

SUMMARY REPORT ON ENERGY EFFICIENCY OPPORTUNITIES NSW AND QLD DOMESTIC PROCESSORS

Project Code: AM12-5066 Domestic Processors Energy Efficiency Program

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EXECUTIVE SUMMARY

Small to medium domestic red meat processing businesses, processing in the order of 10 to 1,500 head per day (in some cases mixed species), have limited capability, capacity and resources to proactively manage energy cost and consumption. In recognition of this knowledge and resource gap, the Australian Meat Processor Corporation (AMPC) and the Australian Meat Industry Council (AMIC) commissioned a study in NSW and QLD to detail small to medium processing facilities energy consumption and where there are opportunities to save energy.

The study involves two main phases:

- Phase one included a level 1 audit resulting in energy consumption data collection and analysis from four small to medium red meat processing facilities located in NSW (sites A to D), development of energy use benchmarks, and identification and evaluation of energy saving opportunities (ESOs).
- Phase two included a pre-survey resulting in annual energy consumption data collection, site visit and identification of energy savings opportunities for small red meat processing facilities in QLD (site E to I).

Overall, for both cases, there are significant energy efficiency opportunities which are cost effective, easy to implement and can reduce total annual energy consumption at small to medium red meat processing facilities by at least 20-30%. These opportunities can be broadly categorised into four categories; (1) Energy efficient technologies; (2) Alternative energy systems; (3) Maintenance; and (4) Behavioural and Procedural. The areas with greatest energy saving opportunities were found to be refrigeration (53% of savings), steam and hot water (30%) and lighting (11%).

A Level 1 energy audits undertaken at the four abattoirs located in NSW covered a wide range of energy saving, renewable energy and on-site generation options. A total of 63 energy savings opportunities (ESOs) were identified across these sites, requiring a total capital investment of \$6,588,677 and with predicted annual energy savings of \$1,158,803 and an average simple payback of 4.5 years, without grant funding contributions from the Clean Technology Food and Foundries Investment Program.

The pre-survey undertaken for the five sites in QLD didn't allow predicting the annual energy savings of the energy opportunities identified. Most of the opportunities identified focus on the refrigeration and hot water system.

A summary of the ESOs is shown in Table 1.

Area (N° projects)	Site A (13)	Site B (16)	Site C (6)	Site D (17)	Site E (6)	Site F (6)	Site G (6)	Site H (4)	Site I (7)	Total
Refrigeration (14)	\$235,364 (5)	\$124,644 (4)	-	\$142,466 (5)	--(3)	--(4)	--(4)	--(4)	--(5)	\$502,454
Lighting (12)	\$6,894 (2)	\$12,885 (6)	\$1,211 (2)	\$9,028 (2)	-	-	-	-	-	\$30,018
Hot Water Services (8)	\$476 (1)	\$13,376 (3)	\$1,941 (1)	\$40,195 (3)	--(2)	--(2)	--(2)	-	--(2)	\$55,988
Process (3)	\$7,136	\$7,871	-	-	-	-	-	-	-	\$41,139
Steam (3)	\$95,964	\$4,794	-	\$6,945	-	-	-	-	-	\$107,703
Renewable Energy (3)	\$26,188	\$30,996	-	\$26,757	-	-	-	-	-	\$83,941
Compressed Air (4)	\$3,180	-	\$334	\$8,899 (2)	--(1)	-	-	-	-	\$12,413
Power Quality (3)	\$22,251	-	\$4,820	\$17,405	-	-	-	-	-	\$44,476
Sterilisers (1)	-	-	\$2,003	-	-	-	-	-	-	\$2,003
On-Site Generation (1)	\$304,800	-	-	-	-	-	-	-	-	\$304,800
TOTAL per site	\$695,117	\$194,566	\$10,309	\$258,811	-	-	-	-	-	
TOTAL all opportunities and sites										\$1,158,803

Table 1: Annual cost savings identified per category and site, projects <7 year payback

RECOMMENDATIONS

The ESOs detailed in this report were developed to within 40% data accuracy, therefore it is recommended that the energy savings and capital expenditure figures are investigated further to obtain higher accuracy of savings and capital expenditure before proceeding with the implementation of the projects.

SECTION 1. INTRODUCTION

The Australian Red Meat Processing Industry is faced with a wide range of challenges, including; vigorous domestic and international competition; labour shortages; changing consumer and trading partner requirements; increasing regulatory pressures relating energy use and greenhouse gas emissions; and rising costs for energy, water and waste.

Many red meat processing plants in Australia are well over 30 years old, with processing operations that have grown in size to meet production levels. Ageing plants have a combination of old and new equipment and technologies, and there are various levels of energy management experience within the workforce. In recognition of this knowledge and resource gap, the Australian Meat Processor Corporation (AMPC) and the Australian Meat Industry Council (AMIC) commissioned a study to detail small to medium processing facilities energy consumption and where there are opportunities to save energy.

The study involves two main phases:

- Phase one included energy consumption data collection and analysis from four small to medium red meat processing facilities located in NSW, development of energy use benchmarks, and identification and evaluation of energy saving opportunities (ESOs). A level 1 audit has been done for each of the 4 sites in NSW
- Phase two included electricity and gas bill collection, site visit and identification of energy savings opportunities for small red meat processing facilities in QLD. Due to the small size of the facilities, only a pre-survey has been conducted.

Phase one of the study revealed a wide range of ESOs for small to medium red meat processing facilities ranging from simple housekeeping activities through to investing capital to upgrade or replace existing equipment. ESOs were broadly categorised into four categories; (1) Energy efficient technologies; (2) Alternative energy systems; (3) Maintenance; and (4) Behavioural and Procedural. The areas with greatest energy saving opportunities include: refrigeration (53% of savings), steam and hot water (30%) and lighting (11%).

Due to the small size of the QLD sites, the phase two revealed that the ESO's are mainly concentrated in the refrigeration and heating area.

SECTION 2. BREAKDOWN OF ENERGY SOURCES USED BY SITE

Meat processors use a range of energy sources to power equipment and provide heat to processes on the site. In general, the energy is a combination of electric power and a heating source, most commonly natural or liquid petroleum gas.

The relative use of electric and heating energy, in GJ and \$, for the four sites investigated in NSW and the five sites in QLD is shown in Figures 1-9. An extrapolation from monthly electricity or gas bill to annual consumption has been done for the sites located in QLD.

NSW SITES

The first site, site A, is a rendering site while the other site, site B to D, are non-rendering sites.

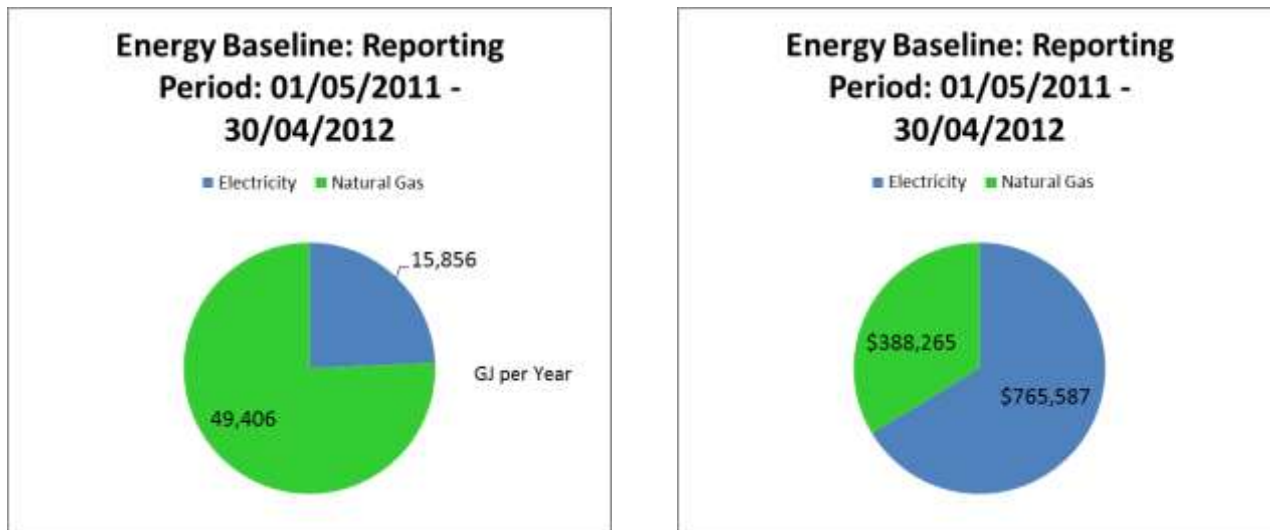


Figure 1: Breakdown of energy consumption and cost, Site A – render site

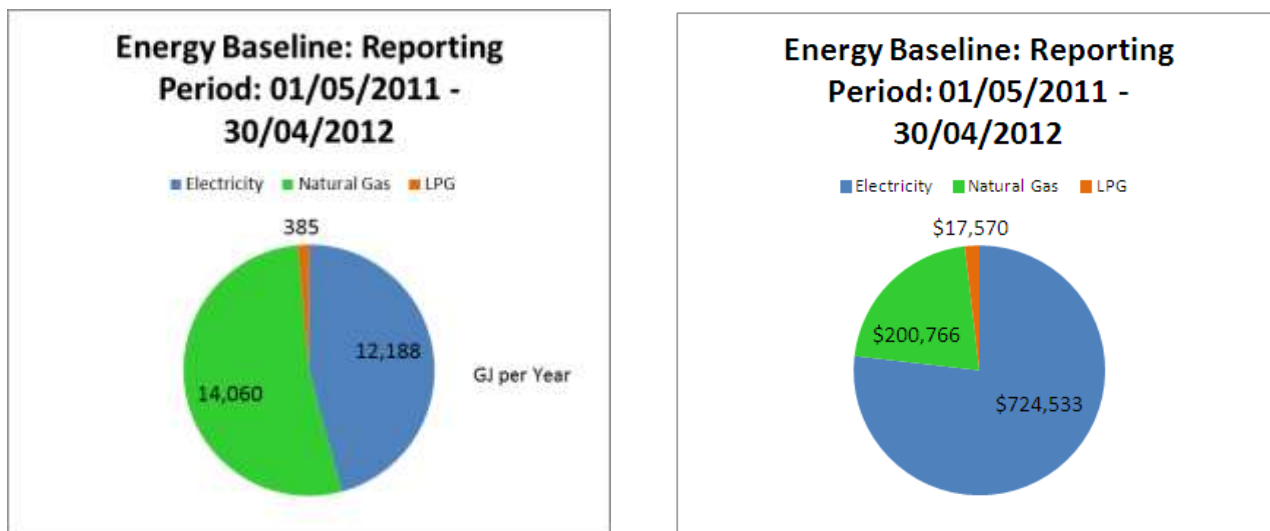


Figure 2: Breakdown of energy consumption and cost, Site B – non render site

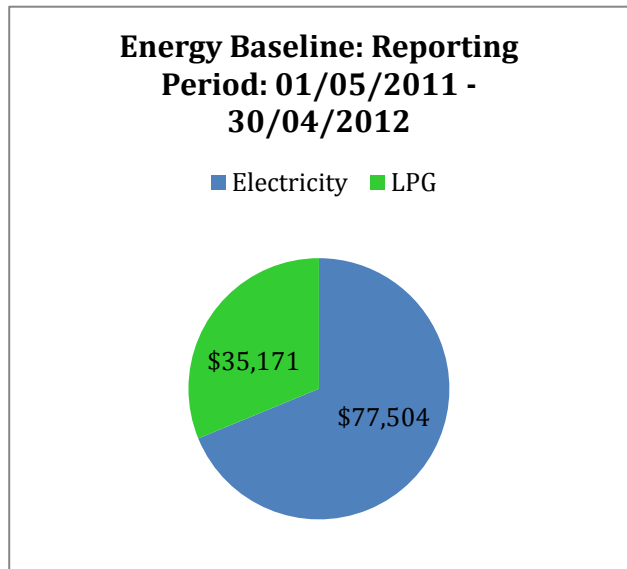
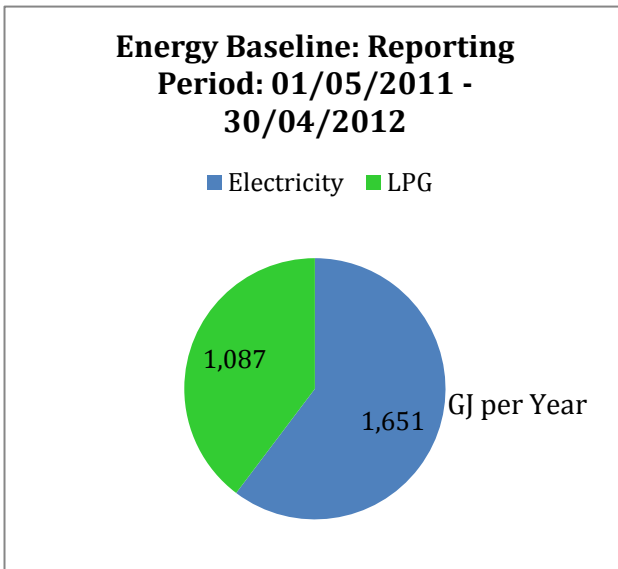


Figure 3: Breakdown of energy consumption and cost, Site C – non render site

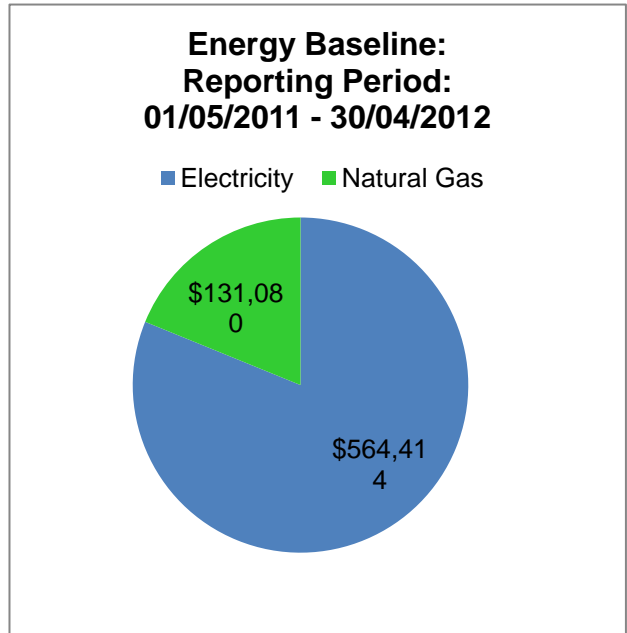
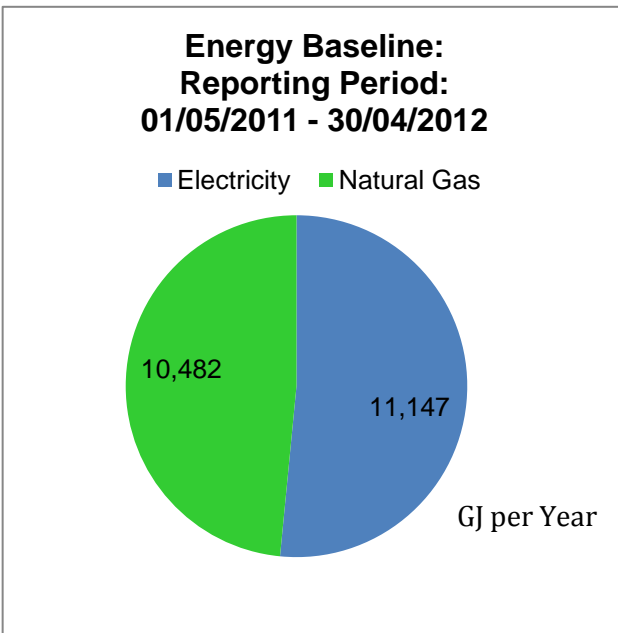


Figure 4: Breakdown of energy consumption and cost, Site D – non render site

QLD SITES

The following charts show the energy breakdown of the five sites in Queensland. The first site, site E, is a rendering site while the other sites, site F to I, are non-rendering sites.

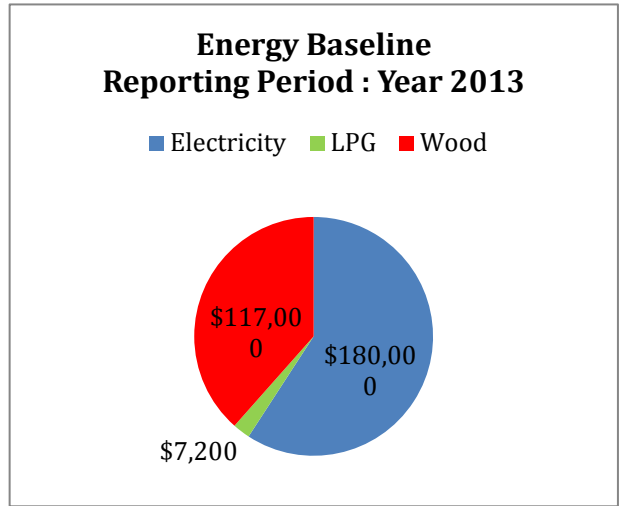
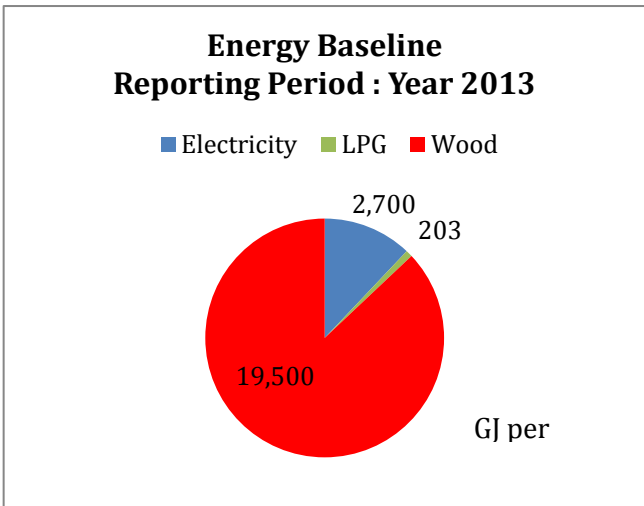


Figure 5: Breakdown of energy consumption and cost, Site E - render site

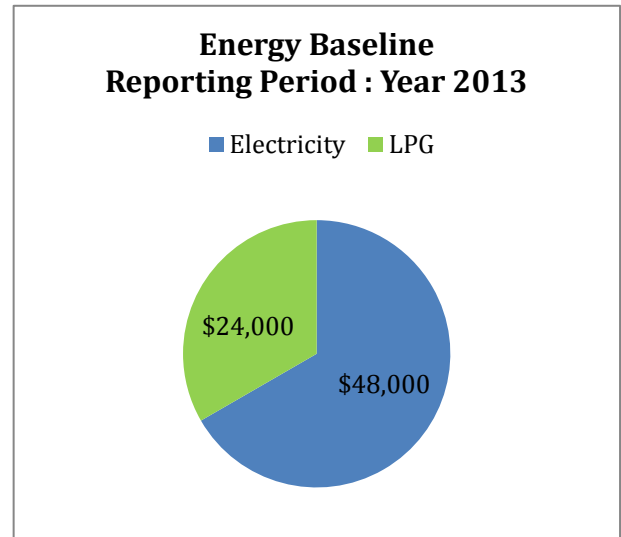
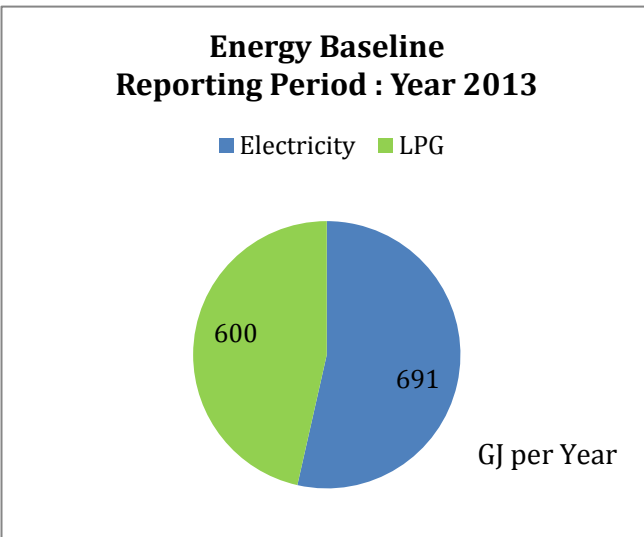


Figure 6: Breakdown of energy consumption and cost, Site F – non-render site

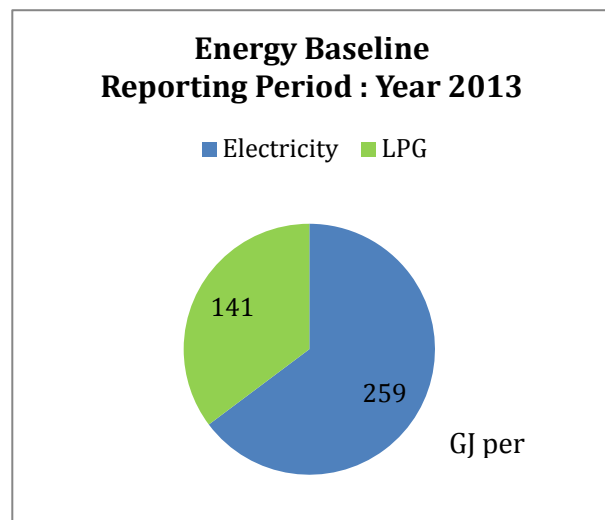
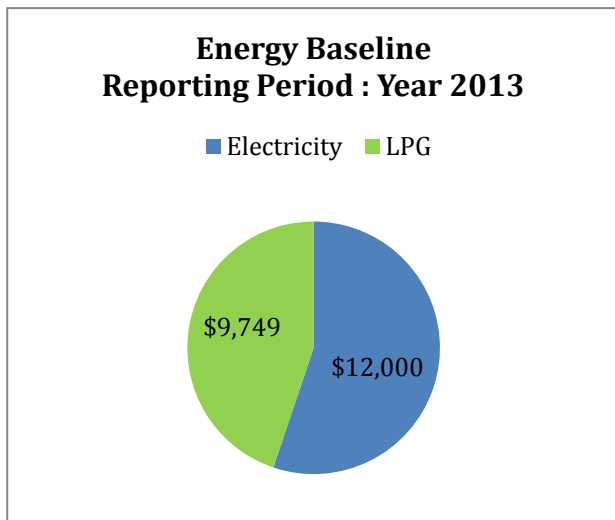


Figure 7: Breakdown of energy consumption and cost, Site G - non render site

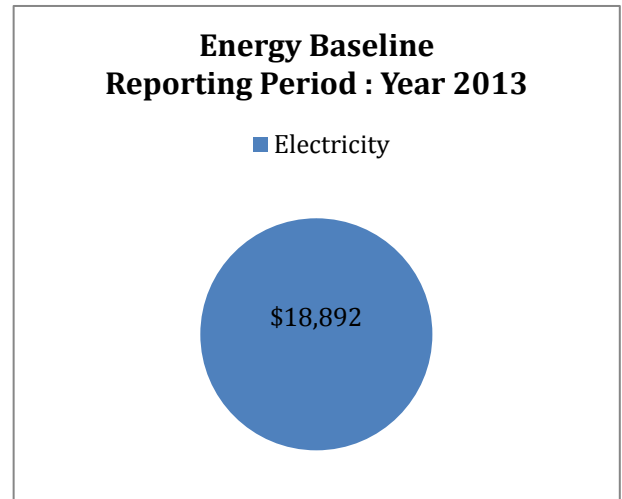
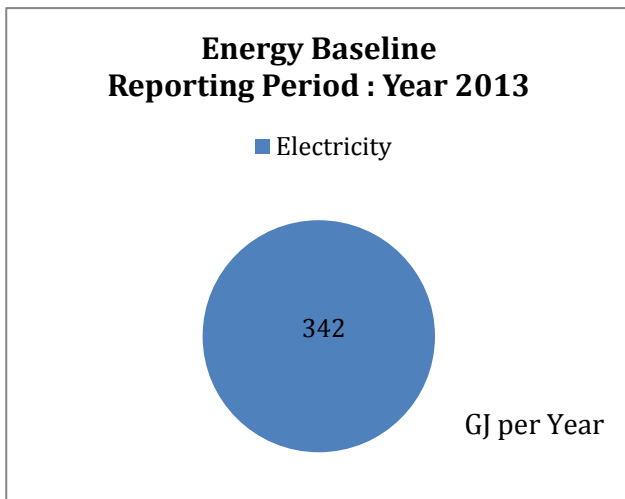


Figure 8: Breakdown of energy consumption and cost, Site H – non-render site

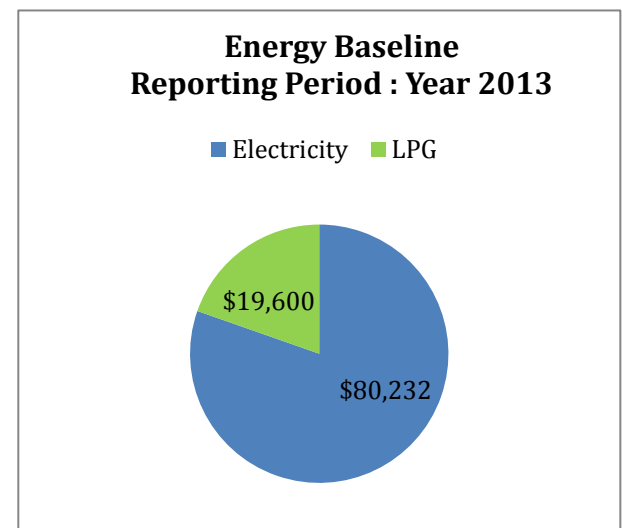
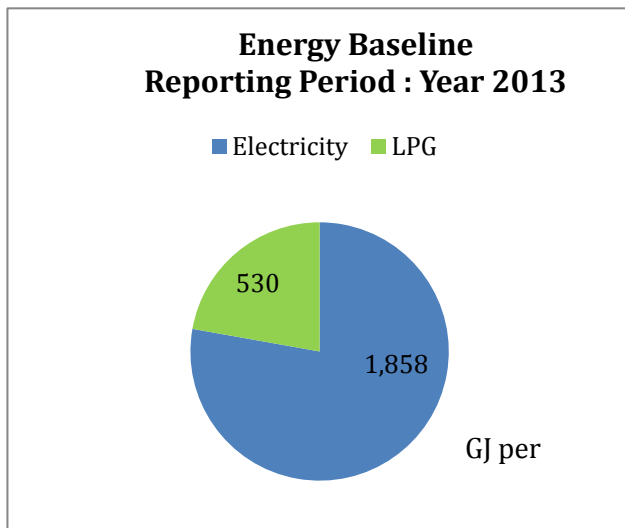


Figure 9: Breakdown of energy consumption and cost, Site I – non-render site

Consistently, across all four sites investigated in NSW, electric power was the largest energy cost item; although in most cases a similar or larger amount of energy (GJ) was used for heating/steam generation purposes. This is easily explained by the relatively high cost of electrical power.

While across all five sites investigated in QLD, except the rendering site, electric power is the largest energy consumption and cost item. The difference in between the sites in NSW and QLD can be explained by a lower production, a smaller building size, and/or by the fact that most the electrical equipment, especially the refrigeration system, is old.

BREAKDOWN OF ENERGY USERS BY SITE

Electrical and heating energy was used in a number of processes ranging from refrigeration and steam generation through to lighting and compressed air systems. Refrigeration represented the most significant user of electrical energy at the nine sites surveyed and accounted for 6%-59% of total energy use as shown in Figures 10-18. Steam and hot water generation represented the largest user of heating energy and accounted for 22%-88% of total energy use.

The following pie charts were generated on the basis of energy used (GJ) and not cost of energy, hence steam and hot water represents the largest used of energy, although refrigeration accounts for the second largest use. However, as electrical energy is more costly, the operating cost of the refrigeration systems is likely to represent the single largest energy cost on each site.

The energy consumption each of the nine sites were categorised according to end use and represented in the Figures 10-18.

NSW Sites :

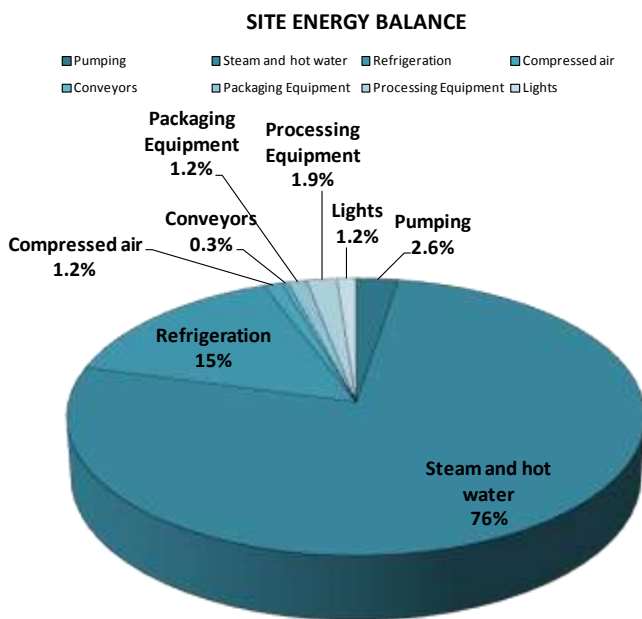


Figure 10: Energy consumption categories, Site A.

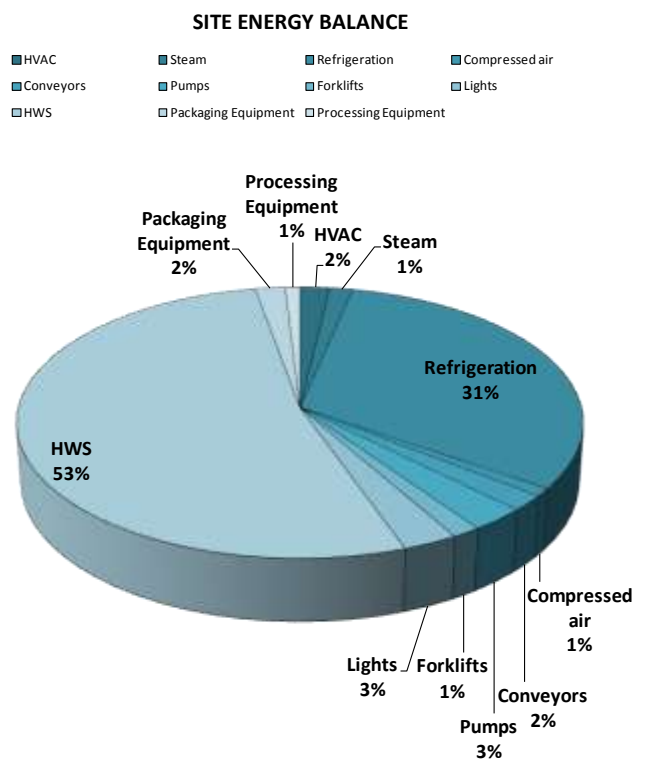


Figure 11: Energy consumption categories, Site B.

SITE ENERGY BALANCE

■ Refrigeration ■ Lighting ■ Compressed air ■ Pumping ■ Other ■ HWS

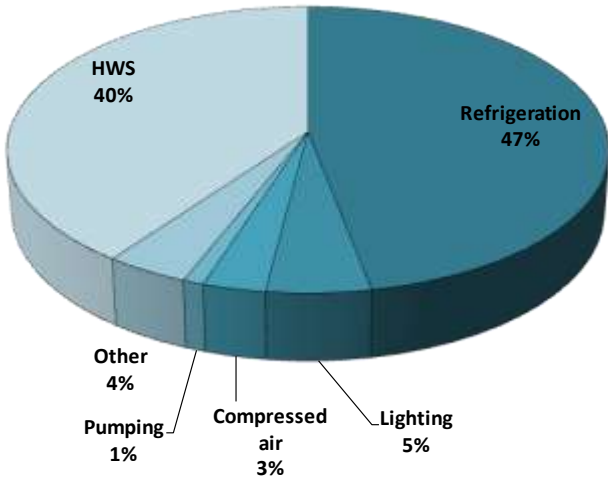


Figure 12: Energy consumption categories, Site C

SITE ENERGY BALANCE

■ Refrigeration ■ Steam ■ Compressed air ■ Pumping ■ Lights ■ HWS ■ Packaging Equipment ■ Other

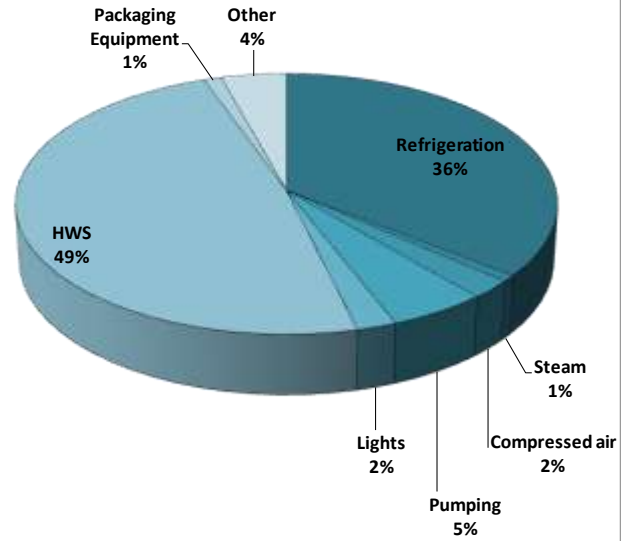


Figure 13: Energy consumption categories, Site D.

Contrary to the NSW sites where a level 1 audit has been carried, only primary information such as pictures of the equipment, couple of hours site visit, and analysis of monthly bills have been collected. Consequently the breakdown of the energy use is based on assumptions:

- Equipment power input has been assumed for the equipment where the nameplate was not readable
- The running time and the loading percentage of the equipment have been assumed based on the knowledge of the processing time.

SITE ENERGY BALANCE

■ Compressed Air ■ Steam and Hot water
■ Refrigeration ■ Other

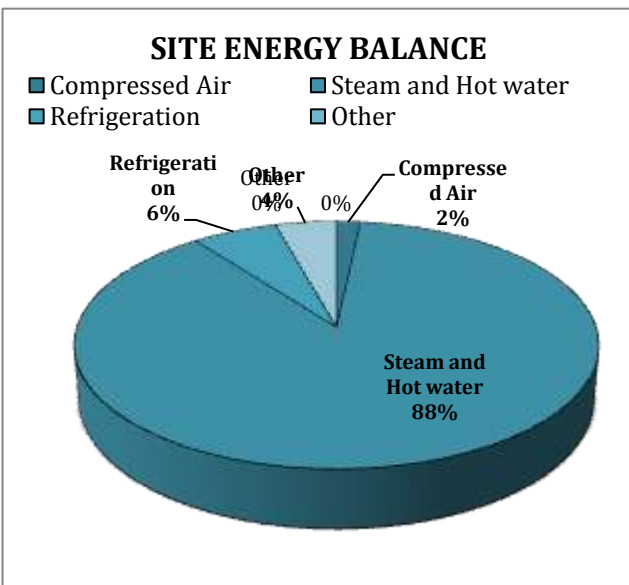


Figure 14: Energy consumption categories, Site E.

SITE ENERGY BALANCE

■ Steam and Hot water

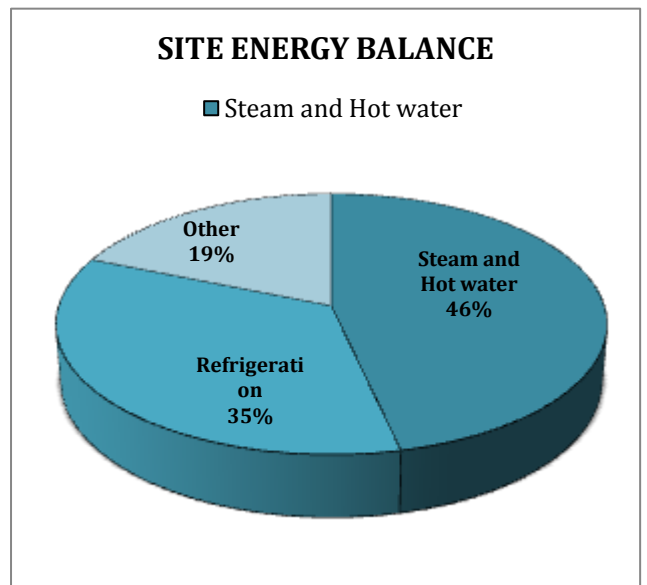


Figure 15: Energy consumption categories, Site F.

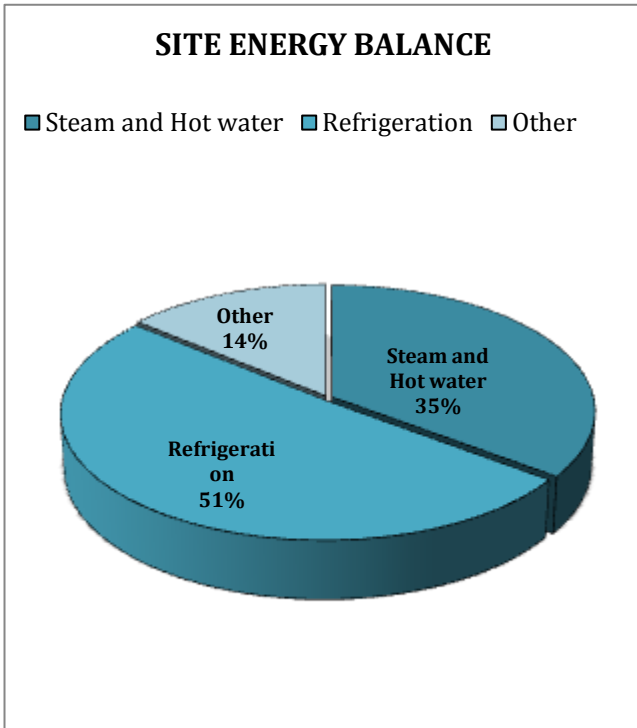


Figure 16: Energy consumption categories, Site G.

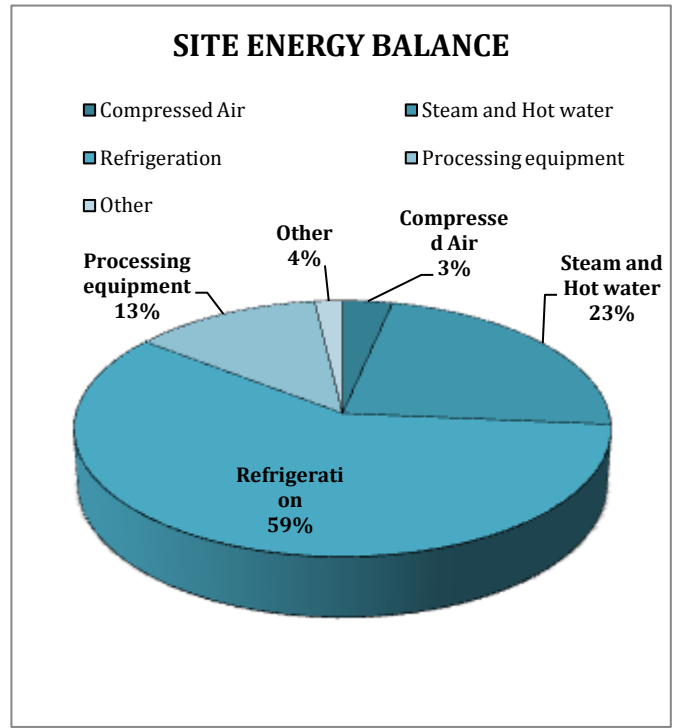


Figure 17: Energy consumption categories, Site H.

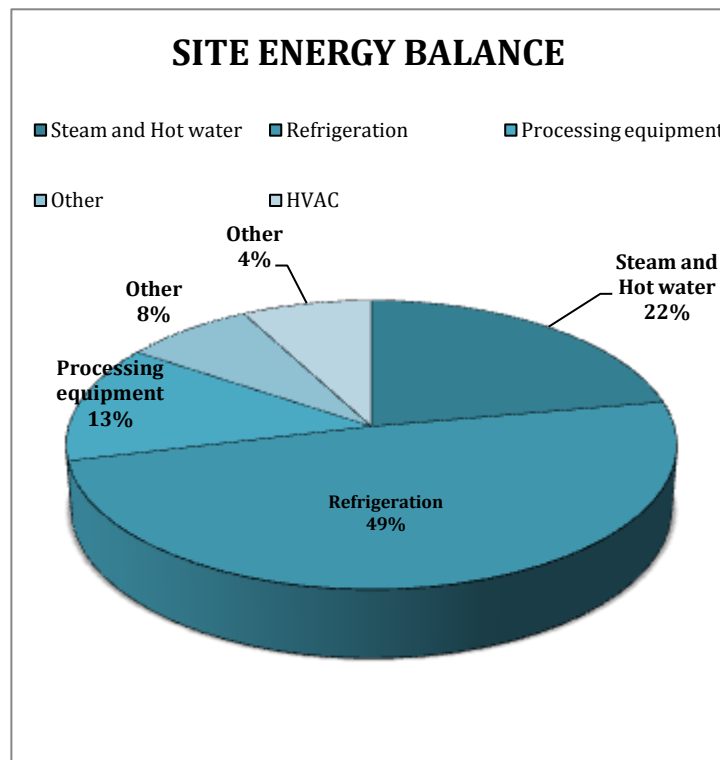


Figure 18: Energy consumption categories, Site I.

SECTION 4. PERFORMANCE INDICATOR

The coefficient of performance indicates the amount of energy and the energy cost involve per tonnes of hot standard carcass weight produced (tHSCW).

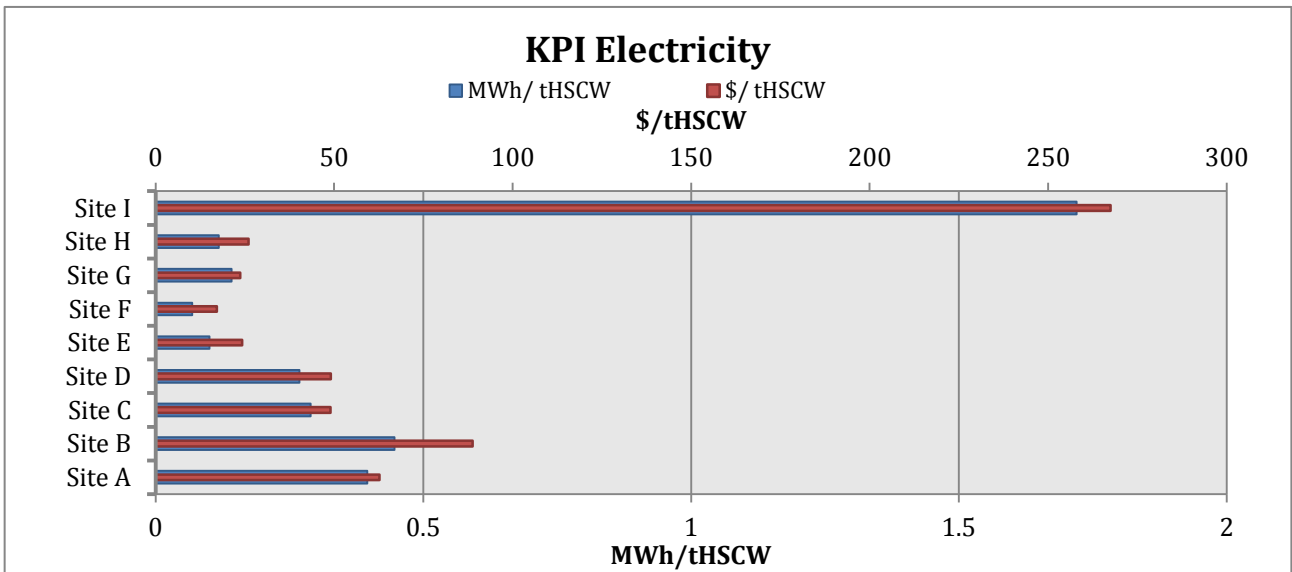


Figure 19: electricity performance indicator for the nine sites

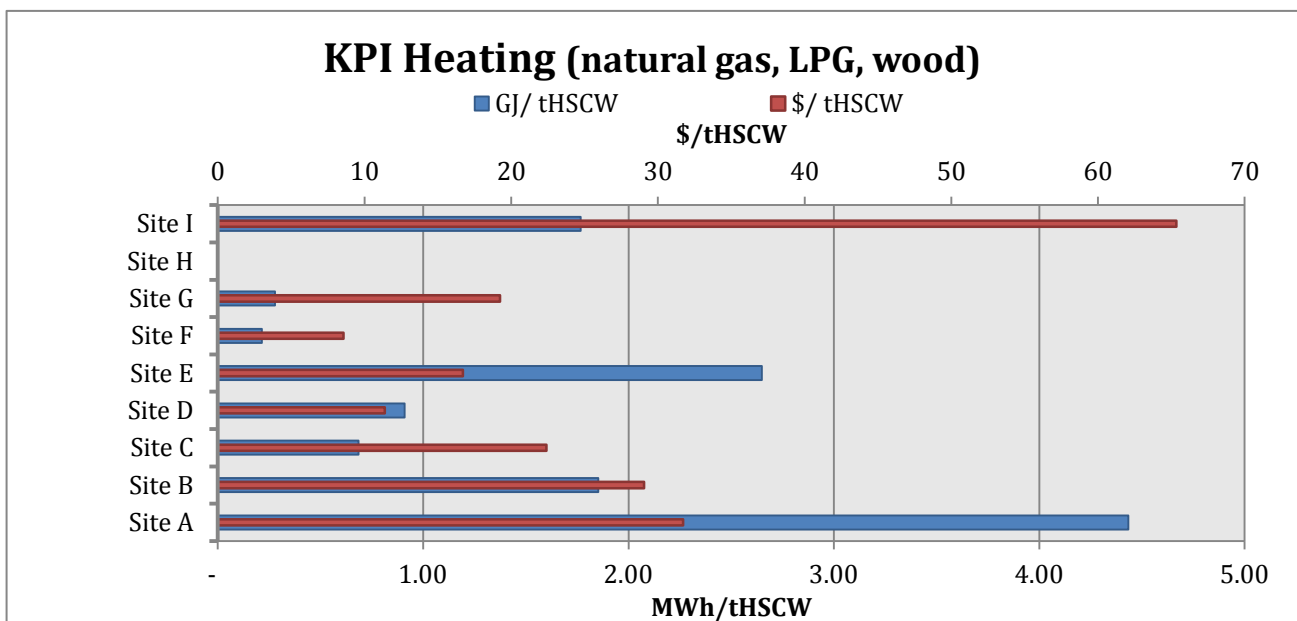


Figure 20: Heating performance indicator for the nine sites

The performance indicators disparities among the nine sites can be explained by the facilities difference. Some of sites have boning rooms, groceries/butcher area, rendering facilities which can greatly change the indicabased on the tHSCW.

ENERGY SAVING OPPORTUNITIES

The energy savings opportunities across the four sites were classified into 10 main areas:

- Refrigeration, including fan power of fan coil units in processing areas
- Lighting throughout processing and external areas
- Hot water services to processing and other areas
- Processing systems
- Steam generation
- Renewable energy
- Compressed air generation and distribution
- Power quality
- Sterilisers in processing areas
- On site generation

In this section the common opportunities within each area are identified.

REFRIGERATION

Opportunity	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I
Variable head pressure control, including variable speed condenser fans	✓	✓	✓						
Compressor staging and capacity control, including variable speed compressor operation	✓	✓	✓						
Worn screw compressor replacement and/or high efficiency compressor motors	✓		✓						
Absorption chillers using waste heat	✓	✓							
Evaporator fans Speed control		✓	✓		✓	✓	✓	✓	✓
Condenser location						✓	✓	✓	✓
Upgrade to ammonia system with smart controls (VSD's)					✓				
Upgrade to glycol or CO ₂ central system with smart controls (VSD's)						✓	✓	✓	✓
Open drive compressor replacement with hermetic compressor									✓
Insulation and cladding					✓	✓	✓	✓	✓

LIGHTING

Opportunity	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I
High bay lighting upgrade	✓	✓	✓	✓					
Voltage reduction units for stockyard lighting	✓	✓							
Zoned push button timers or switching		✓		✓					
T5 lighting upgrade		✓	✓						
50% light switching		✓							
Exterior lighting upgrade		✓							

HOT WATER SERVICES

Opportunity	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I
Fuel switch hot ware for shrink tunnel		✓	✓						
Enhance heat transfer in boilers with larger turbulator		✓	✓						
Hot water lagging	✓	✓							
Boiler – heat recovery condensing unit			✓		✓ (if ammonia plant upgrade)	✓ (if central system upgrade)	✓ (if central system upgrade)		✓ (if central system upgrade)
Rationalisation of hot water system				✓					
Heat Pump					✓	✓	✓		✓

PROCESS

Opportunity	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I
Revise blood tank operation		✓							
ProVac system – cleaning shift speed control			✓						

STEAM

Opportunity	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I
Fuel switch electric steam generator to gas		✓	✓						
Steam boiler replacement	✓								

RENEWABLE ENERGY

Opportunity	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I
Solar PV electricity generation	✓	✓	✓						

COMPRESSED AIR

Opportunity	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I
Identify and repair leaks			✓						
Energy recovery from compressed air	✓		✓						
Compressed air optimisation				✓	✓				

POWER QUALITY

Opportunity	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I
Optimise power factor correction	✓		✓						
Power factor correction				✓					

STERILISERS

Opportunity	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I
Remove boning room electric steriliser and connect to hot water				✓					

ON SITE GENERATION

Opportunity	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I
Cogeneration	✓								