

# Nottinghamshire Police and Crime Commissioner

## Notice of Decision



Nottinghamshire

**POLICE & CRIME COMMISSIONER**

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<b>For Decision or Information</b>	<b>Information</b>
<b>Date received*:</b>	<b>28<sup>th</sup> November 2013</b>
<b>Ref*:</b>	<b>2013.33</b>

\*to be inserted by Office of PCC

**TITLE: Replacement of oil – fired heating at Sherwood Lodge**
**EXECUTIVE SUMMARY:**

A report was provided to the Force Executive Board (FEB) on 11<sup>th</sup> November outlining proposals to replace the existing oil-fired heating provision at Sherwood Lodge with a biomass boiler system.

This will provide annual reductions in energy bills and reduce the carbon dioxide emissions in relation to the Sherwood Lodge Site.

**INFORMATION IN SUPPORT OF DECISION:** (e.g report or business case)

Please see attached the paper submitted to the FEB on 11<sup>th</sup> November, along with the full business case.

**Is any of the supporting information classified as non public or confidential information\*\*?**

Yes

No

X

If yes, please state under which category number from the guidance\*\*:

**DECISION:**

For the Nottinghamshire Police and Crime Commissioner to note the attached reports relating to the replacement of the oil-fired heating provision at Sherwood Lodge.

**DECLARATION:**

I confirm that I do not have any disclosable pecuniary interests in this decision and I take the decision in compliance with the Code of Conduct for the Nottinghamshire Office of the Police and Crime Commissioner. Any interests are indicated below:

The above request has my approval.

Signature:

**Nottinghamshire Police and Crime Commissioner**

Date:

6/12/13

**OFFICER APPROVAL**

I have been consulted about the proposal and confirm that the appropriate advice has been taken into account in the preparation of this report. I am satisfied that this is an appropriate request to be submitted to the Police and Crime Commissioner.

Signature:

**Chief Executive**

Date:

4<sup>th</sup> December 2013

\*\* See guidance on non public information and confidential information.

<b>For Consideration and Decision</b>	
<b>Public/Non Public*</b>	<b>Public</b>
<b>Report to:</b>	<b>Force Executive Board</b>
<b>Date of Meeting:</b>	<b>11 November 2013</b>
<b>Report of:</b>	<b>Tim Wendels, Head of Estates and Facilities</b>
<b>Report Author:</b>	<b>Tim Wendels</b>
<b>E-mail:</b>	<a href="mailto:tim.wendels@nottinghamshire.pnn.police.uk">tim.wendels@nottinghamshire.pnn.police.uk</a>
<b>Other Contacts:</b>	<b>Ainsley Peters</b>
<b>Agenda Item:</b>	<b>6</b>

\*If Non Public, please state under which category number from the guidance in the space provided.

## **REPLACEMENT OF OIL – FIRED HEATING AT SHERWOOD LODGE**

### **1. Purpose of the Report**

- 1.1 This Report seeks FEB approval to replace the existing oil-fired heating provision at Sherwood Lodge, serving the main building, former recreational block and remaining huts structure, with a biomass boiler system.

### **2. Recommendations**

- 2.1 To agree to the proposals for replacing the existing oil-fired heating provision at Sherwood Lodge, serving the main building, former recreational block and remaining huts structure, as detailed in the attached Business Case.

### **3. Reasons for Recommendations**

- 3.1 To provide annual reductions in energy bills and reduce carbon dioxide emissions in relation to the Sherwood Lodge site.

### **4. Summary of Key Points (this should include background information and options appraisal if applicable)**

- 4.1 The attached document outlines the business case to support the proposal to replace the existing oil-fired heating provision at Sherwood Lodge, encompassing the main building, former recreational block and remaining huts structure (see Appendix 1 of the Business Case for site map reference).
- 4.2 Sherwood Lodge has undergone a range of fabric improvements in recent years to improve working conditions as well as reduce the energy consumption of the buildings. The site currently uses a Hoval oil fired system that is in need of replacement in order to reduce running costs and carbon emissions, in line with the Force's efficiency savings and carbon management plans respectively.
- 4.3 An assessment of viability was commissioned earlier this year by the Estates & Facilities Department with Carbon Zero – specialist consultants in water and renewable energy, to assess the potential for installation of either a

ground source heat pump (GSHP) or a biomass system as a suitable replacement for the existing heating provision.

- 4.4 Biomass boilers efficiently (and therefore cost effectively) extract energy from the burning of biomass fuels (wood pellets, chips or logs) to provide heating and hot water. Installation of a biomass system at Sherwood Lodge would require few changes to the main building emitter system (radiators etc.) and no change of emitter pipework for delivery of heat, although some upgrades will need to take place with regards to pumping, monitoring and control.
- 4.5 Whilst an open loop GSHP system is a technically feasible solution (as the site stands on an excellent sandstone aquifer) the emitter systems within the main building, recreation block and huts structure would require major re-design and re-fitting to interface effectively with the heat pump. The potential cost of this re-fit, and more importantly the degree of disturbance, are likely to be considerable.
- 4.6 As a result of this initial assessment and further internal reviews, including carbon reduction calculations and investment appraisal contained in the Business Case, the recommendation is to install a biomass system to replace the existing oil-fired boilers.
- 4.7 The proposal to replace the oil-fired heating system at Sherwood Lodge is one of a number of initiatives listed in the Force's carbon management plan that contribute to lowering our overall carbon dioxide emissions and a total capital budget of £870,000 has already been approved by the PCC for energy initiatives and is available in the current capital programme. Additional capital provision for these proposals is therefore not required.
- 4.8 In addition to the financial savings set out at 5.2 below, the biomass boiler will only generate 36,400 kg of carbon dioxide per year which represents a reduction of 319,800 kg per year, which is a 90% reduction on the 356,200 kg produced by the current system and also considerably lower than the alternative GSHP system which would produce 193,670 kg of carbon dioxide per year.

<b>5 Financial Implications and Budget Provision</b>
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- 5.1 The capital cost of installing a biomass boiler system is approximately £296,000. This will be funded from the existing capital programme provision of £870,000 for energy initiatives.
- 5.2 The proposals will produce an average annual revenue saving of £24,063. This represents an average annual return on investment of 8% and a 9 year payback period.

<b>6. Human Resources Implications</b>
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- 6.1 There are no Human Resources implications arising directly from these proposals.

<b>7. Equality Implications</b>
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- 7.1 There are no equality implications arising directly from these proposals.

<b>8. Risk Management</b>
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- 8.1 Please see Section 8 of the Business Case.

<b>9. Policy Implications and links to the Police and Crime Plan Priorities</b>
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- 9.1 The business case seeks to contribute towards priority 2 of the current policing plan "spending your money wisely".

<b>10. Changes in Legislation or other Legal Considerations</b>
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- 10.1 Not applicable.

<b>11. Details of outcome of consultation</b>
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- 11.1 Consultation has taken place with all members of the Corporate Services Programme Board and the Business Case has been approved by the Board.

<b>12. Appendices</b>
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- 12.1 Business Case – Replacement of Oil-Fired Heating at Sherwood Lodge.

# Business Case



<b>Project:</b>	Replacement of Oil-Fired Heating at Sherwood Lodge
<b>Date:</b>	23/10/2013
<b>Author:</b>	Ainsley Peters

## 1. Executive Summary

This document outlines the business case to support the proposal to replace the existing oil-fired heating provision at Sherwood Lodge, encompassing the main building, recreational block, and remaining huts structure (see Appendix 1 for site map reference).

Sherwood Lodge has undergone a range of fabric improvements in recent years to improve working conditions as well as reduce the energy consumption of the buildings. The site currently uses a Hoval oil fired system that is in need of replacement in order to reduce running costs and carbon emissions, in line with the Force's efficiency savings and carbon management plans respectively.

An assessment of viability was commissioned earlier in 2013 by the Estates department with Carbonzero – specialist consultants in water and renewable energy, to assess the potential for installation of either a ground source heat pump (GSHP) or a biomass system as a suitable replacement for the existing heating provision. A CYMAP software modelling exercise was also carried out to quantify the heating requirements of the buildings under consideration in order to specify the peak output requirements of the replacement technology.

Biomass boilers efficiently (and therefore cost effectively) extract energy from the burning of biomass fuels (wood pellets, chips or logs) to provide heating and hot water. Installation of a biomass system at Sherwood Lodge would require few changes to the main building emitter system and no change of emitter pipework for delivery of heat, although some upgrades will need to take place with regards to pumping, monitoring and control.

Whilst an open loop GSHP system is a technically feasible solution (as the site stands on an excellent sandstone aquifer) the emitter systems within the main building, recreation block and huts structure would require major re-design and re-fitting to interface effectively with the heat pump. The potential cost of this re-fit, and more importantly the degree of disturbance, are likely to be considerable.

As a result of this initial assessment and further internal reviews, including carbon reduction calculations and investment appraisal contained herein, the recommendation is to install a biomass system to replace the existing oil-fired boilers.

The proposal to replace the oil-fired heating system at Sherwood Lodge is one of a number of initiatives listed in the Force's carbon management plan that contribute to lowering our overall carbon emissions and a total capital budget of £870K has already been approved by the PCC for energy initiatives to be undertaken in the current Financial Year.

### 1.1 Issue

The existing oil-fired boilers at Sherwood Lodge are oversized, inefficient and costly to run as well as being carbon emission intensive. The proposed replacement biomass system will reduce running costs and cut carbon emissions.

The installation of a heating system that uses renewable energy will also result in the generation of the Central Government endorsed Renewable Heat Incentive (RHI) which will enable internally generated revenue for the Force (subject to the application process).

### 1.2 Benefits and impact of this work

The cashable benefits include:

- Reduced heating and hot water costs
- Generation of RHI revenue

The non-cashable benefits include:

- Increased energy efficiency
- Reduced carbon emissions

### 1.3 Summary costs

#### **Option 1 – Do Nothing**

Capital investment: - £nil.

Revenue cost implications: - running costs for the existing oil-fired boilers are currently around £65K per annum to heat the Sherwood Lodge main building and recreational block. These costs will continue to rise in line with the inflation of energy prices in future years.

#### **Option 2 – Install a Biomass Boiler**

Capital investment: - Biomass boiler installation and associated costs estimated to be around £296K. A detailed breakdown of these costs can be found in Section 5.

Revenue cost implications: - The cost of further consultancy work with Carbonzero is anticipated up to £10K to conduct further piping and heat loss surveys and also assist in the RHI application process.

#### **Option 3 – Install a Ground Source Heat Pump**

Capital investment: - GSHP installation, changes to heating pipe infrastructure and associated costs estimated to be around £904K. A detailed breakdown of these costs can be found in Section 5.

Revenue cost implications: - The cost of further consultancy work with Carbonzero is

anticipated up to £10K to conduct further piping and heat loss surveys and also assist in the RHI application process.

Due to the additional conversion work involved in installing a GSHP system compared to a biomass system it should be noted that both the capital and revenue costs indicated here for Option 3 could infinitely increase dependant on the result of further detailed surveys needed to facilitate a full and final quote for the entire project cost.

**Option 4 – Defer the decision and retain the existing boilers in the short term**

Should the Board wish to defer the decision to invest until the next quarterly RHI tariff announcement (due January 2014), the cost implications will be the same as Option 1 (Do Nothing) until such time a decision is made and initial work on the system of choice is commissioned and commenced.

Explanation of why this has been noted as an option can be found in Section 5.

**2. Project Overview and the situation the project will address**

The existing oil-fired boiler system was installed in 1999 and is oversized, inefficient and costly to run as well as being carbon emission intensive. With a life expectancy of c20 years it has a remaining life of approximately 6-7 years.

The proposal to replace the system before the end of its useful life arises for a number of reasons, not least the succession of traditional heating methods with new renewable energy source technology, facilitating:

- Fuel efficiency
- Carbon emission reduction
- Ongoing running cost savings
- RHI revenue generation

The 2 options considered for viability to replace the existing system were a ground source heat pump (GSHP) or a biomass system.

GSHP systems use pipes buried underground to circulate a water and antifreeze solution and extract heat from the earth, whilst biomass systems (also called wood-fuelled heating systems) simply burn wood pellets, chips or logs.

Both systems can be used to power central heating radiators, under floor or warm air heating and hot water systems. Running costs are inherently lower than the existing oil-fired system due to the renewable nature of the fuel source, which also presents a low (or nil in the case of the GSHP) supply chain risk.

Installation of a biomass system at Sherwood Lodge would require few changes to the main building emitter system and no change of emitter pipework for delivery of heat, although some upgrades will need to take place with regards to pumping, monitoring and control. It requires a

much smaller capital investment than the GSHP, will involve a far simpler commissioning and installation process and carries far less inherent risk for unforeseen project costs to occur.

Whilst an open loop GSHP system is a technically feasible solution (as the site stands on an excellent sandstone aquifer) the emitter systems within the main building and the recreation block would require major re-design and re-fitting to interface effectively with the heat pump system. The potential cost of this re-fit, and more importantly the degree of disturbance, are likely to be considerable. There is also a far greater risk that unforeseen project costs could occur and impact on day to day operations within the specified building areas could be significantly affected. Consequently this is not the preferred option.

There is further rationale to consider the installation of a new renewable energy source heating provision as soon as possible in order to maximise the amount of RHI revenue available to the organisation. The RHI non-domestic incentive scheme has an inbuilt degression mechanism designed to ensure that the national RHI spend does not exceed its fixed annual budgets. Therefore, once uptake pushes up the total RHI payable on a national level, some or all tariffs will be lowered (known as degression).

RHI tariffs are reviewed and set quarterly by the Department of Energy and Climate Change (DECC) and are published by Ofgem (the regulatory body for the gas and electricity markets in Great Britain). Unfortunately there is no inevitability in uptake trends and therefore it is very difficult to predict how tariffs will be affected each quarter, but it should be expected that the rates will go down as well as up (rates can be increased to encourage uptake of certain technologies although there is no precedent of this since the scheme was introduced in November 2011).

Degression in RHI rates would significantly affect the viability of a new installation by reducing the organisation's ability to generate revenue from this project. If a timely decision is made to progress the proposal to install a biomass system at Sherwood Lodge, the necessary work can be commissioned and the application process can commence, in order to "lock in" the most favourable rate on offer at this current time. Once the locked in rate is confirmed this is guaranteed for 20 years and rises in line with RPI.

Degression of some rates has already occurred in 2013 and although there is no further forecast degression in 2014/15 this is entirely dependant on national uptake of the scheme so should not be ruled out.

### **3. Detail how the approach you are taking is innovative**

The proposal to replace the existing oil-fired heating provision is innovative because it involves the use of a sustainable energy source to reduce revenue costs and carbon emissions for the Force, helping to achieve the required efficiency savings in this and future CSR periods whilst also having a positive impact on the environment.

This innovative project also upholds the Force's PROUD ethos as a way of approaching the current situation differently or: *"Doing things differently"*.



#### 4. How does this support Force Objectives/Strategic Objectives?

This business case proposal supports the Force's objective 2, namely, "*Spend your money wisely*", demonstrating a good rate of return to the Force against the capital investment proposed.

This project also promotes the PCC and Force Corporate Social Responsibility agenda by creating a more sustainable fuel supply and reducing its impact on the environment.

#### 5. Options with costs and risks

##### Option 1 – Do Nothing

Capital investment: £nil  
 NPV of revenue **costs** over 20 years: £1.6M  
 Payback period: not applicable  
 Average annual return on investment: not applicable  
 Annual reduction in CO2 emissions: nil

Risks:  
 Increased running costs of oil-fired boilers in line with escalating fuel prices  
 Loss of potential RHI revenue through rate depression

##### Option 2 – Install a Biomass Boiler

Capital Investment: estimated at around £296K covering:

Heat hub packaged plant room with integrated fuel store and fill pipes (for wood pellets).  
 Concrete base, 400 kW biomass boiler and buffer tank.  
 Boiler to buffer connecting pipework.  
 Twin-walled stainless steel flue system.  
 £219K

Connection from buffer tank into pre-insulated district heat pipe, pre-insulated district heat mains, trenching and re-instatement connection.  
 Plate heat exchanger.  
 Pump sets.  
 £45K

Connection from pre-insulated district heat pipe termination into existing plant room pipe work and pump set.  
 £32K

NPV of revenue **savings** over 20 years: £0.4M  
 Payback period: 9 years  
 Average annual return on investment: 8%

Annual reduction in CO2 emissions: 319,800kg

Risks: Please refer to Section 8.

### **Option 3 – Install a Ground Source Heat Pump**

Capital investment estimated at around £904K covering:

Open loop 400 kW installation including drilling and construction of boreholes.

Borehole geophysics, test pumping and test pump analysis including re-injection testing and water quality analysis.

Consultancy for application process to Environment Agency for licence and permit.

Supply and install wellheads, permanent submersible pump, abstraction borehole riser and injection borehole pipework.

Plant room costs, heat pumps, cylinders and controls, insulated pipework from new heat pump to heat distribution pipe work.

£470K

Additional work to 254 separate areas requiring change in emitter system and 1 or more larger radiators installing.

Supply and install new emitters, removal of old emitters.

Move pipework connections to radiators and redecoration around completed works.

Pipework, fittings and TRVs around emitters.

Zoning controls.

£254K

Thermal stores and buffer vessels.

£30K

Interconnecting pipework from plant room and insulation.

£50K

Interconnecting pipework from buffers to zones.

£100K

NPV of revenue **savings** over 20 years: £0.7M

Payback period: 13 years

Average annual return on investment: 4%

Annual reduction in CO2 emissions: 162,530kg

Risks:

Higher inherent investment risk due to the size of the capital investment proposed.

Capital investment proposal exceeds existing capital budget and additional funds may not be approved by PCC.

Complex commissioning and installation process meaning considerable disruption on site.

Vast scope for unforeseen costs to escalate due to complexity of project.

Length of implementation period means undue delays in commencing the RHI application process - could mean potential depression in rates.  
 Considerably longer payback period when compared to Biomass.  
 Considerably lower average annual return when compared to Biomass.  
 Considerably less reduction in carbon emissions than Biomass.  
 Requirement to retain 1 oil-fired boiler to support output in peak heating demand periods and provide a small percentage of the domestic hot water demand. Additionally, the GSHP runs on electricity meaning running costs will still be more susceptible to fuel price volatility than other sustainable fuel sources (e.g. wood pellets to run biomass).

#### **Option 4 – Defer the decision and retain the existing boilers in the short term**

Option 4 would be to defer the decision point for investment until the next quarterly RHI tariffs are announced to see if the rates for GSHP significantly increase and therefore change the investment appraisal to such an extent that this then becomes the preferred option.

A report from the DECC dated 31st May 2013 (*Renewable Heat Incentive: Non-Domestic Scheme Early Tariff Review*) suggested that following an early tariff review in the first half of 2013 the rate for large GSHP systems (over 100kw in size) could increase by as much as 3.7p per kWh of output in order to stimulate the market for this type of system. This would considerably affect the return on investment for the size of system that could be installed at Sherwood Lodge.

However, there has been much (as yet unsubstantiated) speculation around rate increases to date and neither DECC or Ofgem are willing to commit to any firm indication of this prior to the next rate announcement (due January 2014). It should also be noted that there has been no precedent of rate increases since the RHI scheme was introduced in November 2011. This is why this is not the recommended option.

Evaluation of the investment in a GSHP system at this point in time has been based on current rates (in Option 2), but the option to defer the decision was considered, and an NPV calculation can be found in Appendix 2 to show the potential returns on a GSHP system should a rate increase of this size occur. This is heavily caveat with the fact that any rate increase is speculative at this point in time, and a further NPV calculation should be conducted if a rate increase does occur to take account of the rates applicable at that time.

The capital investment and carbon emission savings would be the same as Option 3 above for the GSHP system.

The main risk associated with deferring the decision is the potential depression of RHI rates during the deferral period. System and fuel costs could also increase in this period.

See Appendix 2 for full NPV calculations for all options and statement of underlying assumptions.

## 6. Preferred option

Option 2 - installation of a biomass boiler system is recommended for the following reasons (as previously outlined in Sections 1-5):

- Lower inherent investment risk due to the size of the capital investment proposed.
- The capital investment required can be funded out of the existing capital budget already approved by PCC for energy initiatives.
- Simpler commissioning and installation process meaning less disruption on site, less risk for budget and scope “creep”, and the ability to accelerate the RHI application process to “lock in” the best available RHI tariff before any potential degradation.
- Quicker payback period when compared to GSHP.
- Better average annual return when compared to GSHP.
- Far better reduction in carbon emissions than GSHP.
- Able to decommission all of the existing 4 oil-fired boilers (GSHP would require 1 oil-fired boiler to remain to support output in peak heating demand periods and provide a small percentage of the domestic hot water demand).

## 7. Costs of the preferred option

Please refer to Section 5 for Option 2 – Install a Biomass boiler and the detailed NPV calculation in Appendix 2.

<b>8. Risks associated with the preferred option</b>	
Fuel price volatility	<p>EMSCU will facilitate the set up of a long term fuel procurement strategy.</p> <p>Regional procurement frameworks will be used to secure the optimum price for wood pellets.</p>
Fuel supply chain continuity	<p>EMSCU will facilitate contract negotiation with suppliers to ensure continuity of supply and longevity of contract.</p> <p>Long term prospects for the supply of wood pellets are less volatile than for gas oil as it is an abundant and sustainable fuel source.</p>
Timescales of tendering process	<p>The procurement strategy has not yet been established for this project although it is anticipated that an EU procurement process will be required due to the value and nature of the works.</p> <p>The timescales for procurement are approximately 6-8 months if the EU procurement process is initiated. EMSCU will lead on this process to help avoid slippage.</p>
Planning permission requirements	<p>Planning permission will be sought before commissioning the system and commencing any install.</p>
Spatial constraints	<p>The Estates department will conduct site surveys in order to mitigate spatial issues as part of the project planning phase.</p>
Existing pipe work insufficient for new boiler plant	<p>Piping surveys to be done by Carbonzero prior to installation.</p>
Not qualifying for RHI	<p>The Estates department will work closely with the principal contractor, Carbonzero and regulator to mitigate this risk.</p>
Degression in RHI rates during the application process	<p>Decision to proceed with the recommended option as soon as possible will aide a quicker application and mitigate this risk. Once the application is accepted the rates are "locked in" for a guaranteed 20 years and rise in line with RPI.</p>

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Retention of Sherwood Lodge	<p>Sherwood Lodge is not under retentive scrutiny as part of the Estates rationalisation plan to 2016.</p> <p>Investment of £5M capital was used to refurbish the site in 2009 with a view that this would sustain its viability for the foreseeable future.</p> <p>Sherwood Lodge is also situated on a 'green belt' site which limits the options for redevelopment and hence the commercial resale value. This negates any justification for selling the site at this current time.</p>
All prices as quoted for capital investment are currently estimations and subject to change	<p>Estimations were obtained through Carbonzero who sourced and verified this information with principal contractors who have a track record of these types of install.</p> <p>The recommended option for a Biomass system carries less inherent risk in unforeseen costs arising due to the less complex nature of the system and installation requirements.</p>

## 9. Timescales

### Milestone/Deliverable

Design & specification

Procurement process

Start of installation

Completion of RHI

Completion of installation

### Target Date

01/12/13

01/12/13 – 01/04/14

01/04/14

01/10/14 – 01/11/14

01/07/14

## 10. Project Team

Estates and Facilities Department, EMSCU, Carbonzero consultants, Principal & sub contractors.

## 11. Benefits Expected and Benefits Realisation

The cashable benefits include:

- Reduced heating/hot water costs (specific and measurable)
- Generation of RHI revenue (specific and measurable)

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The non-cashable benefits include:

- Increased energy efficiency (calculable)
- Reduced carbon emissions (calculable)

See below for Benefits and Measurement Plan table.

Benefits and Measurement Plan							
Benefit No.	Benefit category	Measurement plan					
		Benefit delivery date	Benefit measure	Data source	Contact for measure	Frequency of measure	Baseline date

12. Impact	
Business Area	Impact
HR	N/A
PCC	Will support CSR agenda of becoming a more sustainable force.
Regional Implications	N/A
Operating Model	N/A
L & D	N/A
Procurement	Procurement will assist when using frameworks to appoint contractors
Information Services	N/A
Estates	N/A
Finance (Business Partners)	Have been consulted. Ongoing work to document financial benefits
Information Management	N/A
Information Security Manager	PSD (Vetting) will be engaged to process contractors on site
Research	N/A
Business Benefits	The business realisation officer has been consulted
Corporate Communications	N/A
Equality Impact Assessment	N/A
Privacy Impact Assessment	N/A
Victim Focused	N/A

13. Project Spend

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Refer to Appendix 2 NPV calculations for project spend and cash flow projections.



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**ADMINISTRATION**

**Business Case History**

Document:

Location:

**Revision History**

Revision Date	Previous Revision Date	Author	Summary of Changes	Changes Marked

**Approvals**

Name	Title	Date of Issue	Version

**Distribution**

This document requires distribution to the business experts as follows. The PMO will circulate this business case to all parts of the business that should have site of and comment on this work. Full consultation needs to have taken place before this business case will be considered ready for submission to the Programme board for approval. A hard copy of the document should be held by the project manager with the appropriate signatures to confirm the document has been assessed.

Name	Business Area	Signature Confirm Assessed
Ronnie Adams	Procurement	
Christi Carson	Head of Information Services	
Paul Dudley	Business Benefits	
Keiley Freeman	Research	
Richard Hitch	Information Services	
Glen Langford	Information Management	
Jacky Lloyd Lindsey Stillings Jill Samuels	HR Business Partner HR Business Partner (Crime and Justice) HR Business Partner	
Pat Stocker	Information Security Manager	
Matt Tapp ( Paul Coffey)	Corporate Communications	
Simon Tovey	Head of Business & Finance	
Ann Marie Hughes Andrea Naylor Sarah Odam	Business Partner (Corporate Services) Business Partner (Local Policing) Business Partner (Ops Support)	

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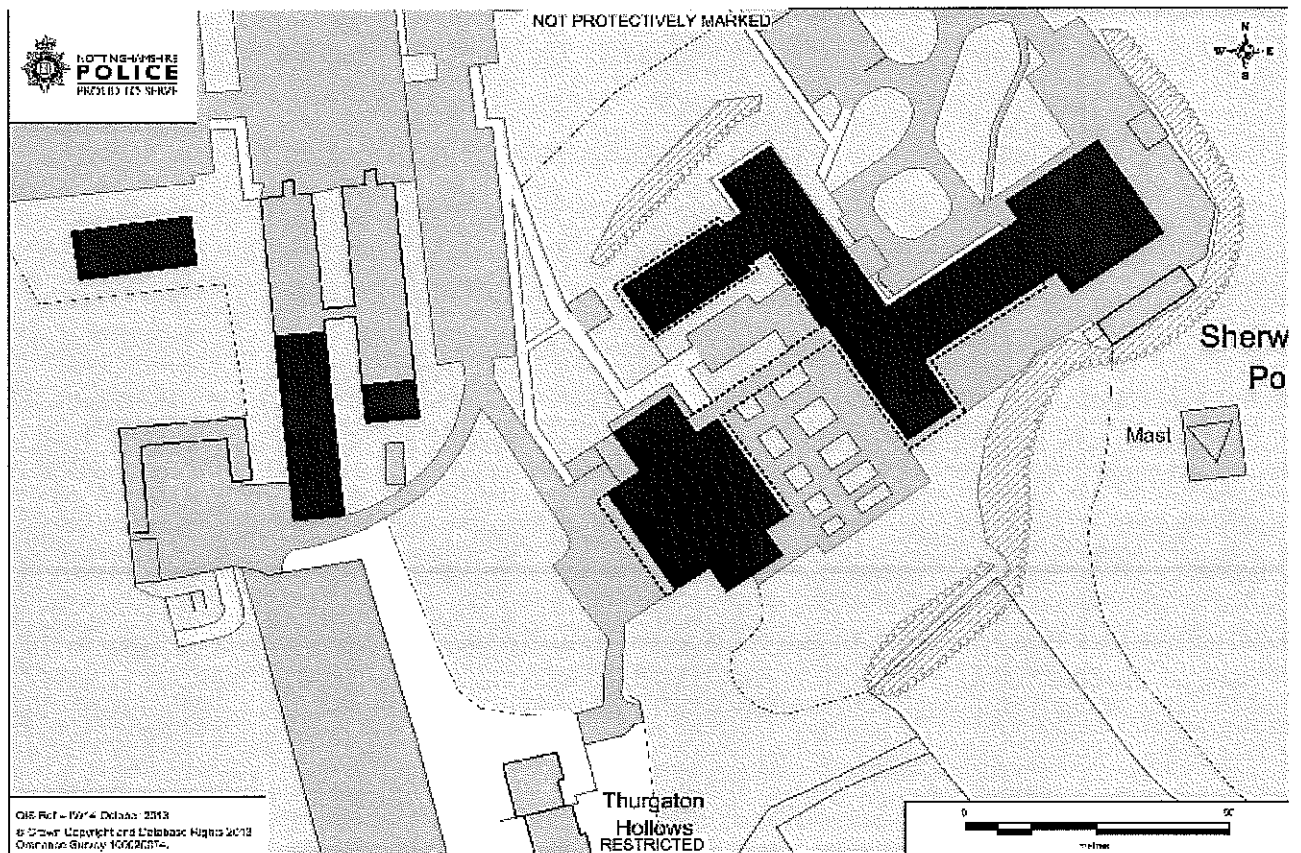
	DELETE AS APPROPRIATE	
Tim Wendels	Estates	
Ak Khan	Ch Supt, County Divisional Commander	
Simon Nickless	Ch Supt, City Divisional Commander	
Ian Howick	T/Ch Supt, Ops Support	
Helen Jebb	DCS, Head of Crime and Justice	
Pauline Smith	Head of Contact Management	
Ian Waterfield	CS	

<b>Programme Management Office</b>	
<b>DATE RECEIVED</b>	<b>GOVERNING BOARD</b>

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## Appendix 1 – Site map showing the areas affected (marked in red)



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Appendix 2 – NPV calculations and assumptions

Option 1 - Do Nothing	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	TOTAL
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
<b>NPV of Project</b>																					
Capital Cost	0																				0
RHI Generation Income	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost (renewable)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Energy Cost (non-renewable)	-65,000	-68,250	-71,663	-75,246	-79,008	-82,958	-87,106	-91,462	-96,035	-100,836	-105,878	-111,172	-116,731	-122,567	-128,696	-135,130	-141,887	-148,981	-156,430	-164,252	-2,149,287
Annual System Service/Maintenance Cost	-2,500	-2,575	-2,652	-2,732	-2,814	-2,898	-2,985	-3,075	-3,167	-3,262	-3,360	-3,461	-3,564	-3,671	-3,781	-3,895	-4,012	-4,132	-4,256	-4,384	-67,176
Annual Energy Cost Saving (from de-commission of old system)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>NET TOTAL COSTS</b>	<b>-67,500</b>	<b>-70,825</b>	<b>-74,315</b>	<b>-77,977</b>	<b>-81,822</b>	<b>-85,856</b>	<b>-90,091</b>	<b>-94,536</b>	<b>-99,202</b>	<b>-104,098</b>	<b>-109,238</b>	<b>-114,633</b>	<b>-120,295</b>	<b>-126,239</b>	<b>-132,477</b>	<b>-139,025</b>	<b>-145,899</b>	<b>-153,113</b>	<b>-160,686</b>	<b>-168,636</b>	<b>-2,216,463</b>
<b>CUMULATIVE</b>	<b>-67,500</b>	<b>-138,325</b>	<b>-212,640</b>	<b>-290,617</b>	<b>-372,439</b>	<b>-458,295</b>	<b>-548,387</b>	<b>-642,923</b>	<b>-742,124</b>	<b>-846,223</b>	<b>-955,461</b>	<b>-1,070,093</b>	<b>-1,190,388</b>	<b>-1,316,627</b>	<b>-1,449,104</b>	<b>-1,588,129</b>	<b>-1,734,028</b>	<b>-1,887,141</b>	<b>-2,047,827</b>	<b>-2,216,463</b>	
Discount Factor (3%)	1.00	0.97	0.94	0.92	0.89	0.86	0.84	0.81	0.79	0.77	0.74	0.72	0.70	0.68	0.66	0.64	0.62	0.61	0.59	0.57	1.03
<b>Discounted Cash Flow</b>	<b>-67,500</b>	<b>-68,762</b>	<b>-70,049</b>	<b>-71,360</b>	<b>-72,698</b>	<b>-74,061</b>	<b>-75,450</b>	<b>-76,867</b>	<b>-78,311</b>	<b>-79,783</b>	<b>-81,283</b>	<b>-82,813</b>	<b>-84,373</b>	<b>-85,962</b>	<b>-87,583</b>	<b>-89,235</b>	<b>-90,919</b>	<b>-92,636</b>	<b>-94,386</b>	<b>-96,170</b>	<b>-1,620,200</b>
<b>Payback</b>	<b>-67,500</b>	<b>-136,262</b>	<b>-206,311</b>	<b>-277,671</b>	<b>-350,369</b>	<b>-424,429</b>	<b>-499,879</b>	<b>-576,746</b>	<b>-655,057</b>	<b>-734,839</b>	<b>-816,123</b>	<b>-898,936</b>	<b>-983,308</b>	<b>-1,069,270</b>	<b>-1,156,853</b>	<b>-1,246,088</b>	<b>-1,337,008</b>	<b>-1,429,644</b>	<b>-1,524,030</b>	<b>-1,620,200</b>	
<b>Cashflow of Annual Returns</b>																					
Capital Repayment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest @ 5%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RHI Generation Income	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Energy Cost Saving	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>ANNUAL CASHFLOW</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Assumptions</b>																					
Peak heating demand in kW						400															
Annual increase in peak heating demand						0%															
Annual total heating demand in MWh						1,200															
Annual domestic hot water (DHW) demand in kWh						100,000															
Annual total heating and DHW demand in kWh						1,300,000															
Annual increase in total heating and DHW demand						0%															
Annual servicing costs (nominal)						£ 2,500															
Annual inflation rate (not including fuel)						3%															
Cost of oil per kWh						£ 0.05															
Annual inflation rate for fuel oil						5%															
<b>CO2 emissions:</b>																					
Heating Oil = 0.274 kgCO2/kWh						356,200															
<b>Total</b>						<b>356,200</b>															

Option 3 - Install Ground Source Heat Pump (GSHP) System																					
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	TOTAL
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
NPV of Project																					
Capital Cost	-904,000																				-904,000
RHI Generation Income	45,045	46,396	47,788	49,222	50,699	52,220	53,786	55,400	57,062	58,774	60,537	62,353	64,223	66,150	68,135	70,179	72,284	74,453	76,686	78,987	1,210,376
Annual Energy Cost (renewable)	-34,933	-36,680	-38,513	-40,439	-42,461	-44,584	-46,813	-49,154	-51,612	-54,192	-56,902	-59,747	-62,734	-65,871	-69,165	-72,623	-76,254	-80,067	-84,070	-88,274	-1,155,088
Annual Energy Cost (non-renewable)	-650	-683	-717	-752	-790	-830	-871	-915	-960	-1,008	-1,059	-1,112	-1,167	-1,226	-1,287	-1,351	-1,419	-1,490	-1,564	-1,643	-21,493
Annual System Service/Maintenance Cost	-2,500	-2,575	-2,652	-2,732	-2,814	-2,898	-2,985	-3,075	-3,167	-3,262	-3,360	-3,461	-3,564	-3,671	-3,781	-3,895	-4,012	-4,132	-4,256	-4,384	-67,176
Annual Energy Cost Saving (from de-commission of old system)	65,000	68,250	71,663	75,246	79,008	82,958	87,106	91,462	96,035	100,836	105,878	111,172	116,731	122,567	128,696	135,130	141,887	148,981	156,430	164,252	2,149,287
NET TOTAL COSTS	-832,038	74,709	77,568	80,544	83,641	86,866	90,223	93,718	97,357	101,147	105,094	109,206	113,488	117,949	122,597	127,440	132,486	137,745	143,226	148,939	1,211,906
CUMULATIVE	-832,038	-757,329	-679,760	-599,216	-515,575	-428,709	-338,486	-244,768	-147,411	-46,264	58,831	168,036	281,524	399,473	522,070	649,510	781,996	919,742	1,062,967	1,211,906	
Discount Factor (3%)	1.00	0.97	0.94	0.92	0.89	0.86	0.84	0.81	0.79	0.77	0.74	0.72	0.70	0.68	0.66	0.64	0.62	0.61	0.59	0.57	1.03
Discounted Cash Flow	-832,038	72,533	73,116	73,709	74,314	74,931	75,560	76,201	76,855	77,521	78,200	78,892	79,598	80,318	81,051	81,799	82,561	83,338	84,130	84,938	657,528
Payback	-832,038	-759,505	-686,389	-612,680	-538,365	-463,434	-387,874	-311,673	-234,818	-157,297	-79,097	-205	79,394	159,711	240,762	322,561	405,122	488,460	572,590	657,528	
Cashflow of Annual Returns																					
Capital Repayment	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-45,200	-904,000
Interest @ 5%	-45,200	-42,940	-40,680	-38,420	-36,160	-33,900	-31,640	-29,380	-27,120	-24,860	-22,600	-20,340	-18,080	-15,820	-13,560	-11,300	-9,040	-6,780	-4,520	-2,260	-474,600
RHI Generation Income	45,045	46,396	47,788	49,222	50,699	52,220	53,786	55,400	57,062	58,774	60,537	62,353	64,223	66,150	68,135	70,179	72,284	74,453	76,686	78,987	1,210,376
Net Energy Cost Saving	26,917	28,313	29,780	31,322	32,943	34,646	36,437	38,318	40,296	42,374	44,558	46,853	49,265	51,799	54,462	57,261	60,202	63,293	66,540	69,952	905,530
ANNUAL CASHFLOW	-18,438	-13,431	-8,312	-3,076	2,281	7,766	13,383	19,138	25,037	31,087	37,294	43,666	50,208	56,929	63,837	70,940	78,246	85,765	93,506	101,479	737,306

Assumptions

Peak heating demand in kW	400
Annual increase in peak heating demand	0%
Annual total heating demand in MWh	1,200
Annual domestic hot water (DHW) demand in kWh	100,000
Annual total heating and DHW demand in kWh	1,300,000
Annual increase in total heating and DHW demand	0%
Demand met by new system	99%
Demand met by old system (1 remaining oil boiler)	1%
Heat pump efficiency	350%
System degradation (efficiency)	0%
Cost of electricity to run heat pump system per kWh	£ 0.095
Annual inflation rate for electricity	5%
Annual servicing costs (nominal)	£ 2,500
Annual inflation rate (not including fuel)	3%
Cost of oil to run 1 oil boiler per kWh	£ 0.05
Annual inflation rate for fuel oil	5%
RHI Generation Income per kWh	£ 0.035
Annual inflation rate for RHI	3%

CO2 emissions:

Heating Oil = 0.274 kgCO2/kWh	3,562
Electricity = 0.517 kgCO2/kWh	190,108
Total	193,670

**Overarching assumptions/caveats (specific cost and performance assumptions are appended to the individual NPV calculations above):**

Assumptions on demand and relative system size are based on the Carbonzero reports and have been ratified by the Estates department.

RHI tariffs have been taken from [www.ofgem.gov.uk](http://www.ofgem.gov.uk) – tariffs applicable for non-domestic RHI for Great Britain from 1 October 2013.

No provision has been made for the degression of RHI tariffs between now and the acceptance of our application (the point where the 20 year rate is “locked in”).

RHI tariff once locked in rises in line with RPI – set at 3% for the purposes of this model.

The Biomass system appraisal is based on the use of wood pellets and not wood chips or logs (prices and CO2 emissions vary materially between the different fuel options).

Capital costs are based on current estimates from Carbonzero and could be subject to change following further detailed survey/commissioning work.

The NPV calculations do not make provision for any additional revenue costs associated to the project. We do not have estimates for these currently so we assume the same level of costs for the 2 different system options. The type of costs in question would include additional consultancy costs, pipe and heat loss surveys and decommissioning of the old oil-fired boilers. The aim would be to keep these costs at a minimal, and a more detailed estimate of these additional costs would be obtained for the selected option before any work is undertaken to ensure they are not prohibitive.

There are some revenue costs associated with the running of the new systems that have not been included as these have not been provided by Carbonzero. These include the running cost of the open loop submersible pump for the GSHP system and the electrical power consumed by the biomass boiler. It is not believed that these costs would materially affect the investment appraisal model.

Cost of Capital is calculated on a 5% EIP (Equal Instalment of the Principle) loan over 20 years (the life of the project).

**Summary of Investment Appraisal:**

System Type	Capital Cost	Discounted Cashflow	Payback (Years)	Average Annual Revenue Saving	Average Annual Return	Annual CO2 Emissions (kg)
Oil-Fired Boilers (existing)	£ -	-£ 1,620,200	N/A	£ -	N/A	356,200
Biomass Boiler (using wood pellets)	£ 296,000	£ 400,168	9	£ 24,063	8%	36,400
Ground Source Heat Pump	£ 904,000	£ 657,528	13	£ 36,865	4%	193,670
Ground Source Heat Pump *SHOWING SPECULATIVE TARIFF INCREASE*	£ 904,000	£ 1,609,908	8	£ 100,842	11%	193,670