Energy Audit Summary Report
CIT
Audit no. 08 – IRL01
Food industry

Institiúid Teicneolaíochta Chorcaí
Cork Institute of Technology

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AUDIT no. 08 – IRL01

1. Data on the auditor

1.1. Contact data of the auditor

Eileen O'Leary, Clean Technology Centre, Cork Institute of Technology, 53 Melbourne Road, Bishopstown, Cork, Ireland. Phone: +353 21 4344864. Chemical engineer and environmental consultant. Visit to site, 1 day duration: April 2011. Follow up with company via phone and e-mail for additional information over a number of weeks.

2. Introduction

2.1. Objectives

The company wishes to investigate options to reduce energy costs, mainly focussed on recovery of heat and optimal use of existing boiler.

3. Status Quo: processes, distribution, energy supply

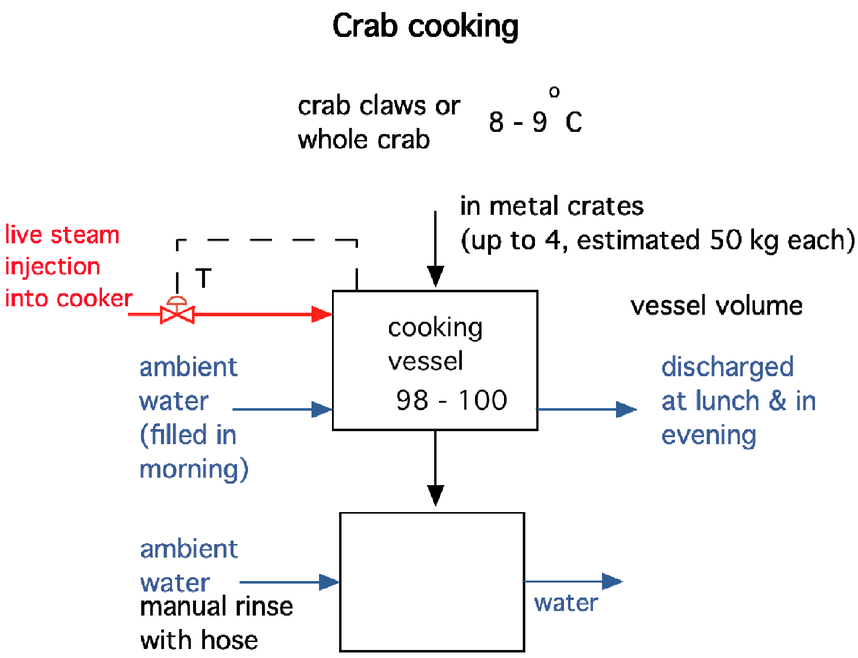
3.1. General info of company

Seafood processor – cooking a variety of fish. Main products are crabs and shellfish.

3.2. Manufacturing Process

Crab cooking

The site undertakes two different cooking processes, the one modelled here is crab cooking.



3.3. Description of the existing system

- ***Energy Supply***

Steam for the cooking process is supplied by a steam boiler burning liquified petroeum gas (propane). Design working output of 1600 kg steam/hour, giving a design rating of 1200 kW.

Gas Usage at the site	**Present state** *[MWh]*
Primary energy consumption	1400
Final energy consumption (FEC) propane	1100
final energy demand thermal (FET), propane	1100
useful supply heat (USH)	940
Heat demand (UPH) – crab processing	660

- ***Distribution system***

There is one steam header supplying the steam using processes at the site at 7 bar(g). The steam distribution is an open system, which is unusual, but since all use of the steam at the site is in direct contact with the food product, it is not suitable for return as condensate.

- ***Main energy consuming energy processes and buildings***

The main energy consuming processes at the site are:

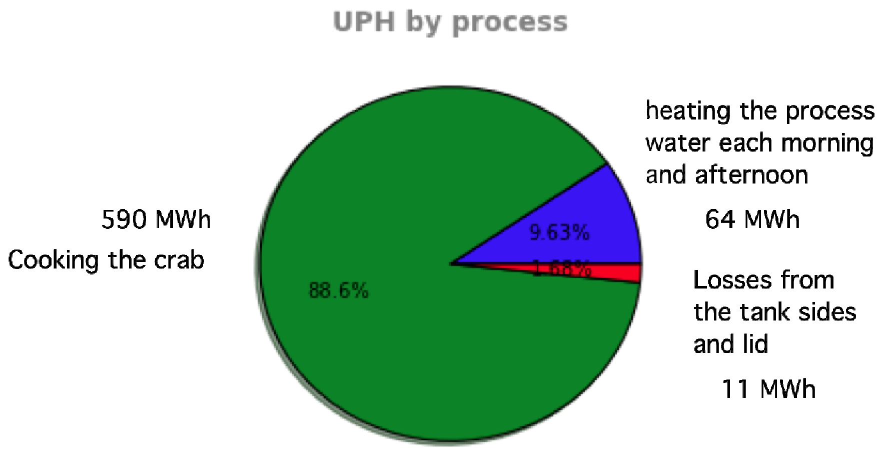
- Crab cooking vessels
- Whelk cooking retorts
- Refrigeration

There are some small offices, toilets and a canteen within the building, but these have been ignored since they are small energy consumers relative to the rest of the site.

Crab Cooking Process

The crab cooking process takes place in a 1.2 m^3 vessel. Ambient water is added in the morning and heated using steam. Cooking of individual batches of crab takes place from approx 07:00 until 17:00.

The following figure for the crab cooking process shows the distribution of the heat demand according to the different steps of this process.



Following on from the site audit, the company has since insulated the walls of one of the two crab cooking vessels, and plans to do the same for the second vessel at the end of 2011 during Christmas shut-down. Thus, the above losses will be reduced by up to 90% based on the thickness of the insulation installed.

3.4. General

- ***Assumptions***

The following key assumptions have been made:

- The start up time for the heating up of the process vessel in the morning and afternoon was assumed to be 30 minutes, based on expected steam flow-rates to the process.
- The heat required to raise the metal baskets containing the crab has been omitted from the modelled process. Values were calculated, but were relatively low, and cannot be improved upon in any case.

- ***Measurements performed by the auditor***

The following measurements were performed by the auditor:

- Temperature of the outside wall of the crab cooking vessel was measured to assist in calculating losses.

4. Comparative study

4.1. Proposed alternative

The company is interested in installing equipment to recover heat at the site. At present there is no heat recovery associated with the flue gases. The proposed alternative is heat recovery on the boiler flue gases to be used to preheat the air feed to the boiler.

The proposed alternative is an air to air heat exchanger with a rating of 9 kW, and a heat transfer area of 6 m^2.

5. Selected alternative(s) and conclusions

5.1. Selected alternative

The company is interested in installing equipment to recover heat at the site that has a reasonable payback (less than 3 years). However, complete replacement of the existing 19 year old boiler would not be a option in terms of investment required. Thus the study was confined to heat recovery.

5.1.1. Heat recovery

Name	Flue gas heat recovery	**Hot medium**	**Hot medium Temperature in**	**Hot medium Temperature out**
Power	9 kW	Boiler 1 waste heat	82 °C	25 °C
Heat transfer surface area	5.8 m^2	**Cold medium**	**Cold medium Temperature in**	**Cold medium Temperature out**
		Boiler 1 combustion air	25 °C	132 °C

5.2. Comparative study and conclusions

The following table compares the existing situation (present state) and the proposed alternative.

		Present state	**Alternative**	**Saving**
Total primary energy consumption (1)	*[MWh]*	4900	4700	4%
CO_2 emissions	*[tons/a]*	900	860	4%
Annual energy system cost (2)	*[EUR]*	€150,000	€143,200	€6,800

Total investment costs	*[EUR]*		€12,000	
Payback period (3)	*[years]*	1.26 years		

(1) including primary energy consumption for non-thermal uses

(2) including energy cost (fuel and electricity bills), operation and maintenance costs and annuity of total investment.

(3) Assuming 0% funding of the total investment (subsidies or equivalent other support mechanisms)

Conclusions and outlook

The payback is favourable and within the allowable range for the company.

The company has made an application for part-funding for an investment programme in energy efficiency measures. If successful, the company plan to install heat recovery equipment as well as additional insulation for un-insulated process equipment. A more detailed analysis of the whelk cooking process, particularly the unrecovered condensate from this process, as well as looking at potential heat recvery from the refrigeration plant at the site may yield additional heat recovery options.