Making industrial history
by Natasha Spencer

On 12 January this year, Finnish forestry company and renewable energy producer, UPM started commercial production at its biorefinery in Lappeenranta, Finland.

In 2008, with the popularity of printing paper declining, the company decided to transform itself in a bold way. Biofuels was a prevalent trend and UPM had suitable residues available from their own production as feedstock so it became a clear option. This venture was made easier by the site’s existing 140 year-old pulp mill site, which creates a significant amount of crude tall oil as a residue of pulp production that can be utilised for renewable diesel production.

The forest company, which wanted to build value and participate in the industry’s development of advanced biofuels, made a breakthrough to develop processes and technology and so subsequently went on to advance its operations in the sector. ‘UPM’s established supply chain, and knowledge of wood-based raw material, industrial processes, and sustainability, enabled the relatively fast entrance into biofuels,’ says Sari Mannonen, international sales and marketing executive, UPM Biofuels.

At a time when other producers were focusing their efforts on utilising traditional feedstocks, including soyabeans, rapeseed and canola, UPM took a leap of faith into the commercially-unknown world of wood-based renewable diesel.

Two main drivers affected the decision to locate the facility in Lappeenranta, Finland. Firstly, when the company decided to enter into the advanced biofuels market it conducted a feasibility study to ascertain the different location possibilities available. It quickly became apparent that the best option was Lappeenranta as the plant would be able to utilise its onsite mills and R&D centre. The onsite pulp mill – one of the biggest in Finland – offers ongoing advantages in feedstock availability. With its pulp, paper and saw mill, biomass power plant, and R&D centre all nearby, placing the biorefinery in Lappeenranta was a natural choice for the wood-based producer as its locality enables it to use UPM’s own local raw material, people and energy. Secondly, it became clear from initial discussions that the facility would be best placed in Europe to maintain close links with European and domestic markets.

UPM’s production levels do not affect global crude tall oil market as the biorefinery is a minor addition to the global demand and UPM uses its own production residue by increasing the processing value of wood biomass. The Finland-based producer can also use a lower-quality form of tall crude oil not suitable for further processing by the chemical industry.

‘One of UPM’s key values is to renew with courage and to have now reached commercial production as the world’s first-of-its-kind renewable diesel biorefinery is a massive achievement,’ says Mannonen.

Getting ahead of the curve was achieved by producing advanced biofuels from residues and waste, and not competing with food-production, also favoured by current legislation. With 25% of the world’s forests located in Europe, large-scale sustainable biofuels production from wood feedstock is competitive when compared with European renewable energy production. The forest industry is also one of the few industries that has enough capacity to undertake development work and invest in biofuel production on a commercial scale.

With a GHG emission reduction of 80% compared to fossil fuels, UPM’s wood-based renewable diesel, UPM BioVerno, has a significant impact on the environment. Yet, it functions just like fossil diesel in all diesel engines, without the need for any modifications.

As such, the plant has been open to public discussion and has received a warm welcome. Over the past decade,
The total investment of the Finnish biorefinery was €175 million and came solely from UPM without public investment funding.

Legislation has not considered the use of land in the pursuit of fuel instead of food. However, in the coming years, policy will concentrate on favouring biofuel growth that does not conflict with food production. ‘Although the positives of wood-based feedstock utilisation far outweigh the negatives, the move may be challenging for new companies entering the sector,’ adds Mannonen. ‘In addition to having an existing supply chain, access to raw material and modern technology, a responsibility in all operations is essential.’ To constantly improve operations, it is important to engage stakeholders, from customers to environmental and non-governmental organisations (NGOs), such as WWF. ‘We started collaboration with WWF Finland on the biofuels prior to production to promote a discussion about the environmental impacts and opportunities of advanced biofuels and have recently published joint measures to promote sustainability of wood-based liquid biofuels.’

A number of small challenges appeared throughout the construction and start-up process. Safety must come first, above any financial targets and oil refining government processes. The commissioning of the biorefinery was expected to reach completion by the end of 2014, but safety and process issues had to be ironed out before commercial production could officially commence in early January 2015. ‘This was a turning point for the company as it had to combine different knowledge sectors including wood-processing, chemistry and oil refinery processing with the complete construction of the biorefinery,’ says Mannonen.

The biorefinery has been in talks since 2012, when UPM announced to invest in the Lappeenranta Biorefinery. In summer 2014, following the planning stages, the company completed the construction of the biorefinery. Then, in autumn last year, the commissioning started in phases. It is not possible to commission simultaneously all the individual parts of the facility, such as the hydrogen unit, pre-treatment unit and hydrotreatment unit. Commissioning each part individually enabled the comprehensive testing of temperature and pressure factors to ensure there were no leakages. Once this phase-by-phase operation was complete, commercial production could begin.

UPM partnered with Danish-based technology and catalyst provider Haldor Topsoe in the development of the hydrotreatment unit. In addition, 200 different supply agreements were sought to cover all aspects of the plant from supplying the 50km of piping that runs through the plant, to the electrical installation. The whole process, from the feedstock and its innovative pre-treatment to the final product was developed by UPM.

The plant, which received a total investment of €175 million, came solely from UPM who did not apply for public investment funding. ’UPM’s aim is to be the major player in advanced biofuels, and so the focus is now on ramping up production,’ says Mannonen. ‘It aims to run up to full production, which is 100,000 tonnes – or 120 million litres of renewable diesel per annum – as soon as possible.’

Biofuels are heavily regulated. The Renewable Energy Directive (RED), which has recently celebrated its second birthday, and the Fuel Quality Directive (FQD) are fundamental to the sustenance and growth of the market. The associated Indirect Land Usage Change (ILUC) Directive is currently under development, and the industry is heavily reliant on that taking place sooner, rather than later.

Focus now needs to shift towards creating legislation that advocates the production of advanced biofuels. Europe must have clear, progressive targets to ensure certainty and enable future development.

At present, the renewable energy target throughout Europe sits at a 10% share of renewable energy in the transport sector by 2020. Finland’s goal, however, is double this and so the country must reach a 20% share of renewable energy in the transport sector by 2020. Despite these aims, there is no formal mandate after 2020 and so further targets, including a sub-target for advanced biofuels are required.

‘Lack of long-term regulation and certainty regarding advanced biofuels requires an EU-wide legislation beyond 2020, rather than the fragmented market that exists at present,’ says Mannonen. ‘European companies are world leaders in developing pioneering technology and European industry is ready to meet these targets. However, new investments are put on hold or go somewhere else as no predictions can be made, and this is the biggest threat that the advanced biofuels industry currently faces.’

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