

PELLETS
Added value to Malaysian palm residue

BIOGAS
WWTP's: boosting secondary sludge gas yield

SPOTLIGHT
The Liquefied Petroleum Gas bio buzz

HEAT & POWER
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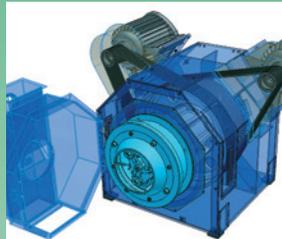
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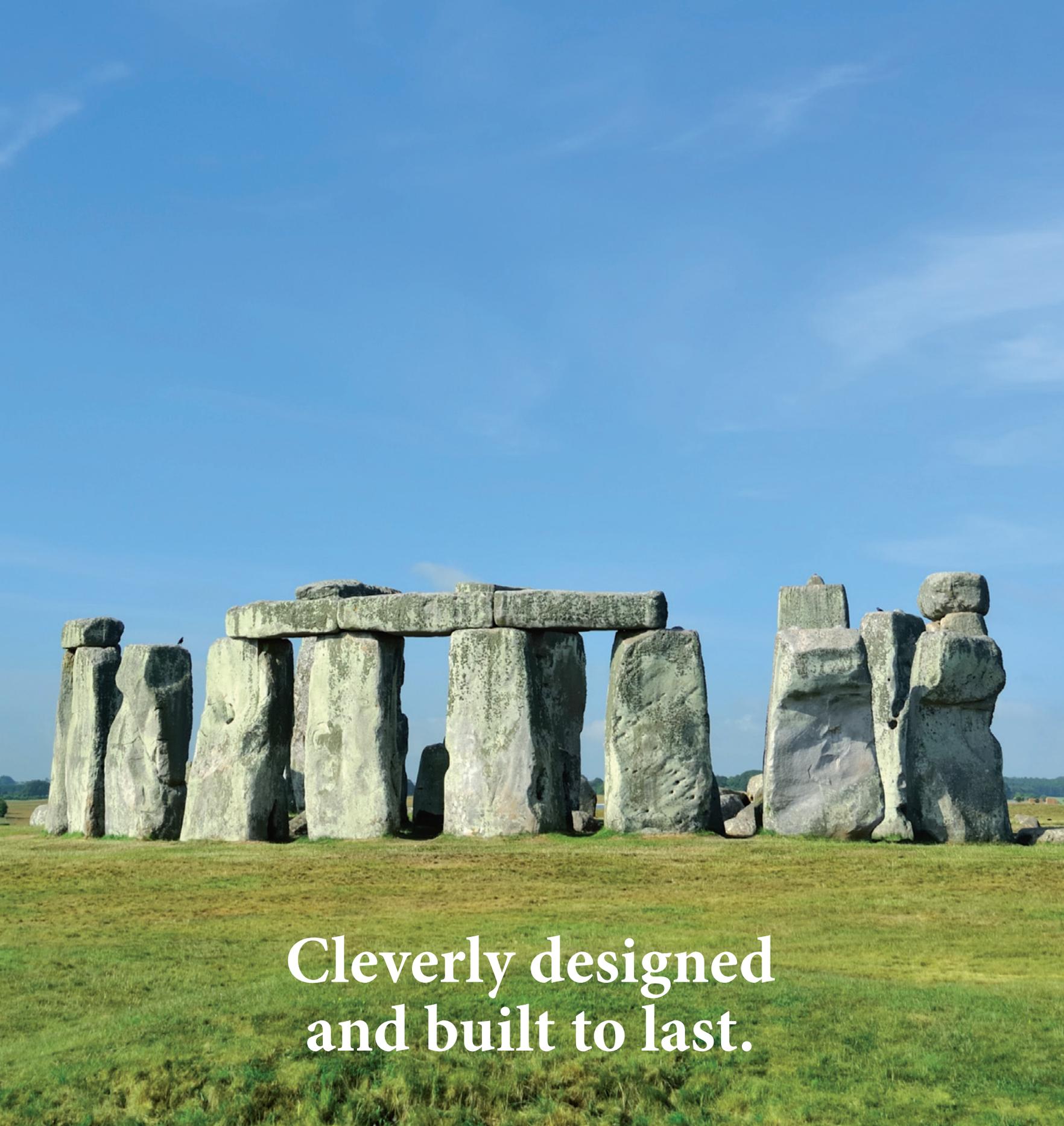
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COVER PHOTO



Top on the new “Rauchgas” (flue gas) treatment unit installed at one of Austria’s oldest cement production plants, Kirschdorfer Zementwerk. Founded in 1888 the company prides itself on taking a lead in reducing its environmental impact, willing to test new technologies and methods (photo courtesy Scheuch).

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HIGH TIME TO COP ON, NOT COP OUT

This issue comes out a month or so prior to the next annual Conference of Parties negotiations to be held in Paris, France, aka COP21. Expectations are running high in many quarters that the discussions in Paris will result in concrete measures and options to reduce greenhouse gas (GHG) emissions and mitigate climate change. The expectation is for a robust new international deal to be reached with the overarching aim of keeping global warming to within the 2 °C threshold, and applicable to all countries. The hope is that heads of state, other elected officials and public representatives will have the courage to see beyond their term in office and “risk” showing bold political initiative. After the disappointment in 2009 at COP15 in Copenhagen, Denmark when no agreement was reached to succeed the Kyoto Protocol, COP21 is destined to be a pivotal moment – for better or for worse remains to be seen, but the general sentiment is that the last train for the 2 °C target is leaving the station.

It is worth bearing in mind that this is the 21st COP since the United Nations Framework Convention on Climate Change (UNFCCC) came into force in 1994. The main objective of COP is to review the implementation of the UNFCCC. The UNFCCC itself was adopted at the 1992 Rio-Convention, the first international political response to climate change, and set out a framework for action aimed at stabilising atmospheric concentrations of GHGs to avoid “dangerous anthropogenic interference with the climate system”.

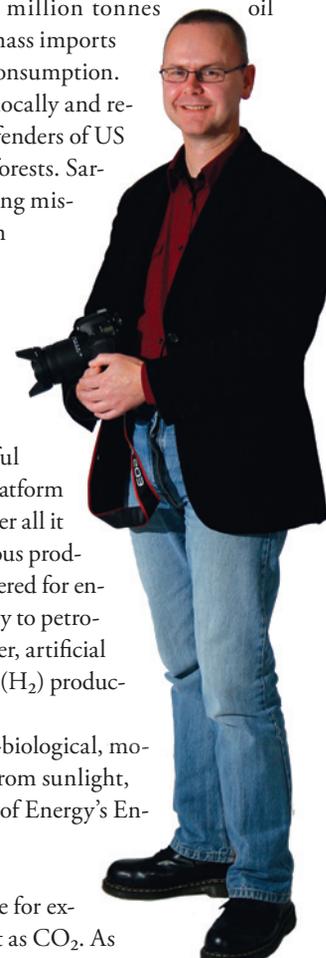
Bioenergy could and should play a bigger role than it already does. However, the use of biomass for energy is often hampered by half-truths, myths, lies and damned lies wielded by a mighty sword called statistics. With this in mind the European Biomass Association (AEBIOM) recently published its annual Statistical Report, arguably one of its most important publications to date as it does some serious “myth-busting”, bringing much needed contextual order. Contrary to what others will have you believe almost three-quarters of the EU’s 105.1 million tonnes oil equivalent (Mtoe) biomass consumption in 2013 was for heat and biomass imports represented less than four percent of the EU’s bioenergy gross inland consumption. This suggests that to a very large degree biomass is produced and used locally and regionally, which ought to be good news for self-proclaimed desk-top defenders of US Southeast bottomland hardwoods, and Indonesian and Brazilian rainforests. Sarcasm aside it is not about winning a factual argument, its about changing misguided thinking as forest-owner Chuck Leavell explains passionately in BioOpinion.

Whilst the atmospheric accumulation of carbon dioxide is unquestionably the unwanted consequence of various human activities that use fossil and geological carbon sources from the Earth’s crust, CO₂ in itself is also a resource. This was the focus of a recent conference looking at what must be the world’s most frowned-upon gas, converting it into useful products such as synthetic fuels, polymers, pharmaceuticals and other platform chemicals using carbon capture and utilisation (CCU) technologies. After all it is about recycling existing CO₂ converting it into a useful liquid or gaseous product, which ultimately will be converted back to CO₂ when used or recovered for energy. Ultimately it seems that CCU technologies may hold a potential key to petro-free renewable and sustainable chemical and energy integration. On paper, artificial photosynthesis would appear to be the “Holy Grail” for cheap hydrogen (H₂) production and direct CO₂ conversion into synthetic fuels using solar energy.

If nothing else it sparks the imagination with “highly efficient, non-biological, molecular-level energy conversion ‘machines’ that generate fuels directly from sunlight, water and carbon dioxide” as Dr Nathan Lewis at the US Department of Energy’s Energy Innovation Hub, Joint Center for Artificial Photosynthesis, put it.

It should be stressed that a CCU technology in itself is not an excuse for extracting more fossil-derived carbon from the ground and billowing it out as CO₂. As Dr Markus Freidl noted CCU is case dependent, only making sense if the energy used is renewable and the CO₂ used is biogenic or “unavoidable.” An integrated biogas and biomethane upgrading plant comes to mind as a suitable CCU application. Perhaps a sludge sewage energy recovery plant like Tuen Mun in Hong Kong would be a suitable candidate or as Freidl suggested, a cement plant, assuming that society continues to view concrete as a necessity. The emissions from the process, not the heat source, are unavoidable. Maybe that will be a next step for our feature story on Kirschdorfer Zementwerk in Austria.

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ARTICLES



FEATURE: RESIDUES TO RESOURCES

Cutting emissions, front- and backend	8
Unlike any other	12
HTC biocoal and phosphorus recovery from sewage sludge	15
Boosting secondary sludge gas	16
New biogas plant environmental boost for Stockholm	17
Huishan to acquire biomethane producer	17
Onsite oil-well flaring reduced with ORC	17
WELTEC Group acquire two biomethane to grid plants	17
Much "to do" about CO ₂	19

PELLETS

Added value to Malaysian palm residue	21
Wood pellet losing competitiveness in Korean market	23
A "Start Me Up" USIPA	25

HEAT & POWER

Biocoal plant planned for Kaliningrad	27
Lignetics acquire Geneva Wood	27
Wind and solar could boost biogas in Brandenburg	29
PHG Energy expands capabilities with acquisition	31

SPOTLIGHT:

The Liquefied Petroleum Gas bio-buzz	32
--------------------------------------	----

LIQUIDS FUELS

Advanced Biofuels Conference	35
------------------------------	----

MARKETS AND FINANCE

BioOpinion: Chuck Leavell - Forest Owner & Rolling Stones keyboardist	37
Pix Pellet Nordic CIF	40
Carbon pricing, state and trends 2015	40
BTEC Update	42
Serious "myth-busting" with new AEBIOM statistics	42
Devious "defeat device" might be good for biofuels	43
Size Reduction & Densification Directory	44

EVENT REPORTS:

Bioenergy 2015 – covering all commercial aspects	50
KPA Unicon awarded new supply contracts in Finland	51
Expobiomasa 2015	52
Stronger global biomass demand, if climate policy is taken seriously	54
Hills alive with sound of AUSTROFOMA	57
Small but successful debut	57
Calendar	46

ADVERTISERS

Adforum AB, World Bioenergy	57	Jiangsu Liangyou Renewable Energy Mech.	38
Advanced Cyclone Systems, S.A.	36	Komptech GmbH	48
Amandus Kahl	10	La Meccanica srl di Reffo	48
Andritz Feed & Biofuel	2	Liyang Yuda Machinery Co., Ltd	36
AS Hekotek	22	Minimax GmbH&Co.KG	36
Bandit Industries, Inc	59	Morbark, Inc.	24
Biomass Pellets Asia	56	Muyang Holdings Co., Ltd	18
Bruks Holding AB	34	Münch-Edelstahl GmbH	30
Bruzaholms Bruk	37	Prodesa Medioambiente S.L.	26,45
BTS Biogas Srl/GmbH	30	Radviliskis Machine Factory, JSC	38
C.F. Nielsen A/S	37	Recalor S.A.	38
Continental Biomass Industries, Inc. CBI	60	RUF GmbH & Co KG	26
Costruzioni Nazzareno	48	Salmatec GmbH	3
CPM Europe B.V.	4	Stela Laxhuber GmbH	22
Di Piu s.r.l	47	Stockholms Bulkhamn AB	37
Dieffenbacher GmbH	36	Sugimat S.L.	37
Ekoterm Proekt Ltd	37	Swedish Exergy AB	46
ETA Florence - Renewable Energies	56	Swiss Combi - W.Kunz dryTec AG	36
Ferotec	38	Teccon Konstruktionen GmbH	48
Fisker A/S	37	UAB "Kalvis"	38
German Bioenergy Association (BBE)	56	Uniconfort S.r.l	36
Host Bio-Energy Installations	14	Urbas Maschinenfabrik GmbH	34
IFP Ingenieurbüro für Pelletiertechnologie	38	Valmet	28

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35 An inauguration of the largest renewable hydrogen refuelling station in Sweden also took place during the debut edition of the Advanced Biofuels Conference at Arlanda Airport with Hyundai and Toyota (shown) showcasing fuel cell models.



12 Aesthetically pleasing, technically advanced, and open to visitors – not terms normally associated with a sewage sludge treatment plant. Then again this 110 MW thermal capacity combined heat and power (CHP) facility in Hong Kong is anything but your average plant.



21 In 2012 the Chinese company Beijing Wind-bell Technology set up shop in Malaysia with its sights set on transforming residue from the palm oil industry into a biomass fuel for export to China. Early this year it commissioned its first commercial biochar, bio-coal and activated carbon production plant and more are in the pipeline.



33 Bio and Liquefied Petroleum Gas (LPG) is all the buzz. Finnish oil major Neste have begun construction of a bio-LPG unit at its Rotterdam biorefinery as Kaisa Hietala, Executive Vice President of Renewable Products at Neste revealed in Stockholm, Sweden.

39 Parallel to a legendary musical career, not least as long-standing keyboardist for the Rolling Stones, Chuck Leavell is one of the most respected advocates for land conservation and the environment in the US. In BioOpinion, he shares some personal notes on balancing forestry with conservation and why biomass is a key part of the equation.



8 For energy intense industries, tightening restrictions means emission compliance can be a cumbersome and costly affair. An Austrian cement plant has commissioned a novel solution that simultaneously reduces carbon monoxide (CO), nitrogen oxides (NO_x) and volatile organic compounds (VOCs) with residual heat.



25 – Things get better with age, remarked Harold Arnold, USIPA Chairman and President of Fram Renewable Fuel in his opening address of USIPA's 5th Annual Exporting Pellets Conference in Miami Beach, Florida, US. For the first time market opportunities in other sectors besides European energy utilities were also discussed.

19 What's not to love about CO₂? As a fossil derived greenhouse gas (GHG), carbon dioxide (CO₂) is a major problem. But parallel to source emission reduction policies and technologies, a new strand of research is rapidly emerging under the umbrella term "carbon (dioxide) capture and utilisation" (CCU). The focus is on looking at the world's perhaps most frowned upon gas as a resource instead.



Cutting emissions, front- and back-end

For energy intense industrial processes like cement production, tightening exhaust air restrictions means emission compliance can be a cumbersome and costly affair. An Austrian cement plant is tackling the issue from two directions. It has introduced alternative fuels to replace coal and gas. It has also commissioned a novel and seemingly cost-effective solution - a single unit that simultaneously reduces carbon monoxide (CO), nitrogen oxides (NOx) and volatile organic compounds (VOCs) using residual heat.

CEMENT PRODUCTION IS ENERGY INTENSIVE and, depending on the fuels and downstream flue gas treatment systems used, can be heavy on air emissions. Recently Kirchdorfer Zementverk, one of the oldest cement plants operating in Austria, commissioned a new and innovative process for industrial exhaust air cleaning to reduce carbon monoxide (CO), nitrogen oxides (NOx) and volatile organic compounds (VOCs). Part of the privately held Kirchdorfer Industries GmbH, what is now a 500 000 tonne-per-annum cement plant has been in operation since its founding in 1888. Given its location just 600 m from Kirchdorf town centre, environmental impact reduction has always been a focal point for the company.

Two-in-one concept

Developed and supplied by compatriot air emission technology providers, Aulolzmunster-based Scheuch GmbH, the novel “DeCONOX” unit reduces all three pollutants at the same time in a single unit. Furthermore the new process does not require additional heat to operate as it uses residual heat, in this case from the cement production process.

– Simultaneous reduction in one unit is the biggest advantage of the new process, explained Alois Hermandinger, Head of Industrial Minerals at Scheuch GmbH.

The new process, which recently earned the company an Energy Globe Award, ensures high degrees of CO, NOx and VOC removal from exhaust streams by combining the advantages of a conventional clean-gas catalytic convertor with a regenerative thermal oxidation (RTO) plant. According to Hermandinger, other benefits of combining the technologies include minimal spatial footprint, lower operating costs, lower energy consumption through the use of waste heat and lower maintenance requirements.

Piloting success

At the end of 2010, a twin-tower pilot unit was installed at the cement plant in Kirchdorf to test and verify the process concept under real-life industrial operating conditions. The results of the pilot obviously impressed the decision-makers at Kirchdorfer Zementverk as last summer it contracted Scheuch to install an industrial-scale DeCONOX plant.

– The big advantage of the new system is its



Installation of the modular DeCONOX unit at Kirchdorfer Zementverk.

ability to reduce NO_x using SCR, along with CO and VOC with an RTO in one device and with only one pressure drop point, said Anton Secklehner, Plant Manager, Kirchdorfer Zementverk.

Process details

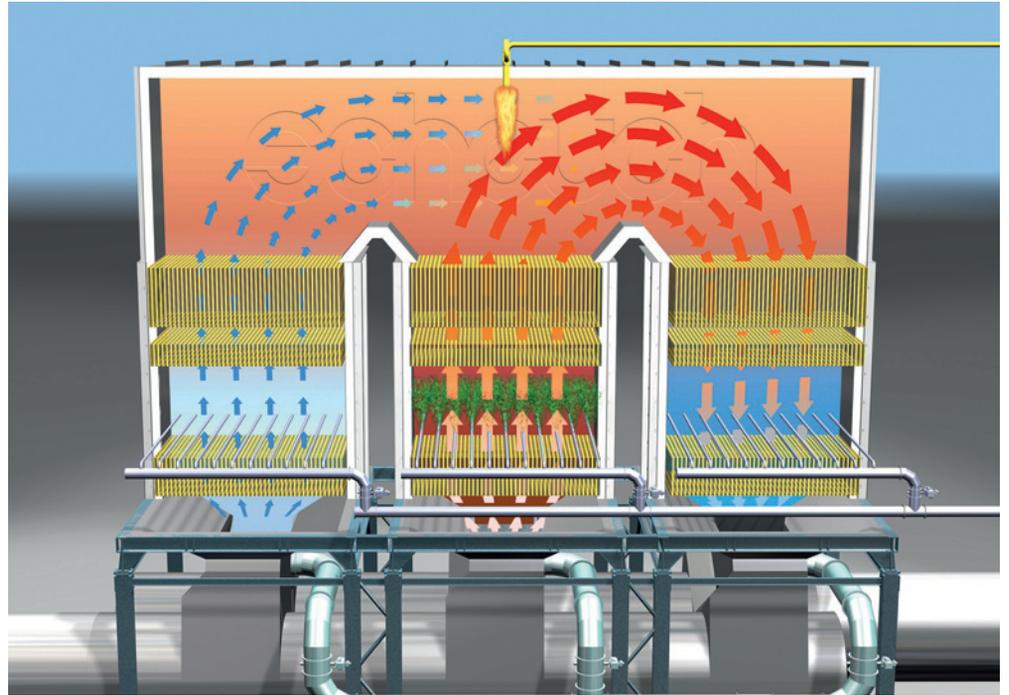
To decompose NO_x the unit uses a proven low-dust Selective Catalytic Reduction (SCR) process with ammonia (NH₃) as the reducing agent. A Regenerative Thermal Oxidiser (RTO) – controlled combustion in a combustion chamber – removes the VOCs and any odours associated with them.

At its most basic setup the DeCONO_x functions as a two-tower system. The crude gas flows into each of the towers in turn at one-minute intervals. The gas absorbs heat from the regenerators in the upward flow and releases it again in the downward flow. The lower regenerator heats the gas to a temperature of at least 240 °C before it flows through the catalyst. In the upper regenerator the gas is heated to the combustion chamber temperature of 850 °C enabling the complete oxidation of VOCs.

– For large-scale industrial applications, plants should have three, five or more towers. In the three-tower model, for example, the third tower is flushed with clean gas to minimise the migration of pollutants into the clean gas chamber, commented Hermandinger.

Environmental credibility

– Environmental protection costs money and energy. The operating costs will be comparable to an SCR alone; the effect on maintenance work has yet to be seen whereas the overall energy requirements will be about eight per-



The crude gas flows into each of the towers in turn, absorbing heat in the upward flow and releasing it in the downward flow. Complete oxidation occurs in the combustion chamber at a temperature of 850°C. The illustration shows the denitrification and separation process.

cent higher, said Anton Secklehner commenting on seen and foreseen operating costs for the novel installation.

It is not the first time the two companies have cooperated but it is a recent example of how Kirchdorfer Zementverk strives to find ways of reducing its environmental impact.

– We want to actively contribute to Austria achieving its National Emissions Ceiling (NEC) target for air pollution and therefore always seek to use the best and most efficient technologies for reducing emissions. I am impressed by Scheuch's courage when it comes to exploring new technologies. It is a partnership between two innovative companies, stated Anton Secklehner.

A glance at some environmental investments made during Kirchdorfer Zementverk's 127-year track record certainly adds credence to Secklehner's claim. In 1958 it commissioned Austria's first rotary kiln and ancillary equipment and shortly after installed the first electric filters reducing dust to a minimum. In 1983, a 2 MW heat recovery plant to

capture heat from the excess cooling air was installed and it provides hot water for the local district heat network operated by Energie AG Oberösterreich Wärme GmbH. In the 1990's the focus turned to noise reduction at the plant, which according to the company, has largely been achieved.

Alternative fuels and raw materials

On the frontend, like many cement plants, Kirchdorfer Zementverk is working to reduce its reliance on coal and fossil gas as energy sources by switching to alternative high-energy fuels. In 2011 it formed ALFUMA GmbH, a company specialised in identifying and trading alternative fuels and materials also based in Kirchdorf.

– Our focus is on rubber granulates from scrap tire recycling. This homogenous material has a high heating but low chloride value making it especially suitable as an alternative fuel, explained Anton Secklehner who is also a Director of ALFUMA.

Other fuels used at the cement plant include textile lint, as well as plastic light fraction and polyurethane (PU) pellets from the recycling of refrigerators. Currently the cement plant is working with 60 to 70 percent alternative fuels. This can reduce its annual coal demand by up to 50 »



Anton Secklehner (left), Plant Manager, Kirchdorfer Zementverk and Alois Hermandinger, Head of Industrial Minerals, Scheuch.

“The central idea is to use resources as sustainably as possible and to minimise the requirement for primary resources.”

ANTON SECKLEHNER
Plant Manager, Kirchdorfer Zementverk

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From the top of the installation a panoramic view of Kirschdorf highlighting the close proximity of cement plant to the town and residential areas.

Cont. from page 9

percent cutting its carbon dioxide (CO₂) emissions by about 20 000 tonnes. Important too is that the use of these alternative fuels has absolutely no adverse effect on the cement factory or cement quality.

– At present ALFUMA works on the purchase and sale of alternative fuel and alternative raw materials. In the future we will also deal with the preparation of alternative energy carriers, revealed Secklehner adding that the com-

pany already supplies alternative fuels to other third-party cement plants.

Looking ahead

In addition to alternative fuels ALFUMA has a range of secondary or recovered raw materials such as iron, aluminium and a silicon carrier that is used for the production of clinker.

– The central idea is to use resources as sustainably as possible and to minimise the requirement for primary resources. On the short or medium term ALFUMA shall become the number one address in the field of alternative fuels and alternative raw materials in and around Austria,

said Anton Secklehner about ALFUMA's ambitious goals.

For the cement plant the new DeCONOX unit also enables the company to supply more waste heat to the district heat network.

– We would like to provide about 4 MW into the network, which is a tripling or even quadrupling of the previous amount, said Secklehner.

Furthermore, in combination with the use of alternative fuels, the production quantity and capacity of the cement plant can be optimised as it achieves steadier furnace operation and lower emissions per tonne of cement produced, about 20 percent less compared to a few years ago.

– With DeCONOX, existing cement plants and other energy intensive processes can be upgraded with relative ease to make sure that they comply with future legal requirements for NO_x reduction. In fact we have developed a mobile pilot plant to offer interested companies the opportunity to trial the process on their own sites and see how it fits in with their operations, ended Alois Hermandinger.

Text: Alan Sherrard

Photos & illustration courtesy Scheuch

B182/5050/AS

Facts: Kirchdorfer Industries

Founded in 1888 as a cement plant in Kirschdorf, Upper Austria the company is now part of the privately held Kirchdorf Industries, an industry group active in three product lines: cement, raw materials (stone, sand, gravel, ready-mixed concrete), as well as pre-cast concrete components, products and pre-fabricated houses.

The group operates worldwide, has approximately 1 400 employees in 13 countries and an annual turnover in excess EUR 200 million. In June 2013, almost exactly 125 years since it started cement production, Kirchdorfer Zementwerk produced its 20 millionth tonne of cement.

Facts: Scheuch GmbH

Founded in 1963 in Ried, Austria as a sheet metal fabrication workshop the family-owned company has evolved into an international business focused on developing and manufacturing air and environmental technologies including extraction, de-dusting and flue gas cleaning within many sectors of industry. The company has around 1 000 employees and a turnover in excess of EUR 127 million.

UNLIKE ANY OTHER

A very special sludge treatment plant

Aesthetically pleasing, technically advanced, and open to visitors – not terms normally associated with a sewage sludge treatment plant. Then again this 110 MW thermal capacity combined heat and power (CHP) facility in Hong Kong is anything but your average plant.

THE ENVIRONMENTAL PROTECTION Department (EPD) of Hong Kong had a not-so-unique challenge: what to do with the mounting volume of sludge from wastewater treatment plants. The EPD's solution to this problem however was anything but ordinary.

An island of sludge

Over 90 percent of Hong Kong's population is served by a public sewer system with the sewage sent to wastewater treatment plants. The sludge from the treatment process has traditionally been disposed of at three landfills on the island. While it seems that all growing metropolitan areas have the challenge of disposing of municipal sludge, the fact that Hong Kong is an island makes land availability

even more critical. In just a few short years, the sludge volume that Hong Kong generates has nearly doubled to about 1 000 tonnes per day. Moreover it is predicted to continue increasing, thus in the long-term landfilling of sludge will not be an environmentally sustainable option. In order to deal with this ever-expanding need for sludge disposal and to relieve the pressure on landfill capacity, a unique sludge treatment facility has been built in Tuen Mun on the northwest part of the island.

Unique development

The EPD awarded the US\$ 660 million Design-Build-Operate contract to Veolia Water and Veolia Environmental Services. Veolia will also operate the plant for a pe-

riod of 15 years. Emmanuel Toulan, Project Director for Veolia Water Solutions, joined the project in 2010. He has years of international project experience in many different industries.

– I am supported here by a very large team, I was involved very heavily in the design and procurement stages, while the construction is primarily overseen by our partners at Leighton and John Holland, said Toulan.

ANDRITZ Energy & Environment (AE&E) was awarded the contract to supply four EcoFluid bubbling fluidised bed (BFB) steam boilers, which form the heart of the power plant. The power plant uses wastewater sludge as fuel. Not only does this generate low-cost electrical power, it also eliminates the cost and space required to landfill the sludge.

– What makes this plant unique – in addition to its large size – is the building design, degree of self-sufficiency, and educational purposes, explained Toulan.

Design. The wave-like shape of the buildings makes harmonies with the sea and mountains. The plant meshes beautifully with its location next to Shenzhen Bay.

Self-sufficiency. The plant is not connected to a potable water network or a public sewer system. Seawater is desalinated in an on-site plant. Rainwater is also collected and used as process water. The plant has its own wastewater treatment system to eliminate discharges to the sea. Energy generated from the plant will exceed the needs of the plant and surplus energy will be supplied to the public power grid.

Educational purpose. In addition to the technological advances, the site is being constructed as an architectural and cultural landmark for Hong Kong. A unique aspect is the concept of including ecological education and leisure space for the public. An auditorium, conference centre, exhibition space, spa, coffee house, shops, and ecologically arranged gardens provide attractions for the public. A view of the bay, including the city of Shenzhen on mainland China across the bay, is available from an observation platform in the administration building – being built around the boiler stacks.

Power from sludge

– All of Hong Kong's sewage treatment facilities together produce close to 1 000 tonnes per day of

The Environmental Protection Department of Hong Kong provided funding for this unique sludge treatment facility in Tuen Mun on the northwest part of the island. The city of Shenzhen (mainland China) is in the background.



“What makes this plant unique in addition to its large size is the building design, degree of self-sufficiency, and educational purposes.”

EMMANUEL TOULAN

Project Director Veolia Water Solutions

sludge, Toulan said.

The Tuen Mun facility will have a capacity of 2 000 tonnes per day when fully completed. It will also be capable of generating 14 MW of electricity.

According to Gottfried Mittendrein, ANDRITZ's General Site Manager for the project, the power plant is based on AE&E's EcoFluid BFB boiler technology to incinerate the incoming sludge. AE&E has supplied four boilers that are arranged in two sets. Each has a 14 MW steam turbine.

Some of the sludge is delivered to the facility by truck, but most comes by barge to reduce local pollution. The incoming sludge is dewatered and then fed to the EcoFluid boiler plant. The EcoFluid boiler incinerates the organic substances in the sludge, creating ash, flue gas, and heat. Each EcoFluid boiler can generate 27.5 MW from a maximum throughput of 23 tonnes per hour of sludge. The maximum steam output is 31.3 tonnes per hour for each boiler, at a temperature of 383 °C and 42 bar pressure.

This means, at maximum capacity, each of the four boilers can ac-

commodate 550 tonnes per day of sludge. At this throughput, the EcoFluid boilers will lower greenhouse gas (GHG) emissions and also reduce the volume of sludge going to landfill by 90 percent.

– The EcoFluid boiler is very flexible in its ability to utilise alternative fuels. On average, the dewatered sludge entering the boiler is only about 31.4 percent dry solids. This is sufficient for sustaining incineration in the fluidised bed without having to add fossil fuels or thermally drying the sludge beforehand, said Mittendrein.

The flue gas treatment system was designed to meet the strict environmental requirements and emissions standards of Hong Kong. The flue gas goes through a series of treatments before discharge, including a Selective Non-Catalytic Reduction System for nitrogen oxide (NOx) control, a dry reactor for acidic gases reduction, and a multi-cyclone and bag filter system for fine particulates removal. A monitoring station is being installed in the centre of Tuen Mun to continuously analyse the air quality, ensuring that operation of the plant will not have an ad-



Emmanuel Toulan, Project Director for Veolia Water Solutions (left), with Gottfried Mittendrein, ANDRITZ's General Site Manager for the project, on the public observation deck overlooking the plant and the boilers.

verse effect on the environment.

Reaching performance

The boilers are being commissioned on a staggered schedule and there are two separate performance test periods.

– This has been a difficult project. We have had to do a lot of training. Also, we have invested a lot of time working with local authorities to get the necessary permits and authorisations, explained Toulan.

Mittendrein said, “I have spent many years in Asia, but this is my first project in Hong Kong. This project confirms my experience that each country is different and that we cannot calculate project costs and schedules using European measures, for example. Every-

thing – construction techniques, available skills, government oversight, and subcontractor quality – is different in each country. We have to do a professional job of managing those resources and delivering a quality power generation system to our customer, said Mittendrein.

Toulan has positive things to say about the collaboration.

– I am familiar with the ANDRITZ name because my company has purchased their equipment such as decanters, filters, and centrifuges for wastewater projects in the past. The on-site team is a good one. They know what they are talking about. Their equipment is proven and they have been very professional during the design, installation, and commissioning of »



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The power plant uses four EcoFluid boilers (bubbling fluidised bed technology), arranged in two sets, to incinerate the incoming sludge. Each has a 14 MW steam turbine.

Cont. from page 13

their plant. They have consistently met their schedules and commitments, said Emmanuel Toulan.

The Tuen Mun facility is currently operating with three boilers and a throughput of about 900 tonnes of sludge per day. This will be increased over the next few months to 1200 tonnes. One thing that has been a bit different than what was expected by Mittendrein is the huge variations in sludge.

– We have noticed that the heat value of the incoming sludge changes on a daily basis. One day it will be 3.2 MJ per kg and the next day 4.5 MJ per kg. This demonstrates the flexibility of the EcoFluid technology to handle these large swings, ended Gottfried Mittendrein.

Editor's note: This is an edited version of a client feature commissioned by ANDRITZ and originally published in Spectrum 2/2015. It is used with kind permission. Photos courtesy ANDRITZ.

B182/5000/IAS

THE ECOFLUID STEAM BOILER SYSTEMS AT TUEN MUN

Technology	Bubbling fluidised bed (BFB) Ecofluid AC
Number of units	4
Fuel	Sewage sludge
Heating value range	3.0-5.8 MJ/kg
Max. fuel heating capacity	27.5 MW each unit
Max. sludge throughput	23 t/h each unit
Max. steam output	31.3 t/h each unit
Steam temperature	383 °C
Steam pressure	42 bar



The EcoFluid boilers are being commissioned and started up on a staggered schedule. The Tuen Mun facility is currently operating with two boilers and a throughput of about 660 tonnes per day of sludge. Shown here is Johannes Geiger, ANDRITZ Commissioning Manager, checking the instrumentation at one of the boilers.

HTC biocoal and phosphorus recovery from sewage sludge

The German hydrothermal carbonisation (HTC) developer, AVA-CO2 has announced it will receive support from the German Federal Environmental Foundation (DBU) to set up a phosphorus extraction pilot plant in Karlsruhe. The company is developing hydrothermal processes to produce materials and energy from biomass and its “AVA cleanphos” process has already been successfully tested in AVA-CO2’s laboratories. It will now be tested at pilot scale for the next 12 months, in cooperation with the project partners – the University of Hohenheim and the project group for material cycles and resource strategy at the Fraunhofer Institute for Silicate Research. The project aims to demonstrate that with phosphorus recovery technology, recycling fertiliser with a high, plant-available nutrient content can be produced efficiently and cost-effectively from sewage sludge.

According to the company, its recovery technology could prove a breakthrough for the wastewater treatment industry for compliance with the amended German Sewage Sludge Ordinance. The process has the potential to be more efficient and cost-effective than existing methods, as municipal sewage sludge is converted first into HTC-coal before the phosphate is isolated, creating two products of commercial interest – a valuable fertiliser, and

phosphorus-free HTC-coal that could be used as a substitute for brown or black coal.

– The HTC process, in combination with the AVA cleanphos solution, paves the way for a useful, long-term application for sewage sludge, commented Thomas Kläusli, Chief Marketing Officer at AVA-CO2.

For the agricultural sector, the method also offers new possibilities.

– Although sewage sludge contains a lot of valuable phosphate, there is a lot to be said against its use in agriculture. It can carry pathogenic substances and contains many heavy metals. Many existing phosphorus recovery technologies incinerate sewage sludge to extract the phosphorous from the ash. However, these methods are more expensive and complicated than the HTC route, said Prof. Dr. Andrea Kruse, agricultural technologist at the University of Hohenheim.



B182/5070/IAS

Boosting secondary sludge gas

A common challenge for all types of biogas plants, including municipal wastewater treatment plants (WWTP), is how to increase the methane yield from the substrate as, compared to its theoretical potential, a relatively large portion share is not converted to gas in the digestion process. For WWTPs this is of particular significance as a means of both improving the treatment process while reducing operating costs and environmental footprint.

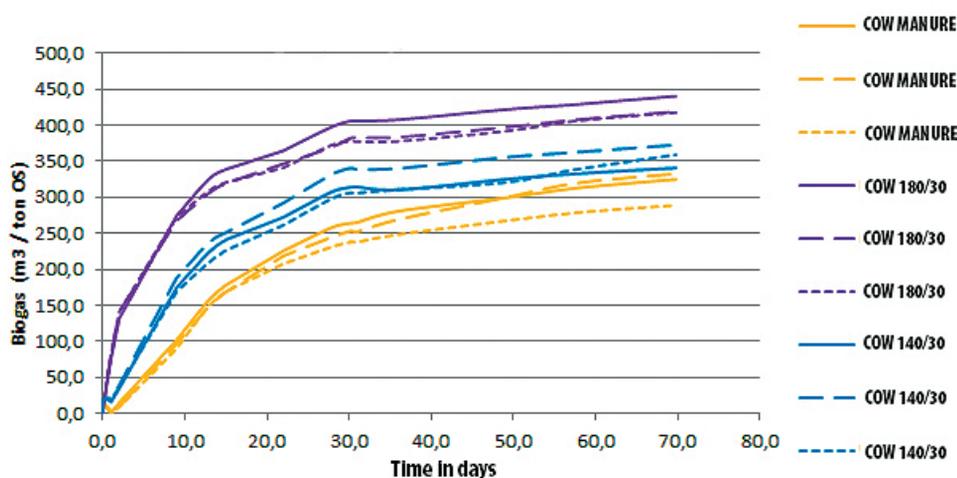
THE MAIN OBJECTIVE OF A MUNICIPAL wastewater treatment plant (WWTP) is the removal of various physical and chemical pollutants and biological pathogens from the water before recirculating or discharge to a recipient. As a substrate sewage sludge is differentiated according to the treatment process it has been through. Primary sludge is the result of post-primary treatment, which typically consists of mechanical separation of debris along with other physical or chemical processes to remove suspended particles, large and/or dense particles (grit, grease and scum). Secondary or activated sludge is the residue generated from the biological treatment of wastewater after primary treatment whereas mixed sludge is a combination of the two.

The Dutch company HoSt BV is one of the larger European developers and suppliers of biogas technology specialising in the digestion of various types of municipal, industrial and agricultural sludge and organic waste residues including so-called Category 2 residues from the meat industry. In 2012 the company started a broader research project with the objective of increasing the methane yield from the conversion of biomass to biogas in the digestion process. Together with the Technical University of Münster, Germany and the University of Twente, the Netherlands, research has been carried out on several types of biomass like secondary sludge from municipal wastewater treatment plants (WWTP), straw, grass and manure with several different technologies; biomass grinding and size reduction, thermal treatment at several temperatures and chemical treatment at temperatures between 30-90 °C.

Economy and scalability

Thermal treatment at high temperatures (120-160 °C) and pressure was found to be one of the best pathways to increase the gas production.

COMPARISON TPH COW MANURE



For straw and cow manure (shown) it increases the gas production significantly. Secondary WWTP sludge also has a significantly higher conversion rate after thermal treatment whereas grass did not. In fact, in some experiments the thermal treatment of grass even reduced the gas yield. Demonstrating proof of concept in the laboratory is one thing, ensuring it works at industrial scale and is economically feasible is something else.

– For animal manure it is difficult to make thermal treatment feasible because of its low organic content. The additional heat needed would mean using additional gas as fuel eating into the yield gain so there is no real economic benefit. Of course, there can be circumstances where manure is feasible. For example if it needs to be sanitised at high temperature, if the material is first thickened, or if the plant has strong heat integration with other heat sources. But still, the additional gas gain becomes relatively expensive compared to other substrates, explained Herman Teeselink, Director for HoSt BV.

For straw, the research suggests that biochemical pre-treatment using medium temperature is the best solution and according to Teeselink, the company is building several biogas units with high straw content at the moment.

Volume reduction benefit

For sewage sludge the situation is different as the additional gas yield is not the only benefit. As most municipal wastewater companies have no means of further onsite residual sludge treatment or disposal they have to pay for sludge removal and disposal, typically to landfill. In the Netherlands the cost of sludge disposal is approximately EUR 40 per tonne.

– When our Thermal Pressure Hydrolysis (TPH) pre-treatment is applied, the conversion of organics into gas is increased by between 30-40 percent. This results not only in more gas, but also in less residual sludge. Furthermore it seems that the ability to dewater the residual sludge post-treatment is improved leading to a further volume reduction, said Teeselink.

Pilot-testing

In 2013, HoSt together with the municipal wastewater treatment company Waterschap Rest en Wieden commissioned a new municipal sewage sludge digestion plant in Echten, the Netherlands. The Echten plant is a small WWTP. Its main purpose is to receive and treat secondary sludge from other WWTPs and the plant has a capacity to treat 193 000 m³ of secondary sludge per annum. It is the first system in the Netherlands that digests sludge in a two-step digestion process, a thermophyll digester, followed by a mesophyll digester. The plant is also already energy self-sufficient with a 600 kW gas gen-set providing the heat and power needed »

Facts: Echten WWTP

Start-up: May 2013
Capacity: 193 000 m³/annum
Input: Secondary sludge
Digester(s): 1 x 4 100 m³ thermophylllic
 1 x 5 500 m³ mesophylllic
Post-digester: 1 x 2 000 m³
Reception: 1 x 100 m³ mixing tank
 2 x 2.500 m³ silos for receipt
CHP: 1 x 600 kWe
Digestate treatment: Phosphate removal in struvite reactor

Facts: MAP

Struvite crystal is a mineral compound made up of magnesium, ammonia and phosphorus (MAP) that under certain conditions precipitate. MAP elements are found in WWTP water due to the composition of wastewater. Phosphorus comes in as a phosphate from dishwasher and laundry detergents. Urea breaks down into ammonia and carbon dioxide (CO₂) in the anaerobic digester and potable water usually contains trace amounts of magnesium that gets concentrated in the anaerobic digester.

New biogas plant environmental boost for Stockholm

A new waste to biogas plant in Stockholm, Sweden, has been officially inaugurated by the Swedish Minister of Energy, Ibrahim Baylan. Located in Södertörn, south Stockholm the new plant will increase the amount of biogas produced in Stockholm by 50 percent (based on 2013 figures).

The facility is a joint project between the Swedish biogas technology developer, Scandinavian Biogas and SRV Recycling, a waste management company owned by the south Stockholm municipalities Huddinge, Haninge, Botkyrka, Salem and Nynashamn. Supplied by Scandinavian Biogas, it is the first biogas facility designed to use food waste as feedstock in Stockholm and is collected from local residents in the same municipalities.

The plant will convert around 50 000 tonnes per annum of sorted food waste, almost 30 percent of the total amount generated in Stockholm, into 80 GWh of vehicle-grade compressed biomethane, equivalent to around 8.8 million litres of petrol (gasoline). In addition it will pro-

duce around 16 000 tonnes of biogas, closing the loop for nutrients like nitrogen, phosphorus and potassium.

– The Government's ambition is for Sweden to become one of the world's first fossil-free welfare states. The Södertörn biogas plant is a modern example of how we can use the local resources we have, in this case household waste, and convert it to renewable energy. With this kind of initiative local jobs are created and the environment benefits, said Energy Minister Ibrahim Baylan.

Of Stockholm's 26 municipalities only three have introduced the mandatory collection of food waste.



Photo: Anders Haaker

– Now we have a biogas plant here in Huddinge, it means that residents can drive on their own and neighbours' sorted food waste. It means we can use the energy and recycle the nutrients back into the soil, said Göran Persson, former Prime Minister of Sweden and Chairman of Scandinavian Biogas.

B182/5051/AS

WELTEC Group acquire two biomethane to grid plants

In Germany, biogas technology specialist WELTEC Group announced it has acquired two biomethane plants in Hesse and Saxony-Anhalt, Germany bringing to total to four such facilities. One of the plants is located in Ebsdorfergrund, Hesse, and has been acquired within the framework of an asset deal. Nordmethan Produktion Ebsdorfergrund GmbH, an affiliate of the WELTEC Group, is now responsible for the operation as the new owner. The plant pro-

duces 1,000 Nm³/h of raw biogas and upgrades it to 550 Nm³/h biomethane for grid injection. In Saxony-Anhalt it has repurchased Könnern, one of the world's large biogas parks with gas-to-grid technology, from the insolvency assets of AC Biogas GmbH. Annual production of the plant, which was planned and set up by WELTEC, is about 15 million Nm³ of biomethane. At both sites all employees have been taken over.

B182/5076/AS

Onsite oil-well flaring reduced with ORC

American Organic Rankine Cycle technology provider, ElectraTherm, has partnered with Gulf Coast Green Energy a major oil and gas company to commission its "Power+ Generator" at a North Dakota oil well. The unit captures the gas released during oil extraction and would otherwise be flared, to generate electricity instead. The project demonstrates an effective means of flare reduction, and changes the landscape for industries where flaring was seen to be the only solu-

tion. The project was funded by the US Department of Energy's Research Partnership to Secure Energy for America (REPSEA) program and the Houston Advanced Research Center's (HARC) Environmentally Friendly Drilling Program. Current North Dakota state regulations require that oil and gas companies reduce the amount of natural gas flared over the next several years or face steep penalties and potential curtailment of oil production at offending wells.

B182/5075/AS

» using the biogas produced as fuel. This is made possible using a very efficient mixer along with dewatering and thickening the sludge before feeding it into the digester with heat recovery from the process used to pre-heat incoming sludge.

However the ultimate goal is for the plant as a whole to become an energy exporter and further cut its OPEX by reducing its sludge disposal costs. In June last year HoSt installed a research and demonstration pilot of its new TPH pre-treatment system at the WWTP in Echten. The aim of the pilot TPH unit is to have very low

energy consumption when only secondary sludge is used. Supplied as a turnkey delivery, the EUR 7 million unit includes all civic works and integration along with all the equipment: sieves and TPH unit, sludge storage and receiving tanks, belt dewatering and thickening installation, digester and post digester, digestate and biogas storage, a Magnesium Ammonium Phosphate (MAP) recovery reactor and a gas CHP engine.

Positive results

The unit has been in operation for almost a year

Huishan to acquire biomethane producer

In China, Liaoning-based China Huishan Dairy Holdings Co., Ltd, a vertically integrated dairy group, has announced it is to acquire Renewable Energy Company (REG) pending the fulfilment of a number of customary conditions. REG commissioned its first bio-waste to compressed biomethane (CNG) plant at the end of August in Faku county and currently has 100 percent equity interests in six operating subsidiaries all incorporated in China, which together engage primarily in bio-waste processing for the production of CNG with organic fertiliser as a by-product. According to a statement from Huishan, the deal would make available "a significant business opportunity" and is in line with the Group's goal of becoming "China's largest renewable energy company and China's largest organic fertiliser producer".

B182/5069/AS

and the system has already proved a gas yield improvement from secondary sludge of between 30-60 percent depending on the residence time and temperature. In doing so it has demonstrated thus far that Echten WWTP as a whole could reach its target of increasing its biogas production by 40 percent and reduce the amount of residual sludge for disposal. Work is now focused on further optimising the TPH for operating conditions at Echten.

Text: Alan Sherrard

Illustration courtesy HoSt

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MUCH "TO DO" WITH CO₂



Photo courtesy nova-institute

Opening session: Andreas Pilzecker, European Commission; Søren Bøwadt, European Commission; Dr Lothar Mennicken, Federal Ministry of Education and Research (BMBF); Michael Carus, Managing Director, nova-Institute; Dr Martin Lange, Federal Environment Agency (UBA) and Kathryn Sheridan, Sustainability Consult.

As a fossil derived greenhouse gas (GHG), carbon dioxide (CO₂) is a major problem and widespread efforts are being made to curtail its accumulation in the atmosphere. Parallel to source emission reduction policies and technologies, a new strand of research is rapidly emerging under the umbrella term "carbon (dioxide) capture and utilisation" (CCU). The focus is on looking at the world's perhaps most frowned upon gas as a resource instead.

HELD IN ESSEN, GERMANY under the patronage of Svenja Schulze, Minister of Innovation, Science and Research in the German State of North Rhine-Westphalia, the 4th Conference on Carbon Dioxide as Feedstock for Fuels, Chemistry and Polymers attracted some 170 academic and industrial experts from 25 countries. The two-day conference was organised at the end of September by nova-Institute, a private independent research and consultancy focused on the biobased and carbon dioxide (CO₂) based economy.

CO₂ usage today

With the exception of urea, aspirin and carbonates the industrial utilisation of CO₂ as a chemical feedstock is limited by thermodynamic and kinetic constraints. In contrast it is the properties that these constraints give rise to – inert, stable and heavier than air – that makes it a major commercial product for fire extinguishing systems, refrigerants and the food and beverage industry. Recent advances in carbon capture and utilisation (CCU) technologies, so-called "power-to-x" pathways where x is a product, presented during the event suggest that CO₂

could become an industrial-scale feedstock for synthetic fuels and other key chemicals sooner not later.

Visionary potential

– The complete needs of energy sources and platform chemicals could be sustainable and covered with renewable energies and CCU technologies, stated Michael Carus, physicist and Managing Director of nova-Institute and conference organiser in his opening address.

Carus highlighted that in 2050, 5-10 percent of the world's desert area would be enough to cover both the global energy demand and the carbon needs of the chemical and polymer industry with solar power, even taking into account grid and storage construction. The cost to "solarise the world" he suggested would only be 5-10 years worth of the annual global spend of US\$ 1 300 billion on arms and defence.

– This implies that it is primarily a question of the right political guidance and of investments, whether we will have raw material shortage in the future or not, said Carus stressing the need and importance "to show society and politicians a positive vision, to encourage them to break new ground."

Katy Armstrong from the international CO₂Chem network and the European research project Smart CO₂ Transformation (SCOT) cautioned against exaggerated expectations.

– Much would be achieved if a pilot project could provide a local population with wind power and CCU fuels, remarked Armstrong, bringing to mind lessons learnt from talk of potentials and hype in other sectors such as cellulosic biofuels.

Unavoidable CO₂

Dr Markus Friedl, Professor and Head of Institute for Energy Technology Hochschule für Technik Rapperswil, Switzerland reminded the audience that power-to-gas only makes sense if using the methane produced has less negative impact on the environment than using fossil derived methane. First Life Cycle Assessments (LCA) for Switzerland suggest that this is only the case, if the following two conditions are fulfilled: the power used for the electrolyser is renewable and the CO₂ used in the methanation is of biological nature or its production is "unavoidable".

– Unavoidable means CO₂ that »



Christian von Olshausen, sunfire, outlining some of the company's power-to-liquids activities and milestones.

Cont. from page 19

is released as part of a necessary process other than combustion of fossil fuels, explained Friedl, adding that 18 percent of Swiss man-made, unavoidable CO₂ emissions are concentrated in 36 locations and candidates for power-to-methane plants.

Incentives needed

Delegates called upon politicians to create market incentives to facilitate bringing new CCU technologies to the market. The European Commission (EC) took a first step in this direction with the reform of the "Renewable Energy Directive (RED)", partially equating CCU fuels with biofuels, as Andreas Pilzecker, DG Climate, reported.

A particularly intense discussion ensued on whether a mandatory blend of CCU based kerosene in aviation fuel would be a good route to develop market and capacity as CCU fuels and platform chemicals remain around a factor of 2-3 times more expensive than their fossil counterparts, yet show really low carbon footprints after first life cycle assessments, clearly less than even the best biofuels.

CCU state-of-play

Hydrogen (H₂) is a key component for most CCU-technologies as it is used to reduce the CO₂. However conventional H₂ production, such as by electrolysis of water, is energy intensive and, as pointed out by Dr Friedl, may defeat the purpose. Several speakers remarked that H₂ production represents over 80 percent of the costs for CO₂ based fuels and chemicals. Lowering the cost of H₂ production is a critical factor and the research race is on.

Well-developed CCU technologies on the cusp of industrial-scale



Dr Christoph Gürtler, Covestro, revealed production of CO₂-based polyurethane foams will start 2016.

commercialisation were presented as well as those still in laboratory or pilot scale. Icelandic company International Carbon Recycling (ICR) is an example of the former with its 4 000 tonne-per-annum renewable methanol plant in Iceland making it the largest CCU plant of its kind.

Another pathway has been demonstrated by American company, Joule Fuels Unlimited, with its continuous flow "reverse combustion" CO₂-to-fuel production platform. According to Kees van de Kerk the pilot plant in New Mexico uses sunlight, non-potable water and engineered cyanobacteria that function as living catalysts to produce specific products, ethanol or hydrocarbon fuels that are "inherently compatible" with existing infrastructure.

Thomas Heller with MicroBenergy, owned by Viessmann Group, presented a novel microbiological process set up as a demonstration power-to-gas at a biogas plant in Alldorf (Eder), Germany. The project is part of the German BioPower2Gas subsidy programme. The process combines hydrogen from an external source with the CO₂ generated during fermentation in a biogas plant converting it into methane. A PEM electrolyser built by Carbotech, another Viessmann company, is used to produce hydrogen.

– Specialised microorganisms perform the actual methanisation. They absorb the carbon dioxide and the hydrogen in liquid form through their cell walls, 'digesting' and converting them into methane. The only thing left over after this process is water. Biological methanation impresses due to its optimum flexibility, making it eminently suitable to absorb fluctuating quantities of power produced by wind or solar power, said Heller.



Benedikt Stefánsson ICR explained how power-to-methanol uses power and CO₂ from a geothermal plant.

Leading in the usage of CO₂ for production of CO₂ based polymers is Covestro, formerly Bayer Material Science and one of the world's largest polymer producers, which will be the first to produce CO₂ based polyurethane foams in Dormagen, Germany next year.

– This should be the start for a new product family based on CO₂ based polyols and polymers, said Dr Christoph Gürtler from Covestro.

Also in an advanced state of pre-commercial deployment are CCU systems that combine electrolysis of water and then from the hydrogen plus CO₂ produce a variety of synthetic fuels and platform chemicals via Fischer-Tropsch processes. This includes for example the technologies from the German company sunfire and the Israeli company NewCO₂Fuels.

Artificial photosynthesis

Dr Dunwei Wang, Professor from Boston College, US presented the latest update on work to develop cheap low-cost metallic catalysts, which may enable artificial photosynthesis with high efficiency.

– The promise held by solar water splitting, however, cannot be materialised unless the process can be carried out using earth-abundant, low-cost materials, said Wang.

Wang's research involves using hematite (alpha phase iron oxide) and addressing the key problems shared by low-cost materials.

– Many of these issues are addressable and collectively our improvement strategies demonstrate that the performance of hematite can be improved dramatically, enabling complete solar water splitting without the need for external power input other than the presence of a silicon-based photocathode. These



Bio-electrocatalytic CO₂ reduction with microbes and enzymes, Stefanie Schlager, Johannes Kepler University.

results open up new opportunities toward practical low-cost solar hydrogen generation, said Wang.

– The design of highly efficient, non-biological, molecular-level energy conversion "machines" that generate fuels directly from sunlight, water, and carbon dioxide is both a formidable challenge and an opportunity that, if realised, could have a revolutionary impact on our energy system, said Dr Nathan Lewis, Professor at the California Institute of Technology and US Department of Energy Energy Innovation Hub, Joint Center for Artificial Photosynthesis (JCAP).

Lewis presented a bold example of mimicry. His research thus far has developed so-called "silicon microwires", which can split water directly into hydrogen and oxygen with the use of sunlight. These "polymer mats" can be rolled out like a carpet and produce hydrogen from sunlight and humidity.

– Basic research has already provided enormous advances in our understanding of the subtle and complex photochemistry behind the natural photosynthetic system, and in the use of inorganic photocatalytic methods to split water or reduce carbon dioxide – key steps in photosynthesis, Lewis said.

In a second step these could be designed to produce synthetic fuels using CO₂ from the air. In other words solar energy could be tapped and transformed into high energy density synthetic fuels and stored in decentralised locations.

When could such technologies appear on the market? The next edition of the event, slated to be held in December 2016, is a good place to find out.

Text & photos: Alan Sherrard
B182/5065/AS

Added value to Malaysian palm residue

Founded in 2002, the Chinese company Beijing Windbell Technology Co., Ltd originally operated in the explosion-proof products sector. In 2012 the company expanded into the biomass industry. However unlike the majority of Chinese companies in this sector, Windbell based their core biomass business on oil palm industry residue in Malaysia, establishing a pilot torrefaction factory there in 2012. In June of this year their China-Malaysia joint venture factory began operation. It has a biochar and biocoal co-production system line, co-located with an activated carbon production line.

WINDBELL EXPANDED INTO THE BIOMASS INDUSTRY in 2012, when there were already a lot of players in the Chinese bioenergy market.

– We were looking for some raw biomass materials, low cost, big amount and easily collect. The domestic market price of woody and agricultural residues has already increased a lot due to a lot of pellets mills and biomass power plants setting up. We found there is annually over 100 million tonnes of palm biomass residues in South East Asia, so we started invest into this field, said De Li, General Manager of Beijing Windbell Technology.

In China's 2014-2020 Energy Development Action Plan, the broadening of international cooperation is encouraged through the "Silk Road Economic Belt Plan". South East Asian countries are included the Maritime Silk Road and Windbell's strategy is to provide technology and equipment to these countries, using their plentiful supplies of palm residues to produce biomass fuels and import them back to China.

No import restrictions

The pellets made from empty palm fruit branches (EFB) have 4-12 percent ash content, 0.1-0.5 percent sulphur (S), 0.3-1 percent chlorine (Cl) and its Ash Fusion Temperature (Initial Deformation Temperature) is 900 °C. According to current pellet standards in the EU, Japan, Korea and China, only the Chinese market can accept EFB-based solid fuel.

– We trust that the demand of biomass fuels in China will increase dra-

matically under the current air pollution control action plan. Biomass will be a crucial alternative to coal said De Li.

The only obstacle for palm-based fuels, EFB pellets and palm kernel shell (PKS), is that they are classified as biomass waste in the China Customs Dictionary.

– However, our torrefied EFB pellets don't have this problem as it can be directly imported to China as charcoal without customs quarantine inspection. This torrefied EFB pellets can be used in existing coal-firing boilers without any modification, said De Li.

Windbell built a pilot plant in Seremban, Malaysia in 2012. This year their new 20 000 tonne-per-annum capacity, biocoal and biochar co-production system factory located at Port Kelang in Selangor, Malaysia started operation. The company has also signed for another 150 000 tonne-per-annum capacity factory contract in Segamat, Malaysia. All these palm residue based fuel products are planned for import to China.

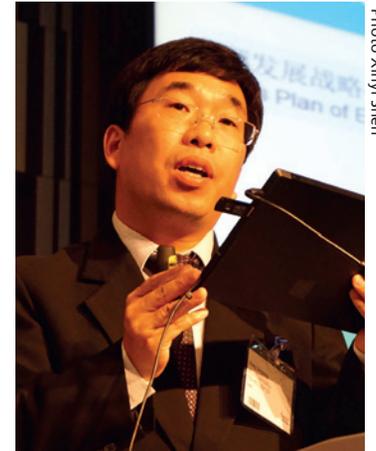


Photo Xinyi Shen

– The strategy is to provide our technology and equipment to South-East Asian countries, use the abundant palm residue there to produce biomass fuels and then import the fuels back to China, explained Zhang Qingqiang, Vice President, Beijing Windbell Technology Co.,Ltd during CMT's Biomass Power conference in Seoul, South Korea (photo Xinyi Shen).



Carbonised PKS

Text: Xinyi Shen

Photos courtesy Beijing Windbell
B182/4910/AS



Vertical carbonisation kiln, 1000 kg per hour, 4.5 kW, operation temperature at 500 °C. 5-6 tonnes raw PKS or EFB can produce 1 tonne biochar. The biochar fixed carbon content is 60-70 percent, volatile content is 30 percent.



Empty fruit bunches (EFB) is a plentiful but challenging residue to handle.

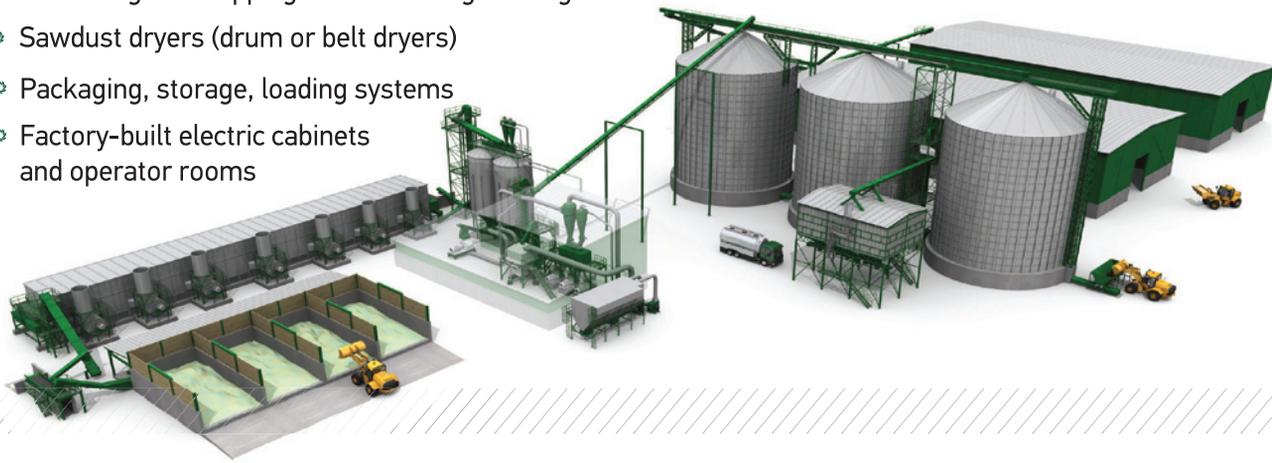


Two rotary dryers and one torrefaction kiln. One dryer for a vertical carbonisation kiln and the other for a torrefaction kiln. Raw EFB has over 50 percent moisture, so EFB moisture should be reduced through drying to 10 percent before carbonisation and torrefaction. The torrefaction operating temperature is about 260 °C, with 3 tonnes raw EFB producing 1 tonne of biocoal. The biocoal fixed carbon content is 30 percent, volatile content is 60 percent.

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Wood pellet losing competitiveness in Korean market

CMT's annual Biomass Pellets Trade & Power was once again co-hosted with EnerOne in mid-September in Seoul, South Korea. About one hundred professionals attended this the 6th edition, fewer than previous years reflecting the current price trend in the Korean pellet market.

THE DRAMATIC SURGE in South Korean wood pellet imports since 2012, when the renewable portfolio standard (RPS) was introduced, declined significantly both in volume and prices in the first and second quarter this year. The drop in crude oil and natural gas prices, and the shift in policies has led to wood pellet losing its competitiveness in the South Korean market.

– Considering the economic feasibility, the electricity production fuel cost for coal is KRW 37.98 [≈US\$0.033] per kWh, while for wood pellet is KRW 84.75 [≈US\$0.074] per kWh. So the cost of coal is less than half of wood pellets, commented Ho-sung Jang, Korean Southern Power Co.

According to EnerOne's data, the price of wood pellet in South Korea has dropped from over US\$170/tonne CIF in 2014 to a more recent US\$120/tonne CIF. Imports from the first half of 2015 amounted to 610 000 tonnes, compared to 670 000 tonnes in the same period last year. The 2014 annual total was 1.85 million tonnes. Vietnam is the biggest wood pellet exporter to South Korea and due to oversupply, Vietnamese producers are pushing prices down.

Wood pellet preference

For the Korean Gencos, wood pellet is preferred over palm based biomass fuel from South-East Asian countries, such as empty fruit branches (EFB) pellet and palm kernel shell (PKS). This is because EFB has a high chlorine (Cl) and ash content and low initial deformation temperature (IDT), while PKS is high in chromium (Cr) and Cl and has a low volume mass. EFB pellets and PKS are only suitable in fluidised bed type boilers whereas wood pellets can be used both in pulverised coal and fluidised bed type boilers.

Producer consolidation

This creates a big challenge for EFB pellet producers from South-East

Asian countries. When they started to invest in EFB pellets plants in 2012, they expected the export of EFB pellets to Korea would increase steadily as the RPS obligation ratio increases year by year. As a result of lower demand and prices, both wood and EFB pellet producers in South East Asia are struggling to survive sparking a wave of consolidation and curtailment.

Many have stopped operation and small family firms are leaving the business. Only those with high quality control and big players can survive.

– There were over 180 pellets producers in Vietnam previously. Now there are about 80, but the production amount remains similar. Vietnam will remain as biggest and cheapest supplier in Asia. For Cellmark, we look forward to the long-term development. We have invested in a 120 000 tonne-per-annum wood pellet plant in Borneo, Sarawak, Malaysia, said Nguyen Tan, Sales Manager, Cell-Mark, Vietnam.

Look to China

As the world's second largest energy market, China is searching for ways to increase its portfolio of renewable energy, and biomass utilisation, such as supplementing its coal usage with biomass pellets, is one of the country's priorities.

– While the market is currently in its infancy with minimal import volume, the potential of the Chinese appetite is massive, commented Zhang Qingqiang, Vice President, Beijing Windbell Technology Co.,Ltd. The company is currently setting up biocoal plants in Malaysia using residues from the palm oil industry for export to China.

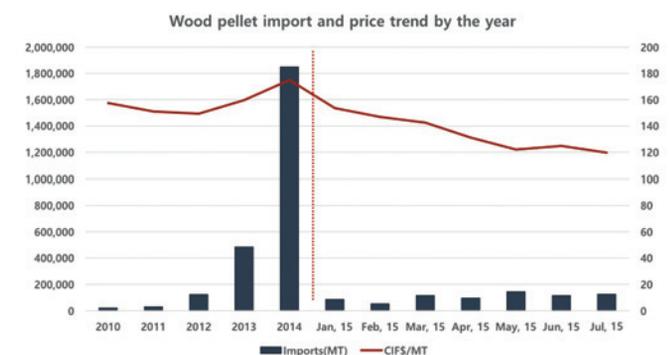
– We are intensively cooperating with academic institutes. The co-firing with coal test result shows it is possible to use up to 5 percent palm pellet without slagging. We will focus on industrial boiler to replace from coal to biomass, and low temperature boiler operating



The panel of Korean power utilities (Genco's) commenting the pellet market.

Wood Pellet Market Trends in S. Korea

1. The Amount and Price Trend of imported Wood Pellets in S.Korea



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Figures over South Korean wood pellet imports and prices (courtesy EnerOne).



Zhang Weidong, Programme Manager, United Nations Development Programme (UNDP), spoke on regulatory policy development in biomass



(Above) Malaysian producers look to China, Md Arfzal Md Ariffin, Detik Aturan Sdn Bhd, with EFB pellets. (Below) Cellmark have a 120 ktpa wood pellet plant told Ngyuyen Tan.

below 900 °C. The coal ban in China opens new opportunity in palm pellet production, said Md Arfzal Md Ariffin, Executive Director, for Detik Aturan Sdn Bhd, a Malaysian producer of EFB pellets.

Text & photos: Xinyi Shen
B182/5041/AS



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A "Start Me Up" USIPA

– Things get better with age, remarked Harold Arnold, USIPA Chairman and President of Fram Renewable Fuel in his opening address of USIPA's 5th Annual Exporting Pellets Conference in Miami Beach, Florida. This year's edition was characterised by mature reflection and a sober outlook. It was the best yet in terms of dedicating time to a much broader discussion on industrial pellet markets other than the European utility sector in general and the UK in particular.

MAKE NO MISTAKE, MIAMI BEACH was by all accounts the place to be. Driven by 2020 targets, the energy sector in the European Union (EU) remains the largest volume market for industrial pellets and US producers' major suppliers for the foreseeable future – foreseeable being the operative word. Arnold continued his address to describe how far and fast the US industrial pellet industry has moved since the first conference, which was held just five years ago in New Orleans. He noted several milestones including safety, sustainability, standards and scale, the roll-out of production- and supply-chain capacity all adding up to US\$ billions in investment capital. In a word "remarkable" as Harald Arnold put it.

Thinking beyond the fire

Arnold's milestones also indicate a degree of industry maturation. Coupled with the final Clean Power Plan (CPP) issued 3 August requiring the US power sector as a whole to reduce greenhouse gas (GHG) emissions by 32 percent from 2005 levels by 2030, not to mention movements in other non-subsidised markets for woody lignin-based applications, such as the chemical industry, it was very timely that such topics were also on the "exporting pellets" conference agenda to be "explored". Judging from the questions and comments heard during the event, it was also a

welcome development.

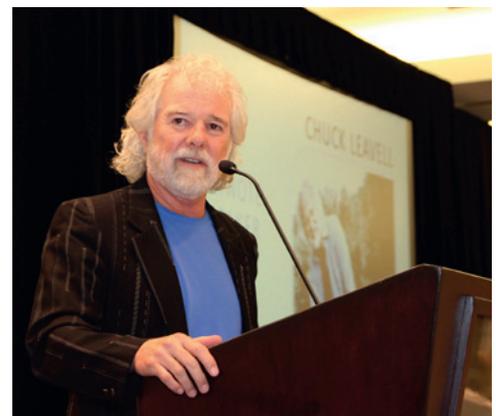
Providing an inspirational and well-received insight into the latter, Dr Federico M. Berruti, Consultant, McKinsey & Company, reminded delegates that there are numerous pathways to consider for extracting the most value from biomass and three "investment horizons" for biomass technologies; proven, emerging and demonstration. Pelletising falls into the first category, pellets are well proven, have a transportation cost advantage over other solid biomass forms and a near-commodity.

– We should learn from the crude oil world. The largest share of revenues from petroleum refining comes from the smallest share of end-use, speciality fuels and chemicals, explained Berruti before ending with a recent example of Canadian cellulose to glucose research using pellets.

Wilco van der Lans, Senior Business Developer Industry and Energy, Port of Rotterdam, the Netherlands took the train of thought one step further; van der Lans is also Project Manager for the Rotterdam Biorefinery concept. The objective is to set-up a second-generation integrated ligno-cellulosic project using 1 million tonnes-per-annum of pellets as feedstock. It makes much more sense than it may first sound. Rotterdam is the location of the largest refining, petro-chemical and chemical industry cluster in »



– Oddly we're picked up a bit of Moore from the electronics industry along the way. The more we produce the cheaper it gets, quite unintentionally, remarked Harald Arnold, USIPA Chairman.



Well-tuned keynote speaker, Chuck Leavell, award winning forester, forest owner and Rolling Stones keyboardist, spoke of forest owners' stewardship and the importance of partnership in the industry.

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» Europe, the supply-chains and other infrastructures already exist, also of course for pellets. A parallel can be drawn to liquid biofuels and refining majors like Neste.

First SBP certified producer

Nonetheless a key and popular feature of the conference are the producer and utility market panels whereby moderated panellists share views on the current (and conventional) markets for pellets, supply and demand forecasts all within the bounds of competition and anti-trust limitations. Sustainability was discussed. Deborah Keedy, arguably the world’s single largest pellet buyer in her role as Head of Biomass Procurement at Drax Power, remarked that “we want all of our producers to be SBP [Sustainable Biomass Partnership] certified by 2016.” A tough call given that news only emerged during the event that The Westervelt Company had become the first SBP certified producer.

What’s happening in the UK?

As at previous editions John Bingham, Director, Hawkins Wright, provided the backdrop for market panel discussions with an outlook on industrial wood pellet markets in Europe and Asia. Being policy driven markets, political risk and policy uncertainty remain an almost constant macro-challenge but so too did “plummeting” energy and weak carbon prices compounded by a strong US\$ translating to a 15 percent increase in the cost of pellets for those buying with EUR.

On the upside side Bingham noted that the market as a whole has continued to grow, progress can be reported on some large power projects, there have been some positive policy developments such as in the Netherlands and perhaps more importantly as a result there is an improvement in long-term visibility. The big question on many minds: what more (or less) can be expected from the new Conservative regime in the UK now that it has full control over energy policy for the first time in almost a decade?



The “traditional” pellet market panel session with Jason Woods (left), Head of Biomass, Vattenfall Trading; Martin de Wolff, Head of Biofuel Trading, RWE Supply & Trading; Peter Thomsen, VP DONG Energy Thermal Power; moderator Thomas Meth, Co-Founder & Executive VP Sales & Marketing, Enviva Biomass; Fabien Mehu, Head of Biomass Trading, Engie and Deborah Keedy, Head of Biomass Procurement, Drax Power.



Dynamic duo who spoke on other pellet markets, Wilco van der Lans, from Port of Rotterdam (left) and Dr Federico Berruti, McKinsey & Company.

– The immediate priorities have been to control overspending in the Levy Control Framework (LCF), the budget that caps spending on support for renewable electricity. But note that as a whole these cost cutting measures are not aimed at biomass specifically, he explained.

Other forms of support that affect pellets have been reduced or removed including grandfathering of renewable obligation certificates



John Keppler, Chairman & CEO, Enviva, currently the world’s largest producer and first to “go public” in the US, spoke pellets in non-policy driven markets.

(ROC) for conversion and co-firing, removing renewable electricity’s exemption from the climate change levy (CCL), and postponing the autumn contract for difference (CfD) auction. With the 2015/2016 capacity margin down to around 1.5 percent, there will be plenty to report on from next year’s USIPA, 6-8 November 2016.

*Text & photos: Alan Sherrard
B182/5053/AS*

Biocoal plant planned for Kaliningrad

Finnish torrefaction technology developer Torrec Oy has revealed it has signed a contract with Kaliningrad-based wood processing company OOO Baltic Forest Company (BFC) to build a biocoal production plant in the Kaliningrad region. Kaliningrad is a Russian territorial enclosure on the Baltic Sea coastline bordering Poland and Lithuania.

According to Heikki Sonninen, Director of Marketing and Sales for Torrec Oy, the design production capacity of the plant will be 30 000 tonnes-per-annum of torrefied wood (TW) pellets using mixed hardwood species as feedstock. Torrec is the main designer of the plant with some of the equipment to be procured locally by the client. The total investment value is around EUR 4 million and plant is estimated to begin production early summer of 2016.

The company has been developing its own torrefaction technology in Mikkeli, Central Fin-

land, in co-operation with the local development company Miktech Oy, Etelä-Savon Energia Oy and the Finnish development fund Tekes.

– For Torrec this contract with BFC means a remarkable opening to the Russian market, where the advantageous raw material availability provides excellent opportunities for profitable production, said Heikki Sonninen.

The plan is to supply TW pellets for co-firing at coal-fired power plants around the Baltic Sea enabling an increase of renewable power output at minimum capital investment.

– Torrefied wood pellets can be mixed with fossil coal up to 50 percent without new investments at the power station, said Sonninen adding that the consumer market is of interest though market entrance is more complicated.

B182/5037/AS

Lignetics acquire Geneva Wood

One of the largest residential wood pellet manufacturing companies in the US, Idaho-based Lignetics, Inc., has announced the acquisition of Geneva Wood Fuels (Geneva) pellet production facility in Strong, Maine from GF Funding LLC. The facility produces hardwood pellet fuel for residential and commercial use. The deal enables Lignetics to expand its overall production capacity to over 500 000 tonnes per annum and makes it the only pellet producer that has manufacturing plants on both the East Coast and the West Coast with a spread of six plant locations in the states of Maine, Oregon, Idaho, West Virginia and Virginia.

Founded in 1983, Lignetics is one of the pioneers of wood pellets and compressed wood fire logs manufacturing that also includes flavoured BBQ pellets and animal bedding.

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Wind and solar could boost biogas in Brandenburg

Despite “Energiewende”, with continued reliance on coal Germany’s clean energy implementation leadership image is somewhat sooty. Yet a thin silver lining is beginning to appear in the nation’s coal state, Brandenburg.

FURTHER DEVELOPMENT IN BRANDENBURG will not be limited to the quantitative growth of bio-energy plants, but increasingly the state is going to promote energy efficiency and the intensified use of biogenic waste material, which as a result can promote the biogas industry.

More than 300 politicians, energy experts and leading representatives of the German energy industry discussed the ongoing energy transition, called “Energiewende” (Energy Transition), at the 17th Energy Day of Brandenburg. The event took place in the city of Cottbus at the beginning of September.

The conference, one of many German gatherings on the subject, saw Energiewende debated with particular intensity. The German energy conversion is estimated to cost EUR 20 billion.

In June 2011, three months after the disaster in Fukushima, the German Government announced that it would pursue an Energiewende and phase out nuclear power. Shortly thereafter the government shut down eight German nuclear power stations.

Most of the Brandenburg conference exhibition inside the auditorium comprised of booths presenting biomass and biogas innovations and new clean plant technologies in the state of Brandenburg.

– Even in this coal-producing state biogas can be the intelligent link and solution between the electricity grid and the natural gas grid and as such it can play a key role, said Brandenburg’s energy minister, Albrecht Gerber in his key note speech.

Several wind power presentations bore witness to strong regional ambitions to develop these renewable technologies too. But the future of the Swedish state-owned company Vattenfall and its coal business dispute in Brandenburg and Sachsen dominated the debate.

Germany was one of the few countries in the world to take a no-excuses approach to developing renewable energy by creating a highly motivated set of policies to promote localised, distributed generation. But today the country is facing some harsh realities. Mounting legacy costs of feed-in tariffs, increasing electricity rates and rising CO₂ emissions are feeding a debate about the effectiveness of the country’s energy transition.

Recently, Fraunhofer Institute released the latest data on Germany’s electricity production mix. It reveals that on an annual basis, coal is still winning out over everything else. Despite some impressive single-day records for solar and wind power production, these still trail coal, biomass



Call for coal closure, a demonstration organised against the use of coal power in Lausitz-Brandenburg.

and nuclear in monthly generation totals.

The dominating position of coal generation shows that large amounts of renewables aren’t enough to quickly unroot fossil fuels, nor to compensate for a phase-out of nuclear power. Some experts argue that true energy transitions do not happen within a decade.

Germany might be developing renewable power faster than other countries, but it’s also demonstrating that energy changes don’t happen quickly, no matter how dynamic the policies are.

– We have decided to launch a forceful use of environmentally friendly and sustainable biomass in our Biomass Strategy. The provision of electricity, heat and fuels from biogenic materials already achieved the strategic target of a 58 PJ share of primary energy use by 2030, through an increase in the combustion of biomass in conventional power stations and an increase in processing in refineries, which have reached over 60 PJ, explained Brandenburg’s energy minister, Albrecht Gerber at the conference.

Gerber said that the focus of future expansion includes combined heat and power (CHP), feeding biomethane into the natural gas network, using the potential of livestock manure and the multiple uses of biomass and bio-refineries.

Seven locations

Coal power today represents about 46 percent of the country’s electricity production and still dominates in Brandenburg and Saxony where Swedish state-owned utility Vattenfall operates coal mining in large pits. It remains an open question whether Germany wants to transform its energy mix to renewables at the same time as keeping its coal.

– Negotiations for a new owner for Vattenfall’s lignite operations in Germany are expected to be completed by the first quarter of next year, declared Hubertus Altmann, CEO for Vattenfall Europe AG without revealing any further details.

At the same time as searching for a buyer for the existing operations at 7 different locations in the states of Brandenburg and Saxony, Vattenfall is planning a new open pit in Welzow-Süd, which is located on the border between these two

states and contains more than 200 million tonnes of lignite.

– Vattenfall is investing at the moment in the development of new processes that significantly reduces the amount of carbon dioxide in coal mining and the production of electricity. These include various forms of dry treatment of lignite, said Hubertus Altmann during the Cottbus conference.

Cleaner technology

The latest regional research aims for the rehabilitation of power plants for the use of so-called dry brown coal, along with the combustion of coal dust from brown and hard coal under pressure, and the combustion of lignite, coal and biomass through pressurised steam fluidised bed drying (PSFBD).

Technologies to reduce carbon dioxide (CO₂) emissions from coal power plants are very expensive.

– Such renewal will however raise the end customers’ electricity costs by 10 percent, said Vattenfall’s German CEO, Altmann.

Altmann also mentioned former carbon, capture and storage (CCS) projects as still being an opportunity. The method means that from the main emission points, CO₂ is separated, after which it is compressed and transported in pipelines to, for example, a storage site where it is pumped into a geological formation deep under the earth.

– Unfortunately the practice has shown that it is politically unfeasible in Germany, said Hubertus Altmann.

Outside the conference building in Cottbus a group of regional environmentalists demonstrated against both Vattenfall’s plans to sell its coal plants to “untrustworthy bidders” and to open new pits in Welzow-Süd and Nochten. This would, according to the activists, give rise to an additional three East German villages being displaced with residents forced to move to another location.

Vattenfall’s sale of the business is also not popular with Brandenburg and Saxony’s environmental organisations.

– One of the bidders is said to be a shadowy »

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Helsingør to convert CHP to biomass

The Danish energy utility Helsingør Utilities has announced that it has appointed consulting and engineering company Grontmij (now Sweco) to convert its natural gas fired combined heat and power (CHP) plant in the harbour town to biomass. With the construction of a new boiler-unit and the redevelopment of existing facilities, Helsingør Utilities aims to lower CO₂ emissions, in line with the ongoing sustainable transformation of the Danish energy sector. Grontmij has been commissioned for the total project management, health and safety issues and the design of all mechanical and electrical installations. For the new facility this involves the design of a boiler unit, flue gas cleaning and condensing systems, fuel management systems and supporting equipment. In the existing plant, the steam turbine will be prepared to run on steam from both the existing and the new plant. The entire facility will have a fuel capacity of 70 MW.



B182/5054/AS

B&W awarded multi-million build and operate contract in UK

The US-headed energy and environmental technology service provider, Babcock & Wilcox Enterprises, Inc. (B&W) has announced that a joint venture including its Denmark-based subsidiary, Babcock & Wilcox Vølund A/S, has been awarded a contract to design and build the Teesside Renewable Energy Plant near Middlesbrough, England. B&W Vølund was also awarded a separate contract to provide operations and maintenance services for the plant. B&W's portions of the two contracts total more than US\$190 million (≈ EUR 172 million).

B&W Vølund, through its UK subsidiary and a joint venture with Lagan Construction Group Limited, has contracted with developers Eco2 Ltd and Temporis Capital to build the 40 MW waste wood fired biomass power plant for Port Clarence Energy Ltd.

The project scope includes a boiler and environmental controls designed by B&W Vølund and its Swedish subsidiary Götaverken Miljö AB, including a dry flue gas desulphurisation system (dry FGD), fabric filter baghouse, continuous emissions monitoring equipment and a DynaGrate® fuel combustion system. The plant is designed to burn 34 US tons (≈ 30 tonnes) of waste wood per hour.

Project engineering is currently underway and construction is scheduled for completion in the first quarter of 2018. B&W Vølund will operate the plant under a 15-year contract.

B182/5067/AS

PHG Energy expands capabilities with acquisition

The US-based gasification technology developer PHG Energy (PHGE) has acquired the assets of ARiES Energy of Knoxville, Tennessee (TN) adding significantly to its established business lines and formalising the ongoing partnering relationship between the companies.

ARiES Energy, a solar, lighting and energy efficiency company has successfully provided solar photovoltaic, LED lighting, power conditioning and energy efficiency systems for commercial businesses, res-

idences and municipalities in the US Southeast.

– Our companies have worked very closely together over the past two years in both project development and in researching ways to better serve this dynamic and growing energy market. Both PHGE and ARiES have come to realise that an integration of our product and service offerings will bring a higher level of service to our customers, and just makes good business sense, said Tom Stanzione, President of PHG

Veolia to operate Ireland's largest independent biomass CHP

Veolia Energy Services, the Irish subsidiary of global energy and environment company Veolia, has announced it has been awarded a major operations and maintenance contract by Mayo Renewable Power. Worth EUR 450 million the 15-year contract is to operate a biomass power plant in Killala, Co. Mayo, in Ireland.

The 42.5 MW combined heat and power (CHP) plant will be the largest independent biomass power plant in Ireland. In addition to operating and maintaining the power production plant and the adjacent fuel processing plant, Veolia will also supply the total biomass fuel requirement for the facility. The plant will use similar technology to that applied at Veolia's biomass facilities at Merritt and Fort St. James in British Columbia, Canada, which are among the largest plants in North America. Moreover, the operations and maintenance contract will directly create 30 new jobs at the facility in Killala. The plant will be in commercial operation in mid-2017.

– This project marks a significant step on Ireland's path towards developing sustainable energy solutions. We are looking forward to collaborating with our project partners to deliver best in class energy management for the successful delivery of this milestone project, said Estelle Brachlianoff, Senior Executive Vice President, Veolia UK and Ireland.

Veolia has been operating in Ireland since 1990 and currently works with industry, commercial customers and public authorities to find solutions for the sustainable management of their resources. It employs 500 staff across its three business activities in water, waste management and energy.

B182/5058/AS



Vattenfall Europe AG's Managing Director, Hubertus Altmann believes that coal is needed to ensure the transition to renewable energy over the next few decades.

Cont. from page 29

private energy magnate from the Czech Republic, warned one of the activists outside the conference room in Cottbus.

Brandenburg's energy minister Albrecht Gerber would prefer to keep Vattenfall, which employs 8 000 people in his state, so a phasing-out of coal is for him not yet on the table. The German States of Brandenburg and Saxony want Vattenfall to continue with the process of opening new lignite pits. There are many jobs that are at stake in this part of Germany, which is already short on jobs.

A buyer needed

There has been a broad consensus in German society and the main parties agree to that by the year 2022 Germany's electricity supply will be free from nuclear power and largely come from renewable sources.

The goal of Angela Merkel's grand coalition government is that green energy will account for 80 percent of electricity generation by 2050. Coal is not supposed to play any role at all by then. Before this becomes reality it is essential that Vattenfall finds a buyer, so that the owner, that is to say the Swedish Government, is able to consider a deal when it is presented by the company.

Text & photos
Markku Björkman
B182/5022/AS

B182/5042/AS

THE LIQUEFIED PETROLEUM GAS BIO-BUZZ

Ironic as it may seem, liquefied petroleum gas (LPG) can play an increasingly important role for developing biomass fuel markets as a whole. The specific characteristics of LPG and its advantages over other fuels – fossil and non-fossil alike – along with its current uses suggest LPG may be exceptionally well suited to act as a “bridging” fuel for renewables. Commercial pathways to produce Bio-LPG are emerging and the race is on to secure production and distribution.

LEAVING ASIDE THE APPARENT CONTRADICTIONS of a “liquefied gas” or having “bio” and “petroleum” in the same term, Liquefied Petroleum Gas (LPG) is a generic name for commercial blends of light gaseous hydrocarbons, predominantly propane (C₃H₈) and butane (C₄H₁₀). These change from a gaseous state at normal temperature and pressure to a liquid state when cooled or compressed at moderate pressure. This liquefaction property increases the density and, in its liquid state, the energy content of LPG on a per-tonne basis is higher compared to other fuels including most oil products.

LPG is extracted as a by-product from crude oil refining or separated out from natural gas or oil production streams. LPG is normally refrigerated for shipment by sea and storage of large volumes at receiving terminals whereas smaller volumes are usually stored and distributed in pressurised vessels. It burns readily and cleanly in the presence of air giving off a hot flame with low NO_x, SO_x, aromatics and ultra-low soot emissions. LPG in itself is not a greenhouse gas (GHG) and is non-toxic. However being heavier than air it is hazardous and explosive.

Residential sector largest user

Being a function of oil and gas production LPG is supply driven. According to the 2013 “*Statistical Review of Global LP Gas*” jointly published by Argus and the World LP Gas Association, 2013 global LPG production reached just over 280 million tonnes and consumption was 265 million tonnes, both up just over 2 percent on 2012 figures, whereas the 15 million tonne gap between supply and demand remained the same. LPG accounts for around 2 percent of global primary energy supply.

From a renewables perspective it is worth noting what LPG is used for. The residential sector is by far the biggest user, accounting for around 46 percent of all LPG consumed. In developed regions its use is highest in off-gas grid locations for heating and cooking whereas in other regions cooking fuel is the dominant use. Non-energy use in the petrochemicals sector accounts for about 25 percent of consumption whereas transport, industry, refinery and agriculture make up the balance. In Europe an estimated 6 million vehicles use LPG, “Autogas” as it is often called, as road transportation fuel and specific applications include machinery operating in confined spaces.

BioDME and LPG

Dimethyl ether (DME) is another non-toxic gas under normal temperature and pressure conditions but liquefies at about 6 bars and has properties similar to propane. According to the International DME Association, global DME produc-

tion is a modest 5 million tonnes per annum and it is produced from a variety of fossil and biomass feedstock, notably methanol. DME has been used for decades as an aerosol propellant in the personal care industry. More recently it is attracting attention as a (bio)fuel for backup power generation, heating, cooking or transportation. In June the Swedish renewable DME producer **LTU GREEN FUELS AB** revealed that its BioDME is being tested for industrial heating usage blended with LPG (propane) in a project with **FLOGAS SWEDEN AB**. A subsidiary of UK-headed Flogas Europe, it is the country’s largest supplier and distributor of LPG having a 55 percent share of an “addressable” Swedish market of about 340 000 tonnes, the vast majority of which is propane used in industry for process heat.

The BioDME from LTU Green Fuels is produced by gasification of black liquor, a by-product of the pulp industry, at its 1 000 tonne-per-annum pilot plant in Piteå, northern Sweden. In the project a first delivery of 20 percent BioDME-blended LPG has been shipped to an asphalt plant located by Stockholm Arlanda airport where it is currently being tested. Operated by Svevia, one of the largest road infrastructure construction and maintenance companies in Sweden, its Arlanda asphalt plant uses around 800 tonnes of LPG per annum supplied by Flogas Sweden. According to Jan Ström, Regional Manager, Flogas Sweden, the switch to using BioDME-blended LPG is easy and the market demand for renewable LPG is unquestionably there.

– If we had sufficient volumes of BioDME tomorrow we could switch all our customers, Ström remarked during a visit to the Svevia asphalt plant in conjunction with the recent Advanced Biofuels conference in Stockholm Arlanda, Sweden.

According to Ström up to 20 percent blend of

BioDME in LPG is technically possible without any need to adjust equipment, whereas higher blends up to and including 100 percent BioDME require slight modifications. Based on its current market volume, a 20 percent blend for Flogas Sweden translates into a BioDME demand for around 37 400 tonnes of BioDME.

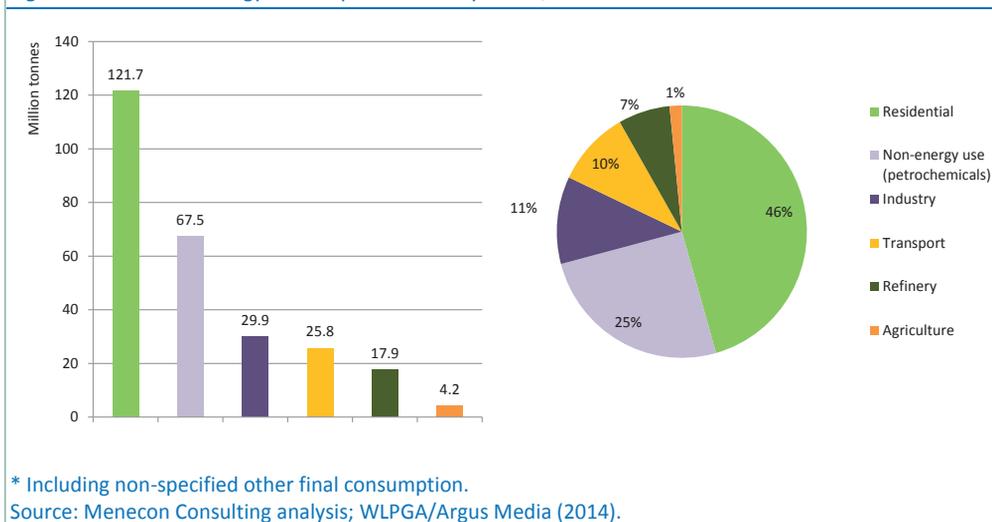
It seems though that commercial-scale BioDME from black liquor, in Sweden at least, may take some time. According to Jonas Rudberg, Director for **PORCUPINE**, a consultancy company and one of the developers behind the LTU Green Fuels pilot plant, if and when commercial-scale BioDME from black liquor becomes a reality is dependent on stable long-term policy, a minimum of 13 years when allowing three year plant build.

– It’s a policy-dependent financing issue. The technology for producing and using BioDME works. The black liquor feedstock is available and, as we can see, the market is ready and waiting. To build the first commercial 100 000 tonne-per-annum facility will require an investment of around SEK 3 billion (≈EUR 322 million), said Rudberg, during the said conference pointing out costs are likely to come down for subsequent plants.

Biogas to BioDME or biopropane

Others are building commercial BioDME but at much smaller scales and using different feedstock. Last year US-based **OBERON FUELS, INC.**, received US Environmental Protection Agency (EPA) approval for its biogas-based DME for inclusion under the Renewable Fuel Standard (RFS) and earlier this year its DME was approved as a “legal” vehicle fuel by the State of California. Oberon Fuels has developed proprietary skid-mounted units that convert methane and carbon dioxide (CO₂) to DME from feedstock such as biogas and natural gas. Capacities are in the range

Figure 3: World final energy consumption of LPG by sector, 2013





– We have developed an innovative renewable product family based on our NEXBTL production technology. BioLPG is the latest addition to our list of renewable products, said Kaisa Hietala, Executive Vice President of Renewable Products at Neste. Production of BioLPG at its Rotterdam biorefinery is expected to begin by end of 2016.

3 000 to 10 000 gallons per day of (Bio)DME.

An alternative biogas route is methane to propane. In July, **ALKCON CORPORATION**, a newly formed US-based company specialising in developing natural gas processing equipment announced it had entered into an “exclusivity agreement” and signed a Letter of Intent (LoI) with **FLOGAS EUROPE**. Alkcon recently filed a provisional patent for its methane-to-propane conversion process and is currently developing a series of industrial gas conversion technology products directed at flare gas recovery, coal seam gas conversion and biopropane production from biogas.

It is the latter that the approximately US\$60 million deal involves. Flogas Europe has the exclusive right to market and sell Alkcon’s proprietary methane-to-propane gas conversion technology in Belgium, France, Ireland, the Netherlands, Norway, Sweden and the UK. Under the terms of the agreement, Flogas will purchase a minimum number of Alkcon’s “MP32K” gas conversion systems annually for five years. Flogas intends to install the units at biogas production sites throughout Europe. Each system could produce up to 1 600 tonnes of biopropane annually. The resultant biopropane will be used to enrich biomethane, increasing its caloric value, before it is injected into national gas grids. The first deliveries are expected to begin in 2016.

BioLPG straight

For the moment it seems that Finnish oil refiner and renewable fuel producer **NESTE** have the upper hand when it comes to producing BioLPG at scale. In September it broke ground on what is described as the world’s first BioLPG production and storage facility at its renewable fuel refinery in Rotterdam, the Netherlands. Announced in December last year the new facility will have a production capacity of 40 000 tonnes per annum of BioLPG for the European market. With a pro-



– Someone has to build the first commercial 100 000 tonne-per-annum facility and to do that they need sufficient confidence in the investment. Taxation and other steering instruments affecting the price of BioDME relative to fossil gas need to remain stable over time, said Jonas Rudberg, Director, Porcupine.

duction process designed by Finland-based technology, engineering and project management company **NESTE JACOBS**, the new facility will purify and separate BioLPG from the side-stream gases produced by the Rotterdam refinery, which primarily produces its NEXBTL renewable diesel from various waste, residues and vegetable oils.

Exclusive distributor for Neste’s BioLPG is the Dutch-headed ‘off-grid’ energy supplier **SHV ENERGY**, which will market and sell the BioLPG. Production at the EUR 60 million facility is scheduled to begin by the end of 2016 and SHV Energy are to supply 160 000 tonnes of BioLPG over a four-year period to clients across the full range of standard LPG applications in six European countries.

– BioLPG is a wonderful addition to our product portfolio, and our customers can benefit as it can be used within a full range of existing LPG applications, from transport and commercial heating to retail leisure cylinders, demonstrating the versatility of the fuel without having to change conventional equipment. This provides our customers with an even cleaner rural energy alternative to the high-carbon fuels many are dependent on in off-grid areas, said Fulco van Lede, Management Board Member of SHV Energy.

It seems that the new biofuel is gaining recognition from policy-makers in some quarters. For instance the UK Department for Transport has issued Renewable Transport Fuel Certificates (RTFCs) for BioLPG under its Renewable Transport Fuel Obligation (RTFO) accreditation.

Bio-isobutene, blessing for butane

For butane, the other major LP gas, the situation is slightly different as there is yet no renewable source of butane. Bottled butane is a major consumer gas used for cooking, camper stoves and portable heaters amongst others. In France,



– From a technical standpoint it is easy to switch to using BioDME blended LPG. If we had sufficient volumes of BioDME tomorrow we could switch all our customers, remarked Jan Ström, Regional Manager, Flogas Sweden, during a visit to Svevia Arlanda asphalt plant in conjunction with the recently held Advanced Biofuels conference in Sweden.

COMITÉ FRANÇAIS DU BUTANE ET DU PROPANE

(CFBP), an industry organisation representing six major gas supply and distribution companies, announced a partnership with **GLOBAL BIOENERGIES**, one of the few companies worldwide and the only one in Europe that is developing a process to convert biomass into some of the key petrochemical hydrocarbons, such as isobutene, via fermentation. The company operates an industrial pilot in France and has begun the construction of its demo plant in Germany. The company is preparing the first full-scale renewable isobutene production plant in France, IBN-One, through a joint-venture with **CRISTAL UNION** with construction expected to begin in 2017. According to current regulations, bottled butane gas may contain a high proportion of isobutene. Using bio-isobutene is an attractive solution to some 10 million French households that use bottled butane.

– Blending isobutene from renewable resources into domestic bottled gas is a practical and everyday application of benefit to a large number of households, commented Marc Delcourt, CEO of Global Bioenergies.

Last July, CFBP and Global Bioenergies started a series of tests based on a batch of bio-isobutene produced by Global Bioenergies at its French pilot site in Pomacle, Marne. The tests focused on the product’s compatibility with the logistics chain and domestic appliances such as cookers.

– At this stage the tests show that renewable isobutene produced by Global Bioenergies is compatible with commercial butane. The CFBP is keen to continue this collaboration to enable the addition of renewable energy in bottled gas in the short term, said Joel Pedessac, CEO of CFBP.

With all the bio in LPG buzz, perhaps its time to introduce Liquefied Renewable Gases, LRG?

*Text & photos: Alan Sherrard
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Advanced Biofuels Conference

Held in mid-September at Stockholm-Arlanda airport, Sweden the inaugural edition of the Advanced Biofuels Conference proved an intensive affair. Organised by the Swedish Bioenergy Association (Svebio), the overall intention was to attract national and international stakeholders across the board interested in “creating a sustainable transport sector.” It succeeded.

SOME 200 DELEGATES COMPRISED of a mix of national and European Parliament politicians, policy-makers, researchers and senior executives from industry made their way to Stockholm-Arlanda airport for two intensive days of knowledge-sharing and networking. The event also included optional pre-conference site visits to the Svevia asphalt plant and the DriveLab Stockholm test lab both located in close proximity to the airport as well as a hydrogen refuelling station opening.

Know your oil

At first glance, David Livingston, Associate in Carnegie’s Energy and Climate Program, University of Southern California, seemed to be the cat amongst pigeons as he began speaking of oil. By slide nine he was a golden eagle.

– Climate research consensus is that two-thirds of fossil fuels – including one third of oil reserves – should not be burned if global warming is to stay below the 2 °C target. The question is which one-third of oil supplies, and are biofuels displacing them, asked Livingston.

Carnegie’s Oil-Climate Index compares global oils’ greenhouse gas (GHG) emissions throughout the supply chain in a bid to assist stakeholders in developing a targeted climate strategy for fossil fuels. According to Livingston there is at least an 80 percent difference in GHG emissions between global oils.

– If carbon isn’t priced, explicitly or implicitly, business as usual won’t consider the climate. Therefore there is a need for informed policy-making to ensure biofuels are displacing the right oils, Livingston concluded.

2030 Renewable Energy Package

On the subject of policy, Sarah Sheridan, Senior Policy Officer, European Commission DG for Climate Action reminded delegates that with 24 percent (in 2012), the transport sector is the second largest source of GHG emissions in the EU and toughest to deal with, before outlining the current policy landscape for advanced biofuels. Looking post-2020 Sheridan highlighted a number of points agreed by the Commission under the Energy Union Package earlier this year that

pertain to biofuels 2030. Amongst other things the Commission will propose a new Renewable Energy Package in 2016-2017.

– The new Renewable Energy Package will include a new policy for sustainable biomass and biofuels as well as legislation to ensure that the 2030 EU target is met cost-effectively, she said.

Food and fuel for thought

A clearly thought-provoking and educational presentation was given by Jeremy Woods, Imperial College UK and one of 137 experts that contributed to a major SCOPE assessment report “*Bioenergy & Sustainability*” published earlier this year.

– Conflicts surrounding bioenergy are nearly always to do with land use or availability, said Woods citing the ‘food cap’ revisions to the EU Renewable Energy Directive (RED) as a recent example affecting transportation biofuels.

Food security and development are critical dimensions. A conclusion of the report “*One Billion Hungry: Can We Feed The World?*” was ‘global population over the past fifty years has increased 110 percent while global cropland has only increased by 10 percent, indicating a lack of available new land’ serves to illustrate a widely held assumption that relationship between food production and land-use is that of land constraint.

– Are we really running out of land globally? For farmers it has been less costly to increase yields rather than expand into ‘new’ land, said Woods drawing from the report.

Woods illustrated with pastureland revealing that 40 percent of world’s 3 500 million ha pasture may have no livestock on it, that it represents 26 percent of the world’s land but currently provides less than 5 percent of the calories and less than 3 percent of dietary protein.

– Much of the world’s pasture land is extremely unproductive not because of fundamental biophysical constraints but due to socio-economic and developmental reasons, said Woods adding that bioenergy is not a competitor to food security but an “enabler” for more resilient, higher carbon and productive landscapes.

*Text & photos: Alan Sherrard
B182/5032/AS*



Opening of the largest renewable hydrogen refuelling station in Sweden at Arlanda Airport. Hyundai and Toyota (shown) showcased fuel cell models.



Gustav Melin, Svebio (left) in lunch time conversation with Jukka Horelli from Diffenbacher.



– Know your oil and which oil biofuels replace, said David Livingston, Carnegie Oil-Climate Index.



– Are we really running out of land globally, asked Jeremy Woods, Imperial College. Short answer, no.

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Increasing biodiesel yield using glycerol to methanol catalysis

New research from the Cardiff Catalysis Institute (CCI) in Wales, UK has revealed a novel way of increasing the yield of biodiesel produced from oils and fats via the fatty acid methyl-esterification (FAME) process by using the crude glycerol by-product. Crude glycerol is often an undesired by-product as it is formed on a large scale and, depending on the initial feedstock, can contain many impurities making it costly to purify and re-use in other areas. By using simple catalysis the research highlights the ability to utilise the crude glycerol and convert it into methanol, a key FAME process ingredient to produce even

more biodiesel.

– We've provided unprecedented chemistry that highlights the potential to manufacture biodiesel in a much more environmentally friendly and potentially cheaper way, by converting an undesired by-product into a valuable chemical that can be reused in the process, said Professor Graham Hutchings, lead author of the study and Director of CCI.

In the study, which has been published in the journal Nature Chemistry, CCI researchers developed a way of turning the crude glycerol back into methanol, which could then be used as a

starting reactant to create more biodiesel. To achieve this, glycerol was reacted with water, to provide hydrogen, with a magnesium oxide (MgO) catalyst. The reaction involved a simple one-step process and could be performed using mild conditions. It is estimated that using the recycled methanol could increase the biodiesel yield by up to 10 percent without the need for additional inputs while potentially reducing the biodiesel production process.



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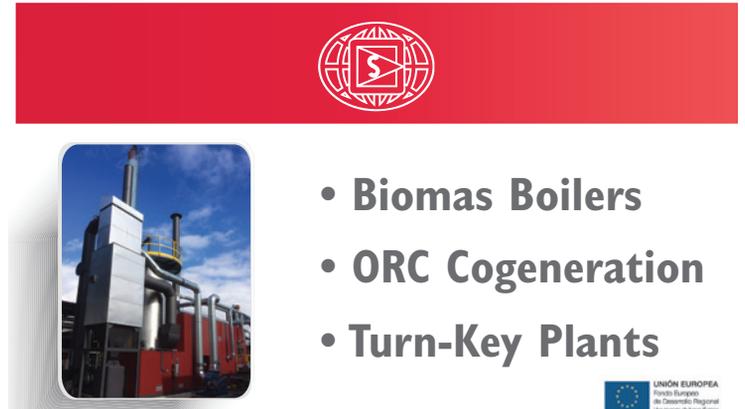
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OMC retail fuels biodiesel growth in India

US-based advanced renewable fuels and biochemicals company, Aemetis Inc., has announced that biodiesel produced by its Indian subsidiary, Hyderabad-based Universal Biofuels has begun to be sold at retail outlets owned by one of the three major Indian government oil marketing companies (OMCs). The company owns and operates a 50 million gallon per annum capacity (~190 million litres) biodiesel production facility near Kakinada on the East Coast of India. The OMCs supply more than 95 percent of the gasoline, diesel and jet fuel in India. Beginning in August 2015, the OMCs have is-

sued tenders to purchase up to 225 million gallons (~855 million litres) per year of biodiesel as a step towards implementing the government's five percent blend policy. The India diesel market is currently estimated at 25 billion gallons (~95 billion litres) per annum and a five percent blend gives a 1.25 billion gallon (~4.75 billion litre) biodiesel market. The current biodiesel production capacity in India is approximately 250 million gallons (~950 million litres).

B182/5021/AS

Algenol sign fuel deal

US-based algae to biofuel technology developer, Algenol Biotech LLC and fuel distribution company, Protec Fuel Management, LLC have entered into an agreement to market and distribute the ethanol produced at Algenol's commercial algae-to-ethanol demonstration module in Fort Myers, Florida, USA. Protec Fuel will distribute and market the ethanol fuel for E15 and E85 applications for both retail and general public consumption, as well as fleet applications in central Florida. The deal includes output from a planned commercial plant.

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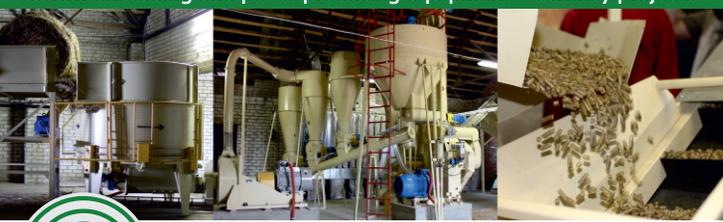


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Stora Enso commission Europe's first commercial lignin extraction plant

The first commercial lignin separation plant in Europe has been handed over to global forest industry major Stora Enso. Supplied by Finland-based pulp and energy industry technology major Valmet, the "LignoBoost" unit, which includes a lignin dryer, is installed at Stora Enso's Sunila pulp mill in Finland. Integrated with the 370 000 tonne-per-annum pulp mill the unit separates, collects and dries lignin from the black liquor. The plant has been running since January 2015 with production ramp up during the year.

– Through the lignin extraction process we have replaced a great amount of natural gas with the dried lignin produced, thus reduced our car-

bon dioxide emissions. We are developing this new product and working together with our customers to start external sales, said Sakari Eloranta, Senior Vice President, Operations and Investment Projects, Stora Enso Biomaterials.

The investment is seen as a significant step in transforming the pulp mill into an innovative and customer-focused biorefinery.

Originally developed in Sweden by Chalmers University of Technology together with Inventia, an applied forest industry R&D company that also operates a demonstration facility at Bäckhammar pulp mill in Sweden, the patented process, by which lignin is extracted from the spent cooking chemicals (black liquor) in

kraft pulp process, is owned by Valmet. By treating the black liquor with carbon dioxide and a strong acid, the lignin is precipitated then washed and dried. Lignin is an organic polymer and has a heating value similar to carbon. Along with cellulose and hemi-cellulose, lignin is the most common material in wood.

The world's first commercial-scale unit was installed in 2014 in the US at a pulp and paper mill owned by Domtar in Plymouth, North Carolina. Apart from fuel, lignin has a number of potential applications such as antioxidants, binders and dispersants.



BioOpinion: Chuck Leavell

- Forest Owner & Rolling Stones keyboardist

Parallel to a legendary musical career, not least as long-standing keyboardist for the Rolling Stones, Chuck Leavell is one of the most respected advocates for land conservation and the environment in the US. Running an award-winning forest estate with his wife, he has authored four books on forestry and served on the board of the American Forest Foundation (AFF) and the US Endowment for Forest and Communities. In 2012 he became the second person ever to become an honorary Forest Ranger by the US Forest Service. In BioOpinion, Chuck Leavell shares some personal notes on balancing forestry with conservation and why biomass is a key part of the equation.

When did it all start, how did you come to be a forest owner in aptly-named Twiggs County?

– It is all my wife's fault! Rose Lane's family have been connected to the land for generations being good stewards as farmers, tending livestock and tending forestland. We met back in 1970 when she was working at Capricorn Records, and I had come to Macon, Georgia to engage with the record label. We started dating in '72 and were married in '73. We celebrated our 42nd wedding anniversary on the last Stones tour.

As I began to get to know her family, the love of the land rubbed off on me. Then in '82 her grandmother passed away and left her about a thousand acres of land. I investigated several options of what to do, but gravitated toward forestry, as it seemed to fit with being able to pursue my musical career. There was a direct connection for me, as my own instrument, the piano and so many other musical instruments come from the resource of wood. So I started studying forest management and we began to actively manage our land for forestry. We now have about three thousand acres under management.

As an environmentalist and forest owner what's your perspective on using biomass?

– I think it is a very important part of the world's energy needs. Let's remember that we're talking about material that is natural, organic and most

importantly, renewable. And of course one of the most important things is that the parts of the trees we use are for the most part material that would otherwise go to waste like low-value wood, twigs and limbs. I like to say that we take material that is a result of "weeding the garden" of our forests. And let us all remember that for the years that wood has grown, it has been sequestering carbon, so it is a carbon neutral source of energy.

Of course we want to continue the traditional uses of wood; pulp for paper and packaging products, and lumber from larger diameter logs. But I can tell you that right now on our place, we have large stacks of material that came from a thinning we did earlier this year and the sad thing is that we don't have any place to take it. If we had a biomass plant near us, that material could go to make energy. As it is, the only choice I have is to light it up and let it burn where it is. To me, that is so sad and such a waste.

Is the argument against biomass an expression for a lack of understanding and confidence in US forest regulation and forest owners?

– It is simply misguided thinking. Somehow there are some folks that think we're talking

about clear-cutting all our forests for biomass. Wrong, wrong, wrong. I am a conservationist. I am an environmentalist. I love my land and my forests. I love all the flora and fauna within my forest. I have and always will manage our forest sustainably. Every other forest landowner I know feels this way, and we have a wonderful community and network of forest landowners in the US. Even the industrial landowners, the big timber companies manage sustainably. Again, this is material that would otherwise just rot or be burned up. If we can use that material to make pellets, use the chips to run boilers, even use it to make liquid fuels, wouldn't that be a better choice?

I would invite anyone to come see our forests and see the forests of other landowners in the southeast or in other parts of the US and see how they are being managed. We have an abundance of wood, we manage it carefully and responsibly, and we are very proud of that.

"Stewardship" and "partnership", can you explain what you mean?

– These are two things that I believe are essential for success, and for living in the right way. We want to be good stewards of our lands, our forests but also of our businesses, our communities, our cities. To be good stewards, it is essential to understand that we can't do it all by ourselves. We need strategic partners that will work with us and help us to meet our stewardship goals.

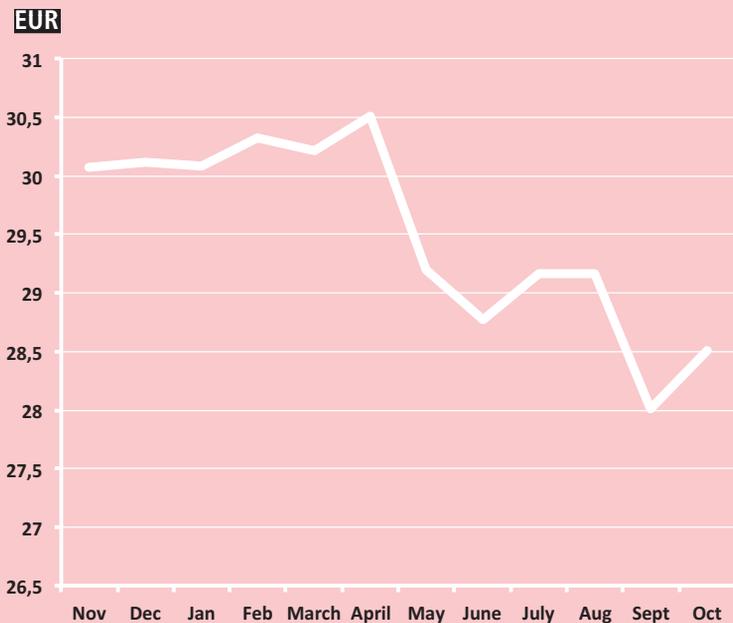
Mountain pine beetle (MPB) is one major US forest health issue but also something you've termed the "invisible forest health crisis"?

– Well, MPB is what I would call a "very visible forest health crisis". Anyone that has travelled to the areas in the US and Canada where this is going on can see with their own eyes what is happening. It is a terrible tragedy and very visible. What is not so visible, and what I mean by the "invisible forest health crisis" is the loss of natural lands to growth and development. It happens by "osmosis" that is, it happens right under our noses, but we don't really think about it that much. We see a new development, a new building, new mall and we don't think so much about all the loss of trees or agricultural lands that result in that development.

Now, we know we can't wave a magic wand and just stop it all but what we can do is to be thoughtful and smart about how we grow. That is the theme of my most recent book, *"Growing A Better America: Smart, Strong and Sustainable"*. We need some lands for our homes, schools, offices, churches and such. We need some lands for production of food, wood and other needs and of course we want some lands to be protected for recreation, for aesthetic use, for the sheer beauty of it. It's all about balance.

*Text & photo: Alan Sherrard
B182/5062/AS*

"Let's remember that we're talking about material that is natural, organic and most importantly, renewable"

PELLETS EUR/MWh • November 2014 - October 2015**Pix Pellet Nordic CIF**

There has been a growing interest in pellets in Finland, especially after Helsingin Energia's example to start co-firing pellets, according to Vapo, the current provider of pellets for Helsingin Energia. There is enough growth reserve in Finnish pellet production capacity to meet this growing demand, and e.g. Vapo's plant in Iломantsi can still increase its production by 50% if demand goes up.

According to Hawkins Wright Forest Energy Monitor, there is an oversupply in industrial spot pellets, hence the prices of industrial pellets in ARA area have continued to come down. This is, however, expected to be only short term. E.g., Drax's unit 2 had a lengthened maintenance time which affected the supply/demand balance. On the residential side in Central Europe, the pellet prices have been rather stable. The wood pellet imports to Europe (EU28) from outside the EU area totaled 3.139 million tons in the first half of 2015, up by 7% compared to the same time period last year.

The main trade flow was again imports from the USA to the UK, representing almost 50% of the to-

tal European imports from the non-EU sources. Canada and Russia accounted for 21% and 12%, respectively, of the total imports to Europe. Globally, the wood pellet market is expected to keep growing.

One estimate is an annual growth of over 14% by the year 2023. At the start of the heating season, the September temperatures were generally higher than on average in the Nordics.

Changes in price quotes reported to the PIX Pellet Nordic Index were mixed but with an upward majority.

The Euro value dropped against the Swedish Crown in September by 1.3%, compared to the August 2015 average. This meant some upward pressure to the Euro-value and the opposite to the SEK-value. After removing the highest and lowest 10% of the price quotes, the PIX Pellet Nordic index value increased in Euro-terms by 0.50 euros, or by 1.79%, ending at 28.51 EUR/MWh. The value increased also in Swedish Crowns, by 1.25 crowns, or by 0.47%, and closed at 267.78 SEK/MWh.

BI8215060/DN

Note: PIX Pellet Nordic CIF focuses on industrial pellets use in the Nordic and Baltic Sea region. The index is based on the previous month's data and published the 3rd Tuesday of every month at 12 noon GMT+2. For price conversion between price per ton and price per MWh, a coefficient of 4.8 is used, if not otherwise informed by the price provider. The PIX indexes are trade mark registered, worldwide, by FOEX Indexes Ltd. Using the PIX indexes commercially is subject to approval by FOEX Indexes Ltd, the owner of the PIX index trademark.

Carbon pricing,

With the countdown on to the Paris, France climate change conference, the new World Bank/Ecofys report "State and Trends of Carbon Pricing 2015" shows clear evidence of growing momentum to put a price on carbon. The share of emissions covered by carbon pricing has increased threefold over the last decade to cover 12 percent of global emissions.

The growth of carbon pricing around the world has been substantial. Currently, about 40 national jurisdictions and over 20 cities, states, and regions—representing almost a quarter of global greenhouse gas (GHG) emissions—are putting a price on carbon (Figure 1). Together, carbon pricing instruments cover about half of the emissions in these jurisdictions, which translates to about 7 gigatons of carbon dioxide equivalent (GtCO₂e) or about 12 percent of global emissions.

China and US largest volumes

To date, China and the United States are the two countries with the largest volume of emissions covered by carbon pricing instruments. In China carbon pricing instruments cover 1 GtCO₂e, while in the United States they cover 0.5 GtCO₂e. China has announced its intention to move to a national emissions trading system (ETS). It currently has seven pilot ETSs, which combined form the largest national carbon pricing initiative in the world in terms of volume. The European Union Emissions Trading System (EU ETS), which covers 2 GtCO₂e of emissions, remains the single largest international carbon pricing instrument.

So far this year, the Republic of Korea launched an ETS, and California and Québec's cap-and-trade programs expanded their GHG emissions coverage from about 35 to 85 percent by including transport fuel. Also, Ontario announced its intention to implement an ETS linked to California and Québec's programs. A major structural reform in the EU ETS was approved for implementation starting in 2019, and a proposal to revise the EU ETS after 2020 has been put forward. These changes should make the EU ETS more resilient to sudden changes in macroeconomic conditions and help ensure that the EU ETS enables cost-effective

emission reductions in the decade to come.

The advances in 2015 follow on the heels of 2014 milestones such as the implementation of two new subnational ETSs in Hubei and Chongqing (both Chinese jurisdictions), the implementation of carbon taxes in France and Mexico, and the adoption of new tax legislation in Chile. The year has also seen more companies using an internal price on carbon.

Worth US\$50 billion

The combined value of the regional, national, and subnational carbon pricing instruments in 2015 is estimated at just under US\$50 billion globally, of which almost 70 percent (about US\$34 billion) is attributed to ETSs and the remainder (about 30 percent) to carbon taxes.

The existing carbon prices vary significantly—from less than US\$1 per tCO₂e to US\$130 per tCO₂e (see Figure 3). The majority of emissions (85 percent) are priced at less than US\$10 per tCO₂e, which is considerably lower than the price that economic models have estimated is needed to meet the 2°C climate stabilization goal recommended by scientists.

Carbon pricing is increasingly being used internally by firms as a tool to analyze business and investment strategy. Some of these carbon prices are substantially higher than current price levels in mandatory carbon pricing instruments. Internal carbon pricing is part of a risk management strategy to evaluate the current or potential impact of a mandated carbon price on business operations. It is also used as a means to identify and value cost savings and revenue opportunities in low-carbon investments.

In a world of fragmented carbon pricing instruments, the potential impact of carbon pricing on the international competitiveness of some domestic industrial sectors

state and trends 2015

has been a concern. The risk of carbon leakage is real as long as carbon price signals are strong and the stringency of climate policies differs significantly across jurisdictions.

Carbon leakage

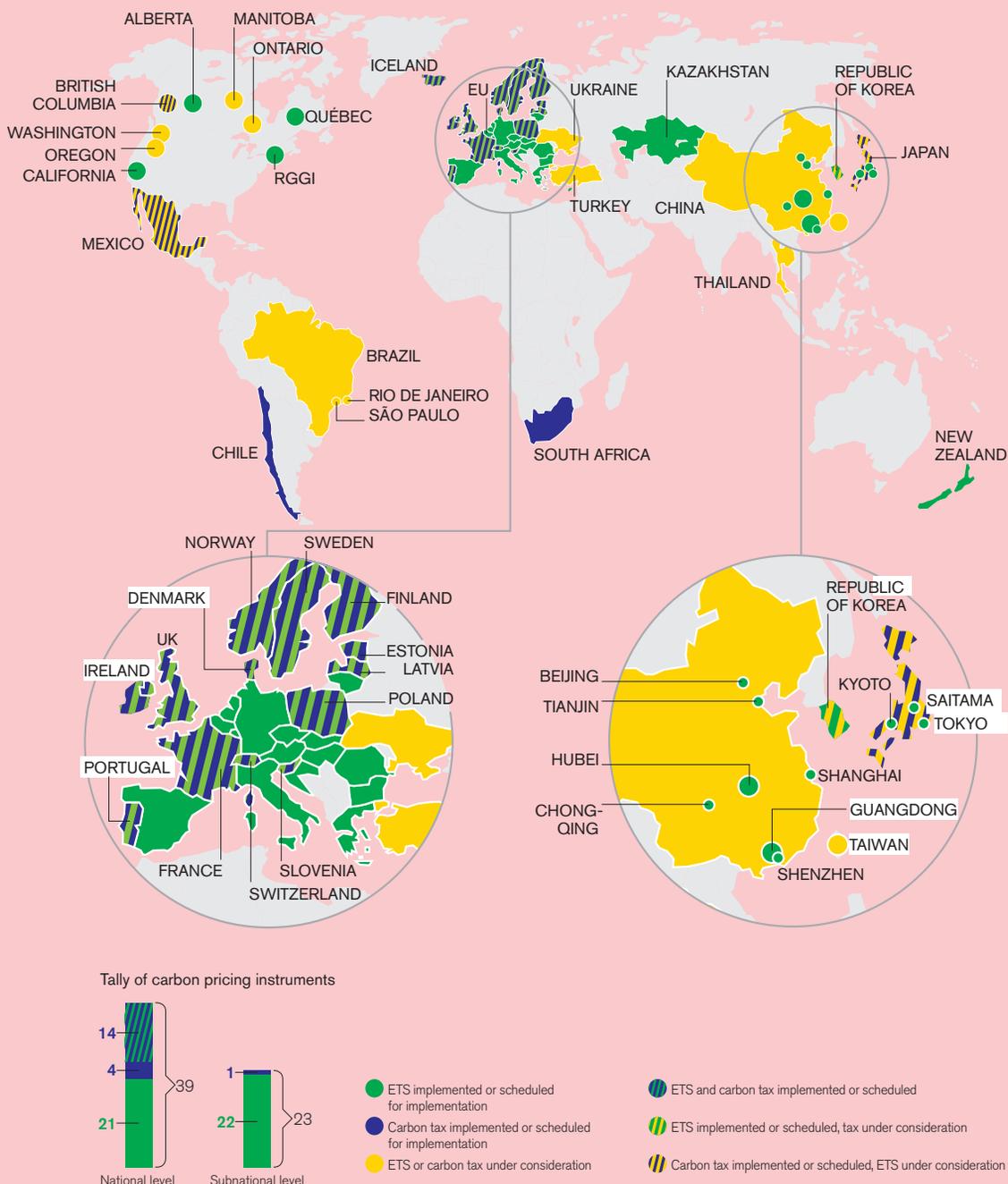
However, the report finds, based on available research, that carbon leakage—the phenomenon of companies moving their production and/or re-directing their investments to other jurisdictions where emissions costs are lower, thereby increasing emissions there—has not materialized on a significant scale. This risk tends to only affect a limited number of exposed sectors, namely those that are both emissions- and trade intensive. This risk can be effectively managed through policy design components, such as free allocations, exemptions, rebates and border adjustment measures, as well as specific complementary measures, for example, financial assistance.

The risk of carbon leakage declines as more countries take concrete actions to prevent climate change. International cooperation through carbon pricing instruments and climate finance can help redress the existing asymmetry in carbon pricing signals, reduce concerns about their impact on competitiveness, and eliminate the need for protection of firms. Under these circumstances, carbon prices can be used to enhance the performance of economies—specifically benefiting innovative, low-carbon firms, and promoting the technical upgrade or exit of the least efficient firms in emissions-intensive industries. This would improve the overall efficiency of the economy.

Cooperation can cut costs and leakage

In addition to reducing the risk of carbon leakage, cooperation between countries can significantly reduce the overall cost of achieving a 2°C climate stabilization goal compared to domestic actions alone, as countries have more flexibility in choosing who undertakes emission reductions, and who pays for them. Moreover, such cooperation could drive low-carbon growth in lower-income countries, some of which might lack the re-

Figure 1 Overview of existing, emerging, and potential regional, national, and subnational carbon pricing instruments (ETS and tax)



The circles represent subnational jurisdictions. The circles are not representative of the size of the carbon pricing instrument, but show the subnational regions (large circles) and cities (small circles).

Note: Carbon pricing instruments are considered “scheduled for implementation” once they have been formally adopted through legislation and have an official, planned start date.

sources to modernize their economies, create jobs in low-carbon sectors, or reduce poverty in a sustainable manner. Through international cooperation, the global costs associated with a given emission reduction target can be lowered or a larger mitigation target can be achieved at a given cost, and development gaps can be narrowed.

According to estimates from economic models, financial transfers through cooperation could reach up to US\$100–400 billion

annually by 2030, possibly increasing to over \$2 trillion dollars by 2050. The size of the transfers will be beyond the level of public sector spending, and will need to be channeled through a blend of instruments. These include carbon pricing instruments such as ETSs, carbon taxes, offsets and a combination thereof and linkages between them, as well as innovative hybrid instruments, such as variations of results-based climate finance. Climate finance and carbon pri-

cing instruments will be essential in leveraging these financial transfers and enabling cooperation to mitigate climate change.

Editor's note: This is the introduction to the full World Bank/Ecofys “State and Trends of Carbon Pricing 2015” (September) report, which is available on www.worldbank.org

B182/5077/AS

Biomass Thermal Energy Council Update

Biomass Caucus Re-Chartered by Congress

Under the leadership of Representatives Bruce Westerman (AK-R) and Ann Kuster (NH-D), the Biomass Caucus in the US House of Representatives has recently been re-chartered. This is the first time that there has been a Biomass Caucus in the House of Representatives since 2012. Westerman and Kuster are both extremely committed to the sustainable use of biomass as an energy source, and their

bipartisan collaboration may serve as a major benefit for the biomass industry. A Congressional caucus, whether on the House or Senate side, may best be described as a group of Representatives or Senators with a common interest. Unlike a formal committee, they have no legislative authority but serve as a meeting ground for members of similar interests to discuss their concerns, and to come up with concepts that frequently are turned into proposed legislation. With the support of the House Biomass Cau-

cus and other interest groups, biomass can assume the role in the clean energy family that it deserves.

Biomass Thermal DC Summit

BTEC is excited to be hosting the 2015 Biomass Thermal DC Summit, with the support of various industry organisations, which will take place in Washington, DC from 17-18 November. The purpose of this event is for participants to engage federal policy makers and improve their understanding of the



substantial benefits of biomass thermal energy in US energy policy. The Summit will include networking events, guest speakers, a Congressional Briefing, and a reception, all of which will add to attendees' insight into the role that biomass currently has in US policy.

Meghan Martin,
BTEC Clean Energy Fellow
www.biomassthermal.org/
B182/5034/JH

Serious "myth-busting" with new AEBIOM statistics

– Bioenergy is by far the leading renewable energy source in Europe, accounting for 61.2 percent of all RES energy consumed in 2014, explained Cristina Calderón, Publishing Director of the recently released *AEBIOM Statistical Report 2015*. European countries committed to achieving their 2020 renewable energy targets are relying strongly on bioenergy, in countries like Estonia, Poland or Latvia it represents over 85 percent of renewable energy.

Published annually by the European Biomass Association, AEBIOM, the 2015 edition highlights that the final energy consumption of bioenergy has almost doubled during 2000-2013 to reach 105.1 million tonnes oil equivalent (Mtoe). This trend is set to continue and, according to Members States' projections, the consumption of biomass for energy should increase by at least 33 Mtoe by 2020.

– When it comes to renewable energy discussions, the key role played by bioenergy in Europe is often underestimated, compared to its actual contribution, commented Jean-Marc Jossart, AEBIOM Secretary General.

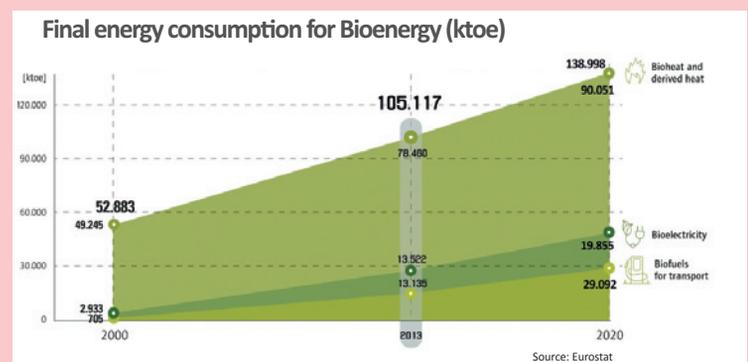
Over 95% from within EU

The increasing demand can be explained by the fact that biomass is the only renewable energy source providing solutions for all energy sectors: transport, power, heat and cooling. According to the report, 74.6 percent of the biomass consumed today for energy purposes is used to produce heat (78.4 Mtoe), followed by biopower (13.5 Mtoe) and transportation biofuels (13.1 Mtoe). Given that heat accounts for half of the EU28's final energy consumption, biomass can play a cru-

cial role in solving the EU's energy dependency challenge. According to the European Commission (EC), this dependency currently costs EUR 1 billion per day in fossil fuels imports to Europe. In stark contrast biomass imports currently represent only 3.84 percent of the EU's bioenergy gross inland consumption. This means that over 95 percent of bioenergy consumed in Europe is produced within EU borders.

Forest and job growth

The report also highlights that the sector has a significant potential to further increase. About 70 percent of the total bioenergy feedstock delivered in Europe today originates from the forestry sector, while the rest comes from waste and agriculture. Contrary to some held beliefs, the EU forest estate keeps growing since only 62 percent of the annual EU forest growth, in areas available for wood supply, is currently annually harvested. Bioenergy also fosters considerable economic growth and contributes to job creation in Europe. The employment potential in bioenergy is superior compared to other renewable and non-renewable energy technologies, due to the additional elements of feedstock



production, supply, handling and logistics. Previous studies have already shown that the labour required to produce electricity from biomass is 3 to 6 times higher than for fossil fuels. According to EurObserv'ER statistics (used for the AEBIOM report), the number of jobs in the bioenergy sector in 2013 amounted to almost 500 000 with the added value estimated at EUR 56.1 million.

Editor's note: A summary with key findings is available on www.aebiom.org where the full report can also be ordered.

B182/5071/AS



DEVIUS “DEFEAT DEVICE” MIGHT BE GOOD FOR BIOFUELS

September proved eventful for diesel. The EU extended anti-dumping and anti-subsidy duties on US biodiesel imports whereas California, the strictest regulatory board in the US, affirmed biodiesel as the lowest-carbon liquid fuel. Yet it was auto-maker Volkswagen Group (VW) that put diesel onto global headlines. For VW it was for all the wrong reasons but for biofuel stakeholders, on both sides of the Atlantic, it might be a good thing.

ON SEPTEMBER 15 THE EU regulations 2015/1518 and 2015/1519 were published, extending both anti-dumping and anti-subsidy duties, the so-called “B99” measures, on US biodiesel imports for an additional 5-year period. This ends a 12-month investigation initiated by the European Commission (EC) acting on an expiry review request filed in April 2014 by the European Biodiesel Board (EBB), a trade organisation that represents almost 80 percent of European biodiesel production.

US\$1 per-gallon issue

The original “B99” complaint was first lodged in 2008, resulting in the placement of anti-dumping and anti-subsidy measures for 5 years, starting in July 2009. Duties were then “circumvented” via Canada, which led to the imposition of anti-circumvention measures in 2011. Upon the expiration of the original B99 duties in July 2014, the EBB asked for their extension.

– The US biodiesel industry has benefitted from favourable taxation policy, at both Federal and State levels, for many years. Ever since the US\$1 per-gallon biodiesel tax credit was first implemented a decade ago, it never ceased to play a key role in upscaling US biodiesel production and securing it a significant advantage. Even though it kept expiring several times, the US authorities have established a tradition of reinstating the tax credit in a retroactive manner as part of the so-called ‘tax extenders package’ policy, said Raffaello Garofalo, EBB Secretary General.

According to Garofalo the EC decision was very timely since the approval of the most recent tax extenders package made it “crystal clear” that the draft of the bill, extending the US\$1-per-gallon biodiesel tax credit through 2016, is progressing well through the US legislative pipeline. The EU also has five-year anti-dumping duties on biodiesel imports from Argentina and Indonesia imposed in November 2013.

EU protectionism?

Across the Atlantic the National Biodiesel Board (NBB), a trade organisation representing the US biodiesel industry challenged the duties throughout the expiry review emphasising that European producers are able to sell biodiesel in both Europe and the US without duties or limitation and can freely participate in US policies such as the Renewable Fuel Standard (RFS) and, before it had expired, the US biodiesel tax incentive.

– The EC has decided to continue a policy that is clearly aimed at giving European biodiesel producers an edge over their competition and a lock on the European market. It is disappointing, and we will continue evaluating our options for fighting these protectionist duties, said Anne Steckel, NBB Vice President of Federal Affairs in a statement.

According to Steckel, citing the US\$1-per-gallon biodiesel tax incentive as a reason ignores the fact that the biodiesel tax incentive is currently expired and that European biodiesel was eligible to receive the tax credit so long as it was blended in the US. Statistics from 2009–2014 imports of “biomass-based” diesel fuel from EU member states by the US Energy Information Administration (EIA) show steady imports of under 160 000 barrels per annum during the last four years, except for 2013 when imports jumped ten-fold.

– This decision highlights why the US biodiesel tax incentive should be reformed and converted into a domestic production credit. When the incentive is in effect under the current structure, European biodiesel can be shipped to the US only to be rewarded with a US\$1-per-gallon incentive, while at the same time US biodiesel shipped to the EU is slapped with punitive duties, said Steckel.

At the end of September, California Air Resources Board (CARB) finalised California’s revised Low Carbon Fuels Standard affirming that biodiesel reduces greenhouse gas (GHG) emissions

by 50 to 81 percent versus petroleum making it the best performing liquid fuel.

Defeat by own device

It was the revelation on 18 September by CARB and the US Environmental Protection Agency (EPA) that Volkswagen Group (VW) had intentionally installed a “defeat device” on over 480 000 diesel vehicles sold between 2009 and 2015 in the US that made global headlines. The “device” consists of an embedded engine software programme designed to detect if the vehicle is being driven under test conditions, and, if so, adjust all engine operating parameters to provide lowest possible emission results. Under normal driving conditions the engine performs differently with far more emissions as a result.

It was independent on-road testing of the EPA simulated route tests by the International Council on Clean Transportation (ICCT) that found real world results were far worse than expected compared to EPA simulated route tests on VW vehicles but not on other tested manufacturers. Subsequently VW admitted that a staggering 11 million diesel vehicles globally had such a programme, which means significantly higher actual emissions of diesel-specific pollutants such as NOx and particulate emissions (PM) than originally supposed.

This is of particular significance for Europe. Not just because VW is a German-headed corporation, but Europe is a diesel market. In 2014 diesel accounted for 70 percent of the European liquid transport fuel market and 17 EU Member States were found to be in breach of their air quality targets the same year.

– A rebalancing of the European transport fuel market in favour of petrol with increased ethanol content is one solution to the problem, commented the European Renewable Ethanol Association (ePURE), an organisation that represents 90 percent of fuel ethanol production capacity in Europe.



– The so-called double counting incentives in the old RED Directive 2009/28, continued in the new article 3 advanced biofuel amendment, Directive 2015/1513, have led to cases of fraud. The lack of a single EU-wide certification and traceability tool has enabled virgin-oil based biodiesel to be passed off as UCO-based as well as multi-state registration of a single unit of product. The Register of Biofuels Origination (RBO) project seeks to address this, told Chiara Girardi, Project and Communication Manager, European Biodiesel Board (EBB) during the recently held Advanced Biofuels conference in Stockholm-Arlanda, Sweden.

Call for “well-to-wheel”

The good thing is that the VW episode has brought much-needed attention to the broader issue of real-world emissions, not just for diesel. It highlights the difficulty in ensuring that the policy objectives of reducing air pollutants and GHG emissions from vehicles are not only met during certification/type-approval testing but throughout the full vehicle life across a wide range of operating conditions. Several governments around the world have since launched investigations related to such “defeat devices”, and policymakers are looking for ways to address the challenge of controlling real-world emissions.

However as pointed out by ePURE such tests should “assess the well-to-wheel emissions of the transport fuels used in the engines to ensure that the full life-cycle emissions of fuels are fully taken into account when assessing real-life vehicle emissions.”

*Text & photo: Alan Sherrard
B182/5031/AS*

US forest residue project suggests bright future

Last year, Humboldt State University (HSU), California, and 15 regional partners began the Waste to Wisdom project after receiving a US\$5.88 million grant from the US Department of Energy (DOE), part of the Biomass Research and Development Initiative, a collaborative effort between the DOE and Department of Agriculture, to expand biomass research and make use of forest residues—low quality trees, tree tops, limbs, and chunks that formerly would have been left in slash piles at the landing and burned or left to rot.

– Due to the high cost of collection and transportation, woody biomass is a promising but widely untapped source of renewable energy, said Arne Jacobson, one of the principal investigators on the Waste to Wisdom project who is focusing on developing new biomass-to-energy conversion technologies.

Chipping and transporting the slash to a processing site in today's market is worth about US\$40 to \$50 per bone dry ton making it often economically unfeasible.

The new methods being developed by the project group will make a range of bio-products such as biochar, torrefied woodchips and briquettes, worth from US\$150 to US\$2,000 a ton.

– Our approach is different. We're adapting our operations to take advantage of the opportunity the waste materials present. Briquetting and torrefaction of woodchips at or near the forestry sites add value, said Han-Sup Han, HSU forestry professor, and one of the project's lead researchers.

B182/5078/AS

DARKO PRODAN IS A MAN WITH a mission. Next year he hopes to commission the largest and most modern hardwood sawmill in Croatia. Part of the investment is already operational busy making heating fuel from biomass using a high capacity mobile shredder/chipper.

For many Croatia is a holiday destination. With a scenic coastline on the eastern shores of the Adriatic Sea it's easy to understand why. Yet few realise that Croatia is a forested country. In fact with over 43 percent forest cover, it is one of the most wooded countries in Central Europe with forestry and the wood products industry playing a major role. However being dominated by small companies with modernisation needs, the sector faces major challenges that often make it difficult to compete on the international market space.

Major investment

One company, Cedar d.o.o., is tackling this challenge head-on. For over 20 years this family-owned company has run a hardwood sawmill in Vrbovsko northwest Croatia, specialising in the production of sawn beech (*Fagus sylvatica*) for export to the Middle East, China, Japan and neighbouring countries in Europe. Darko Prodan, who heads the company, grew up with the smell of freshly sawn wood, and he hasn't been able to get away yet. Nor does he want to – Prodan is currently in the process of transforming his company into one of the largest beech producers in Europe.

With investments to the tune of EUR 50 million backed by enormous entrepreneurial courage, he is setting out to ensure a good future for his region and its job market. To do so, he is literally leaving no stone unturned. Soon, on almost double the space he had before, computer-controlled sawing lines will transform 250 000 m³ of beech logs per annum into sawn wood, and modern loading equipment will load complete tractor-trailers in just three minutes.

"It was important to us to get a machine with the broadest possible range of uses."

DARKO PRODAN
General Manager, Cedar d.o.o.

THE COURAGE TO SUCCEED



The Axtor 8012 turns sawmill waste into fuel for the heating and power plant. Screen basket and teeth determine the chip size.

Experience, motivation and location

Prodan is certain that this bold step will reap rewards.

– We have years of experience, our employees are motivated and we have the ideal location, explained Prodan referring to the proximity to the beech that grows abundantly in the surrounding forests. Good transportation infrastructure is almost just as important.

– We're right on the motorway, and just 70 kilometres from the Port of Rijeka. Plus, in the future we want to use the railroad that runs past here, so we included our own loading terminal in our planning, said Prodan of his all-out approach.

Making biomass fuel

Work is still under way on the job site, but a universal shredder/chipper from Austrian material handling technology providers Komptech has already gone into operation processing waste wood into chips for use as heating fuel. The 800 hp Axtor 8012 may seem a little over dimensioned but once the 8 MW combined heat and power (CHP) plant currently under construction is commissioned, the Axtor will have its hands full. The CHP will supply the heat needed by the kilns to dry sawn wood for shipment as well to the local district heat network whereas electricity will be fed

into the power grid.

Once fully operational the CHP plant will require logging residues as well as all the wood processing residues such as sawdust, slab wood, off-cuts and bark something that was thoroughly tested by Prodan prior to purchasing the Axtor.

– It was important to us to get a machine with the broadest possible range of uses. We need to be flexible about fuel, and so does the machine, explained Prodan adding that having Teknoxgroup as Komptech's Croatian sales and service partner is a plus. The company is a Caterpillar sales partner, thoroughly experienced in servicing heavy machinery and with service points throughout the country, ready when and where needed.

Editor's note: This is an edited version of a client feature originally published in Komptech Magazine 2/2015. It is used with kind permission.

*Photo courtesy Komptech
B182/5012/AS*

Facts: Cedar d.o.o.

A family run business founded in 1992, Cedar d.o.o. in Vrbovsko, Croatia specialises in the production of beech sawnwood products for use in construction and furniture manufacturing industries in North Africa, Middle East, Asia and Europe. The company is investing around EUR 50 million to increase log processing, sawn wood drying capacity and a new rail loading terminal. The investment also includes an 8 MW biomass fired combined heat and power (CHP) plant that will also supply heating to a local network and power to the grid.

Size Reduction & Densification Directory 2015

Size reduction and densification - two of the most widely established and used forms of solid biomass pre-treatment. Reducing bulk volume and increasing bulk density means a more uniform product, better payloads and enables longer transport distances. Depending on the downstream application, size reduction is, as the term implies, reducing the overall size of a variable feedstock to produce a more uniform size-specific product, say converting roundwood or billets into micro-chips. Or it can be an issue of increasing the surface area for a better reaction, say in a biogas plant, or converting wood pellets to a powder for combustion. Densification on the other hand, for pellets or briquettes, is about increasing the bulk density of size reduced material by compressing particles together.

There are many manufacturers and suppliers of these types of equipment and the purpose of this directory is to provide an overview. To qualify companies have to be engaged in export and/or have subsidiaries in other regions, the country shown is where it is headquartered. Although comprehensive the listing is not exhaustive neither is it an endorsement.

COMPANY	COMMENTS	COUNTRY	WEB
Aimo Kortteen Konepaja Oy (Murska)	Manufactures modular pellet production plants for sawmills, furniture factories or cattle feed production	Finland	www.murskabiopacker.fi
Amandus Kahl GmbH & Co.KG	Designs and builds machines, turnkey production factories for the conditioning and compacting of different products, and equipment for pellets production	Germany	www.amandus-kahl-group.de
Andritz Feed & Biofuel	Complete process systems for industrial biomass pelleting. Total process solutions from raw material (i.e. wood logs, chips, sawdust, straw, agricultural byproducts) intake to ready pellets including debarker, chipper, dryer, grinders and pellet mills	Denmark	www.andritz.com
Anyang Gemco Energy Mashinery Co. Ltd (AGICO GROUP)	Provides several types of equipment for biomass preparation, complete plants for biodiesel as well as pellets, briquets or charcoal	China	www.agitc.cn, www.gemco-machine.com
Arjes GmbH	Solutions for wood processing equipment and recycling machines and shredders	Germany	www.arjes.de
AS Hekotek	Offers turnkey pellet factories, debarking and chipping lines for low quality logs	Estonia	www.hekotek.com
Asket	Technology for straw, reed canary grass processing: Tomasser shredding, biomass briquetting	Poland	www.asket.pl
Astec Industries Co.	Designs, manufactures and markets a complete line of continuous and batch-process hot-mix asphalt facilities, and soil remediation equipment	USA	www.astecinc.com
B. Maier Zerkleinerungstechnik GmbH Dieffenbacher Group	Supplier of single machines and turnkey solutions for the size reduction of wood and biomass including drum chippers, crushers, knife ring flakers, hammermills, prallfiners, conveyors, cleaning units, and separating and fractioning systems	Germany	www.maier-dieffenbacher.de
Bandit Industries, Inc	Manufactures chippers and recyclers for the transformation of biomass material into valuable feedstocks for fuel applications. Grinds grasses, pallets, wood and more into any size product, even down to dust	USA	www.banditchippers.com
Beaver Korea (KB E&I Co.,LTD)	Provides biomass pellet producing equipment such as sawdust producer, wood log providing feeder, debarker	Korea	www.biobeaver.net
Beijing Aoke Ruifeng New Energy Co.,Ltd	Designs and manufactures pellet and briquette equipment, biomass boilers, and residential stoves	China	www.bjakrf.com/en
Beijing Panda Pellet Machinery Co., Ltd.	Specialised in designing, manufacturing, installing and commissioning complete pellet lines	China	www.pelletwood.com.cn
Bioenergy Machinery Sdn Bhd.	Manufactures wood pellet equipment. Provides machinery, training and marketing for local customers	Malaysia	www.greenbioenergy.net
Bliss Industries LLC	Manufactures a complete line of hammermills (5-600 hp), counter flowcoolers (1-100 tph), pellet mills (80-500 hp) and crumblers for residential and commercial pellet production	USA	www.bliss-industries.com
BMH Wood Technology	Turnkey supplies of bulk materials, handling systems for energy generation, solid waste treatment and recycling as well as pulp & paper industries	Finland	www.bmh.fi
Briklis Spol. s r.o.	Producer of briquetting presses for wood waste and complete drying lines	Czech Republic	www.briklis.cz
Bruks Holding AB	Develops, manufactures and markets complete fuel handling systems for the wood-processing industry around the world	Sweden	www.bruks.com
Brunette Machinery Co.	Machinery and material handling systems for the biomass industry: whole log chippers, microchippers, grinders, log decks, rotary debarkers, conveyors, and vibratory equipment	Canada	www.brunetteinc.com
BS Bollareto Implants	Manufactures machinery for biomass recovery. Assists companies that want to reprocess their products into powder, fibers and flocs	Italy	www.bsbollaretoimpianti.it
Bühler AG	Offers technology for wood pellet projects (equipment for drying, grinding, pelleting, cooling, bagging, loading, automation) and for biomass cofiring projects (vertical and horizontal hammermills)	Switzerland	www.buhlergroup.com
Büttner Energie- und Trocknungstechnik	Manufacturer of industrial drying systems, energy plants, pellet plants	Germany	www.buettner-dryer.com
C.F. Nielsen A/S	World-wide supplier of briquetting solutions with mechanical briquetting presses ranging from 200 to 5 000 kg/hour for pressing biomass and other types of waste materials	Denmark	www.cfnielsen.com
Caravaggi S.r.l.	Manufactures bio-shredders, chippers and a full range of machines for special applications	Italy	www.caravaggi.com
Carmanah Design & Manufacturing Inc.	Provides technology and equipment to optimise fibre utilisation	Canada	www.carmanahdesign.com
Caterpillar	Products and work tools for different industries e.g forestry (harvesters, wood extraction machines, processing, loading and reforestation), mining and construction	Switzerland	www.cat.com
Cellwood Machinery AB	Conditioning of biomass to a suitable size for pelletising or pyrolysis. Can be done in a wet state to increase dryer efficiency. Treatment of sludge, slaughterhouse and organic waste for increased digester performance and gas yield	Sweden	www.cellwood.se
CherkassyElevatorMash BRONTO	Manufacturer of extruders, briquettes and pellets machines, extrusion line, oil presses, conveyers, handling systems	Ukraine	www.bronto.ua
Chinese Academy of Agricultural Mechanization Sciences	Provides straw balers, cotton stalk harvesters, straw cutting-rubbing equipment, biomass gasification technology and equipment, and resource utilisation technology for farm and livestock wastes	China	www.caams.org.cn
Continental Biomass Industries, Inc. CBI	Manufactures a complete line of grinders, shredders, chippers, flail debarkers and attachments that produce pulp chips, fuel chips and ground wood fuel from trees, forestry debris, demolition debris and industrial waste	USA	www.cbi-inc.com



Cormall A/S	Provider of straw technology solutions and automatic feeding system	Denmark	www.cormall.dk
Costruzioni Nazzareno	Specialises in the construction of complete turnkey wood pellets plants	Italy	www.nazzareno.it
CPM Europe B.V.	Pelleting technology, providing machinery for crushing, grinding, densifying, cooling, drying, sifting, computerised process controls, ingredient scaling systems and extrusion equipment	Netherlands	www.cpmeurope.nl
Crowley Engineering	Turnkey projects: grain handling, feed milling, wood pelleting, bioenergy plants, drying plants. Also supplies pre-owned equipment and servicing	Ireland	www.crowley.ie
CSB bvba	Manufacturer and turnkey service of grinders, shredders, industrial granulators, wood boilers, conveyor belts, deferation systems, special machines, and mobile shredders	Belgium	www.csb-wastesolutions.be
Di Piu s.r.l	Designs, manufactures and supplies mechanical briquetting presses	Italy	www.di-piu.com
Dieffenbacher GmbH Maschinen- und Anlagenbau	Engineering and supply of complete pellet plants. Individual supply of the Maier chipping lines, Maier flaking & milling equipment, energy generation, Schenkmann & Piel dryers for hot gas or steam, Dieffenbacher Panelboard, ClassiCleaners and ClassiScreens, and pelletising equipment	Germany	www.dieffenbacher.de
Doppstadt Calbe GmbH	Providing stationary and mobile machines lines used for recycling of different materials e.g. biowaste, C&D, waste wood and trunks	Germany	www.doppstadt.com
Dorssers Inc	Manufacturers of pellet mill dies, roller shells and roll replacement parts for all makes and models of pellet mills	Canada	www.dorssers.com
Double Crane Machinery Manufacture	Specialised in feed machinery, grass machinery, chemical equipment, organic fertiliser production equipment, etc.	China	www.sdshuanghe.com
Doza-Gran Ltd	Equipment for pellet as well as animal feeding production: ring-die pellet mills, wood chippers, rotary dryers, silos, etc.	Russia	www.dozagran.com
EDGE Innovation at Work	Designs and manufactures stacker conveyors, tracked stackers, mobile stockpilers, trommels, shredders and tracked loaders	Northern Ireland	www.edgeinnovate.com
Erjo-osw AB	Manufactures forestry machines, mobile and stationary chippers	Sweden	www.erjo-osw.se
Ferotec	Manufactures and supplies replacement pelleting parts for the animal feed milling industry, and all types of pellet dies	France	www.ferotec.eu
Five Continents Machinery Co. Ltd.	Manufacturer and supplier of feed machines and feed mill plants	China	www.fcm-cn.com
Franssons Recycling Machines	Manufacturer of fast-running shredders and slow-running mills for recycling, fuel preparation and waste management	Sweden	www.franssons.se
Fredrik Mogensen AB	Designs and manufactures screening equipment for industries worldwide	Sweden	www.mogensen.se
Friedli AG Engineering und Anlagenbau	Develops and improves facilities in the area of grinding, forming and finishing for pellet production. Provides individual components and produces complete systems	Switzerland	www.friedliag.ch
General Dies s.r.l.	Produces pellet mills and other machines for pellet production such as coolers, crumblers, sieves and spare parts	Italy	www.generaldies.com
Global Times Bioenergy Co.Ltd	Provides pelleting technology designed for small and big pellet manufacturers	China	www.cntrades.com/b2b/global_times/
Gongyi Xiaoyi Mingyang Machinery Plant	Manufactures machines for charcoal-making, sawdust carbonising, and charcoal powder forming, as well as cold rolled ribbed equipment	China	www.eng.zgmingyang.com
GreenMech Ltd	Manufacturers of wood chippers, green waste shredders and stump grinders	United Kingdom	www.greenmech.co.uk
Henan Kingman M&E Complete Plant	Manufactures and designs wood pellet equipment and pellet mills	China	www.woodpelletline.com
Henan Strongwin Machinery Equipment-fCo., Ltd	Manufactures pellet machines, edible oil production line, briquetting machines, environmental protection equipment and other mechanical equipment	China	www.strongwin.cn
Hi-Tech Agro Projects Pvt. Ltd.	Developer, manufacturer and worldwide supplier of biomass briquetting/pelletising machinery including preprocessing equipment (dryers, hammer mills, separators, conveying and conditioning systems) and MSW to RDF plants and machinery. Capacity from 100 to 5 000 kg/hour	India	www.hitechagro.org
Holzmatic engineering GMBH	Produces woodworking plants, stationary and mobile chippers, and sawmill technology	Italy	www.holzmatic.com
HRV Equipamentos de Processo SA	Complete process solutions for industrial biomass pelleting from raw material intake to ready pellets including de-barker, chipper, dryer, grinders and pellet mills	Portugal	www.hrv.pt
Hugo Vogelsang Maschinenbau GmbH	Manufactures pumping, grinding and spreading technology for municipal, industrial and agricultural markets globally	Germany	www.vogelsang-gmbh.com
IFP Ingenieurbüro für Pelletiertechnologie	Manufactures spare parts for pelleting: dies, rolls, beaters and sieves, and die and roll revision	Germany	www.pressformen.com
IQR Systems AB	Solutions for energy recovery from waste materials	Sweden	www.iqr.se
J.P Carlton Company	Stump cutters and chippers for an international market	USA	www.stumpcutters.com
Jacobs Corporation	Provides replacement parts for hammermills and pellet mills	USA	www.jacobscorp.com
JCB	Product and work tools for different industries e.g. forestry (harvesters, wood extraction machines, processing, loading and reforestation), mining and construction	United Kingdom	www.jcb.com



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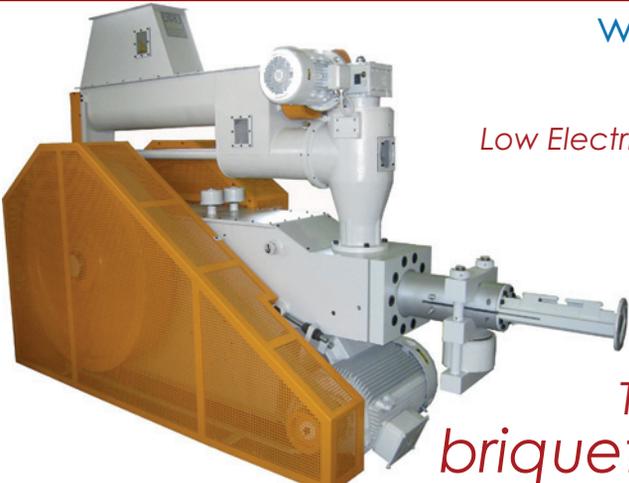
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Jiangsu Liangyou Renewable Energy	Specialized in manufacturing of biomass pellet machinery and biomass fertilizer machinery as well as design, manufacturing, installation, sales and service of turnkey project solution	China	www.fdsp-reme.com
Jiangsu Yongli Machinery Co.,Ltd	Producers of equipment for complete pellet systems including hammermills, chippers, dryers, presses, and conveyors	China	www.yongli-machine.com
Jiaozuo Hengmu Husbandry Machinery	Produces feed machines and packing units, and compound fertiliser processing machines	China	www.jzhmjx.com
Jinan Jihong Machinery Co., Ltd.	Manufactures tower cranes, construction elevators, and large pellet mill machines	China	www.jnjhtj.com
Komptech GmbH	Technology supplier of machinery and systems for the mechanical and mechanical-biological treatment of solid waste, and for the treatment of biomass as an energy source	Austria	www.komptech.com
Konecranes AB	Provides solutions as well as services for lifting equipment and machine tools of all makes. Serving a broad range of customers, including manufacturing and process industries, shipyards, ports and terminals	Sweden	www.konecranes.com
La Meccanica srl di Reffo	Feeding plants, pelleting line for wood pellets, mills, dehydration plants, sugar refineries, oil mills, organic and mineral-organic fertiliser processing plants	Italy	www.lameccanica.it
Lambton Machinery (Zhengzhou) Ltd.	Provides conveyors and pellets presses for the grain industry	China	www.lambtonchina.com
Lasco Heuthechnik GmbH	Technology for timber and hay handling including log transport trailers (tumbri), timber loading cranes, log grabbers and a patented log splitter	Austria	www.lasco.at
Liaoning Modern Agricultural Machine Equipment Co., Ltd.	Modern large-scale agricultural equipment base integrating learning, research and production of tillage land preparation machinery and seeders, harvesters, and equipment for biomass straw particles	China	www.lnxdnj.cn
Linddana A/S	Manufacturers of wood chippers for use in gardens, parks and forests	Denmark	www.tp.dk
Liyang Rongda Feed Equipment	Provides engineering design, product manufacturing, installation, customer training and other integrated services.	China	www.lyrdgj.com
Liyang Tongfu Feed Machinery Co., Ltd.	Producer of biomass wood pellet machines, straw particle machines, feed machinery sets and accessories	China	www.liyangtongfu.com
Liyang Yuda Machinery	Producer of grain feed machinery and grazing machinery.	China	www.yd-js.com
Mabrik S.A	Manufactures pellet equipment such as presses, refrigerators, air conditioners, dies and rollers	Spain	www.mabrik.com
Maschinenbau Siegel	Producer of hydraulic briquette presses for dry wood shavings, chopped wood and grinding dust	Austria	www.siegel-mb.at
Mechanika Nawrocki Sp.z o.o.	Producer of universal pelleting units for milled biomass	Poland	www.granulatory.com
MeWa Recycling Maschinen und Anlagenbau GmbH	Manufactures a range of size reduction equipment and recycling machinery for different types of materials. Single machine or integrated in complete plant solutions	Germany	www.mewa-recycling.de/
Mion&Mosole I.A.I. Spa	Development of suction and purification plants for industry	Italy	www.mionmosole.it
Morbark, Inc.	Builds equipment for process organic materials for forestry, recycling, sawmill, bioenergy, and tree care markets	USA	www.morbark.com
Morums Mekaniska	Manufactures a pellet press	Sweden	www.morums.se
Muyang Holdings Co., Ltd	Provides research and development, project design, manufacturing, installation and services for process industries including biomass; pellet presses and lines, conveying equipment and automatic control systems	China	www.muyang.com
Münch-Edelstahl GmbH	Manufacturers of complete pellet mill and grinder lines and spare parts for pellet mills	Germany	www.muench-gmbh.net
O.M.A Impianti	Manufactures pellet presses, briquette presses, dryers, complete plants for pellets production, storage silos, separator cyclones and mills and refiners for wood	Italy	www.oma-srl.com
Obilni Technika, s.r.o.	Supplier of technologies for drying, pelleting or briquetting lines inclusive of installation and service. Provides installation and servicing of technologies for post-harvest lines and storage of cereals	Czech Republic	www.obiltech.cz
P System S.r.l.	Pelletising technology: patented hydraulic system for pelletising from raw material to bagged pellet. Modular units producing up to 3 tonnes per hour. Turnkey projects also include drying and packaging systems delivered globally	Italy	www.psystemsrl.it
Pawert - SPM AG	Sets up briquetting plants all over the world, from 150 to 4 600 kg/hour capacity	Switzerland	www.pawert-spm.ch
Peterson Pacific Corp.	Manufacturer of whole tree pulpwood chippers and debarkers, horizontal grinders, blower trucks and trailers	USA	www.petersoncorp.com
Petkus Technologie GmbH	Suppliers of a comprehensive range of seed and grain handling and processing technologies as well as feed plants	Germany	www.petkus.de
Pezzolato Costruzioni Meccaniche S.p.A.	Manufacturer of machines for the preparation of firewood, refuse and recycling, and saw-mill integrated systems	Italy	www.pezzolato.it
Precision Husky Corp.	Engineer and manufacturer of heavy equipment for the forest products, logging, and recycling industries, including tub and horizontal grinders and whole tree chippers	USA	www.precisionhusky.com
Prodesa Medioambiente S.L.	Biomass solutions, EPC and turnkey wood pellets plants with or without cogeneration, and both low- and high-temperature biomass thermal dryers	Spain	www.prodesa.net



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Promill-Stolz SAS	Designs and manufactures hammer mills and pellet mills; business sectors are: sugar, alfalfa, feed, oil, starch, wood energy, urban sludge, diester and bioethanol	France	www.promill.fr
Radviliskis Machine Factory, JSC	Manufactures pellet mills, hammer mills, conveyors, coolers, shredders, bunkers, and rollers. Engineering and construction of complete pellet plants for straw, wood, peat, sunflower husks, bran and other materials	Lithuania	www.factory.lt
Rosal S.A.	Designs, manufactures, mounts and starts up complete wood pelleting lines. Manufacturers of pellet mills, hammer mills, walking floors, belt conveyors, silos, bucket elevators and chain conveyors	Spain	www.rosal-feedmills.com
Rotawave Ltd	Developer and supplier of torrefaction plants based on microwave technology	United Kingdom	www.rotawave.com
Rotochopper, Inc	Manufactures machines for forestry and recycling industry including grinders, chip processors and bagging solutions	USA	www.rotochopper.com
Rudnick & Enners GmbH	Feeding systems for biomass plants, turnkey pelletising plants, wood working and conveying systems	Germany	www.rudnick-enners.de
RUF GmbH & Co KG	Designs and manufactures a range of briquetting presses that can handle between 30 and 1 500 kg/hour of waste material	Germany	www.briquetting.com
S-E-G Svenska AB	Producers of industrial weighing, belt scales, feeders and solid mass flow meters. Operates through a network of representatives and material handling specialists who also provide engineering, support and service worldwide	Sweden	www.s-e-g.se
Saalasti Oy	Manufacturer of innovative heavy machinery for the forest and bioenergy industries including special freight transportation solutions	Finland	www.saalasti.fi
Sahut-Conreur	Offers design and construction of briquetting and compaction-granulation units	France	www.sahutconreur.com
Salsco inc	Manufacturer of equipments like chippers, shaving mills, and balers in sizes up to industrial scale	USA	www.salsco.com
Salmatec	Manufactures, designs and delivers complete wood pelleting equipment	Germany	www.salmatec.com
Scheuch GmbH	Provides patented solutions for the wood processing, wood panel and energy industries globally	Austria	www.scheuch.com
Seeger Engineering AG	Provides complete lifecycle power solutions and energy recovery from biomass	Germany	www.seeger.ag
Segem Macbo	Designs and manufactures machines for the wood industry and wood energy	France	www.segem.com
Shanghai Shende Machinery Co., Ltd	Manufactures feed machinery and provides whole-plant turnkey project design and building for feed mills as well as the auxiliary equipment and spares	China	www.shendemach.com
Shanghai ZhengChang International	Manufactures pellet mills, conveyers, extruders, hammer and roller mills, and cleaning, screening and drying equipment	China	www.zhengchang.com
Smartec Srl	Develops and manufactures equipment for pellet production: a range of systems for biomass both for private and business customers to reuse processing waste	Italy	www.smartecsr.com
SPC Sweden Power Chipper	Complete solutions for small-scale pellet production	Sweden	www.pelletpress.com
Stolz S.A.	Manufactures and installs machinery for bulk solids including storage silos, mechanical and pneumatical handling, and port silos	Spain	www.stolza.com
SunCoal Industries GmbH	Develops, builds and operates facilities that refine organic waste into SunCoal® biocoal with the patented CarboREN® technology based on hydrothermal carbonisation, for bioenergy generation	Germany	www.suncoal.de
Tana Oy	Specialised in technology for solid waste management combined with control and monitoring systems	Finland	www.tana.fi
Teccon Konstruktionen GmbH	Supply of turnkey wood pellet plants, OEM of Pellet.Tower modules (up to 120 000 tonnes per annum per unit), and consulting engineering services for pellet production projects	Austria	www.teccon.at
Terex Environmental Equipment	Designs and manufactures wood processing, biomass and recycling equipment. Products include whole tree chippers, horizontal grinders, trommels, slow speed and medium speed waste shredders, waste handlers, windrow turners and recycling screens with Spaleck technology	USA	www.terex.com/environmental-equipment
TransRental UAB	Provides wood processing, forestry, utility and construction equipment, wood-cutting machines and log debarking equipment both for sale and rental	Lithuania	www.transrental.lt
TVM Termoventilmec S.p.A	Supplier of turnkey wood pellet plants: design, plant layout, engineering, and supervision through to installation and commissioning	Italy	www.tvm-termoventilmec.com
Warren & Baerg Manufacturing, Inc.	Manufactures stringing and grinding systems for agriculture and biomass applications, densifying/cubing systems and a complete line of conveyors	USA	www.warrenbaerg.com
Vecoplan AG	Develops, produces and markets machinery and plants for the resource and recycling industry to shred, grind, convey and process wood, biomass, plastics, paper, and residential and commercial waste	Germany	www.vecoplan.com
Weima Maschinenbau GmbH	Produces machines and briquetting presses for wood, the plastics and recycling industry and for the production of substitute fuels	Germany	www.weima.com
Ventura Máquinas Forestales S.L.	Provides a range of agricultural and forestry machines	Spain	www.venturamaq.com
Vermeer Manufacturing Company	Producer of equipment for agro and forest processing products	USA	www.vermeer.com
West Salem Machinery Co	Manufactures fibre preparation and processing machinery as well as complete, customized installations worldwide: feeders, pre- and post-screeners, grinders, shredders, and hammermills	USA	www.westsalem.com
Vänertekno AB	Provides hot-air furnaces fired with wood waste, wood pellets or grain for heating large buildings from 3 000 to 10 000 m ² , as well as silos and feeding screws	Sweden	www.vanertekno.se
Xuzhou Orient Industry Co. Ltd	Designs and builds pellet and briquette mills, pellets stoves, dryers, gasifiers, chipping, and crushers	China	www.orient-biofuel.com
Ze.Pi Technologie srl	Manufacturer of pelleting presses, spare parts and equipment for complete wood and biomass pelletising lines	Italy	www.zepi.it
Zhangqiu Fada Pellet Machinery Co., Ltd	Manufactures pellet mills, hammer mills, mixers & crushers, as well as feed, forest, organic fertiliser, & energy machinery	China	www.fadajixie.com
Zhangqiu Yulong Machine Co., Ltd	Provides pellet mills, briquette presses, crushers, hammer mills, mixers, coolers and pasture machinery, with global export	China	www.woodpelletmill.net
Zhengyang Machinery Equipment Co.,	Manufactures charcoal briquette machines, biomass machines, environment protection equipment, farm machines and other mechanical equipment	China	www.zyfarmmachine.com
Zhengzhou Alliance Trading Co., Ltd.	Manufactures and designs food, pellet, agricultural and industrial machines	China	www.alliance.com.cn
Zhengzhou Furui Mechanical Equipment	Produces machines for producing hookah charcoal, wood pallets, and various foods	China	www.cnchinafree.cn
Zhengzhou Rephale Machinery Co., Ltd.	Manufactures agricultural machinery, environmental protection machinery, and food and feed machinery	China	www.rephale.com
Zhengzhou Whirston Trade Co., Ltd.	Research and development of agricultural machines, food and feed machines, and briquette machines	China	www.whirstonmachinery.com



Fourth-generation energy wood bundler from Fixteri Oy that offers better economics for pre-commercial thinnings. According to Dr Minna Lappalainen, Managing Director of Fixteri Oy, this is achieved by a higher recovery rate of biomass per hectare along with less handling costs, better drying and improved chipping options.

Jyväskylä, Finland, at the beginning of September was the place to be for the Bioenergy 2015 conference and tour. The information-packed latter, which started from Helsinki airport the morning before, included people from Canada, USA, Australia and Japan. As in the past, the tour arranged by Benet, the Finnish bioenergy consulting company and conference organiser, was full of interest.

THE FIRST STOP ON THE TOUR WAS THE NEW EUR 320 million waste-to-energy plant at Vantaa, Finland's fourth largest city with about 230 000 residents. This state-of-the-art plant achieves an impressive 95 percent energy conversion efficiency and produces about 50 percent of the heat energy demand (about 900 GWh or 100 MWth) and 30 percent of the electricity demand (about 600 GWh or 68 MWe) for the city. The plant, which was commissioned only a year earlier, replaced a natural gas fired plant. The change of fuel has meant Vantaa's greenhouse gas (GHG) emissions decreased an estimated 30 percent and waste going to landfill has now been slashed to only about 2 percent.

BIOENERGY 2015 ASPECTS OF BIO

Sophisticated monitoring

The intake of 320 000 tonnes of mixed municipal waste produced by about 1.5 million people resident in the province (which includes nearby cities of Helsinki and Espo) means a steady flow of 140-180 trucks a day through a sophisticated recording and monitoring process developed by the Finnish company Protocon. The trucks' arrival times and net load weights of between 9-24 tonnes of waste are recorded by the company, and at the unloading point the load content is recorded by CCTV cameras as it is unloaded into a 38-metre deep bunker. An occasional random truck is directed to unload on a sorting apron and the content is checked for compliance. On average it takes 11 minutes between when a truck enters and leaves the gate.

The second visit was to a 10 MW bubbling fluidised bed (BFB) boiler made by the Finish company Renewa, supplying district heat to the township of Rajamäki. This BFB plant is fuelled by any mix of forest chip, sawmill residues or milled peat, and is designed to be run with no staff on site and to be managed remotely. While it is visited once a day by one of the company staff it is managed from the control room of another of the company's four district heating plants. Capital cost of this plant on its greenfield site was about EUR 4.5 million in 1997.

Biomass bundler

The last visits on this tour were at a forest thinning site near Jyväskylä, where it was demonstrated that the Finns are still among the world's leaders in the development of innovative forestry biomass-to-energy equipment and systems. At this site a fourth-generation Fixteri bundler at work showed how this system can offer significantly better economics for doing first commercial thinnings for energy use. Dr Minna Lappalainen, Managing Director of Fixteri Oy, explained how this was done by a higher recovery rate of biomass per hectare along with less handling costs, better drying and improved chipping options.

At the same site Tommi Lahto, the managing director of LHM Hakkuri, demonstrated to the group how the Fixteri bundles were suited to his Giant chipper. As his truck-mounted chipping system chipped bundle after bundle in a continuous stream into a waiting truck, Tommi explained the design features of these high capacity chippers. In his chip supply contracting business he uses about 13 of these mainly around southern Finland. He said that some of them have been working continuously since the late 1990s, and claims production of 3 million m³ of loose chip is achievable from a Giant chipper over its working life. »

15 – COVERING ALL COMMERCIAL BIOMASS TO ENERGY

Temporary policy stall

The following two days of the Bioenergy 2015 conference included the usual wide range of information concerning policy and targets, forestry management, industry and research in Finland, and also information from a significant number of international speakers. Some standout talks on developments in Finland were about progress building the new Metsä plant at Ääneskoski, which will see a near-tripling of wood going into processing, up to about 6.5 million m³ per annum; energy production being sourced mainly from residues, and a widening of the product line to include biofuels and fibre.

International speakers were from Argentina, the USA, Canada, Austria, Korea, Japan, Australia, Estonia and Germany. The changing uses of biomass in the EU were clarified by Jori Sihvonen from the European Biomass Association (AEBIOM), while the current world picture and direction for the coming decades was provided by Dr Heinz Kopetz of The World Bioenergy Association (WBA). Overall, while EU and Finnish policy development in relation to bioenergy and biofuels has stalled temporarily, it is clear that there is no alternative to ongoing development in bioenergy.

Showcasing Finnish tech

Finland is in the box seat to supply plant, equipment, technology and expertise, a message was reinforced a number of times, with countries at the rear in bioenergy development, including the USA, Argentina and Australia, clearly being potential clients for some of this array of services and equipment. Some of these companies at the conference, like Renewa and KPA Unicon, are world leaders in their combustion technologies. Biogas and biofuels companies included BioGTS with a pilot plant demonstrating their innovative anaerobic digester design. At the expo that ran in parallel with the conference many stands were taken up by other leading Finnish manufacturers of forestry and bioenergy equipment, including Kesla cranes, heads and chippers (including their prototype hybrid-powered chipper), AFM heads and Hewsaw one-pass milling systems.

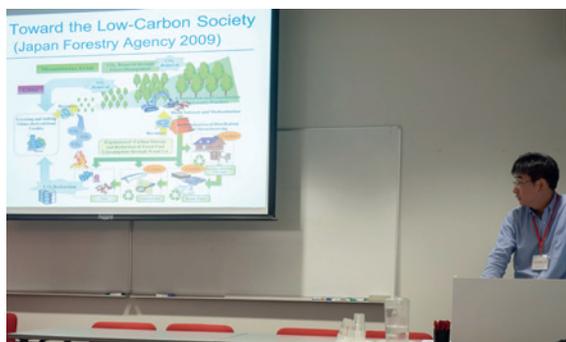
The optional post-conference tour the day after was of a small district heating plant in a village near Joutsa. Here the boiler was in modular housing with an integrated feed supply. The 150 kW_{th} boiler and all of the systems carried the name Säättöuli, a maker well known in Finland but one of many not widely known outside that country yet.

The second site was to a newly completed 3000 m³ per annum municipal anaerobic digester near Joutsa where the biogas was upgraded using the Metener system (developed in Finland) for fuelling cars and buses. The site is just off the E75 highway and the tour group was at the filling station when a pair in their Volvo V70 AFV estate car, heading north on a fishing trip, came in to top up with the cheapest fuelling option of biomethane (the V70 AFV is able to run on methane, gasoline or ethanol).

After the usual hearty lunch the final stop was to visit VTT (the Finnish National Research Organisation) in Jyväskylä, and to see the test rigs for bubbling and circulating fluidised bed furnaces. This was an appropriate end



The new EUR 320 million waste-to-energy plant at Vantaa, Finland's fourth largest city. This state-of-the-art plant achieves an impressive 95 percent energy conversion efficiency and produces about 50 percent of the heat energy demand.



Delegates and speakers came from around the world. Here Dr Kazuhiro Aruga, Dept. of Forest Science, Utsunomiya University, Japan outlining the nation's pathway towards a low-carbon society. He discussed the availability of logging residues for the Nakagawa biomass power plant based on the existing forest management plans for Takahara Area in Tochigi Prefecture (photo courtesy Arto Rummukainen, LUKE).



Finnish bioenergy technology and knowhow is not confined to large forest-based biomass. Here a biogas plant with upgrading to biomethane technology supplied by Metener.

point as many of the innovative systems seen in practice have been developed based, in some way, on the detailed work done by VTT in this and its other laboratories over the last 25 years.

KPA Unicon awarded new supply contracts in Finland



In Finland boiler technology supplier KPA Unicon has been awarded a contract by Porvoo Energy to supply a turnkey 10 MW_{th} biomass heat plant to be built in Loviisa. The deal also includes a five-year plant service and maintenance agreement. A ground-breaking ceremony was held recently and it is scheduled for hand-over in April 2016. The new plant will use local wood-based fuels such as bark and woodchips and serve as a new baseload plant for the Loviisa district heat network. The existing 7 MW_{th} boiler plant will serve as peak load and reserve use in the future.

Also in Finland, KPA Unicon has been awarded a contract to supply a 6.25 MW_{th} flue gas scrubber and heat recovery system to the Pieksämäki district heat plant by energy utility Savon Voima. In addition to the improved energy efficiency of district heat production, the carbon dioxide and sulphur dioxide emissions will be reduced by over ten percent.

– Our target in district heat production is to reach close to 100 percent utilisation rate of domestic fuels. This new investment reduces the use of oil in energy production, said Maija Henell, Business Director of Savon Voima.

Text & photos: Andrew Lang
B182/5029/AS

B182/5028/AS



The home heating sector was well represented during all three days in Valladolid. Many Spanish and international companies showed their latest products and innovations. This year the innovation prize was awarded to Austrian company ÖkoFen for its Pellematic Smart pellet boiler. The unique combination of a solar and pellet boiler in one unit primarily makes use of solar power, but with a high efficiency, with the condensing pellet burner ready to step in when needed. This can mean savings of up to 50 percent in heating costs when compared to conventional pellet boilers.

Gabriele Rossato and Erika Tessari representing Italian company Uniconfort were busy at their stand talking to new customers.

Expobiomasa 2015

EXPOBIOMASA, ORGANISED EVERY YEAR in Valladolid by the Spanish Biomass Energy Association, AVEBIOM, marked its decennial event during 3 days in September. Established 10 years ago, it is now a well-established international trade fair, this year gathering a total of 543 enterprises and brands representing 27 countries. The 26 000 m² total exhibition space included two large indoor halls and outdoor stands.

Not crowded

However, a fall in visitor numbers compared to other years is due, according to AVEBIOM, to attendees being more specialised and better informed – a key factor that means the fair is becoming increasingly professionalised rather than

just a crowd puller. According to the organisers, the event's reduced participation means its professional profile is on the up.

On 24th of September the final headcount was 15 041 visitors. This is smaller than last year, however a high number of attendees was not the target set by the organisers. Visitors represented 32 nations including 5 percent from Portugal alone.

Bioenergy Congress

The International Bioenergy Congress is held every year during the Expobiomasa trade show. This year 150 professionals hungry for the latest information available to adapt their businesses to the next regulatory and market requirements met in congress hall.

Towards a low emissions sector

The European Council has several targets in climate and energy for 2030: reducing greenhouse gases by 40 percent, reaching a 27 percent share of renewable energy and increasing energy efficiency by 27 percent. To achieve these goals, the European Commission is preparing a strategy for heating/cooling and a new package of measures that includes a sustainability policy for biomass. This will be crucial for the bioenergy sector to establish the legislative framework for companies to develop their businesses after 2020.

New emission standards were well discussed by Marco Palazzetti, from the Italian stove manufacturer Palazzetti. He explained the main effects that eco-labeling and eco-design regulations, published last summer in the Official Journal of



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1. Rolf Uhle representing German company RUF GmbH was discussing new potential market trends and partnerships.
2. Among many visitors Walid Ben Amor comes to Valladolid every year all the way from Tunis and represents his company Abou Walid Group.
3. New on the market but already a very active company, Manufacture à Besançon (MaB) from France was constantly busy with visitors.
4. Italian company Smartec demonstrating a small-scale pelletising unit.
5. Alberto Carlesso from Italian company Construzioni Nazzareno describes the Italian market situation.
6. Irina Saksybaeva, Marketing Manager and José Manuel Martínez, General Manager of PRODESA, was proud to announce the establishment of its first large 150 000 tonne-per-annum pellet plant to run in Malaysia from next year.

the European Union, will have on the biomass stove market. Particle restrictions in the Ecodesign Regulation will affect 80 percent of biomass stoves and 20 percent of pellet stoves that are manufactured today, and 100 percent of fireplaces.

As for eco-labeling, although the most advanced pellet stoves can obtain the A++ class, many will remain in class A+. Significant changes are not expected in terms of product range and pellet stoves will benefit the most.

Medium-scale power plants of between 1-50 MW will be affected by the new directive from 2016, when emissions limits and dates will be binding.

Emission control technologies

Controlling emissions requires adopting good

primary measures: choosing the right fuel, good equipment design, proper regulation and proper maintenance and user behaviour.

Alejandro Sanchez, from Spanish company L.Solé, stressed the importance of an engineering and manufacturing strategy to maximise combustion and minimise emissions in biomass boilers. Some proactive practices developed for fireplaces are critical to minimise emissions. Sanchez pointed out the relationship between high energy efficiency, minimal maintenance costs and reduced emissions.

Next year

Despite the positive take on falling visitor numbers, AVEBIOM sees it as something that can clearly be improved upon, which is why the Ex-

pobiomasa team is rethinking parts of its strategy and intensifying some of the activities aimed at attracting professionals to future events.

B182/5056/DN

Text: Dorota Natucka, Antonio Gonzalo Perez

Photo: Jeanette Fogelmark

The presentations can be downloaded from www.congresobioenergia.org and will be available in the AVEBIOM.market YouTube channel.



The 5th European Biomass to Power conference in Berlin, Germany brought together senior executives from several countries, representing the entire value chain, such as power producers, regulatory bodies, raw materials providers and researchers, as well as other influential stakeholders.

STRONGER GLOBAL BIOMASS DEMAND, IF CLIMATE POLICY IS TAKEN SERIOUSLY

“Low oil prices have a strong impact today on the bioenergy industry. An oversupply of biomass might occur in the short run,” said Dr Heinz Kopetz, President, World Bioenergy Association (WBA) in his opening speech at the 5th European Biomass to Power conference held last month in Berlin, Germany.

ACCORDING TO KOPETZ, pellets prices are at a 3-year low and sales of biomass boilers dropped sharply. But on a more optimistic note, he said that serious climate policy will drive up the demand for biomass in all market segments sooner or later.

– Co-firing of pellets in the USA is discussed intensively and highlighted. Carbon taxes or other instruments will be executed to increase the price of carbon, explained Kopetz.

AEBIOM’s annual statistical report, European Bioenergy Outlook 2014, shows that biomass contributed 123 Mtoe to gross inland energy consumption in the EU-28 countries during 2012, with 20 Mtoe of losses resulting in a final consumption of 102 Mtoe. Most of this consumption - 73 percent - is for heat, with the remainder split almost equally between electricity generation and biofuels for transport.

The two day conference covered topics such as ‘Nordic market insights: Role of biomass in utility energy mix analysis of current policy, legislation & sustainability developments’ and many other themes. It provided an in-depth look into case studies giving practical examples of planning, finance and technology strategies utilised for biomass cogeneration projects.

Swedish objectives

The slightly gloomy depiction of the European biomass industry presented by some conference participants was balanced by Robert Fischer from the Swedish Bioenergy Association (Svebio), where he is responsible for coordinating the Biomass to Power platform. Svebio’s goal is to increase biopower in Sweden by 1 TWh per year until 2040, resulting in a total of 40 TWh.

– The share of biomass in Sweden’s total final energy use in 2013, including exported power, was 130 TWh or 33.5 percent of the total 389 TWh, explained Fischer.

He described a significant economic potential for new CHP-plants in existing district heating (DH) networks and large industries as well as small-scale combined heat and power (CHP) in local DH facilities in rural areas, smaller industries and buildings replacing existing heating boilers.

– Small scale is flexible and can be integrated and complemented; the small-scale CHP potential in Sweden is estimated to be about 10 TWh, explained Robert Fischer.

He added that the Swedish farmers’ association’s (LRF) vision of fossil-fuel-independent agriculture in Sweden could become a reality through renewable energy from its own resources by 2030.

Vattenfall objectives

Gunther Müller, from Vattenfall Europe AG, talked about the company’s heat operations in Berlin. He said it is necessary to achieve a fixed reduction in greenhouse gas effects compared to coal, taking into consideration the whole value chain.

– We have developed criteria for sustainable resourcing, before standards are set through legislation or the market. Regarding biomass use, these standards fulfil social sustainability requirements such as business transparency, the protection of labour rights, land rights and a responsible relationship with local inhabitants, Müller stated.

Müller also informed delegates about Energy Crops GmbH, which is a company owned by Vattenfall with the objective of producing its own biomass. The company is currently market leader in Germany. It cultivates about 2 000 hectares of short rotation coppices located in Brandenburg, Schleswig-Holstein and the West of Poland.

Danish conversions

Andreas Nielsen-Refs, Head of Thermal Power Strategy at Danish company DONG Energy Thermal Power A/S, said that “there is a large potential for biomass combustion in Northwestern Europe, especially in Germany. Generally the bioenergy can be a bridge to the sustainable, affordable and secure future energy system”.

– Dong is a market leader in biomass conversions. Right now the Danish power system is undergoing a major transition from fossil fuels to renewable energy. We have completed two unit conversions, Herning and Avedøre 2. The next three units to convert are going to be Studstrup 3, Skaerbaeck 3 and Avedøre 1. We expect the bioenergy market is going to grow. It is one of the reasons why we are converting a large share of our CHP portfolio, explained Andreas Nielsen-Refs.

Southern small-scale plants

Daniella Johansson, from Energikontor Sydost AB located in the southeast of Sweden, demonstrated a pre-study of a small-scale biomass CHP.

– Half of the energy in the southeast of Sweden comes from biomass. A pre-study, which was made in 2013 to review the potential for small-scale CHP, was financed by the Swedish Energy Agency and the Swedish District Heating Association, explained Daniella Johansson.

She said that Southern Sweden has a potential for 80 small-scale plants. Between 40 to 50 plants in the region can achieve a possible average electricity production of 3 GWh every year.

According to Johansson there are several reasons for investing in small-scale CHP based on biomass, like lower costs for imported electricity. Locally produced electricity contributes to better grid security and gives a strong environmental profile for the company. It is also profitable to be part of the leading development.

– Other benefits from small-scale local biomass plants are more locally produced renewable electric power which unburdens the power grid in general. These plants are securing the grid from power outage and they increase the use of biomass and decrease fossil CO₂. They also increase local »



The newly rebuilt Markinch biomass plant reduces carbon footprint in the region by 72 percent, decreasing fossil fuel carbon emissions by 250 000 tonnes annually. (Photo: Siemens)

» employment, explained Daniella Johansson.

Biggest in UK

Ian Calvert, Head of Biomass UK, RWE Innogy UK Ltd (Innogy's UK subsidiary) presented a newly built biomass-based CHP plant to supply power to a paper mill owned by Tullis Russel in Markinch, a small town in Fife, Scotland. Galvert explained that with an installed capacity of 50 MW, it is the largest power plant of its kind in the country.

– The plant was officially inaugurated in March 2015 by Scottish Minister for Business, Energy and Tourism, Fergus Ewing, although it has been generating power since February 2014. It replaces the existing coal-fired power plant at the paper mill site, and required an investment of approximately GBP 200 million (≈ EUR 272 million). RWE, the owner and operator, officially took over the site in November 2010, said Ian Galvert.

The project created more than 600 jobs during construction and 40 permanent positions. With the backing of Scotland's then First Minister Alex Salmond, the project received support of GBP 8.1 million (≈ EUR 11 million) from the Scottish Government's Regional Selective Assistance (RSA) grant. Tullis Russell paper mill is supplied with 120 tonnes per hour of steam. In order to supply the paper mill with a secure supply of steam, three gas fired boilers have been installed. From the total electricity generated, approximately 17 MW is supplied to Tullis Russell and 25 MW is exported.

Plant construction

Around 400 000 tonnes per annum of biomass is consumed by the plant. Biomass from both virgin (10 percent) and recycled wood (90 percent) is used in a fluidised bed boiler and flue gas system, designed according to the rules and regulations of the Waste Incineration Directive.

Valmet (formerly Metso Power) was awarded a contract worth GBP 75 million (≈ EUR 102



(Left) Andreas Nielsen-Refs, Head of Thermal Power for DONG Energy debating with Dr Heinz Kopetz, President, World Bioenergy Association (WBA).

million) for delivery of a 155 MW_{th} circulating fluidised bed (CFB) boiler and a flue gas treatment plant. The remaining sections of the plant were constructed by Jacobs Engineering.

Aker Solutions was awarded a GBP 115 million (≈ EUR 156 million) contract to provide engineering, procurement and construction (EPC), and project management. It was responsible for the design, supply, construction, and installation and commissioning of the plant.

According to Ian Calvert, the CHP plant reduces the carbon footprint in the region by 72 percent, reducing fossil fuel carbon emissions by 250 000 tonnes per annum. It helps the Scottish Government to meet 6 percent of its renewable energy targets.

*Text & photos: Markku Björkman
BI82/5033/AS*

Editor's note: The employee-owned Tullis Russell paper mill went into administration in April 2015.



Gunther Müller, Head of Heat operations in Vattenfall Europe AG, talking about the company's biomass plants in Berlin.



The slightly gloomy depiction of European biomass industry painted by some conference participants, was balanced by Robert Fischer, Project Manager with the Swedish Bioenergy Association (Svebio).



Daniella Johansson, from Energikontor Sydost AB, said that 40 to 50 new small-scale plants in Southern Sweden can achieve a possible average electricity production of 3 GWh per annum.



Ian Calvert, Head of Biomass UK, RWE Innogy UK explained that Markinch biomass plant is the largest power plant of its kind in the country.



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Hills alive with the sound of AUSTROFOMA

Held once every four years, the 12th edition of the international steep terrain forestry trade show AUSTROFOMA proved a resounding success. Held in early October the three-day show attracted almost 19 000 visitors to the forest slopes in upper Austria. Organised by the Austrian Chambers of Agriculture together with the forest enterprise Schlägl-Hochficht, 145 companies exhibited, many of which demonstrated specialist harvesting and extraction equipment such as skyliners, yarders and winches along with chippers, grinders and shredders.

The next edition will take place 8-10 October 2019 in the Esterházy forest, Forchtenstein with the organisers continuing with the proven concept of forestry equipment demonstrated in practical work applications.

*Photos courtesy Pellewood
B182/5073/AS*

Small but successful debut for Forest Romania

Professional forestry in Romania has gained a much longed-for meeting place with the first edition of the Forest Romania forestry fair. Some 1 600 visitors found their way into the Transylvanian woods in mid-September. The exhibitors, representing around 130 companies, praised the trade fair's concept of focusing exclusively on the professional primary forest industry. Having such a highly targeted industry fair is a totally new approach for the Romanian market.

– During my four years at this company we've never before participated in a trade fair that has given us so many valuable customer contacts, said Ovidiu Stănculescu, Product Manager at Terra România. The company is a machinery dealer for construction, timber haulage and handling.

– I believe in this fair as being an important one for the future, said Anders Strömngren, head of John Deere's independent dealers in European.

John Deere's Romanian distributor Elmas presented the new log skidder, Timberhawk, which is designed by Haas Maschienenbau in Germany. The skidder is not part of John Deere's own product range but was shown at the request of its distributors. Weighing in at nine tonnes it is considerably lighter than American skidders and has a winch.

– It was developed to suit the southern European market, so the timing to exhibit here was perfect for us and a good way to complement the range of machines we offer via our distributors, Strömngren said.

A fundamental concepts behind Forest Romania is that new technology should be shown in operation so that visitors see it working.

– The visitor interviews done during the fair reveal that this aspect was greatly valued, said Forest Romania Project Manager Anamaria Deliu. Organised by Elmia AB of Sweden and DLG of Germany. The next fair will be held in September 2017.



Photo courtesy Pellewood

B182/5074/AS

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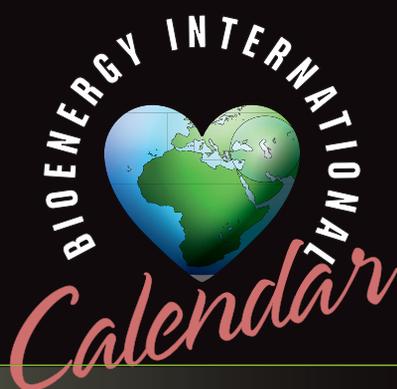
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02-05	F.O. Licht's World Ethanol & Biofuels	Hungary	www.worldethanolandbiofuel.com
03-05	Wood Pellet Association of Canada AGM 2015	Canada	www.pellet.org/wpac-agm
04-05	RENEXPO BiH	BiH	www.renexpo-bih.com
05-08	Ecomondo	Italy	en.ecomondo.com
10-14	Agritechnica	Germany	www.agritechnica.com
15-18	14 th World Congress on Anaerobic Digestion	Chile	www.ad14chile.com
18-20	RENEXPO South-East Europe	Romania	www.renexpo-bucharest.com
24-24	Asia Gasification	Thailand	www.icesn.com
25-27	Biogas Thailand	Thailand	www.icesn.com
26-28	RENEXPO Austria 2015	Austria	www.renexpo-austria.at
30-02	Bioenergy Australia 2015	Australia	www.bioenergyaustralia.org
DECEMBER			
01-03	Algae Europe 2015	Portugal	algaecongress.com
07-08	Energy from Waste	UK	www.smi-online.co.uk/energy/uk/conference/energy-from-waste
15-16	Sino-German BioEnergy Annual Conference	China	www.biogaschina.com.cn
JANUARY 2016			
18-19	Fuels of the Future 2016	Germany	www.fuels-of-the-future.com
18-21	World Future Energy Summit	UAE	www.worldfutureenergysummit.com
20-21	Lignofuels 2016	Germany	www.wplgroup.com/aci/conferences/eu-eef8.asp
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26-28	Biomass & BioEnergy Asia 2016	Thailand	www.cmtevents.com
27-28	Biogaz Europe 2016	France	www.biogaz-europe.com
FEBRUARY			
02-03	Pellets 2016	Sweden	www.svebio.se
03-06	Fieragricola	Italy	www.fieragricola.it/en
23-24	Biomass Trade & Power Europe	Denmark	www.cmtevents.com
23-25	F.O. Licht's Sugar and Ethanol Asia Conference	Thailand	www.sugarethanolasia.com
24-26	European Pellet Conference 2016	Austria	www.pellets16.eu
24-26	World Sustainable Energy Days 2016	Austria	www.wsed.at
MARCH			
05-06	Agro Park	Poland	www.agro-park.pl/en
14-17	World Bio Markets 2016	Netherlands	www.worldbiomarkets.com
15-17	Bois Energie 2016	France	www.boisenergie.com
23-24	Gasification	Netherlands	www.wplgroup.com/aci/event/
29-31	Victam Asia 2016	Thailand	www.victam.com
29-31	Bio-Energy China	China	www.bio-energyexpo.cn
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APRIL			
05-06	Wood Bioenergy Show	USA	bioenergyshow.com/
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