Investigation into refrigeration system optimisation & expansion at Wodonga Rendering

Meat & Livestock Australia acknowledges the matching funds provided by the Australian Government and contributions from the Australian Meat Processor Corporation to support the research and development detailed in this publication.
**Abstract**

Wodonga Abattoirs engaged Minus40 and Namsat Systems Accounting to work with their refrigeration contractors and engineers on this project. After data capture and analysis Minus40 undertook project scoping of refrigeration upgrade options. This included, looking at the greatest opportunity for savings in energy and carbon emissions against capital expenditure required and provide an Energy Efficiency Opportunities Report. This report provided input into application for Grant Funding under the Clean Technology Investment Program. Pre and post production levels and energy usage was calculated and forecast to provide unit cost improvements due to energy efficiencies. This will provide up to 2MW of electricity to the plant that has a lower carbon emission factor than grid supplied electricity. The spread sheet tool developed could be used by abattoirs to quickly assess refrigeration energy efficiency opportunities within their plants.
Executive Summary

The specific report for Wodonga Rendering produced by Minus40 was endorsed by management and used to make an application for CTIP funding. The CTIP application is attached for MLA’s information. As of today the application has been put on hold by AusIndustry subject to instructions from the new government on the future of the program. This application used a combination of energy efficiency opportunities available to Wodonga Rendering including the implementation of Plate Freezers. The Plate Freezers although superior in Energy Efficiency to Blast Freezers were not in the top 10 factors for energy efficiency and correspondingly are not contained in the spread sheet tool. The Plate Freezers benefits of labour cost savings, quicker cycle times, higher quality carton presentation and stowage, etc. were critical in the investment decision and not reliant on energy efficiency in itself.

The Final Milestone was the design and development of the Energy Efficiency Spread sheet Tool. This was developed through analysing data collected at many abattoir plants and statistically analysing the factors impacting energy efficiency/capital costs in regards to refrigeration plant at those sites. Factors that had a high correlation in energy efficiency along with a significant potential saving against the capital cost required to implement were determined. This research determined the key energy efficiency opportunities for refrigeration plant. These factors were then listed as 10 questions, along with electrical usage, cost per kWh and tonnage of Hot Carcase Weight Production. These inputs provide a resulting range of:

1. Refrigeration plant power consumption (RPPC)
2. Potential viable savings expressed as % reduction in RPPC, MWh/year and $/year in savings
3. Upfront capital cost to implement these savings
4. A payback time range in years

These results are not a highly accurate measurement but provide a “ball-park” indication for the quantum of savings achievable. They give management a quick view of energy efficiency opportunities in terms of savings, capital cost to implement and paybacks. If these potential savings and corresponding capital costs are to be verified then a site-specific plant energy audit should be undertaken as a next step.
Contents

Abstract .................................................................................................................................................. 2
Executive Summary ................................................................................................................................. 3
Contents .................................................................................................................................................. 4
1  Project Objective .................................................................................................................................. 5
2  Success in achieving milestone ........................................................................................................... 5
3  Recommendations ............................................................................................................................... 5
4  Appendices .......................................................................................................................................... 6
1 Project Objective

The objective of the project was to identify energy saving opportunities for the existing refrigeration system, in addition to determine the most operationally efficient design (taking into account refrigeration efficiencies in regards to energy, operations, quality and flexibility requirements) for the proposed refrigeration system expansion. This was achieved by

- Detailed measurement of current energy usage at the site level and also the refrigeration system
- Detailed modelling of energy efficiency opportunities for the current refrigeration system
- Full technology options appraisal for the proposed plant upgrade
- Develop a calculator (spread sheet) tool that will allow any plant to model their current and projected refrigeration technology

2 Success in achieving milestone

All milestones have been achieved successful.

A simple but powerful spread sheet tool has been developed that allows abattoir sites to quickly estimate possible energy efficiency savings from their refrigeration plant.

3 Recommendations

MLA publish and promote the spread sheet tool for use by Abattoirs so that they can quickly assess refrigeration energy efficiency opportunities.
4 Appendices

1. CTIP Application (excluding supporting attachments)
2. Refrigeration Energy Efficiency Spread sheet Tool

---

**MEAT PROCESSOR REFRIGERATION PLANT - ENERGY EFFICIENCY OPPORTUNITY TOOL**

**INFORMATION ON REFRIGERATION PLANT DESIGN:**

Please check the yes/no responses to the questions regarding technical aspects of the refrigeration system.

<table>
<thead>
<tr>
<th>PLANT COMPONENT</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condensers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do all the condenser fans have a VSD?</td>
<td>✗</td>
<td>☑</td>
</tr>
<tr>
<td>Is the head pressure fully floating?</td>
<td>✗</td>
<td>☑</td>
</tr>
<tr>
<td>Is the ambient temperature and the humidity considered in control logic?</td>
<td>✗</td>
<td>☑</td>
</tr>
<tr>
<td><strong>Evaporator fans</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are all the carcass chillers' fans fitted with VSD?</td>
<td>✗</td>
<td>☑</td>
</tr>
<tr>
<td>Are all the blaster chillers' fans fitted with VSD?</td>
<td>✗</td>
<td>☑</td>
</tr>
<tr>
<td>Are all the cold and chillers stores' fans fitted with VSD?</td>
<td>✗</td>
<td>☑</td>
</tr>
<tr>
<td><strong>Compressors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there at least one high stage compressor fitted with a VSD?</td>
<td>✗</td>
<td>☑</td>
</tr>
<tr>
<td>Is there at least one low stage compressor fitted with a VSD?</td>
<td>✗</td>
<td>☑</td>
</tr>
<tr>
<td>Is compressor on/off sequencing controlled automatically?</td>
<td>✗</td>
<td>☑</td>
</tr>
<tr>
<td>Is there a weekend mode with a small compressor and a high suction pressure?</td>
<td>✗</td>
<td>☑</td>
</tr>
</tbody>
</table>

**RESULTS**

**INFORMATION ON SITE ENERGY USE AND PRODUCTION:**

Please enter the following data from your electricity bill and production records:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual electricity consumption</td>
<td>$30000/MWh/year</td>
</tr>
<tr>
<td>Average power cost</td>
<td>$200/Wh</td>
</tr>
<tr>
<td>Annual production</td>
<td>66000 tonnes cold carcass weight</td>
</tr>
</tbody>
</table>

---

**DISCLAIMER:** While the accuracy of this tool is based on a considerable amount of information obtained and research conducted by MINUS40, the results of the tool are indicative and no guarantee of their accuracy is given or implied. Responsibility for either the achievable savings or the project costs rests with the user in plant energy audits and business case development required to determine savings and project cost estimates to investments grade level.
The following results are an estimation of the power consumption of your refrigeration plant and of the achievable energy savings.

The colored dot on the graphs represents the position of your site in regard to power consumption and the possible savings compared to other Australian plants.

**Refrigeration plant power consumption (RPPC):** 14,289 MWh/year

**Potentially viable savings:**

- 24.28% of RPPC
- 3,470 MWh/year
- $693,934

**Upfront costs range:**

- From $1,040,902 to $2,081,803

**Payback Time:**

- From 1.5 to 3.0 Years

*) See disclaimer on Input page.
3. SUPPORT DOCUMENTATION for Refrigeration Energy Efficiency Spread sheet Tool

**MINUS 40 Pty Ltd, ABN 36 023 422 582**

**Address:** Unit 7, 22 Hudson Avenue, Castle Hill, NSW 2154

**Telephone:** (02) 8850 4811

**Fax:** (02) 8850 4868

**Web:** [www.minus40.com.au](http://www.minus40.com.au)

---

**SUPPORT DOCUMENTATION**

**ABATTOIR REFRIGERATION ENERGY TOOL**

**REFERENCE:** SUPPORT DOCUMENT - 11 October 2013

**PREPARED BY:** MINUS 40 Pty Ltd

**PREPARED FOR:** Wodonga Rendering Pty Ltd

**MINUS 40 PTY LTD**

UNIT 7 – 22 HUDSON AVENUE

CASTLE HILL, NSW 2154

**WODONGA RENDERING PTY LTD**

54 Kelly Street

Wodonga, VIC 3690

---

<table>
<thead>
<tr>
<th>DATE</th>
<th>REVISION</th>
<th>DESCRIPTION</th>
<th>PREPARED BY</th>
<th>REVIEWED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>30/09/2013</td>
<td>P0</td>
<td></td>
<td>H. Lebreton</td>
<td>M. Bellstedt</td>
</tr>
<tr>
<td>11/10/2013</td>
<td>P1</td>
<td></td>
<td>H. Lebreton</td>
<td>M. Bellstedt</td>
</tr>
</tbody>
</table>