



# RINTEKNO *Newsletter*

November 2006

## REFINING OIL AND BIOMASS – CREATING AN INVESTMENT WAVE

Oil and biomass refinement is experiencing an upward trend all around the world. Existing oil refineries are modernized and brand new “grass root” refineries built to satisfy the continuously increasing demand and higher quality requirements for oil products. At the moment, biomass refineries are designed and built especially to meet the need to increase the renewable biocomponent content in fuel for traffic and transportation vehicles.

### PLENTY OF PROGRESS IN JUST A YEAR

In our previous newsletter, we looked at the future prospects for the use of renewable raw materials in the production of biofuels, biochemicals and energy. A year later, we can point to concrete evidence of fast progress.

Neste Oil, already building the first biodiesel facility in Finland, has stated in its strategy the goal of becoming the leading biodiesel producer in the world. Altia Corporation has announced plans to build Finland's first bioethanol plant that uses grain-based raw material. Neste Oil will use the bioethanol produced at the plant to manufacture ETBE gasoline component, whereas the animal feed by-product will be purchased by A-Rehu. There are also several other bioethanol projects in planning stages in Finland.

### FACTORS AFFECTING BIOETHANOL PROFITABILITY

The profitability of bioethanol production strongly depends on ethanol's world market price as well as the prices that can be fetched for the feed components. The significant cost factors affecting the “refinement margin” include costs of raw material, energy, capital and financing.

Profitability can be enhanced with technological solutions that improve the total yield and energy integration of the facility. The location of the facility can also provide competitive advantages in the form of existing infrastructure and logistics systems.

### THE BIOMASS REFINERIES OF THE FUTURE

A lot of research and development work and new innovations are still needed before the so-called biomass refineries of the future can be designed and built. Possible raw materials for such facilities besides grain-based feedstocks include by-products and surplus biomass from agriculture and forest-derived biomass.

It has been estimated that in the future the commercial-scale biomass refineries will be industrial integrations that produce biofuels, biochemicals, feed, pharmaceuticals and bioenergy more economically than before – and according to the principles of sustainable development.

### DEMAND FOR ENGINEERING & CONTRACTING

The investment boom in oil and biomass refineries provides increased potential demand for Engineering & Contracting companies, equipment and system providers, and contractors specializing in the field. These operators can expect an upturn in business in the coming years.

In this newsletter we will tell you, for example, how Rintekno Group is involved in the refinement of both oil and biomass. We will also introduce Kotka Control Oy – the new company in our group. In the news section, you will find reviews of selected customer projects.

Olli Gerdt  
President, Rintekno Oy

# TOTAL SOLUTIONS FOR CHEMICAL PROCESS AND LIFE SCIENCES INDUSTRIES

Rintekno has provided total solutions for chemical process and life sciences industries from 1970. In recent years, a series of references indicate not only Rintekno's long experience in

serving industry in different investment projects but also the changing trends in industrial development and living standards. The following include different Rintekno services available to

product plant investors, from the idea phase to the commercial realization of a production plant.

IDEA PHASE	LABORATORY PHASE	PILOT SCALE PHASE	INVESTMENT PLANS	IMPLEMENTATION PHASE
<ul style="list-style-type: none"> <li>• Prestudies</li> <li>• Technology survey</li> </ul>	<ul style="list-style-type: none"> <li>• Initial process and reaction modelling and flow sheeting to support the process concept development</li> </ul>	<ul style="list-style-type: none"> <li>• Supply of pilot plants</li> <li>• Modelling and flow sheeting</li> <li>• Scale up criteria</li> <li>• Process development</li> </ul>	<ul style="list-style-type: none"> <li>• Feasibility studies</li> <li>• Permitting support</li> <li>• Basic engineering</li> <li>• Location studies</li> </ul>	<ul style="list-style-type: none"> <li>• EPCM services</li> <li>• Construction services</li> <li>• Turnkey deliveries</li> <li>• Automation and process information systems</li> <li>• Start-up services</li> <li>• Life Cycle Services incl. document management</li> </ul>



## EXAMPLE REFERENCES

### 1970–1980

Basic chemicals, growing market for bioproducts. An era of increased glue resin consumption, indicating improved living standards (chip-board for furniture).

- Stymer Oy 1971–72, polystyrene plant
- PRIHA OY 1972–74, formaline plant, urea formaldehyde resin plant
- Oy Alko Ab 1974–76, enzyme plant

### 1980–90

More fuel needed, speciality chemicals, pharmaceuticals. An era of quality and safety systems, computer-based control systems, and cars as the measure of living standards.

- Neste Oy 1984–85, CCR-platforming and several other projects
- Bergvik Kemi Ab 1982–83, rosin derivative plant, Sweden
- Pharmacia AB 1983–86, synthesis plant, Sweden

### 1990–2000

Cleaner production technologies, functional foods. Clean nature and healthy living are important; pollution prevention pays.

- Fortum 2000, gasoline desulphurization
- Roal Oy 1992–93, enzymes production plant
- Xyrofin (Danisco) 1996, xylose plant, Austria
- Mildola Oy 1997–98, edible oil refining plant
- Raisio Benecol 1998–99, stanolester plant USA

### 2000 ONWARDS

Smart and safe medicine, sustainable development continues. Advanced ICT is within reach of industry and ordinary people.

- Finnish Red Cross 2002, Nanogam (IV IgG)
- Forchem 2001–04, new CTO distillation plant
- Neste Oil 2004–2006, biodiesel plant
- Danisco 2006–2007, xylose plant extension

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**Reino Kalmari**  
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# NESTE OIL AIMS TO BECOME THE WORLD'S LEADING BIODIESEL PRODUCER

Neste Oil's Board of Directors has approved a strategy aimed at making the company the world's leading biodiesel producer. The board concluded that a strong growth strategy, based on biodiesel production and driven by Neste Oil's own technology, is the best way of generating shareholder value.

"The central message that we want to communicate is that we have both the will and the financial resources to invest in growth in the areas where we are strong. By following our strategy, we will make the best use of our know-how. We are aiming to be the world's leading biodiesel producer, which means production volumes of millions of tons annually. Our proprietary biodiesel, which is based on a long-term R&D effort, can be produced from a variety of vegetable oils and animal fats and is a premium-quality fuel that clearly outperforms both the vegetable oil- and crude oil-based diesel fuels currently on the market", says Neste Oil's President & CEO, Risto Rinne.

## HEAD START OVER COMPETITORS

Neste Oil has been very active in launching cleaner petroleum products that have been based either on proprietary technology or the rapid introduction of other new technologies. The most recent example of the company's pioneering role is Neste Oil's premium-quality biodiesel that gives the company a head start over its competitors.

The company says that this improved biodiesel, called NExBTL (Biomass-To-Liquid), is a 'second-generation biofuel'. Not only does NExBTL outperform other biodiesels such as Rapeseed Methyl Ester (RME) and Fatty-Acid Methyl Ester (FAME), both of which are growing in popularity in Europe, but it is also superior to all currently available mineral diesels.

Free of aromatic and sulphur components, NExBTL contains no oxygen, has excellent oxidation stability – which means very good stability in storage – and a very high cetane number, which provides faster fuel ignition in the engine. Unlike RME, NExBTL diesel is a clear and colourless paraffine. It does not require special engine modifications or foul systems in the way ester biodiesel can.



The leading diesel engine manufacturers Man and Scania have tested the product. The results show that the NExBTL diesel fuel is even better for the engine and produces less emission than mineral diesels, and is comparable or even slightly better than the synthetic Gas To Liquid (GTL) diesel fuel produced from natural gas.

## OPERATIONAL PLANT NEXT SPRING

The first biodiesel plant, under construction at Neste Oil's Porvoo refinery, will be started up during next spring, with an annual production capacity of 170,000 tons. The total investment of about 100 million Euros includes raw material storage for vegetable oil or animal fat, product storage, the pretreatment plant to clean the feedstock, and the production unit itself.

The plant can use a number of feedstocks without variation in product quality. Both vegetable oils – including rapeseed, palm and soybean oils – and animal fats, in principal any fatty acid hydrocarbon, can be used.



The raw material will be transported to the plant mainly by tankers – some domestic material by road tankers. The pretreatment consists of much the same type of cleaning as for the food industry or to RME-type biofuel. After cleaning, the oil and fat are kept warm and pumped to the biodiesel unit. There, the first step after heating is a catalytic reaction under a hydrogen atmosphere, where the big oil and fat molecules (triglycerides) are cracked down and hydrogenated to pure paraffinic oil and, as by-products, some water, carbon dioxide and fuel gas.

In the second catalytic step, the paraffinic oil is tailored for cold properties depending on the season and user requirements, normally to a cloud point between -5 to -30°C. The last step is distillation, where the product is stabilized and the light components are sent to other refinery units.

## RINTEKNO HELPS KEEP PROJECT ON SCHEDULE

The biodiesel plant project is managed by Neste Jacobs, with Rintekno Group responsible for detailed engineering for the whole project. Rintekno is in charge of plant engineering, piping and steel construction, while Systecon handles instrumentation, automation and electrification. Rintekno has also participated in process engineering, even in the basic engineering phase, and in equipment engineering.

At the time of writing the project is on schedule, with the main part of the equipment erected and piping and other installation works well ongoing. The last parts of detailed engineering will be finalized in October. This project testifies well to the capabilities of Rintekno Group as a leading engineering and contracting partner for biofuel technology in general.

**Erik Söderström**  
Project and Marketing Director, Rintekno Oy

# WORLD-SCALE HYDROGEN PLANT FOR NESTE OIL

Neste Oil's Porvoo refinery is making one of the biggest investments in its history – over 650 million Euro – in a totally new production line. The purpose of the Diesel Project is to convert bottom oil, which currently ends up as heavy fuel oil, into sulphur-free traffic fuel, primarily diesel. Hydrogen plays a key role in the process, and the new line features one of the largest one-line hydrogen facilities in the world. With the new production line, the refinery will be ranked one of the most efficient in Europe.

The main unit, with a capacity of about 280 t/h, is a heavy residue conversion unit, which produces sulphur-free high-quality diesel fuel. The unit operates in a hydrogen atmosphere under high pressure and temperature. The hydrogen plant to fulfil the huge need for hydrogen, up to 150,000 Nm<sup>3</sup>/h, is licensed by UHDE GmbH. The technology is called steam reforming, and the feed stocks to the unit are natural gas, refinery off-gas, liquid propane and steam generated in the unit itself.

## THE PROCESS – RESULTING IN OVER 99% PURE HYDROGEN

The first step in the process is the compression of natural gas and other feed stocks to about 35 bar pressure, and preheating the feed. As the feed must be almost absolutely free from sulphur, even the clean natural gas requires desulphurization as the next step. The steam reformer reactor is like a big heater, where the tubes are filled with nickel-based catalyst. The reformulation reaction, taking place under pressure at a temperature of about 850 - 900°C, produces a synthesis gas consisting of hydro-



gen, carbon monoxide and carbon dioxide. In the downstream shift conversion reactor, the carbon monoxide and excess steam react to more hydrogen and carbon dioxide.

The last step is the purification of the gas from the shift conversion in an UOP-licensed Pressure Swing Absorption (PSA) unit consisting of twelve reactors or absorption beds. One reactor or more are on the absorption step, the others in various stages of regeneration. The purity of the hydrogen produced exceeds 99%. What's more, in the Porvoo refinery the carbon dioxide stream from the PSA unit is recovered in an outside fence carbon dioxide plant operated by AGA, which reduces carbon dioxide emission.

## NUMBERS SHOW THE SCALE OF THE PROJECT

Numbers illustrate the size of the Diesel Project, including the hydrogen plant:

- about 5,500 tonnes of steel constructions
- a total of about 200 km (or 1,200 tonnes) of pipelines
- more than 10,000 instrument loops
- about 2,000 km of cabling

- almost two million engineering hours
- weight of the biggest reactors: about 1,300 tonnes
- size of the hydrogen “reactor” steam reformer (in the picture): equivalent to a 12-store building
- diameter of the biggest hydrogen pipes: about 1.2 m

## JOINT EFFORT FROM NESTE JACOBS AND RINTEKNO

The Diesel Project in its entirety is managed by Neste Jacobs, with Rintekno Group responsible for detailed engineering for the Hydrogen Plant. Rintekno is in charge of plant engineering, piping and steel construction, while Systecon handles instrumentation, automation and electrification. Rintekno has also participated in process engineering, including the basic engineering phase, and in equipment engineering.

During the installation phase, both Rintekno and Systecon have participated in site engineering. Now, as the test run of the hydrogen plant is in progress, Rintekno's process engineers and Systecon's automation and instrumentation engineers are helping in the operation and trimming in of the plant.

**Erik Söderström**  
Project and Marketing Director  
Rintekno Oy



# THE BIOREFINERY CONCEPT PROVIDES VAST OPPORTUNITIES – AND BIG CHALLENGES

A biorefinery is a facility that integrates biomass conversion and fractionation processes to produce fuels, power, goods and chemicals. The biorefinery concept is analogous to today's petroleum refineries, which produce multiple fuels and products from oil.

By producing multiple products, a biorefinery can take advantage of the differences in biomass components and constituents, and maximize the value derived from the biomass feedstock.

A biorefinery might, for example, produce one or several low-volume but high-value chemical products and low-value but high-volume liquid transportation fuel, while generating electricity and process heat for its own use and perhaps enough for sale of electricity. The high-value products enhance profitability, the high-volume fuel helps meet national energy needs, and the power production reduces costs and greenhouse-gas emissions.

## BIOREFINERY CONCEPT

A biorefinery concept could be built on three main initial "platforms" to promote different product slates. The sugar platform is based on biochemical conversion processes and focuses on the fermentation of sugars extracted from biomass, including obviously lignocellulosic material. The SynGas platform is based on thermochemical conversion processes and focuses on the gasification of variable biomass feedstocks. The constituent platform, based on fractionation processes, focuses on the separation of valuable biomass constituents for further processing. The residues may be utilized by bio-conversion or thermochemical means.

## FOREST-BASED VISION 2030

Perhaps the best example of a biorefinery is a traditional pulp mill, a constituent platform, where a primary product – fibres – is separated from chemical constituents using a chemical or thermomechanical process. From chemical fraction, multiple products may be produced, including commodities, fine chemicals, functional food and pharmaceuticals. Volumewise, the main by-products so far are different biofuels in liquid or solid form.

The European Forest-Based Sector has launched a technology platform initiative, Vision 2030, for innovative and sustainable use of forest resources. One key objective is an improved closed carbon cycle, achieved by making the manufacturing processes more energy-integrated, producing green speciality chemicals and intelligent recyclable products. Some examples of a research approach from the program:

"Development of more selective and milder reaction conditions for wood constituents or their products, such as low temperature delignification, novel pulping processes, and enzymatic processes, for the higher specificity of the desired compounds."

"Development of new and selective fractionation and isolation methods for various wood constituents and their degradation products (from pulping spent liquors), based on high performance membrane technology, ionic liquids, supercritical fluids, chromatographic techniques, and other merging means."

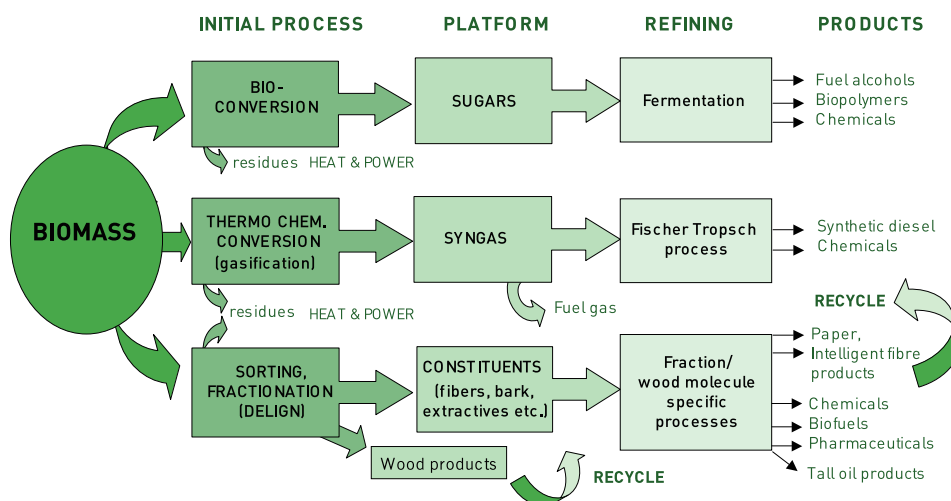
## TECHNOLOGY IN ENGINEERING

The integrated biorefinery concept provides vast opportunities, but also immense challenges. The US Department of Energy, DuPont and Michigan State University have begun to develop a process for converting corn grain and stover to sugars for the parallel production of 1,3-propanediol and ethanol – just to demonstrate the practicality of producing fuels and value-added chemicals from renewable resources.

Proving the credentials of various biorefinery concepts requires innovation networks and teamwork between different research institutes. One key issue is determining the "owner" of the plant concept. For a pulp mill or an ethanol plant, the main investor is self-evident. But the more diverse the mix of expected value-added products is, the more complex it is to initiate an organization or a particular network to promote and finance the project.

Rintekno was established in 1970 mainly for oil-refining and petrochemicals industries. During the 70s we diversified to chemicals, biochemicals, pharmaceuticals, wood-refining and feed industries. All these technologies are required to manage the diverse processes and products of the novel biorefineries. Technology in engineering is needed to support the research institutes and new enterprises in their mission for sustainable future.

**Reino Kalmari**  
Vice President  
Rintekno Oy



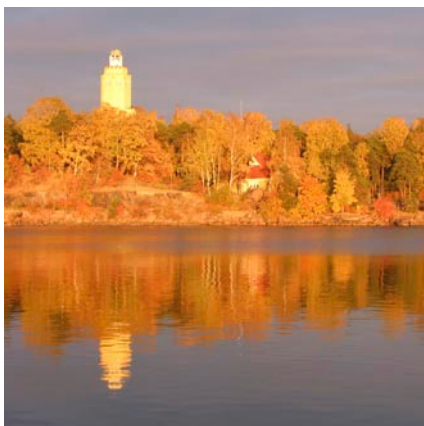


# EXPANDED AUTOMATION SERVICE CAPABILITIES THROUGH KOTKA CONTROL – THE NEW RINTEKNO GROUP COMPANY

Systecon has expanded towards new industry areas through the acquisition of Kotka Control Oy, a consulting and engineering company. Founded in 1981 in Kotka, Finland, the company specializes in automation, instrumentation and electrical engineering, automation deliveries and documentation services.

Kotka Control operates in the following process areas: pulp and paper, marine, energy, process and chemical industries. Consequently, the combined capabilities of Systecon, Kotka Control and Turun Sähkösuunnittelu add up to a one-stop shop able to supply turnkey deliveries of automation systems, instrumentation and electrification, including all engineering and installation services, documentation and equipment.

We deliver a variety of system platforms as well as other equipment and have a thorough knowledge of many process industries – the kind of experience that customers see as a strong asset. Our solid, long-term customer relationships are proof of the direct advantages our customers receive and our ability to work for their benefit.



## PULP AND PAPER

More than 40% of the company's turnover is derived from the pulp and paper industry. Our experience is based on more than 1,000 automation projects ranging from wood yards to reel handling.

The personnel of Kotka Control, highly proficient in languages and willing to serve, work in a great variety of projects with different

customers. At the moment we are engineering two pulp line factory automations: one for APRIL Ltd. in Indonesia and another for SAP in Brazil. The mill in Indonesia is the first project co-ordinated by Kotka Control in co-operation with Systecon.

## SHIP AUTOMATION

The engineers of Kotka Control have worked in co-operation with the Norwegian company Valmarine L3 Communications since 1998, planning machinery and air conditioning automation for over thirty ships.

We have participated in automation projects for cruise, tanker, icebreaker, aircraft carrier, Ro-Ro and Ro-Pax vessels. At present we are doing automation for Brittany Ferries and the research vessel Aranda as well as display planning for the Color Line ferry company. We will invest time and energy to engage in further co-operative efforts with the whole Rintekno Group in this field.



## CHEMICAL AND ENERGY

The main process industry expertise of Kotka Control is in the field of chemistry and power plants. In addition, we also have experience with oxygen, casting machinery, water treatment and foodstuff plants, among others. Our single largest project in this area, which comprises over 35% of our turnover, covered more than 10,000 man-hours.

In the energy sector, we have also specialized in various types of environmental projects by engineering automation for desulphurization plants in coal-fired power plants as well as for odorous gas combustion plants and water treatment plants.

Our projects have ranged from local power

plants to energy production facilities in different parts of the world. For example, we have contributed to the engineering and commissioning of most desulphurization plants built in the Czech Republic. As an ongoing project, we do a lot of planning with Systecon in Keilaranta for Neste Oil's biodiesel project.



## DOCUMENTATION

Our documentation services consist of the production of drawing services for industrial enterprises and engineering agencies. We also produce large color printouts on various materials up to a length of 21 m and a width of 127 cm.

We provide drafting services:

- plant area maps
- automation documentation
- electrical documentation
- flow diagrams
- plant layouts
- electric and HVAC installation drawings
- patent illustrations

## IMPROVED CUSTOMER SERVICE

Our expanded automation group operates in a competitive market. This is why we base our policy and concepts on long-term service and partnering – not once-in-a-lifetime projects. Being part of Rintekno offers Kotka Control new opportunities. Correspondingly, we believe we can help the whole group provide even better service and ensure customer satisfaction.

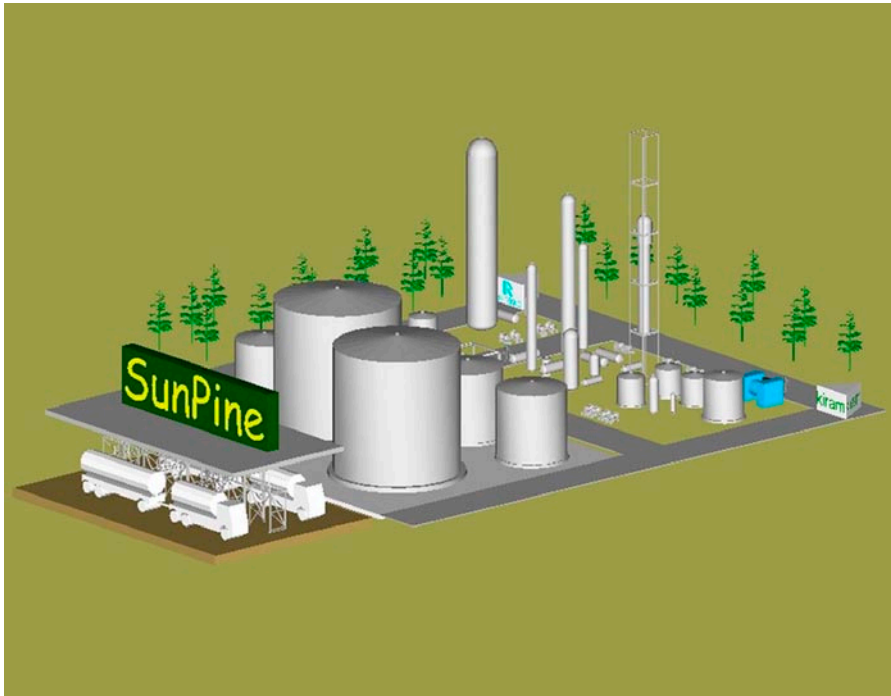
**Pertti Koivuniemi**  
Managing Director  
Kotka Control Oy

# SUNPINE AB TO START BIODIESEL PRODUCTION BASED ON WOOD EXTRACTIVES

Interest in biodiesel has drastically increased during the last couple of years. This is due to a number of factors, such as the increased use of renewable fuel sources to reduce the CO<sub>2</sub>/global-warming effect. Most European countries

have signed the Kyoto protocol for this reason. Also, the EU legislation calls for mandatory blending of biodiesel in ordinary diesel fuel supplied for vehicles.

In many countries there is also interest in using domestic-based/produced raw material for fuel production. Biodiesel/FAME can be produced using many different raw material sources. In Europe, rapeseed is so far the most popular, but more sophisticated processes can handle both animal and vegetable fat sources.



KIRAM AB and its subsidiary SunPine AB in Piteå have developed an alternative route for biodiesel production based on wood extractives as raw material. KIRAM has selected Rintekno as their engineering partner in establishing a new plant in northern Sweden. The plant is scheduled to come on-stream during 2008.

**Lars-Ove Olsson**  
Managing Director  
Rintekno AB



# PREEM PETROLEUM AIMS TO FURTHER REDUCE VOC EMISSIONS



Within the process industry, especially those who handle hydrocarbons, control of VOC emissions is a focus area.

Both industry and environmental authorities are aiming for lower emission values. Even though lessening VOC emissions might also have an economically positive effect, the major reason for reduction is concern about health, safety and environmental impact.

Preem Petroleum has for a long time been undertaking extensive investigations of VOC emissions at its refineries in Lysekil and Gothenburg.

At present, the company is revising its investigation methods to map the sources of VOC emissions even more thoroughly – both theoretically and by means of frequently performed field measurements of different types.

The calculated and measured values are subject to analysis, which then forms the base for investigating possibilities for further reduction of emission levels.

Rintekno has been entrusted by Preem Petroleum to assist in this action program.

**Lars-Ove Olsson**  
Managing Director  
Rintekno AB

# NEWS

## DANISCO SWEETENERS GMBH EXPANDS IN LENZING

Danisco Sweeteners GmbH, a subsidiary of Danisco Group of Denmark, has begun expansion work at their xylose production site in Lenzing, Austria. Danisco has operated the site since 1997 when the first plant started production. Spent liquor from a pulp mill owned by Lenzing AG is used as raw material.

The project begun with the pre-engineering study in 2005 and continued to the basic engineering phase in the second quarter of 2006. The production is scheduled to be on-stream during the second half of 2007.

As the main EPCM contractor, Rintekno Oy is responsible for the engineering, procurement and site supervision activities. Also, part of the equipment is delivered by Rintekno. Danisco Sweeteners is in charge of the main equipment deliveries as well as the construction and installation contracts.

## SYSTECON AUTOMATION DELIVERIES TO POWER BOILERS

Foster Wheeler Energia Oy and Kvaerner Power Oy are power boiler (fluidized bed) suppliers based in Finland. The technology and know-how they have developed for burning biomass, other fixed fuel or waste is considered overwhelmingly the best in the energy-producing business worldwide. In fluidized bed technology, the joint global market share of the two companies is over 80%.

Systecon is currently supplying two large automation and boiler safety systems, including commissioning services, to Kvaerner Power and Foster Wheeler as integral parts of their Engineering & Contracting deliveries to Piteå, Sweden, and Teesside, United Kingdom. In addition the systems, Systecon supplies all instrumentation and electrical engineering as well as operator training simulators for the Foster Wheeler project.

Both of these projects will be commissioned and started up during late 2006 and early 2007.

## NEW SHALE OIL LINE FOR VKG OIL AS

VKG Oil is one of the leading producers of shale oil worldwide. The company belongs to Viru Keemia Group (VKG), the largest chemical industry enterprise in Estonia.

Intending to expand and develop its shale oil industry in Kohtlajärve, Estonia, VKG Oil has decided to invest in a new shale oil production line. The line consists of two processes. Firstly, a retort, where the crossed stone is heated and hydrocarbons evaporated. And secondly, a condensation and distillation plant.

Continuing a long term co-operation, VKG Oil has entrusted Rintekno Group to develop and work out the basic engineering for the condensation and distillation plant. The preliminary design and cost estimate for this part, handed over in January this year, have also been pro-

vided by Rintekno. The basic engineering for the retort, based on a Russian/Estonian technology called Galoter, is done in St. Petersburg by Atomenergoprojekt.

The basic engineering work started in May and will be finished by the turn of the year. The work has involved close co-operation between all of the project partners: VKG Oil, Atomenergoprojekt and Rintekno. The target period for plant erection is 2007-2008.

## SIA BALTIC FEED'S NEW FEED MILL EXPANSION IN LATVIA

SIA Baltic Feed, a major special animal feed manufacturer in Latvia, has completed installation and construction work at their new feed premix mill expansion in Tukums, Latvia. SIA Baltic Feed produces special animal feeds and premixes to clients in Baltic countries, and premixes to Suomen Rehu Ltd. factories in Finland.

Rintekno was the general EPCM contractor, responsible for the engineering disciplines of the process part. SIA Baltic Feed was in charge of the civil works and the co-ordination of the procurement and site works. The project began in the fourth quarter of 2005, with a lead-time of twelve months.



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