



Once in open farmland, Hulshof tannery is now completely surrounded within the town of Lichtenvoorde.

CREDIT: HULSHOF

Tannery of the Year: Hulshof, Lichtenvoorde, The Netherlands

Hulshof Royal Dutch Tanneries has been based in Lichtenvoorde in the east of the Netherlands since the middle of the nineteenth century. It operates from a busy residential part of the town but has won acceptance from its neighbours thanks in part to its innovative approach to environmental management.

There is nothing like forward planning. Herman Hulshof, fourth-generation chairman of Hulshof Royal Dutch Tanneries, based in Lichtenvoorde in the region of Achterhoek in the east of the Netherlands, is also the chairman of a regional body whose aim is to make Achterhoek energy-neutral by 2050. The project will have at its heart green energy based on biogas, with the biogas emanating from waste from the agricultural communities that make up this part of the country.

The contribution his company can make to this is important. Hulshof regards itself less as a tannery than as a processor of hides. Since 2004, its liquid effluent has been transported along two kilometres of pipes to a waste treatment plant outside Lichtenvoorde where it is converted into biogas at a rate of between two million and three million cubic-metres a year at the

moment (including biogas produced from other waste sources). Dr Hulshof has hopes of increasing this to ten million, as well as a vision of five or six networked biogas plants coming into operation across the region to provide energy for the families and businesses based here. He says the biogas potential for the largely agricultural Achterhoek could be as high as 300 million cubic-metres and that a spin-off green energy company will be part of the 2050 vision.

By that time, the tannery chairman is convinced, people in Europe will eat less meat because there will be more people to feed globally and food that uses up too many resources to produce will become less commonplace and more expensive. More expensive and more exclusive bovine hides will inevitably follow with tanners severely restricted, as always, in the raw material sourcing strategies they can employ to address this. "We



The people in white work in the food manufacturing areas, those in blue work in wet end leather processing, those in red in the finishing department, and those at the rear of the photograph work in management and administration.

are recyclers of the by-product of another industry and we always have been," Dr Hulshof says. "But one thing we must do is to make as much use of these exclusive and expensive hides as we can. The hide is food, so why should we flush all the protein away? The shavings and trimmings all have value. The leather industry needs to make the transition to producing food and energy instead of waste. I see the future as no-waste."

Sustainable principles

He is heavily involved in local sustainability initiatives, but passes this off as "just an attempt to pass on my knowledge". Developing sustainable principles and living and working by them is essential, not just for the Netherlands but for the whole of humanity "or we lose anyhow", he says. He is an active member of networking groups that meet senior people from the Dutch ministries for the economy and the environment. He was also vocal at an October 2010 meeting that COTANCE, the EU tanning industry's representative body in Brussels, organised in Bologna with a representative of the European Commission, regarding it as a further opportunity to lobby. Governments

should take the lead, he insists. If they want sustainability, they need to apply rules that will encourage businesses to operate sustainably. In this industry, a good example would be rules that raw hides must be tanned close to source, from fresh to wet blue stage at least.

Weighing on average 47.5 kilos, Hulshof hides come from the large bull calves especially favoured in the Netherlands, with a daily capacity at the Lichtenvoorde tannery of 60 tonnes, or around 1,200 hides. The facility is only 30 kilometres from the border with Germany (some of the company's 160 employees live there because houses tend to be more affordable), giving exceptional access to northern Europe's large slaughterhouses and the high-quality raw material they produce. Being a short distance away from its raw material source gives the company the option of using fresh rather than salted hides. "We went totally to fresh in 1990. You could say it took some courage, but I believed in it. I didn't want to deal with salt," says Herman Hulshof. "It takes more effort to salt the hides than to chill them, then you have salted hides being shipped to Asia, say, where they wash the salt out, getting salt into aquifers. The salt issue is a

shame. And you can tan better without salt; it's harder to know the exact weight of a salted hide, making it more difficult to calculate the correct quantity of chemicals to add. Plus, salt damages the hides themselves."

His tannery has the capacity to make 1.7 million square-metres of wet blue a year, and is producing 700,000 square-metres of finished leather at the moment, with 98% of it going into upholstery leather for furniture, cars and aircraft. Wet blue and wet white are newer, but popular, outputs, with the hides shipping to other tanneries for finishing.

New blood

Its chief operating officer, Sjoerd Kleisterlee, is part of a relatively new senior management team at Hulshof Royal Dutch Tanneries. Before coming to the tannery, he worked in the corrugated paper industry. The main difference that has struck him since starting to work with leather is that it is "more emotional; you feel an emotion for beautiful leather, the finish, the touch, the surface, the smell". This makes it more of a challenge to turn the manufacturing of the material into a process, day in day out. Making boxes is more of a process, he confirms.



From a technical point of view

(1) Overview of operations

Hulshof Royal Dutch Tanneries is located in the town of Lichtenvoorde in the Netherlands. Although the tannery was originally in the countryside, it is now completely surrounded by shops and light industry, but mainly housing which almost adjoins one side of the site: environmental responsibility is therefore part of survival. The tannery processes 60 tonnes or 1,200 fresh hides per day, mainly as furniture leather, but is growing in the automotive sector. The workforce is 130 people in total, but Hulshof also produces collagen fibres for the food industry and 25 people are employed in its manufacture. The Royal Hulshof Group also has operations in Romania (hand craft finishing) and the US (sales).

(2) Manufacture and processing

There are three aspects that influence leather production within the Hulshof tannery:

- It was decided in 1990 that the tannery would only process fresh hides. It was the first tannery to do so.
- The tannery is in the centre of a heavily populated area, and odour and noise will not be tolerated. For this reason the effluent treatment plant is located two kilometres from the tannery.
- Collagen fibres for the food industry are manufactured on site, and this has implications for hygiene.

Most of the hides used for input come from high quality German bulls. Because they are chilled and hygiene is a key component, the initial sequence of operations requires careful management.

Essentially the hides are purchased through selected dealers who work very closely to the company's requirements. The hides are collected by these dealers directly from the abattoirs after an initial chilling, then opened, inspected, graded, trimmed and weighed, then opened fully and chilled for 24 hours at 5°–6°C. The hides are made up into standard input loads of 20 tonnes and delivered to the tannery for arrival at specified times. These hides are dumped into 25 tonne containers that can be angled to make it easier for two automatic cranes to load the drums via a belt running above the three liming drums. If the containers have to travel a long distance this takes place at night as the vehicles are not refrigerated.

On arrival the containers are opened and the hides inspected. If there are signs of hair slip or smell of putrefaction the hides are sent back to the dealer, but if approved then they enter production directly for soaking, unhairing and liming.

Hulshof uses a 24-hour hair-saving process and this is performed in the three liming drums which are supplied by Vallero and Billeri and are double engined and have the capacity to take a 20 tonne load. After liming the hides are washed, and then dumped using chutes into stainless steel containers, loaded onto a conveyor track and inspected to see that they are hair-clean. They are then lime fleshed and split. If there are any shanks or tails these are cut off before fleshing



Hair is recovered using a rotating screen. To avoid the risks of contamination in an area operating to the standards required for food production, the recovered hair drops into a cyclone to be blown away from the processing area.

CREDIT: WTP



Two of the six 4 x 4m Vallero tanning drums.



Blue shaving of hides with dust control for in-house manufacture.



Four 3 x 3.5m Olcina dyeing drums. All of the eight are equipped for recirculation and continuous removal of solids from the dye bath.



It takes five minutes to change the embossing rollers using this hoist and gantry arrangement. This technique has been built into the design of the Bergi Supra Press in the Hulshof finishing department, where five rollers are built into the machine.



To ease handling, leathers are slid from a horse onto a feed table, then forward onto the feed conveyors for spray finishing. The finishing department has two double headed spray lines.

and a claim is made directly back to the dealers.

This area is very clean and limited to authorised personnel. The operatives wear clothing appropriate for food manufacture, and have to walk through sterilised water troughs to access the area.

The tanning loads with the tanning drums (two 4x4m Vallero drums for each liming drum, so six in total), operate a 48-hour deliming, pickle and tanning process. Both wet blue and wet white leathers are produced in an 80:20 ratio. Sales are made to customers for furniture, automotive, leathergoods and footwear to the finished state. When wet blue and wet white are used for in-house production, bactericides are not added, so the hides are stored in the dark at about 10°C to avoid mould growth.

Because of the logistics of managing a complex raw hide collection system, inspections at the various stages have to be particularly comprehensive, with clear identification of all of the leathers back to the individual hide supplier. All of the suppliers are issued with the full records of quality and rejection, and the system demands a considerable level of trust.

After shaving to substance and dyeing and retanning, the leathers are dried using an automated Cartigliano drying system. This includes wet staking after samm/setting, vacuum drying, then tension-free conveyor drying in a drying/conditioning cabinet.

After dry staking and dry tumbling, the leathers are finally finished in a separate environmentally controlled finishing department, where the whole area is dust free, and at standard temperature and relative humidity.

(3) Co-products and solids management

Collagen fibres are a major co-product manufactured on site. The product is called Collapro, and the 1,700 tonnes per year produced are entirely used in the food processing industry.

The standards of hygiene required are very high, and the conditions are under audit and inspection by government bodies according to EU food standard directives 852 and 853. This is unlike technical gelatine manufacture in which by-products are chemically destructured, which does not require such high standards.

The production process relies on fresh hides free of preservatives. Following soaking, unhairing/liming and fleshing, on splitting the limed flesh splits fall into a container, and are then sucked pneumatically from the tannery through stainless steel pipework to an adjacent building for food processing. All personnel operating the machinery in these initial leather/Collapro processing stages have to meet the standards of cleanliness demanded by food manufacture.

The Collapro operation produces a white dry fibrous product, and this can be added to sausages, burgers, prepared meats and similar products. Different fibre lengths produce different textures and taste, while the product allows an increase in water content up to 25 times the weight of Collapro. The product can be mixed with soya and gelatine, and produces



Innovative treatment of wastewater



Looking down on the water treatment plant required for treating the municipal water. The chemical reactions involved ensure the highest quality water for processing, and guarantees stable and high quality wet white, wet blue and crust.



The tall blue tank is used for the enhanced anaerobic digestion of blended tannery effluent. The two green tanks are used to remove nitrogenous chemicals from the effluent after anaerobic digesting and sulphur recovery.



The yellow tank in the foreground is the reaction tank for the controlled oxidation of sulphides to elemental sulphur. The sulphur then settles from the wastewaters at the base of the two yellow settling tanks.



The cylindrical bund-tank contains the gasometer for storing generated methane. The gas powered engine for generating electricity is housed in the adjoining building.

quality texture that these latter products cannot achieve.

However, suitable limed croupon splits (only the heaviest) are processed into wet blue or sold at the limed stage. Other solids from manufacture include:

- About 60 tonnes of limed fleshings each week, being collected from the site and processed into tallow, commercial gelatine, and glue products. Investigations have started to convert these into biofuel.
- Recovered hair is being taken as waste from the tannery, although Hulshof is working on a project to use it in fertiliser.
- Shavings are collected from the tannery and converted into leatherboard.
- Buffing dust is processed in the effluent treatment plant.
- All of the effluent is screened before delivery to the effluent treatment plant, and these screenings are taken from the site for landfill.

(4) Water treatment and energy management

WATER TREATMENT

Because Hulshof manufactures products for the food industry, all of the water received from the municipal supply is subjected to comprehensive water treatment. In addition there are very strict limits to the way the water is used, so there is no recycling or use of regenerated products in manufacture.

Originally, the tannery ran an effluent treatment plant on site, but in 2006 a new treatment plant was brought into full operation. This is located in open countryside, and is served by a two-kilometre pipeline from the tannery and is managed in the following way.

All of the wastewaters within the tannery are enclosed in pipes, and delivered to two capped and banded holding tanks. One holds sulphide containing alkaline discharges, the



other acidic wastewaters. The wastewaters are pumped from these tanks at carefully controlled rates (normally a 60:40 alkali/acid ratio) for mixing in the pipeline. This ensures that no odours are created at the tannery and that the feed to the treatment plant is consistent.

The blended effluent is delivered directly into a high-speed anaerobic digester. The retention time required by this anaerobic processing is less than one day, and it is important that the effluent is maintained at a temperature of 35°C and that it is thoroughly mixed. This reaction tank is 25 metres in height, and the recirculation is entirely provided by the methane evolved from solution due to the anaerobic digestion of the effluent.

This biogas is collected using a separation unit fitted on top of the reactor, while the digested effluent flows into a second sealed reaction vessel for sulphur recovery. In this process the hydrogen sulphide that is dissolved within the treated effluent is wet oxidised using a controlled air offer to form sulphur. The sulphur is then recovered in the form of a wet sludge that settles at the base of two separation tanks.

At the same time the biogas is fed through trunking to a wet scrubbing unit where the hydrogen sulphide is dissolved in solution. This solution is fed into the sulphur recovery unit for wet oxidation, and the purified methane stored in a gasometer contained within an outer sealed tank for safety purposes.

After sulphur recovery, the effluent is delivered to a pair of columns to remove the ammonia/nitrogen content. In this process the wastewaters are subjected to alternating nitrification and denitrification cycles between the two tanks using specific bacterial cultures and carefully controlled use of oxygen from air. This results in the conversion of ammonia

and amines to nitrogen which is released to the atmosphere.

The total chemical oxygen demand (COD) load from the tannery is about 2,100 kilos per day and this first stage of treatment removes approximately 75% of this load. The effluent then flows for conventional activated sludge treatment processing within the municipal treatment plant located on the adjacent site. After full treatment up to 99% of the COD has been removed, and the quality enables discharge into a nearby stream.

ENERGY MANAGEMENT

Between two million and three million cubic-metres per year of biogas is produced from the tannery effluent, and this is used for electricity production. In addition, the heat from the gas turbines is used to keep the special bacteria at the optimal working temperature. It is intended to construct a gas pipeline to the tannery so that in the future all of the heat for processing can be provided by biogas. At the moment the surplus is used as generator fuel to provide electricity for the national grid.

Because of the success of this treatment plant another enterprise has been set up on site. This anaerobically digests sludges from the adjacent municipal activated sludge treatment system, and milk and cheese manufacture to produce biogas. Both the liquid effluent produced and the biogas are then treated within the Hulshof plant. It is intended to expand this operation and to increase the production of biogas up to 10 million cubic-metres per day. Eventually, it is hoped to link this methane production into a grid system with other companies with a potential of up to 100 million cubic-metres per day. ☺

Chief executive Theo Lammers also contributes to the diversity, having arrived at the company in 2009 from the iron foundry sector. He sees parallels between the industries: both are conservative, with many companies being run by families and staying small. The foundry industry has, however, come in recent times to enjoy greater collaboration among operators, at least in the Netherlands, he says, through initiatives such as a joint effort to collect data, identify patterns in the data and share the information. Companies there have also been quicker to identify niches that have helped them prosper rather than try to be all things to all customers. "There is over-capacity in the tanning sector," Mr Lammers claims, "so maybe it's difficult for people to be quite as open with one another. If things get better in tanning, maybe people will become more open."

Attractive to customers

From an outside perspective, the reputation that Hulshof Royal Dutch Tanneries has been building up for years as

a caring, sustainable business, is helping it to attract customers, commercial director, Henk van Leussen, says. "Some customers are choosing us as a strategic partner because of this," he insists. "We were the first tannery to win the Netherlands Care & Profit Prize and we are now developing items that are ready for Cradle to Cradle accreditation."

The first of these achievements is a reference to an accolade the Dutch government awarded to the company in 2006 (the year in which Hulshof also won an accolade called the EU Life Award for its new purification system). Fifty-six leading enterprises had entered a competition to win Care & Profit Prize in this, its inaugural year. The then-new treatment plant with its pipeline connection to the tannery back in the town was a big help in sealing victory for Hulshof. The second is a reference to the Cradle to Cradle movement pioneered by Hamburg-based chemist Dr Michael Braungart and US-based architect William McDonough, which urges consumer products manufacturers to design recyclability and reusability into their wares

from the very start. No certified Cradle to Cradle leather has come onto the market yet, but Hulshof is carrying out trials with "a select group of customers" at the moment, Henk van Leussen says, and is ready to take the next step. "We are ready for certification," he continues, "but there is a cost implication and we need to know that the market is ready to support that."

Collagen colleagues

An important concept in Cradle to Cradle is that waste equals food, even if that means food for plants or insects that then contribute to the wider food chain. One of the latest ventures that Hulshof has embarked on takes this idea to heart. It has set up a new business unit called Hulshof Protein Technologies to produce from the bovine splits the tannery generates collagen that goes straight into the human food chain to give structure, texture and bite to products in the meat processing industry such as sausages, pâtés and hams. Under the commercial name Collapro, Hulshof currently has the capacity to produce 1,700



Overview of the tannery effluent treatment plant. This is situated near to the municipal treatment plant, and both are located on the same site in open countryside. CREDIT: HULSHOF

tonnes of the collagen fibre a year, with splits being sucked across a 20-metre pipe connecting the tannery to the collagen production part of the Lichtenvoorde facility. Around 20 people are working at this part of the plant; it's in operation 24 hours a day and is growing. Soya-based emulsifiers are competitor products, but the Hulshof team believes its use of hides gives it a strong advantage: the controversy over genetically modified organisms is alive and kicking in the soya sector, the presence of soya lessens the meat content manufacturers are able to claim for these products, and the taste is a challenge. Collapro can beat it on all these counts, the company claims. And it sees an unusual (for a tanner) extra benefit. Leather is a by-product of the meat industry, as everyone knows. Global demand for meat is strong and is growing, particularly in developing countries; it's clear, however, that packer firms are coming under pressure from many angles to tackle the carbon emissions associated with raising livestock—from use of land to methane emissions from cattle. Using meat replacement products to make some cuts of meat go further will allow the meat industry to feed more people

without increasing the livestock population.

Hide headaches

As a consequence, the availability of hides is going to decrease, Hulshof purchase manager, Adriaan Hendriks, believes. "The raw material situation in the tanning industry overall is very difficult at the moment and is only going to become more difficult," he says. "Everyone put the brakes on in 2008 and the price of hides dropped. It was unique. I have never seen that situation in 27 years in this business and I don't think I will ever see it again."

He has graphs and statistics on US hide prices that show a fluctuation of only 7%, from the lowest to the highest, over a ten-year period. It's not too much of a difference over that period of time considering the amount of shouting and posturing that goes on in the hide trading arena. "It's nonsense to have all that fuss every day to get the best price; it's making the whole industry crazy," he says. "It would be far better to agree to long-term stable prices. You don't even have to agree the price; you could just use the index system. It would bring the same result over time."

Penalty points

He calls the company's decision in 1990 to work only with fresh chilled hides as a very important one, and the driving force of an impressively strict logistics system that has stood the test of time. Just-in-time deliveries of hides arrive each morning at seven, eight and ten-thirty; there are no hides in stock. "That was the choice we made," he continues. "We were the first tannery in the world to move to fresh hides, but fresh hides are better quality, it's better for the environment because there is no salt in the wastewater and we are in an ideal location, so we thought, 'let's go for it'. It limits our sourcing options, but we don't regret the choice."

Typically, the hide suppliers only work with three or four abattoirs close to their own warehouses and, on transporting shipments to Hulshof, use cold air rather than ice in their trucks to chill the hides because ice can leave warm patches on parts of the material. In the summer months, Mr Hendricks applies his supply chain planning expertise to arranging for suppliers' trucks to travel at night so that the hides stay at the right temperature (anything above 10°C



would ring alarm bells). The whole operation requires high levels of trust and top-class communications, but also, it seems, an element of toughness on the buyer's side.

Adriaan Hendricks explains: "I'm not prepared to pay for excess baggage. I don't want tails and other appendages on the hides. Ten years ago, I started up my own penalty system, adding up the cost of these things in a consignment. I understand that the abattoirs and hide traders sometimes have seasonal workers and that sometimes their people are working at night with less supervision, that they're tired and want to get home. But I pay per kilo, so I weigh all the extra bits in a consignment and if the cost is more than €100, I claim the whole amount back. It was war at first, but it has paid off. I don't want to claim, but I do want suppliers to improve their trimming standards, so I wish more tanners would do this. Suppliers have come and looked at the system and have agreed it's fair. They can see how important this is, how much money is involved."

He points out that he hasn't had to submit any claims at all in the last six months, but still lets each supplier know exactly how they've done under this assessment method to keep

them on their toes. All the hides from one consignment stay together until after wet blue, so there is plenty of opportunity to put together feedback on quality. From this, and from his years of visiting and building up trust with suppliers, he has compiled a ranking of 21 potential providers of fresh chilled hides, but only nine of these are currently sending hides to the tannery. They all know the position they occupy in the ranking.

New possibilities

It's a strategy that has also opened up wet blue and wet white possibilities for Hulshof Royal Dutch Tanneries. Because of the quality of the raw material, tanners in other parts of Europe who are experiencing strong demand from, particularly, high-end automotive customers, are keen to have Hulshof wet blue or wet white to finish. "Beamhouses are disappearing," Mr Hendricks says, "and this gives us extra opportunities for the near future. A big part of our beamhouse production is being sold as wet blue or wet white; that's where the growth is. We've invested in our raw materials sourcing strategy and in our beamhouse and now opportunity knocks. We've invested, now it

looks as though we will be paid back. To be a high-quality end supplier of wet blue and wet white will be more and more our position. But we want to be genuine wet blue partners, not just contract tanners."

The aim at the Lichtenvoorde facility is to try to get the highest possible yield from the hides it brings into its beamhouse. The investment in big machines is high (see technical sections for more details) and the purchase manager explains that the company looks to its machinery and chemical suppliers to share their knowledge to make sure each machine works as well as it possibly can in the Hulshof set-up. "The machines should be long-lasting and focused on our type of production," he adds, "high-value, large surface hides for upholstery applications. The technology has to be equipped for this task."

Hulshof only tans the grain split. As well as passing belly and shoulder splits to the Collapro spin-off, double-butt and croupions are made available to other tanners. "We only want the kind of quality the grain of the bull hide can give," Mr Hendricks continues. "For us there's no use in buying cow hides because we don't want to get into a price competition with tanners in China."

Special care

There is a quality consideration in the new focus on the food industry. Dr Hulshof explains that an important implication for the tanning side of the business is that hides have to be handled in keeping with food safety regulations; the hides require special levels of care, but helps his company produce higher quality leather.

The hides' freshness and food-safety levels of hygiene are a help in Hulshof's relations with the local community. The tannery is in a busy, residential part of Lichtenvoorde, surrounded by houses, shops and other businesses. This is the third location the company has had in its history; two previous sites, even closer to the historic centre of the town, were short-lived because of gentle pressure from local people. When it moved to its current location, there was only farmland in the immediate environs. In the 1970s, new houses went up on that land, the closest of them only 30 metres from the tannery's effluent treatment plant. Odour control was an issue in the company's attempts to maintain good relations with its neighbours and was one of the main reasons for setting up the pipeline and the new effluent treatment plant two kilometres away. The segregation of the main processing streams has helped eliminate any odour problems. The current building, with an attractive brick front, dates from 1919 and is quite an icon in the town. 🌍



The site is odour free and noise levels are very low. Housing is close to the tannery, and there are flats on the other side of the wall that overlook this small on-site garden, which can be reached via the customer reception rooms.