



English

Summary

THE DOWNSTREAM PORK INDUSTRY : ENERGY EFFICIENCY ANALYSIS ON INDUSTRIAL UNIT OPERATIONS

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Energy generates significant operating expenditure for meat-sector businesses. The costs incurred through energy-related expenditure have risen sharply over the last five years. This study, led jointly between the ADIV and the IFIP with technical and equipment input from Tecaliman, was able to highlight liquid-specific consumption levels in downstream processes at pork industry businesses and to audit current sector-wide technical and economic performances. Analysis of the differences in performance profiles between the 12 businesses 'audited' showed that there was potential for making savings on the majority of energy inputs used, both in terms of production unit operations and secondary fluids (refrigeration, coolant circuits, compressed air and vacuum circuits, etc.). The study also highlighted all-round low levels of fluid and/or energy metering equipment at the business studied. Consequently, there is general lack of knowledge on the distribution and proportional breakdown of the main consumption cost items. However, the study does, despite these hurdles, highlight fully-viable strategies for the downstream pork industry to make savings.

Keywords: downstream pork industry, energy efficiency, gas, electricity, cold chain, water.

CHILLING RUMINANT CARCASSES : VASCULAR PERFUSION CHILLING

BROWN T., RICHARDSON R.-I., WILKIN C.-A., EVANS J.A.

Meat carcasses must be chilled to below 7°C before leaving the slaughterhouse. Typically this is done by passing cold air streams over the surface of an eviscerated and de-hided carcass. Because the cooling medium is only acting on the outer surface, it can take many hours for the temperature at the centre of the carcass to drop below 7°C. In vascular perfusion chilling (VPC), a cold fluid is circulated through the intact vascular system, offering significant reductions in cooling time. Reducing the time required to chill carcasses will have substantial benefits to the meat industry.

A small feasibility study to evaluate vascular perfusion techniques for rapid carcass chilling that are not deleterious to meat quality and safety was carried out. Experimental perfusion chilling equipment was assembled based on Star Refrigeration's Flo-ice™ system. This produces pumpable ice slurries containing very fine ice particles, suitable for circulating through vascular systems. For this study, lamb carcasses were used for cost and handling reasons. Perfusion chilling was assessed for various perfusion times with different perfusate salt concentrations and temperatures in comparison with conventional air chilling.

The main factors assessed were the rates of temperature reduction, effects on texture, colour, and microbial quality of resulting meat.

VPC was found to be capable of extremely rapid reduction of deep leg and deep loin temperatures in comparison with air chilling. It had no appreciable effect on texture, colour and microbial quality of the meat. In all cases however, uptake of perfusate into the carcasses occurred.

Keywords: Vascular perfusion chilling, meat carcasses.

AIRFLOW PATTERNS IN CARCASS CHILLERS : MEASURES, MODELLING, IMPROVEMENT SOLUTIONS AND PERSPECTIVES

MIRADE P.-S.

Based on some results obtained in two batch beef carcass chillers, this paper aims at demonstrating how a joint use of experimental investigation and numerical modelling can contribute to assess and improve the airflow patterns and hence the efficiency of meat chilling plants. The ability of

the numerical approach to predicting coupled heat and water transfers of beef carcass placed in airflow together with the propagation and deposition of contaminating biological particles on the walls of cold rooms are also investigated.

Keywords: beef carcass chillers; air velocity; CFD models; coupled heat and water transfers; deposition of biological particles.

SLAUGHTERHOUSE REFRIGERATION : COOLERS AND COOLING CIRCUITS

POTTIER M.

After a concise review on the crucial need for full end-to-end cold chain control in meat processing from slaughter right through to pre-sale refrigeration of the end-product, the study addresses the slow- or fast-chill refrigeration issue from different standpoints :

- qualitative aspects of the meat product chilling and conservation process (tenderness, weight loss, staff working conditions);
- quantitative and economic aspects of the chilling and conservation process (process-related energy costs, chiller and coldroom designs to cut down on facilities volume).

The papers centres on detailing ways to produce the best compression chiller while keeping energy consumption to a minimum, and explores a panel of technical solutions to be integrated into the design of refrigeration facilities :

- choice of refrigerants and secondary refrigerants;
- choice and definition of refrigerator components, service maintenance conditions, and gambling with cleanliness;
- energy recovery in the refrigeration cycle;
- operating conditions (choice of temperature ranges as well as humidity and airflow parameters).

In conclusion, the paper outlines potential solutions for engineering new refrigeration facilities or re-engineering existing facilities, giving quantified illustrations (refrigeration production and distribution systems).

Keywords: Meat products, refrigeration, refrigeration facilities, energy consumption, legislation

COLD-CHAIN ENERGY AUDITS : CONTENT, EXPECTATIONS, IMPACTS

GUILPART J.

Chiller systems often account for a significant proportion of energy consumption at food processing workshops. Energy-auditing the facilities is one way of improving control over this cooling system-related energy consumption. This paper outlines the global energy audit process and the main results audited units can expect to benefit from. The paper also outlines how integrating the chilling process into the production site's global energy conversion and transformation processes can lead to even more tangible savings.

Keywords: refrigeration facilities, energy consumption, audit, environment

REFRIGERATION IN THE MEAT INDUSTRY : MANAGING TRADE-OFFS

PICGIRARD L., PUECH J.-M.

Refrigeration has a long history, and the use of cooling technologies has spread throughout the meat industry, from animal slaughter right through to the storage of end-products in household fridges. However, refrigeration does remain a highly sensitive technology that still largely dictates the extent to which meat and meat products can be safely conserved. Furthermore, industrial operators running refrigeration facilities are now required to meet a raft of economic, environmental, quality-control and food safety obligations. This paper summarizes the various constraints imposed.

Keywords: meat, refrigeration.