

# Nottinghamshire Police and Crime Commissioner

## Notice of Decision



Nottinghamshire

POLICE &amp; CRIME COMMISSIONER

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Date Received*:	9 <sup>th</sup> July
Ref*:	2014.27

\*to be inserted by Office of PCC

**TITLE:** Provision of New Biomass Boiler Plant and Associated Work at Nottinghamshire Police Headquarters

### EXECUTIVE SUMMARY:

1. 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.
2. 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.
3. As a result of this initial assessment and further internal reviews, including carbon reduction calculations and investment appraisal contained herein, the recommendation was to install a biomass system to replace the existing oil-fired boilers.

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

See attached Business Cases and Tender Award Report (includes route to market).

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

No

**DECISION:** Approval of the recommendation to award to Ashwell Biomass Limited for the total contract value of £419,504.00.

### 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:

23/7/14

### 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:

21<sup>st</sup> July 2014.

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

# 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 degression.
- 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.



**8. Risks associated with the preferred option**

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

### Financial

1. Savings of approximately £400,000 over 20 year period.
2. Revenue generation from Renewable Heat Incentive (RHI) of approximately £1.14m over

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20 years.

3. Positive cash flows will be generated by year 9.

4. Positive cash flows will be generated by year 9 .

### **Performance/Productivity**

Reduced carbon emissions by 319,000 Kg CO2 equivalent over 20 years

Delivery - 2034

Measure - Reduction in carbon emissions

Data source - RHI consumption meter

Contact - Facilities & Estates

Frequency - annually

Baseline - 356,200kg CO2 equivalent

Other benefits to note in the narrative.

### **Operational Benefits**

Minimised disruption during installation at FHQ.

### **Risk Mitigation**

Minimal oil stored on site - reduced risk of spillage/leakage

### **Compliance to Standards**

Compliance to PCC Corporate Social Responsibility policy

### **Quality Benefits**

Ability to understand fuel consumption and costs. Enabling improved management and decision making.

## **Benefits and Measurement Plan**

Benefit no.	Benefit category	Measurement plan					
		Benefit delivery date	Benefit measure	Data source	Contact for measure	Frequency of measure	Baseline data
	Financial Savings	2023	Savings accrued	Finance/e-financials	Business Partner	Annually	See NPV
	Financial Savings	2034	Revenue accrued	Finance/e-financials	Business Partner	Annually	See NPV

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	<b>Financial Savings</b>	<b>2023</b>	<b>NPV/Cash flow</b>	<b>Finance/e-financials</b>	<b>Business Partner</b>	<b>Annually</b>	<b>See NPV</b>
	<b>Performance/Productivity</b>	<b>2034</b>	<b>Reduction in carbon emissions</b>	<b>RHI consumption meter</b>	<b>Facilities &amp; Estates</b>	<b>Annually</b>	<b>356,200</b>

**12. Impact**

<b>Business Area</b>	<b>Impact</b>
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**

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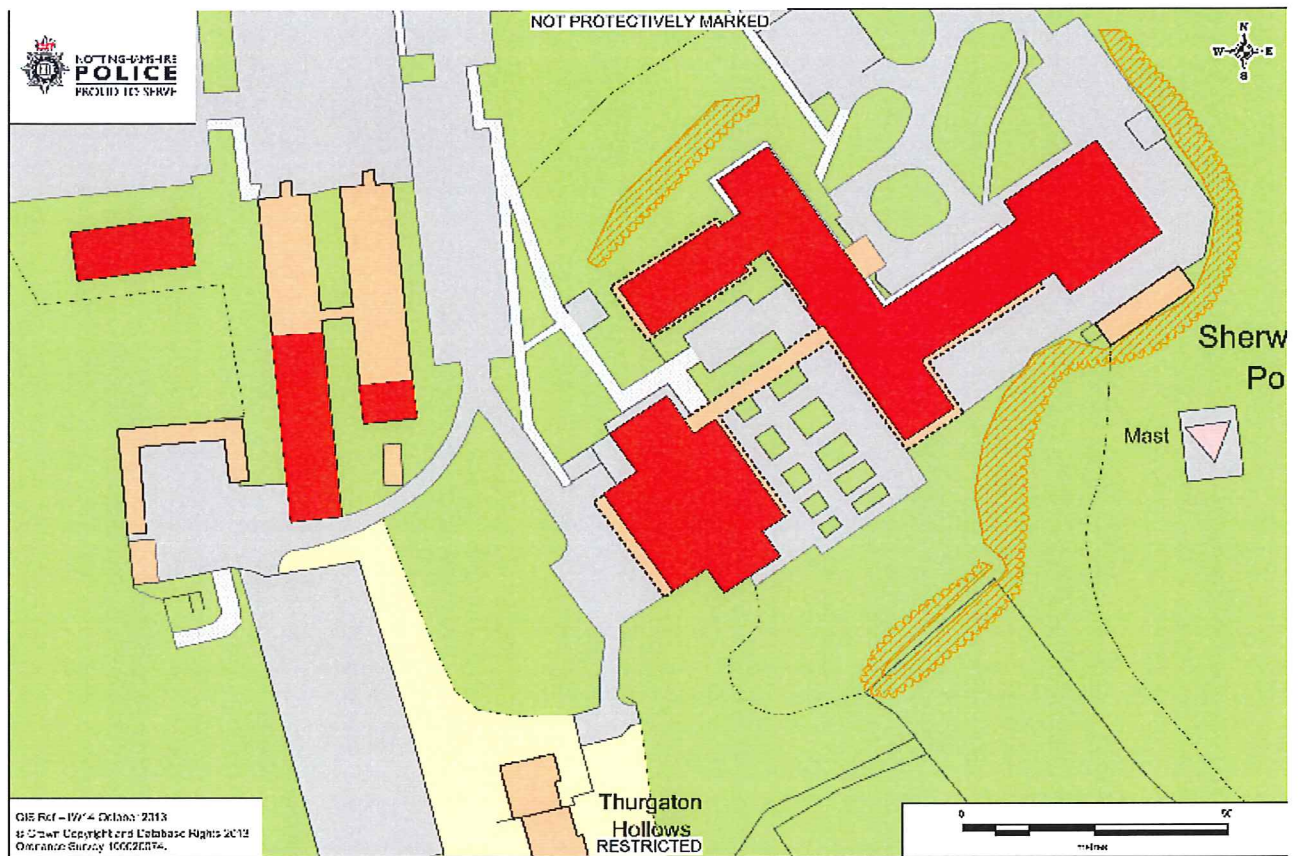
	DELETE AS APPROPRIATE	
Tim Wendels	Estates	
Ak Khan	Ch Supt, County Divisional Commander	
Simon Nickless	Ch Supt, City Divisional Commander	
Ian Howick	T/Ch Supt, Ops Support	
Helen Jebb	DCS, Head of Crime and Justice	
Pauline Smith	Head of Contact Management	
Ian Waterfield	CS	

**Programme Management Office**

<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
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
NPV of Project																					
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
NET TOTAL COSTS	-67,500	-70,825	-74,315	-77,977	-81,822	-85,856	-90,091	-94,536	-99,202	-104,098	-109,238	-114,633	-120,295	-126,239	-132,477	-139,025	-145,899	-153,113	-160,686	-168,636	-2,216,463
CUMULATIVE	-67,500	-138,325	-212,640	-290,617	-372,439	-458,295	-548,387	-642,923	-742,124	-846,223	-955,461	-1,070,093	-1,190,388	-1,316,627	-1,449,104	-1,588,129	-1,734,028	-1,887,141	-2,047,827	-2,216,463	
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	-67,500	-68,762	-70,049	-71,360	-72,698	-74,061	-75,450	-76,867	-78,311	-79,783	-81,283	-82,813	-84,373	-85,962	-87,583	-89,235	-90,919	-92,636	-94,386	-96,170	-1,620,200
Payback	-67,500	-136,262	-206,311	-277,671	-350,369	-424,429	-499,879	-576,746	-655,057	-734,839	-816,123	-898,936	-983,308	-1,069,270	-1,156,853	-1,246,088	-1,337,008	-1,429,644	-1,524,030	-1,620,200	
Cashflow of Annual Returns																					
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
ANNUAL CASHFLOW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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%															
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%															
CO2 emissions:																					
Heating Oil = 0.274 kgCO2/kWh						356,200															
Total						356,200															

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Option 2 - Install Biomass Boiler 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
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
<b>NPV of Project</b>																					
Capital Cost	-296,000																				-296,000
RHI Generation Income	42,542	43,819	45,133	46,487	47,882	49,318	50,798	52,322	53,891	55,508	57,173	58,889	60,655	62,475	64,349	66,280	68,268	70,316	72,426	74,598	1,143,130
Annual Energy Cost (renewable)	-69,333	-72,800	-76,440	-80,262	-84,275	-88,489	-92,913	-97,559	-102,437	-107,559	-112,937	-118,584	-124,513	-130,738	-137,275	-144,139	-151,346	-158,913	-166,859	-175,202	-2,292,573
Annual Energy Cost (non-renewable)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	-260,291	36,694	37,703	38,739	39,801	40,890	42,006	43,150	44,322	45,524	46,755	48,017	49,309	50,632	51,988	53,376	54,797	56,252	57,741	59,264	636,668
CUMULATIVE	-260,291	-223,597	-185,894	-147,155	-107,354	-66,464	-24,459	18,691	63,013	108,537	155,292	203,309	252,618	303,250	355,238	408,614	463,411	519,663	577,404	636,668	
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	-260,291	35,625	35,539	35,452	35,363	35,272	35,179	35,085	34,988	34,890	34,790	34,688	34,584	34,478	34,370	34,260	34,148	34,033	33,917	33,798	400,168
Payback	-260,291	-224,666	-189,127	-153,675	-118,313	-83,041	-47,862	-12,777	22,211	57,101	91,892	126,580	161,164	195,642	230,012	264,273	298,420	332,454	366,370	400,168	
<b>Cashflow of Annual Returns</b>																					
Capital Repayment	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-14,800	-296,000
Interest @ 5%	-14,800	-14,060	-13,320	-12,580	-11,840	-11,100	-10,360	-9,620	-8,880	-8,140	-7,400	-6,660	-5,920	-5,180	-4,440	-3,700	-2,960	-2,220	-1,480	-740	-155,400
RHI Generation Income	42,542	43,819	45,133	46,487	47,882	49,318	50,798	52,322	53,891	55,508	57,173	58,889	60,655	62,475	64,349	66,280	68,268	70,316	72,426	74,598	1,143,130
Net Energy Cost Saving	-6,833	-7,125	-7,430	-7,748	-8,081	-8,429	-8,792	-9,172	-9,569	-9,984	-10,418	-10,872	-11,346	-11,842	-12,361	-12,904	-13,471	-14,064	-14,685	-15,334	-210,462
ANNUAL CASHFLOW	6,109	7,834	9,583	11,359	13,161	14,990	16,846	18,730	20,642	22,584	24,555	26,557	28,589	30,652	32,748	34,876	37,037	39,232	41,461	43,724	481,268

Assumptions

Peak heating demand in kW	400
Annual increase in peak heating demand	0%
Annual total heating demand in MWh (1MWh = 1,000 kWh)	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	100%
Biomass boiler efficiency	90%
System degradation (efficiency)	0%
Cost of wood pellet per kWh	£ 0.048
Annual inflation rate for wood pellet	5%
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%
RHI Generation Income per kWh (Tier 1)	£ 0.050
Annual inflation rate for RHI	3%
RHI Generation Income per kWh (Tier 2)	£ 0.021
Annual inflation rate for RHI	3%
Eligible kWh hours at Tier 1 tariff (1,314 hours x capacity 400kW)	525,600
Eligible kWh hours at Tier 2 tariff (1,936 hours x capacity 400kW)	774,400
Total kWh eligible for tariff	1,300,000

CO2 emissions:

Heating Oil = 0.274 kgCO2/kWh	0
Biomass Pellets = 0.028 kgCO2/kWh	36,400
Total	36,400



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



Option 4 - Defer until GSHP RHI rates increase	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
*SHOWING SPECULATIVE TARIFF INC FROM 3.5P/KWH TO 7.2P/KWH*	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£
NPV of Project																					
Capital Cost	-904,000																				-904,000
RHI Generation Income	92,664	95,444	98,307	101,256	104,294	107,423	110,646	113,965	117,384	120,906	124,533	128,269	132,117	136,080	140,163	144,367	148,699	153,159	157,754	162,487	2,489,916
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	-784,419	123,757	128,087	132,579	137,237	142,069	147,082	152,283	157,680	163,279	169,090	175,121	181,381	187,879	194,625	201,629	208,901	216,452	224,294	232,439	2,491,446
CUMULATIVE	-784,419	-660,662	-532,575	-399,996	-262,759	-120,689	26,393	178,676	336,356	499,635	668,725	843,847	1,025,228	1,213,107	1,407,732	1,609,361	1,818,262	2,034,714	2,259,008	2,491,446	
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	-784,419	120,152	120,735	121,328	121,933	122,550	123,179	123,820	124,474	125,140	125,819	126,511	127,217	127,937	128,670	129,418	130,180	130,957	131,749	132,557	1,609,908
Payback	-784,419	-664,267	-543,532	-422,204	-300,270	-177,720	-54,541	69,279	193,753	318,893	444,712	571,223	698,441	826,377	955,047	1,084,465	1,214,645	1,345,602	1,477,351	1,609,908	
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	92,664	95,444	98,307	101,256	104,294	107,423	110,646	113,965	117,384	120,906	124,533	128,269	132,117	136,080	140,163	144,367	148,699	153,159	157,754	162,487	2,489,916
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	29,181	35,617	42,207	48,959	55,877	62,969	70,242	77,703	85,360	93,219	101,290	109,581	118,101	126,859	135,865	145,129	154,661	164,472	174,574	184,979	2,016,846

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	£ 0.072
Annual inflation rate for RHI	3%

CO2 emissions:

Heating Oil = 0.274 kgCO2/kWh	3,562
Electricity = 0.517 kgCO2/kWh (assuming 350% efficiency)	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

# Business Case



<b>Project:</b>	Replacement of Oil-Fired Heating at Sherwood Lodge (Printing & Stores Block)
<b>Date:</b>	31/02/2014
<b>Author:</b>	Ainsley Peters

## 1. Executive Summary

This business case follows on from the decision to replace the oil-fired heating in the main building at Sherwood Lodge with a 300kW biomass boiler. The Printing and stores block is also heated by an oil-fired boiler and this business case proposes the installation of a further biomass boiler (see appendix 1 for map reference).

Following the approval of the business case in relation to the main buildings, Carbonzero (renewable heat consultants) were asked to assess the viability and prepare proposals for a further biomass boiler in the printing & stores block. Their assessment shows that the biomass option would be viable and should yield similar benefits to the main building biomass proposal and would contribute positively to the force's efficiency savings and carbon management plan. The physical, building & current heating provision variables present a comparable scenario to the main building proposal thus yielding a similar magnitude of efficiency savings.

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 (Printing & Stores Block) 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.

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 in the Printing & Stores block 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
- Future proofing of heating provision

### 1.3 Summary costs

#### Option 1 – Do Nothing

Capital investment: - £nil.

Revenue cost implications: - running costs for the existing oil-fired boiler in the Printing & Stores block is currently around £40K per annum. 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 £185K. 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.

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## 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

Installation of a biomass system in the Printing & Stores block would require few changes to the main building emitter system and no change of emitter pipe work for delivery of heat, although some upgrades will need to take place with regards to pumping, monitoring and control..

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 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 further 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. The biomass boiler should be fully installed and in operation by May 2014 to eliminate risk of RHI tariff degression.

### 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

#### Option 2 – Install a Biomass Boiler

Capital Investment: estimated at around £195K covering:

Heat hub packaged plant room with integrated fuel store and fill pipes (for wood pellets).

Concrete base, 200 kW biomass boiler and buffer tank.

Boiler to buffer connecting pipework.

Twin-walled stainless steel flue system.

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.

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

NPV of revenue savings over 20 years: £0.42M

Payback period: 6.5 years

Average annual return on investment: 15%

Annual reduction in CO2 emissions: 94,309kg

Risks: Please refer to Section 8.

## 6. Preferred option

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

- Low 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 depression.
- Quicker payback period when compared to existing gas oil system.
- Better average annual return when compared to existing gas oil system.
- Far better reduction in carbon emissions than existing gas oil system.
- Able to decommission all of the existing oil-fired boilers for printing and stores area (This would also eliminate the environmental risk posed by the above ground gas oil tank that currently supplies the gas oil boiler in the printing and stores block.
- To eliminate environmental risk of storing gas oil in an old above ground storage tank.

## 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</p>

	years and rise in line with RPI.
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

### Target Date

Design & specification

01/02/14

Procurement process

01/03/14 – 01/07/14

Start of installation

01/08/14

Completion of RHI

01/09/14 – 01/10/14

Completion of installation

01/11/14

## 10. Project Team

Estates and Facilities Department, EMSCU, Carbonzero consultants, Principal & sub contractors (yet to be appointed).

## 11. Benefits Expected and Benefits Realisation

### Financial

1. Savings of approximately £400,000 over 20 year period.
2. Revenue generation from Renewable Heat Incentive (RHI) of approximately £0.42m over 20 years
3. Positive revenue cash flows will be generated by year 6.

### Performance/Productivity

Reduced carbon emissions by 94,309Kg CO2 equivalent over 20 years

Delivery - 2034

Measure - Reduction in carbon emissions

Data source - RHI consumption meter

Contact - Facilities & Estates

Frequency - annually

Baseline – 94, 309kg CO2 equivalent

Other benefits to note in the narrative.

### Operational Benefits

Minimised disruption during installation at FHQ.

### Risk Mitigation

Minimal oil stored on site - reduced risk of spillage/leakage

### Compliance to Standards

Compliance to PCC Corporate Social Responsibility policy

**Quality Benefits**

Ability to understand fuel consumption and costs. Enabling improved management and decision making.

<b>Benefits and Measurement Plan</b>							
<b>Benefit No.</b>	<b>Benefit category</b>	<b>Measurement plan</b>					
		<b>Benefit delivery date</b>	<b>Benefit measure</b>	<b>Data source</b>	<b>Contact for measure</b>	<b>Frequency of measure</b>	<b>Baseline data</b>
<b>1</b>	<b>Financial Savings</b>	<b>2023</b>	<b>Savings accrued</b>	<b>Finance/e-financials</b>	<b>Business Partner</b>	<b>Annually</b>	<b>See NPV</b>
<b>2</b>	<b>Financial Savings</b>	<b>2034</b>	<b>Revenue accrued</b>	<b>Finance/e-financials</b>	<b>Business Partner</b>	<b>Annually</b>	<b>See NPV</b>
<b>3</b>	<b>Financial Savings</b>	<b>2023</b>	<b>NPV/Cash flow</b>	<b>Finance/e-financials</b>	<b>Business Partner</b>	<b>Annually</b>	<b>See NPV</b>
<b>4</b>	<b>Performance/Productivity</b>	<b>2034</b>	<b>Reduction in carbon emissions</b>	<b>RHI consumption meter</b>	<b>Facilities &amp; Estates</b>	<b>Annually</b>	<b>96309kg/CO2</b>

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**12. Impact**

<b>Business Area</b>	<b>Impact</b>
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. Information provided as above.
Corporate Communications	N/A
Equality Impact Assessment	N/A
Privacy Impact Assessment	N/A
Victim Focused	N/A

**13. Project Spend**

Refer to Appendix 2 NPV calculations for projects 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
Margaret Monkton	ACO	March 2014	V0.1
Corporate Service Programme Board		March 2014	V0.1

**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	
Paul Steeples	Head of Business & Finance	
Darren Fox	Business Partner (Corporate Services)	

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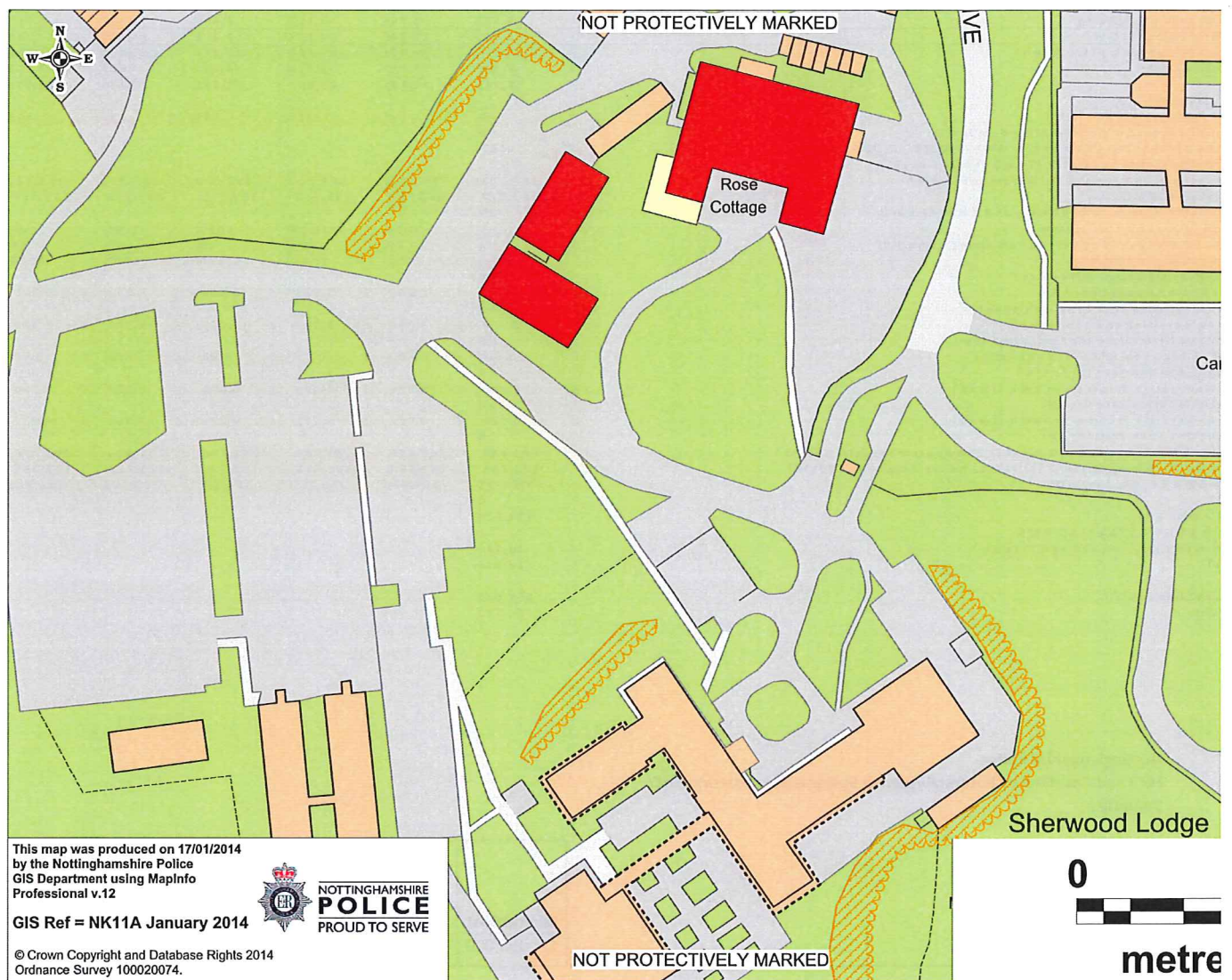
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Tim Wendels	Estates	
Ak Khan	Ch Supt, County Divisional Commander	
Simon Nickless	Ch Supt, City Divisional Commander	
Ian Howick	T/Ch Supt, Ops Support	
Helen Jebb	DCS, Head of Crime and Justice	
Pauline Smith	Head of Contact Management	
Ian Waterfield	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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Nottinghamshire Police  
NPV and Cashflow of Biomass Heating System - Print Works  
Biomass Heating System

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
	£	£	£	£	£	£	£	£
Capital Cost	-195,000							
Generation Income	25,044	25,796	26,569	27,366	28,187	29,033	29,904	30,804
Annual Energy Cost (renewable)	-18,011	-18,912	-19,858	-20,850	-21,893	-22,988	-24,137	-25,341
Annual Energy Cost (non-renewable)	0	0	0	0	0	0	0	0
Annual Servicing Cost to maintain system efficiency + £2000 admin costs	-5,000	-5,090	-5,183	-5,278	-5,377	-5,478	-5,582	-5,689
Annual Energy Cost Saving from de-commission of old system	26,442	27,764	29,153	30,610	32,141	33,748	35,435	37,168
<b>TOTAL COSTS</b>	<b>-166,525</b>	<b>29,558</b>	<b>30,682</b>	<b>31,848</b>	<b>33,059</b>	<b>34,315</b>	<b>35,620</b>	<b>36,972</b>
<b>CUMULATIVE</b>	<b>-166,525</b>	<b>-136,967</b>	<b>-106,285</b>	<b>-74,437</b>	<b>-41,379</b>	<b>-7,063</b>	<b>28,557</b>	<b>65,529</b>
Discount Factor (3%)	1.00	0.97	0.94	0.92	0.89	0.86	0.84	0.81
Discounted Cash Flow	-166,525	28,697	28,920	29,145	29,372	29,601	29,831	29,999
Payback	-166,525	-137,828	-108,907	-79,762	-50,390	-20,789	9,042	38,039
Cashflow								
Capital Repayment	-9,750	-9,750	-9,750	-9,750	-9,750	-9,750	-9,750	-9,750
Interest @ 5%	-9,750	-9,263	-8,775	-8,288	-7,800	-7,313	-6,825	-6,337
Generation Income	25,044	25,796	26,569	27,366	28,187	29,033	29,904	30,804
Annual Energy Cost Saving	3,431	3,762	4,112	4,482	4,871	5,282	5,716	6,174
<b>ANNUAL CASHFLOW</b>	<b>8,975</b>	<b>10,545</b>	<b>12,157</b>	<b>13,811</b>	<b>15,509</b>	<b>17,253</b>	<b>19,045</b>	<b>20,889</b>
Revenue net saving (trackable)	28,475	29,558	30,682	31,848	33,059	34,315	35,620	36,972
Discounted Cost	-9,750	-9,263	-8,775	-8,288	-7,800	-7,313	-6,825	-6,337
Discounted Payback	18,725	20,295	21,907	23,561	25,259	27,003	28,795	30,636
Assumptions								
Peak heating demand in kW	199	199	199	199	199	199	199	199
Annual increase in peak heating demand	0%							
Annual total heating demand in MWh (1MWh = 1,000 kWh)	383							
Annual domestic hot water (DHW) demand in kWh	-							
Annual total heating and DHW demand in kWh	383,220	383,220	383,220	383,220	383,220	383,220	383,220	383,220
System KWH	383,220	383,220	383,220	383,220	383,220	383,220	383,220	383,220
Annual increase in total heating and DHW demand	0%							
Demand met by new system	100%	100%	100%	100%	100%	100%	100%	100%
Demand met by old system (1 remaining oil boiler)	0%	0%	0%	0%	0%	0%	0%	0%
Biomass boiler efficiency	100%	100%	100%	100%	100%	100%	100%	100%
System degradation (efficiency)	0%							
Cost of wood pellet per kWh	£ 0.047	£ 0.049	£ 0.052	£ 0.054	£ 0.057	£ 0.060	£ 0.063	£ 0.066
Annual inflation rate for wood pellet	5%							
Annual servicing costs (nominal)	£ 3,000	£ 3,090	£ 3,183	£ 3,278	£ 3,377	£ 3,478	£ 3,582	£ 3,689
Annual inflation rate (not including fuel)	3%							
Cost of oil to run oil boilers per kWh	£ 0.07	£ 0.07	£ 0.08	£ 0.08	£ 0.08	£ 0.09	£ 0.09	£ 0.10
Annual inflation rate for fuel oil	5%							
Generation Income per kWh (Tier 1)	£ 0.086	£ 0.089	£ 0.091	£ 0.094	£ 0.097	£ 0.100	£ 0.103	£ 0.106
Annual inflation rate for RHI	3%							
Generation Income per kWh (Tier 2)	£ 0.021	£ 0.022	£ 0.022	£ 0.023	£ 0.024	£ 0.024	£ 0.025	£ 0.026
Annual inflation rate for RHI	3%							
Eligible kWh hours at Tier 1 tariff (1,314 hours x capacity 199kW)	261,486	261,486	261,486	261,486	261,486	261,486	261,486	261,486
Eligible kWh hours at Tier 2 tariff (612 hours x capacity 199kW)	121,734	121,734	121,734	121,734	121,734	121,734	121,734	121,734
Total kWh eligible for tariff	383,220	383,220	383,220	383,220	383,220	383,220	383,220	383,220
Emissions:								
Heating Oil = 0.274 kgCO <sub>2</sub> /kWh	383,220	1						
Biomass Pellets = 0.028 kgCO <sub>2</sub> /kWh	10,730							
Total	10,730							
Present Heating Oil	105,002							
Reduction	94,272							

Nottinghamshire Police  
NPV and Cashflow of Potential Heating Systems at Printworks FHQ  
Summary

System Type	Capital Cost	Discounted Cashflow	Payback (Years)	Average Annual Revenue Saving	Average Annual Return	Annual CO <sub>2</sub> Emissions (t)
199w Biomass	£ 195,000	£ 418,900	6.5	£ 26,687	14%	10,730

Co2 Reduction v fuel oil = 94,

Overarching assumptions/caveats:

Assumptions on demand and relative system size are based on the Carbonzero report and have been ratified by the Estates department  
Assumptions on RHI tariffs are taken from www.ofgem.gov.uk - tariffs applicable for non-domestic RHI for Great Britain from December 2013  
RHI tariffs are reviewed and published quarterly on the Ofgem website  
No provision has been made for degression of RHI tariffs (occurs as uptake of RHI increases to ensure the scheme does not exceed its fixed annual budgets  
Assumed RHI tariff applicable upon acceptance is "locked in" for the life of the project (confirmed by Carbonzero)  
Specific cost and performance assumptions are appended to the individual NPV calculation  
Biomass system NPV calculation is based on wood pellets and not wood chips (prices and CO<sub>2</sub> emissions vary materially between the 2 types of fuel)  
Capital costs are based on current estimates from Carbonzero and could be subject to change  
No provision has been made for any additional revenue costs of the project e.g. decommissioning 3 of the 4 old oil-fired boilers, or additional consultancy fees, piping surveys etc  
Cost of Capital is calculated on a 5% EIP (Equal Installments of the Principle) loan over 20 years

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Business Case Final March 2014

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