

Danish Crown throws

The world's latest slaughtering technology now has the perfect showcase: Danish Crown's new plant in Horsens, Denmark. The most advanced slaughterhouse in the world stuns its visitors as well as the pigs it processes.

By Stuart Lumb

To the casual passer-by, the new Danish Crown slaughter plant, situated on a green field site just outside Horsens in Jutland Denmark, could be just another factory, as there is a complete absence of smell and noise. It is, however, the symbol of the Danes' intent to be the major force in pig meat production and processing for many, many years to come.

The original Horsens abattoir was built in 1887 at a budgeted cost of DKK53,000 which grew to DKK91,000. However, this figure is dwarfed by the cost of the new plant DKK2bn (USD328.4mn). The new plant covers an area of 37 hectares and has an actual floor area of 78,000 m². Design work commenced in January 2001 with construction starting in August 2002. The slaughterhouse was inaugurated on last May 23 with the official opening ceremony being performed by Prince Joachim, who is second in line to the Danish throne and who farms a large estate in south Jutland.

Danish Crown is very pleased that the new slaughter facility was built well within the budgeted figure, especially as the cost of extra chilling capacity that was needed was found within the exist-



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down the gauntlet



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ing budget and hence an overspend situation was averted.

Labour automation

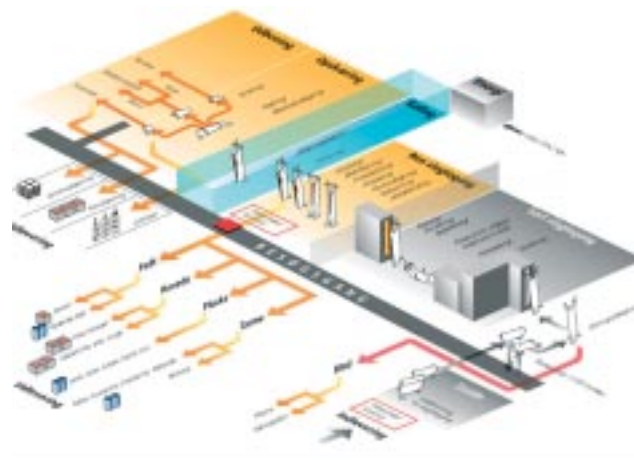
Labour costs in Denmark are high: operatives in the new DC plant are paid DKK160 (USD26) an hour. Much of the work in a slaughter plant is tedious and strenuous and thus ideally suited to be carried out by robots. Several operations on the slaughter line are fully automated, in spite of the fact that robots are not cheap to develop and build.

The robots are made of stainless steel to cope with the harsh environment that they must operate in. They also have to be readily accessible to allow for efficient cleaning. After processing each carcass the robots' tools are retracted into a cleaning cabinet and subjected to "cold-warm-cold" rinsing to eliminate bacterial contamination. The temperature during the cold rinse is 40-42°C and 82°C during the warm treatment. The disinfection of equipment between each carcass is one of the great advantages of automation as less manual handling reduces cross contamination between carcasses.

The increase in automation has also had an effect on working routines and employee skill levels. Operatives must still be able to carry out manual tasks but in addition they must also be able to evaluate quality and possess sufficient technical understanding of the automatic equipment. However, automation of the Horsens plant has meant that staffing has been reduced by 300 operatives. The plant employs 1,360 staff, many with years of experience in the slaughter industry. Operatives work in two shifts, one starting at 6-7am, the other at 2-3pm. The plant operates at a temperature of 7°C. A night shift is employed to clean up the lines and service the equipment, especially the robots.

High-speed logistics

Currently the plant is killing 40,000 pigs per week, although this figure will eventually rise to a maximum of 78,000. This will account for just under 20% of the national pig production. To put this another way, eventually the hourly kill will be 1,100 pigs or one pig roughly every 4 seconds. Consequently the deliv-



Workflow overview. The new Danish Crown plant covers an area of 37 hectares and has an actual floor area of 78,000 m². Design work commenced in January 2001 with construction starting in August 2002. Photos: Danish Crown.



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ery of pigs is a major logistical exercise. Despite this, transport losses are just 1 pig in every 5000, the lowest in the world. Generally pigs are transported in groups of 15. Lairage pens have also been designed to hold 15 pigs thereby avoiding mixing. This has resulted in calmer pigs, reduced aggression and consequently less skin damage occurring prior to slaughter.

The lairage has a maximum capacity of

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3800 pigs, so that fluctuations in delivery of slaughter stock will not reduce the throughput of pigs through the plant. The lairage pens are well ventilated and have watering facilities built into them. In addition misting equipment cools the pigs in warm weather. Pigs are held in the lairage for 1-2 hours to rest and recover from being transported. The pigs then move from the lairage in groups of 15, which research has shown is an ideal group for ease of movement. Then they are split into a group of 7 and a group of 8 after which they are moved gently by automated gates to be stunned with carbon dioxide. The floor has a slight incline of 2% as research has shown that pigs prefer to walk uphill.

Stunning performance

A veterinarian continuously checks that the CO₂ stunning is carried out in a welfare friendly manner. At the start of slaughtering and throughout the day inspectors ensure that the plant is working correctly and that the CO₂ concentration is high enough to anaesthetise the pigs properly. Significantly, the replacement of electrical stunning with CO₂ has led to a halving of the frequency of PSE along with a reduction of blood splashing and broken bones.

Following stunning the pigs are bled and are then scalded. Traditionally pigs have been shackled and then pulled through a large tank of hot water. Naturally as time goes by the water gets dirtier and dirtier as more and more pigs pass through, plus often water enters the

pigs' lungs. This is far from ideal. Therefore, the Horsens plant has incorporated a vertical scalding system into the line, making the process more hygienic and also less water consuming.

A new technique, whipping, has also been developed and installed for the de-hairing process, the reason for this being that whipping causes less damage to the carcass than the previous process.

One of the most arduous tasks on the slaughter line is the cutting and removal of the internal organs, as these weigh 10-12kg and traditionally have had to be lifted manually. The evisceration process is now carried out robotically. Firstly the position of the pig's elbow is located, to set up the robot. The connective tissue is then cut allowing the pluck and intestinal tract to be removed. Finally the tools and other machine parts that have been in contact with the carcass are rinsed and disinfected. Mechanisation of this operation has replaced 2-3 operatives.

Focus on hygiene

Hygiene naturally has a high priority and the slaughterhouse is divided into hygiene zones. Waste, for example, is transported in sealed tubes under a vacuum. Carcasses are graded through one of two AutoFOMs. The AutoFOM system has the advantage of having no moving parts plus high throughput: over 1,300 carcasses per hour.

Cutting up carcasses is risky and tiring and is hence an ideal operation to automate. Sides need cutting into different sized cuts dependent on customer

requirements and this is done robotically. Firstly photos are taken of the side and the images are then transferred to a computer. Information regarding the cuts has already been inputted. This information is relayed to the cutting saws, which move at right angles to the side and then cut the side in the appropriate place, specific to that order.

The boning of fore-ends is another process that has been partially automated. In this instance robots remove the surface bones, namely the neck bone and riblet. Compared to manual boning, robots can cut closer and more uniformly to the bones resulting in a gain in meat yield of 17 g per fore-end. A robot that will remove the internal bones such as the humerus and scapula is currently under development. Some robots are not as accurate as humans but the savings in labour compensate for the loss in yield.

The incorporation of all this technology has involved a great deal of operative re training and this has been a big challenge to plant managers. Unlike manually operated lines, robotic systems are unable to rectify, for example, lack of trimming on a cut, so robots must be exceedingly accurate. Consequently a surveillance system based on traffic lights has been developed. A central database stores information. Green indicates no problems, whilst yellow indicates minor problems that must be rectified as soon as is practical. A red light though represents unacceptable quality and immediate action has to be taken to avoid a decline in quality and yield. The monitoring system is able to send SMS alerts to the supervisors in charge.

Conscious design

On entering the plant visitors are struck by the light and airiness of the building, a conscious design feature. In fact, there is even a garden in the middle. Specific technology has been incorporated to reduce odours and noise. Recycling facilities have been built in plus heating with lard is also a possibility. A wide ele-



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vated passageway, which was built for visitor participation, runs through the length of the plant. Also along the passageway are many canteen areas for the operatives. Large windows allow visitors to look down on the different operations and at regular points there are large

wall-mounted screens showing the operations in detail by means of diagrams and video footage, along with a commentary in Danish, English or German.

At one viewing point part of the processing operation was obscured by two large pipes and we were informed by our

guide, Gudrun Andreasen, that the pipes would be re-routed to improve visibility. The visual aids are impressive and it's obvious that no expense has been spared, but it has been money very well spent. In days gone by the public would have been positively discouraged from visiting an abattoir. Today the emphasis has been reversed and a guide is on hand specifically to show visiting groups round the plant. Local residents and schoolchildren have been actively encouraged to look round the facility in a bid to further improve relations between Danish Crown and the community. The new Horsens plant is an amazing facility. A far cry from the original bacon factory built back in 1887. **MI**