700	134.8
AP 2	Up-grade lighting systems replacing old light tubes with much more efficient units across all sites which could save up to 25% of lighting consumption	£112,000	577,303	£46,700	84.8
AP 3	Re-commissioning existing building systems and improving maintenance regimes to ensure optimum efficiency of plant and equipment which depending on the level of the equipment may achieve a 3 to 8% improvement	£130,000	335,000 to 893,970	£19,700 to £52,800	134.8 to 359.5
AP 4	The provision of voltage optimisation and regulation equipment for Eyre Street should reduce the electrical consumption around 10%. (This work is already being programmed)	£41,000	145,650	£11,500	79.2
AP 5	The provision of voltage optimisation and regulation equipment for the Training and Development Centre [TDC] should reduce the electrical consumption by around 10%. (This work is already being programmed)	£15,000	33,800	£3,400	20.5
AP 6	Educating staff in energy reduction and management initiatives which is a low cost/no cost solution that has reportedly achieved (initially) up to a 10% reduction. Assumed 3% - 5% in SYFR	Staff time	335,000 to 558,730	£19,700 to £28,100	134.8 to 224.7

No	Description	Estimated Cost	Estimated saving in kWh	Estimated annual cost savings	Estimated saving in tonnes CO₂
AP7	Accept the free or enter in to sharing agreement for the provision of Photovoltaic panels with due regard to the overall impact on the use of property by third parties and in line with OGC investigations.	£0 to £250,000	99,600	8,100	53.7
AP8	Provide long term individual Station improvement plans to highlight the potential for renewable energy generation, energy saving and carbon reduction initiatives as part of the condition survey process	Not yet known	Not yet known	Not yet known	Not yet known
AP9	Up-grade insulation to building fabrics to include roof and external wall insulation	Not yet known	Not yet known	Not yet known	Not yet known
	TOTAL (AP1 – 5) + AP7 with no contribution to cost	£242,000 (excludes prior funded works)	1,861,353 to 2,644,053	£128,100 to £170,300	642.3 to 956.9
	Shortfall in Objective 1 - Achieve 20% of supply from Renewable Energy sources by 2020 target (assuming energy reduction, Objective 3, is met)		1,241,357⁸ (92.5%)		
	Shortfall of Objective 2 – Achieve a reduction of 34% in carbon footprint by 2020 target [1,657 tonnes total reduction]				1,014.7 to 700.1 (61.2 to 42.2%)

⁸ Only AP 7 increases the renewable energy capacity all other actions are to reduce energy use

Eyre Street Action Points

No	Description	Estimated Cost	Estimated saving in kWh	Estimated annual cost savings	Estimated saving in tonnes CO ₂
ES 1	The provision of voltage optimisation and regulation equipment for Eyre Street should reduce the electrical consumption around 10%. [AP 4] (This work is already being programmed)	£41,000	145,650	£11,500	79.1
ES 2	Re-commissioning existing building systems and improving maintenance regimes to ensure optimum efficiency heating and cooling chilled beam system [AP 3] Assumed 3% to 8% improvement	£36,000	31,077 to 82,874	£2,170 to £5,785	15.6 to 41.5
ES 4	Provide Photovoltaic panels for electrical generation at roof level	£84,000	16,500	£7,111 (including FiT)	7.1
ES 5	Provide solar hot water panels at roof level (12.5m ²)	£25,000	5,600	£450	2.0
	TOTAL	£174,000 (excludes prior funded works)	166,523 to 233,479	£21,630 to £26,500	107.8 to 140.2
	Shortfall in Objective 1 - Achieve 20% of supply from Renewable Energy sources by 2020 target (assuming energy reduction, Objective 3, is met)		1,318,886 (98.4%)		
	Shortfall of Objective 2 – Achieve a reduction of 34% in carbon footprint by 2020 target [1,657 tonnes total reduction]				1,549.2 to 1,516.8 (93.5 to 91.5%)

Training and Development Action Points

No	Description	Estimated Cost	Estimated saving in kWh	Estimated annual cost savings	Estimated saving in tonnes CO ₂
TDC 1	The provision of voltage optimisation and regulation equipment for the Training and Development Centre [TDC] should reduce the electrical consumption by around 10%. [AP 5] (This work is already being programmed)	£15,000	33,800	£3,400	20.5
TDC 2	Provide Photovoltaic panels for electrical generation at roof level	£84,000	16,500	£7,111 (including FiT)	7.1
TDC 3	Provide solar hot water panels at roof level	£25,000	5,600	£450*	2.0
TDC 4	Up-grade lighting systems replacing old light tubes with much more efficient units across all sites which could save up to 25% of lighting consumption [AP 2]	£20,700	51,200	£4,150	27.9
	TOTAL	£144,700	68,730	£15,111	57.5
	Shortfall in Objective 1 -Achieve 20% of supply from Renewable Energy sources by 2020 target (assuming energy reduction, Objective 3, is met)		1,318,886 (98.4%)		
	Shortfall of Objective 2 – Achieve a reduction of 34% in carbon footprint by 2020 target [1,657 tonnes total reduction]				1,599.5 (96.5%)

*No allowance included for Renewable Heat Incentive

Tankersley Fire Station Action Points

No	Description	Estimated Cost	Estimated saving in kWh	Estimated annual cost savings	Estimated saving in tonnes CO ₂
TFS 1	Re-commissioning existing building systems and improving maintenance regimes to ensure optimum efficiency including the replacement of the Trend BeMS panel. [AP 3] Assumed 5% to 8% improvement	£15,000	17,900 to 28,600	£537 to £890	3.3 to 5.3
TFS 2	Provide Photovoltaic panels for electrical generation at roof level	£42,000	8,100	£3,500 (including FIT)	3.5
TFS 3	Provide solar hot water panels at roof level	£25,000	5,600	£450*	2.0
TFS 4	Provide loft insulation	£10,000	129,600	£3,250	23.9
TFS 5	Up-grade lighting systems replacing old light tubes with much more efficient units across all sites which could save up to 25% of lighting consumption [AP 2]	£8,000	43,190	£4,000	23.5
	TOTAL	£115,000	204,390 to 215,090	£11,737 to £12,090	56.2 to 58.2
	Shortfall in Objective 1 - Achieve 20% of supply from Renewable Energy sources by 2020 target (assuming energy reduction, Objective 3, is met)		1,327,286 (99%)		
	Shortfall of Objective 2 – Achieve a reduction of 34% in carbon footprint by 2020 target [1,657 tonnes total reduction]				1,600.8 to 1,598.8 (96.6 to 96.5%)

*No allowance included for Renewable Heat Incentive