



Innovation

Part 4: Making the most of resources

Twenty world standard tanneries have opened their doors for in-depth study as part of the global Tannery of the Year Awards programme launched by the publishers of World Leather in 2009.

Considerable technical information was published following these visits.

Overviews of good practice have also been reviewed concerning:

- *Recycling and regeneration (Part 1: October/November 2011).*
- *The conversion of waste solids into useful products (Part 2: December 2011/January 2012).*
- *Examples of mechanisation in the movement of hides (Part 3: February/March 2012).*

Part 4 concludes this series with other examples of innovation in practice, where tanners have addressed various issues by making the most of their resources. These examples are sometimes unique to a single individual organisation and at significant cost, but often these measures are common to these tanneries and could be applicable to many others.

The listing is set down in order of date of original publication, and these dates are included for easy reference to the original profiles on each tannery.

1. Avoiding odour: Bridge of Weir Leather, Renfrewshire, Scotland, UK. (WL Jun/Jul 2009)

All of the effluent treatment tanks on this site are capped to contain odour. This includes the reaction vessel for the activated sludge treatment process, and the associated clarification vessel.

Air is usually used as the oxygen source for this biological stage, but in this situation it has been replaced by pure oxygen that is produced on site. This reduces the volume of air that is normally offered to the process, as the excess volume when using air (80% nitrogen) tends to flush volatiles and aerosols from solution, thus encouraging the spread of odour.

The air from the top of each tank is extracted through ducting, and the emissions passed through a wet chemical scrubbing unit to remove these soluble gases that create odour. The gaseous emissions, moisture/aerosols from the scrubbing unit, and air extracted from the buildings housing the dewatering centrifuges, are finally processed to remove trace odour by being passed through a wood-chip bio-filter (*image*). Here aerobic/anaerobic bacterial cycles within the woodchip mass break down residual compounds into carbon dioxide and moisture. ☺



2. Energy savings with partners: Josef Heinen GmbH & Co KG, Wegberg, Germany. (WL Jun/Jul 2009)

In addition to in-house techniques to minimise energy use within manufacture, Josef Heinen has worked with partners to further minimise its carbon footprint.

A new route for treating limed fleshings has been investigated and put into practice where the fleshings are used together with farm and other waste for bio-energy production. Here the alkalinity of the fleshings is useful as it offsets the more acid pH generated by the other major components that normally make up the feedstock for bio-gas production. The methane is used to generate electricity; the energy values of the fleshings can be calculated then deducted from energy used per unit area for each type of leather that is made.

Another opportunity concerns the delivery of hides, where all of the transport used is of high quality to ensure minimum energy use. In addition, all of the hide containers are of uniform size and manufactured from aluminium to reduce tare weight in delivery and the return/reuse of containers. These containers are used exclusively for transport, and on arrival at site the hides are transferred to more substantial stainless steel containers for in-house movement of hides. ☺





3. Happy sheep: Pittards-Ethiopia Tannery Share Company, Ethiopia. (WL Aug/Sept 2009)

In 1990 the flock of Ethiopian sheep was approximately 27m, and the human population was about 50m people. Today the flock is still approximately 27m sheep and the human population is approaching 80m. The off-take from these sheep is approximately 33%, being directly related to the reproductive rate of about 37%, whereas the corresponding rate for New Zealand sheep is taken as 180%.

Pittards have worked closely with different Aid agencies and the Ministry of Agriculture in Ethiopia to find a way forward, and have been involved in many studies over the past 15 years.

About two years ago they bought their own flock of sheep and applied all the best practice techniques to scale up the project work. Results so far are very impressive with gains in meat yield of 25% and premium skin selections up from less than 20% to 80%. Animal health is much improved and mortality rate reduced. The next phase is to scale up to a full farm with up to 10,000 sheep for use as an exemplar farm to illustrate best practice. 🌱



4. Traceability and Value: South Cape Ostrich Tanning, Mossel Bay, South Africa. (WL Aug/Sept 2009)

Each ostrich skin is tagged with a microchip and given an identity number at the abattoir, and this identity is maintained throughout the whole leather making production process. As the skin progresses throughout manufacture, the production history of each skin in terms of process detail, operation and operative is recorded. This continues to the crust state so that a full profile on each skin is thus available. This includes area on receipt and at crust, thickness, quality, production history and value. Once the leathers are dried, and finally measured, the tags are removed and replaced by a bar code.

This system ensures that the true value of the stock is known at any time, and its potential for any customer requirement. Each skin can be traced back to the individual farmer, forming a base for a fair reward scheme based on quality and area. It takes into account good stock husbandry and care. 🌱



5. Pristine finishing operations: Simona Tanning, Huihou, Guangdong Province, China. (WL Oct/Nov 2009)

Roller coating machines are used for applying hot wax to create classic pull-up effects on a range of leathers. At Simona, the preheated wax is stored in an adjacent heated cabinet, and then moved as required to the roller coater in a container fitted within an electrically heated jacket. When in position, this is plugged into an electrical socket at the machine to accurately maintain the temperature of the melted wax.

It is a difficult and time consuming operation to maintain machinery and its surrounding area in a clean condition with this type of finish application. In this situation, these problems of have been resolved.

This has been achieved by positioning the roller coater and ancillary equipment on a stainless steel grid set at floor level (*image*). After each application, the roller coating machine is washed and cleaned with solvent, with the washings collected in a trough beneath the grid. These washings are then pumped away for distillation; the solvent is fully recovered for reuse, and the wax made available for further selected finish applications. 🌱



**6. Energy and water management: ISA TanTec, Guangzhou, China. (WL Oct/Nov 2009)**

Energy management includes replacing air cooling with heat exchangers on setting operations (*image*), and monitoring the electrical energy - including light - consumed by each individual machine. Similarly, water use is monitored as a total, and within defined areas on a daily basis. All wet end formulations shows water volume as well as energy targets, and every worksheet shows electricity and steam targets for each of the work steps. This information reveals target and actual water/power consumption for all individual operations and in total.

Because of this transparency the company is able to give clear values relating to environmental impact expressed as water and CO₂ Kg/1,000 sq.ft. for each product type and at different substances. This information is presented within sales data for every type of leather manufactured. This enables customers to make choices regarding the water consumed and carbon footprint for each leather product, and adjust their purchases according to environmental classification. ☺

**7. Avoiding contamination in dyeing operations: Curtiembres Fonseca, Buenos Aires, Argentina. (WL Dec 2009/Jan 2010)**

Avoiding contamination within the dyeing operation and department has been addressed in several classic ways.

The wall at the rear of the row of elevated drums is fully fitted with white tiles that can be easily maintained to ensure cleanliness. As it is not practical to tile the plinths due to vibration, each plinth is wrapped with heavy duty polythene sheeting which is changed regularly.

All the residual floats from processing stages are discharged into deep collection troughs fitted close to the drums to avoid splashes, and then delivered using horizontal pipework through the tiled rear wall before discharge into the drainage system. This means that the only washings introduced to this area is from the final wash at the time of unloading the goods into stainless steel trucks placed below each drum.

During process, all of the floats are circulated through filter screens fitted to each drum, with the filtered solids delivered by enclosed chutes to floor level for collection in uniform sized polypropylene bags. These bags are fitted within cages, which in turn are set back from the drum line between each pair of drum support plinths so that the bags are protected and thus avoid damage and spillage. ☺

**8. Addressing water shortage: Procesos Húmedos de Lean SA de CV, Leon, Mexico. (WL Dec 2009/Jan 2010)**

There is a shortage of quality water for the tanneries in Leon, and the municipal supply for the tannery needs support from tanker loads of water that are delivered to site. This problem has been addressed by PHL by the installation of systems for reusing pickle and deliming liquors from process to save water, but also to minimise salinity in wastewaters discharged from site.

More than 250 tanneries have been relocated in the same area as PHL, and the Leon Municipality has made massive investments in common effluent treatment for these tanneries. This treatment is specifically designed for water reuse by these tanneries. If the salinity of the in-feed tannery effluent is too high, then the concentration is diluted at the point of receipt using end-of-pipe discharges from the adjacent state-of-the art municipal waste water treatment plant.

PHL manufactures to the wet blue state, and is the first of the tanneries to receive a small percentage of this treated effluent after ultra filtration and chlorine dosing. This dedicated supply is checked for bacteria, salinity and pH by both the municipality and the tannery. It is the company objective that this supply will eventually rise to 90% recycled water and 10% mains supply. ☺



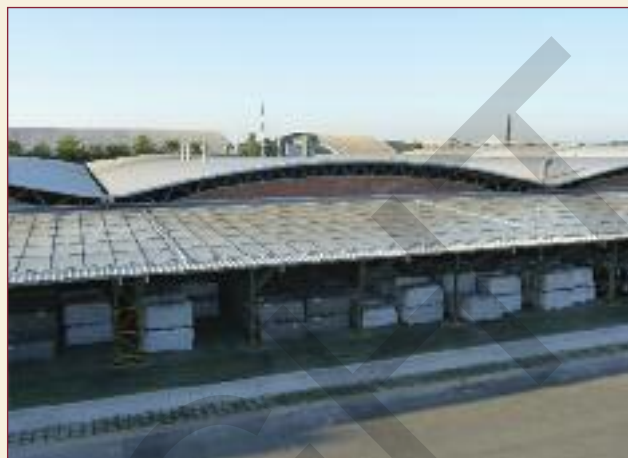


9. Sun-powered tanneries: PrimeAsia, Ba Ria, Vung Tau, Vietnam. (WL Feb/Mar 2010)

Considerable savings in heavy fuel oils are being made by PrimeAsia Vietnam by the installation of solar energy systems. In this example, 768 solar panels, each 2 x 1 metre, have been set on a covered area at the side of the main tannery. The system is capable of raising 75m³ of water from 25°C to 75°C each day, and this is fed into two heavily insulated hot water storage tanks each of 25m³ capacity set beneath the solar array. In addition, six smaller tanks of 15m³ capacity are placed within the tannery.

The system is operated by filling the six smaller tanks from the external hot water supply, then if required, the temperature of this water can be boosted using live steam. This provides enough water to meet the needs of the plant until the solar supply is refilled.

(Solar systems are very expensive to install, and in this example cost \$500,000. However, at the time of these profiles three other tanneries were using full-scale solar systems, with two more investigating the potential on large pilot-scale). ☉



10. In-house quality circles: Tata International Leather Business Unit, Dewas, Madhya Pradesh, India. (WL Feb/Mar 2010)

As part of a continuous product improvement scheme, a number of quality cycles have been put into operation. This comprises staff working with the workforce to identify ways to reduce damage caused within operations, improve the outcome, make the operation more efficient, and reduce energy demands. Continuous assessment takes place throughout the factory where problems are identified, then analysed, and the solution applied.

There are many examples of success. One example involved the buffing operation, where at the end of the evaluation machine damage to the skins was reduced by 80%. This not only involved changing the feed technique, but the speed of the machine was reduced by using a different pulley arrangement, and the size of the drive motor reduced. In addition to product improvement, an energy saving of 50% was gained, and has now been applied to all buffing machines.

In another exercise the energy consumed within the finishing department on the finish line steam heated drying cabinets has been studied. This has led to a decision to replace all of these units with infra-red drying cells. ☉



11. New generation tannage: Heller-Leder, Hehlen, Germany. (WL Dec 2010/Jan 2011)

Both chrome tanned and wet-white leathers are manufactured at this tannery to the finished state, but a new type of leather known as Wet-Green® is now being produced on a commercial scale. Following development work by N-Zyme BioTec together with Lederinstitut Gerberschule Reutlingen, Germany, the tannage has evolved into commercial production in a way so that the conventional acid/salt pickle stage can be avoided.

Based on extracts from leaves and other residues from olive oil harvesting, not only are these leathers free-of-chrome and aldehydes, but can be seen as a “new generation tannage” as the use of common salt in processing is eliminated. Salinity remains probably the greatest environmental issue that must be addressed by many tanners, and this breakthrough has set a “free-of-salt” standard for other suppliers and tanners to match. ☉





12. Energy from effluent: Hulshof, Lichtenvoorde, The Netherlands. (WL Dec 2010/Jan 2011)

Screened effluent from the tannery is delivered directly into a high speed anaerobic digester where it is retained for one-day at a temperature of 35°C. Biogas - mainly methane - is produced from this process and is collected from the top of the reactor, then wet-scrubbing to remove hydrogen sulfide gas.

The effluent is further processed in a second sealed reaction vessel for sulfur recovery. Here, the hydrogen sulfide that remains dissolved in the effluent, together with sulfide containing wet scrubbing, is bio-oxidised to form sulfur using controlled air injection. The sulfur is recovered from suspension in the form of a wet sludge that settles at the base of separation tanks. The effluent is then treated to biologically convert nitrogenous components into nitrogen gas. The treated effluent is then discharged for treatment with municipal sewage at an adjacent site

Between 3 – 5 million m³/day of biogas is produced each day, and part is used to maintain the temperature in the anaerobic reactor. The surplus is used to generate electricity for the national grid. It is planned to pipe this methane to the tannery as a direct source of energy, but in the longer term to link this methane production into a gas-grid system with other companies. ☉



13. In-house training and information: TehChang Leather Products Ltd, Taoyuan, Taiwan. (WL Feb/Mar 2011)

This family business, now in its fourth generation, is fully focused on side leather manufacture from salted hides for shoe upper leathers. It is fully equipped in terms of plant, equipment and control systems, but in addition it has created a department dedicated to information and education. This is used for the training of new employees, but also acts as a centre for the provision of courses that provide a better understanding of leather for customers.

Over the years, the company has developed a comprehensive technical library. This includes a full record of leather related technical literature including ALCA, World Leather, and Chinese publications. This is available for both training purposes and for technical reference as appropriate.

This information centre and library is located next to the two accredited laboratories and the extensive records department where all details of production and analysis/performance of each batch of production are centrally stored. ☉



14. Energy from wood waste: PT Budi Makmur, Yogyakarta, Indonesia. (WL Feb/Mar 2011)

This tannery processes raw and pickled sheepskins to the finished state for gloving and footwear leathers. Energy savings are made by using natural air drying as far as possible within the various drying stages before finishing operation. Sometimes this drying needs support, and on these occasions energy/heat is required. In addition, energy is also required for heating process water.

The city of Yogyakarta, where the tannery is located, is a centre for wood craft and furniture manufacture, and the tannery has installed a wood burning hot water plant. This consumes approximately 6m³ (0.5 ton/m³) of off-cuts (*image*) from these industries as mango, coconut, jack wood and bamboo as these cannot be used for any other purpose.

This wood burning plant was manufactured locally to the tannery specification, and is being used as the source of heat for wet processing and drying. This has saved approximately 400 litres of heavy fuel oil per day.

(In addition to energy from wood, tanners are purchasing steam from specialist companies that generate steam on site from wood chips and building waste, and from companies managing steam-grids to industrial estates. Hot water is also being provided from geothermal sources). ☉





15. Reverse osmosis: Xingye Leather Technology Company, Jinjiang City, Fujian Province, China. (WL Apr/May 2011)

This is a major tannery processing salted hides to the finished state, and there are limitations on the volume of water that can be discharged from the site. Approximately 3,000m³ of water per day is required for leather manufacture, but a reverse osmosis (RO) plant installed one year ago enables 50% of the treated tannery effluent to be recycled within the leather making processes.

This operation can only take place after particularly extensive effluent treatment to reduce the total dissolved solids to the minimum level possible, and to minimise any suspended solids to avoid blockage of the membranes used in the RO process. After RO, the concentrated component of the treated effluent is discharged into the city sewage system for ultimate marine discharge about 30 km from the tannery.

(There are many examples of the use of reverse osmosis for treating effluent, with the permeate being reused in leather making processes. In this situation, because manufacture starts with salted hides, the total salinity is considerable higher than found where leather manufacture begins from the wet blue state). ☉



16. Generating down-stream value: Gansu Hongliang Leather Limited, Guanghe County, Gansu Province, China. (WL Apr/May 2011)

This is a new and unusual tanning operation as its roots are firmly in hide collection, an enterprise started more than 20 years ago. This collection was expanded into a substantial network that now extends up to 500 km from the centre of operations, where hides are purchased from farmers and small slaughter houses. The network operates through 16 hide stores across the region within the geographical centre of China, and the whole system is strongly based on experience and a trust between the organisation and the farmers.

Instead of remaining a hide supply source to other tanners within China, it was viewed that a logical step for the company would be to add value by converting the hides into leather. Construction of a new tannery began in 2008 at a central and strategic location near to the major highway in Guanghe County, Gansu Province, and adjacent a site designated as a major state-owned collection point for hides and leather. The tannery is producing 3,000 hides per day to the wet blue and crust state, and has since extended into leather finishing at a new plant near to the shoe factories in Guangdong. ☉



17. Adding value through retail: Nakara, Windhoek, Namibia. (WL Jun/Jul 2011)

Game and exotic skins – all within CITES certification – are a major component of manufacture at Nakara. Production includes African bovine hides, oryx and kudu as soft full aniline furniture leathers, where natural defects such as scratches and defects work well with rough-wood furniture.

However, the operation also includes a design, cutting and stitching unit that employs about 20 people. This is used to manufacture a wide range of leather garments, bags, belts, accessories and products. Other goods includes game skins such as zebra and springbok which are trimmed, sewn as necessary, and flattened for wall decoration and rugs, and various animal horns that have been sterilised and polished.

These goods are either exported, sold directly from the factory shop, or through retail shops for tourists that are owned and managed by the company.

(Many other companies extend leather manufacture both on site and through separate manufacturing units by making leathersgoods, bags, cases, accessories, and garments including made to measure services). ☉



**18. Colour by nature: Elico, Addis Ababa, Ethiopia.** (WL Jun/Jul 2011)

Hair recovered from hair-sheep skin production at Elico has value. On receipt, in addition to trimming and selection to four quality grades, which in turn are sub-divided into four weight ranges, the sheepskins are segregated according to hair colour – black, brown and white.

After lime painting for hair loosening, then mechanical hair removal, the hair is maintained separately according to colour. It is then paddle-washed in batches, drained on pallets, then spread on a concrete base to naturally air dry. Once dry, the hair is then stored until the stock is of suitable volume, then compacted using a baling machine. The compressed hair is then packaged using hessian into bundles of uniform size.

This hair is distinctly coloured, and needs no artificial dyeing, and is used for local blanket and garment manufacture. ☉

**19. Self-sufficiency in energy: Coming Industria e Comercio de Couros, Trindade, Goiás, Brazil.** (WL Aug/Sept 2011)

This company has heavily invested in systems to recycle both water and chemicals from used lime/unhairing liquors and exhaust chrome liquors.

In addition to these measures to minimise materials consumed, a state of the art wood burning steam generation plant has been installed. This provides all of the steam requirements for the tannery, and for the adjacent rendering plant that provides oil/grease/animal feed and fertiliser from raw and limed fleshings from wet blue manufacture, but also processes all of the bones from supply abattoirs. At the present time the logs used for fuel are purchased and brought to site by companies that provide pre-cut wood from renewable resources.

However, the tannery has recently planted 100,000 eucalyptus trees on land owned by the company. With growth and coppicing managed on a six year cycle, it is the intention of the tannery to use this wood to become fully self-sufficient in terms of energy use. ☉

**20. Fit for purpose: Artículos de Piel Los Favoriros (B'Leather), Dominican Republic.** (WL Aug/Sept 2011)

All of the dye/retanning vessels are elevated and serviced from an overhead mezzanine. Liquid additions are via stainless steel feed hoppers, using Prodomix liquid chemical dosing and Aquamix water systems. However, the vessel configurations found within this dyeing department is intentionally diverse.

There are nine full size wooden drums, and five Dose stainless steel tri-compartmental vessels. Three of the wooden drums and one Dose vessel are fitted internally with steam heating jackets, and the feed containers for these drums are also fitted with steam jackets so that liquid waxes can be offered to the leathers in process and the temperature maintained. One of the wooden drums is fitted with shelves, the rest with pegs only. The internal structure of the Dose vessels is conventional with extended pegs in each section. These variables enable the right degree of mechanical action to be applied to suit specific leather types and to meet technical needs.

To complement this degree of attention to processing detail and to ensure cleanliness, all of the stainless steel vessels are cleaned externally using an automatic spray wash after each load is discharged. The wooden drums are washed once per week, then swab-oiled to maintain condition. ☉

