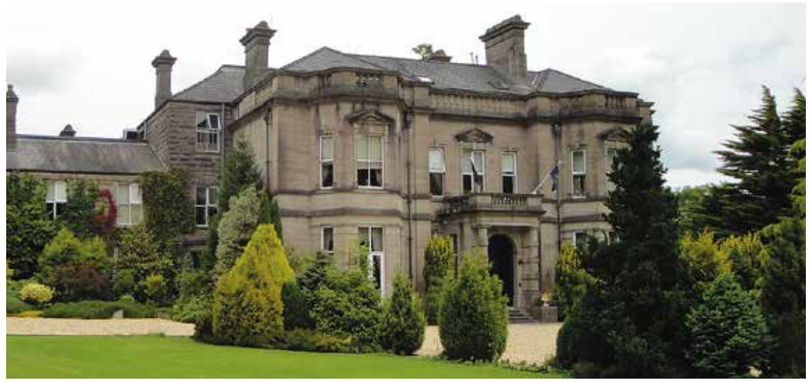
Biomass heats award-winning Welsh hotel

Tre-Ysgawen Hall Hotel is an award-winning luxury spa and hotel scenically set in rolling countryside on the Isle of Anglesey, Wales. Originally built in 1882 as a country mansion it opened as a hotel in 1996 after refurbishment and extensions. In late 2012 it commissioned what is believed to be one of the first biomass heating systems designed and installed specifically for a hotel and spa in Wales.



LOCATED ON AN ISLAND, OFF THE GAS GRID, the four-star Tre-Ysgawen Hall Hotel complex features 29 luxurious rooms in the original mansion building along with a number of conference suites, dining rooms, a swimming pool, thermal suite and gym most of which were previously heated using oil. The owners wanted to cut the heating oil bill which was costing the business some GBP 90 000 (≈ EUR 126 000) per annum while reducing carbon emissions. Employing around 80 staff the hotel is also the island's largest employer.

– We have been spending GBP 200 000 (≈ EUR 280 000) per year on LPG, oil and electricity and in business terms that means I have to have a turnover of GBP 800 000 per year (≈ EUR 1.1 million) just to pay the fuel bills. It was crucial to the future of the hotel that we did something to address this, said Neil Rowlands, CEO of Tre-Ysgawen Hall Hotel.

All-in-one woodchip system

Rowlands commissioned an on-site audit by energy experts Carbon Control Ltd to find ways of reducing energy consumption and improve sustainability. Biomass boiler installers, Rural Energy Ltd, were contracted for the GBP 500 000 (≈ EUR 700 000) investment into a 600 kW woodchip-fired "all-in-one" fuel storage and biomass boiler system from Austrian manufacturers Herz Energietechnik GmbH. The woodchip store and boiler construction takes advantage of the sloped grounds with the fuel store side fitted to match the slope. This enables easy delivery of woodchips by tipper truck. The fuel store is equipped with a walking floor for energy efficient fuel feeding. The boiler, a 600 kW "BioFire", is the largest model type in the Herz woodchip/pellet boiler product series. The model is available in the 500 to 1 500 kW thermal range although, according to Herz, it can be used in projects up to 4 500 kW by cascading. Utilising a step-grate furnace technology developed in-house the unit features compact design. Automatic cleaning of heat exchanger surfaces enables a consistently high level of heat transfer efficiency. Built-in Lambda sensors control primary and secondary air supply together with continuous flue gas monitoring to ensure optimum combustion and extremely low emission values, even in partial load operation and changes in fuel quality.

Six-year payback with RHI

The new biomass boiler system uses about 450 tonnes of woodchips per annum. The woodchips are supplied from a local depot by Stobart Biomass Products Ltd, a subsidiary of Stobart Group, a leading UK infrastructure, logistics and support services company. The running costs are around GBP 40 000 (≈ EUR 56 000) per annum, less than half the amount the hotel was spending on fuel oil. However with the non-domestic Renewable Heat Incentive (RHI), a government financial support scheme that provides regressive payment based on the actual heat output, the estimated payback time is within six years.

– It was still a difficult decision to take because I was very aware that my customers were not going to see the benefits of this large amount of money. It's not like spending it on the refurbishment of rooms or on new carpets where they can see a difference, ended Neil Rowlands.

Text: Alan Sherrard
Photos courtesy Rural Energy
BI81/4926/AS

Boiler and Burners Directory

Despite two mild heating seasons in a row, at least in Europe, now is a good time to take stock of upcoming heating needs and emission compliance requirements. According to a recent market research report published by Transparency Market Research (TMR), a global market intelligence company, the global biomass boiler market is expected to grow "healthily" at a CAGR of almost 20 percent during the period from 2014 to 2022. Entitled "Biomass Boiler Market - Global & UK Industry Analysis, Size, Share, Growth, Trends and Forecast 2014 - 2022"**, the TMR report estimates the global biomass boiler market, segmented as residential, commercial and industrial, was worth US$1.8 billion in 2013. It is forecasted to reach a valuation of US$8.9 billion by 2022. The commercial sector was the major end-user of biomass boilers in 2013 and is expected to dominate the market in the near future. As expected, heating was found to be the largest application of the market in 2013, accounting for around 80 percent. Of the three boiler types, bubbling fluidised bed (BFB), circulating fluidised bed (CFB), and stoker boilers, the latter dominated the overall market in 2013 and is expected to account for the highest market share during the forecast period. Woody biomass was the largest feedstock type for power and heat generation in 2013, accounting for around 78 percent. The other feedstock categories in the report – agriculture and forest residues, biogas and energy crops, urban residues and others including landfill gas – made up the balance though it should be noted that boilers tend to be feedstock flexible.**

The report points out that the rapid industrialisation in developing economies such as India, China, and Brazil has fuelled the demand for energy and this is expected to augment the growth of the global biomass boiler market. Enforcement of boiler standards along with favourable regulatory frameworks and government support in terms of feed-in tariffs and tax incentives, such as the Renewable Heat Incentive (RHI) in the UK, will boost the growth of the overall market during the forecast horizon. On the flip side the report mentions that the challenges related to biomass fuel supply, storage, and handling will hamper demand for biomass boilers.

The purpose of this biomass "Boilers and Burners Directory" is to provide an overview on those who can supply biomass combustion technologies for larger residential, commercial or industrial applications. Note that while the list is comprehensive it is not exhaustive nor does it in any way represent an endorsement of a company and/or product.

Text: Alan Sherrard
BI81/5001/AS

Company	Comments	Country	Website
Alcon A/S	Provides biomass heating equipment up to 750 kW with many models	Denmark	www.alcon.nu
Akron	Akron Bio400 woodchip-fired boilers from 400-750 kW	Sweden	www.akron.se
Alstom Power Group (Headquarters)	Provides equipment and services for power generation and railtransport. Turnkey projects – power, CHP and heat plants – and flue gas cleaning	France	www.alstom.com
Ariterm Group	Central heating boilers and a variety of bioenergy burner devices from 3 kW to 3 MW	Finland	www.ariterm.fi
Babcock & Wilcox Vølund A/S	Supplier of equipment and technologies designed to convert household waste and biofuels into thermal energy	Denmark	www.volund.dk
Baxi AB BDR Thermea	Heating systems for residential and industrial use	Sweden	www.baxi.se
Berkes	Standard combustion systems and gasification technology. Multifuel: wood, husk, waste. Taylor-made from engineering through to turnkey: CHP, DH and industrial	Belgium	www.berkes.es
Beaver Wood Energy, LLC	Offers energy solutions for biomass	USA	www.beaverwoodenergy.com
Binder Energietechnik GmbH	Manufacturer of biomass boilers from 100 kW to 10 MW for commercial, industrial, and communal applications	Austria	www.binder-gmbh.at
Biochamm Calderiras	Producer of boilers, burners, air preheaters, multicyclon filters, and bin dischargers for different applications	Brasil	www.biochamm.com.br
Biomass Heating Solutions Ltd	Provides FBC technology suitable for a wide range of woodchips, including chipped virgin wood	Ireland	www.bhsl.com
Camina Ecotec Sweden AB	Products for pellet, wood and solar heating up to medium size	Sweden	www.ecotec.net
Compte-R	Designs, manufactures and installs wood and biomass furnaces – 250 kW to 8 MW – and peripheral equipment for a wide range of industrial and municipal applications	France	www.compte-r.com
D'alessandro Termomeccanica S.R.L	Manufactures biomass boilers, warm water boiler range from 20 kW to 4.1 MW and steam boiler range from 100 kW to 7 MW	Italy	www.caldaiedalessandro.it
Danstoker A/S	Manufactures furnace and fire-tube oil and gas boilers, boilers for biomass and waste heat recovery boilers for biomass applications	Denmark	www.danstoker.dk
DP CleanTech	Manufactures and delivers turnkey biomass power plants worldwide. Includes boilers and auxiliary equipment for biomass power plants and waste-to-energy plants.	China	www.dpcleantech.com
Ecovision	Provides turnkey solutions for modern heating systems	UK	www.ecovisionsystems.co.uk
Ekoterm Proekt Ltd	Supplier of heating equipment, 18 kW to 50 kW for household use and 300 kW to 1.1 MW for the public sector and industry, complete engineering and servicing of built installations and equipment	Bulgaria	www.greenecotherm.eu
Energy Innovations	Designs, installs and maintains biomass heating systems for a wide range of purposes	UK	www.energyinnovationsuk.com
Enerstena Ltd	Designs and manufactures biomass boilers, flue gas condensers, furnaces and other technological equipment for biomass boiler plants	Lithuania	www.enerstena.lt
Enertech AB Osby Parca Division	Provides solid-fuel boilers from 100 kW to 7 MW that can handle moisture content up to 50 percent	Sweden	www.osbyparca.se
ETA Heiztechnik GmbH	Offers a wide range of boilers including wood gasification boilers, woodchip boilers, and pellet boilers up to 350 kW	Austria	www.eta.co.at
Fabryka Kotłów Sefako S.A.	Manufactures power-generating boilers used in the power industry, heavy industry and food producing and processing plants	Poland	www.sefako.com.pl
FSE Inc	Manufactures solid-fuel boiler systems for industrial applications	USA	www.fseenergy.com
Fire Fox Vertriebs GmbH	Produces forward-looking heating systems, central heating pellet systems from 10 kW to 500 kW as well as stoves	Austria	www.firefox.at
Foster Wheeler Service Oy	Global engineering and construction contractor and power equipment supplier, CHP s larger than 20 MWth, and boiler service	Finland	www.fwc.com

Bioenergy on the ground

Whilst much focus for the aviation sector is on reducing aviation emissions in the air, a lot can be done on the ground. One aircraft manufacturer major, Airbus Group, has reduced carbon dioxide (CO_2) emissions from one of its assembly plants in France by switching to biomass heating.

EMPLOYING OVER 10 000 STAFF IN 350 000 M² OF COVERED SPACE, the Airbus Industries Clement Ader assembly facility in Toulouse, France is an enormous workspace. Here several different aircraft models, from the A320 up to the Primus A380 are assembled. In 2010 a decision was made to oversee the heating needs and environmental impact as part of the Group's overall long-term "eco-efficiency" commitment. This includes its "Blue5" target to reduce total carbon dioxide emissions by 50 percent in 2020 compared to 2006. The choice was to install a 13.5 MW woodchip fired steam boiler from Austrian ventilation and combustion technology specialists Polytechnik Luft- und Feuerungstechnik GmbH. The project received investment support from the French Environment Agency, ADEME, and it is the first biomass installation at an Airbus facility.

Locally sourced woodchips

Commissioned in 2013 the scope of supply for Polytechnik was the boiler excluding the buildings, a contract worth around EUR 3.3 million. The boiler uses around 22 000 tonnes of woodchips per annum and supplies about two-thirds of the heat demand for the facility, replacing fossil gas. The woodchips are sourced locally from forestry operations and short rotation plantations such as eucalyptus. Seventy percent is supplied through the forestry cooperative COFOGAR (union of forest administrations in southwestern France), one of the largest timber providers in the region with the balance coming from local sawmills. Having such a diverse origin of fuel supply can be a challenge as chip size and moisture content vary considerably. However according to Polytechnik the hydraulic grate boiler can handle longs, fines and moisture content from 20 to 55 percent with the key to trouble-free boiler operation attributed to proper staff training and continual monitoring of the thermal output of the plant.

Ash recycling

The compact boiler plant houses three fuel bunkers equipped with a transverse clam-grab. Each bunker has a moving floor to meter out fuel to the boiler and can hold roughly one day's worth of fuel. A special feature is an emergency-cooling by-pass enabling safe shutdown of boiler should a disruptive shutdown in the gas heating occur and threaten to affect the biomass boiler.

The flue-gas cleaning system consists of a multi-cyclone followed by an electrostatic filter that removes particulate matter (PM) down to the 2-8 mg/Nm³ range under normal operating conditions, well below the legislative limit of 20mg/Nm³. Other regulated emissions such nitrogen oxides (NO_x) are well below 200 mg/Nm³, less than half the 400 mg/Nm³ limit, whereas carbon monoxide (CO) and sulphur dioxide (SO_2) are almost undetectable. The resulting ash from the combustion process is, after appropriate treatment, used as a fertiliser in agriculture.

Text: Alan Sherrard
Photos courtesy Polytechnik
BI81/4768/AS

Process steam and heat plant orders for URBAS

Austrian boiler fabricators URBAS Maschinenfabrik GmbH report a busy order period for its biomass-based boilers having announced several orders in different markets. In Sweden an order for a 10 MW, 18 bar process steam plant including buildings was received from mechanical pulp producer Waggeryd Cell AB, a subsidiary of ATA Group. Delivery is scheduled during late 2016.

In Norway an order for a 5 MW hot water boiler with buildings and delivery by end of 2015 was received from sawmill group, RingAlm Tre A/S. In Estonia an order was received from Finnish forest products UPM for a 20 MW process steam boiler and buildings for its Otepää veneer factory with delivery during late 2016.

Much closer to home is an announcement by Austria's largest heat utility KELAG Wärme GmbH that it will establish a district heating plant in Völkermarkt, where URBAS is based. KELAG has placed an order for a 4 MW plant, which is to be operational by the end of the year.

BI81/4956/AS

Company	Comments	Country	Website
Fröling GmbH	Manufactures boilers for firewood, woodchip and pelletsupto 1MWaswellasfuelfeedsystemsandstoragetanks	Austria	www.froeling.com
Fumo Aps	Manufactures of boilers for pellet, woodchip and grain from 12 kW to 500 kW	Denmark	www.fumo.dk
Garioni Naval SpA	Offers boilers, steam generators and heating systems and installations, which are innovative and are based on an awareness of consumption, energy saving and the environment	Italy	www.garioninavale.com
Gilles Energie & Umweltrtechnik GmbH&Co KG	Manufactures boilers for firewood, woodchip and pelletsupto 1MWaswellasheatingcontainers, fuelfeedsystems and storage tanks	Austria	www.gilles.at
Guntamatic Heiztechnik GmbH	Manufactures boilers and heating systems for biomass – pellets, firewood, woodchips – up to 400 kW	Austria	www.guntamatic.com
Hamont Trading	Fully automatic boilers for biomass burning – pellets, woodchip and other wood residues – from 15 kW to 500 kW	Austria	www.hamont.com
HDG Bavaria GmbH	Manufactures boilers and heating systems for biomass: pellets, firewood, woodchip	Germany	www.hdg-bavaria.de
Herz Energietechnik GmbH	Manufactures environmentally friendly heating systems: wood gasification boilers, pellet boilers, woodchip boilers, heat pumps, buffer and hot water tanks and valves	Austria	www.herz-energie.at
Hitachi Zosen Inova AG	Engineering, procurement and construction (EPC) contractor delivering complete turnkey plants and systems solutions for energy recovery from waste	Switzerland	www.hz-inova.com
Hollensen Energy A/S/Industrivarme A/S	Turnkey biomass-fired boiler plants that operate with woodchip, straw, waste wood or pelletsfrom 400kWto15MWperunit	Denmark	www.hollensen.dk
Host Bio-Energy Installations	Supplies biomass-fired hot water and steam boiler plants ranging from 1 MWth to 25 MWth	Netherlands	www.host.nl
Hurst Boiler & Welding Co., Inc.	Designs and manufactures hybrid and solid-fuel-fired biomass boilers	USA	www.hurstboiler.com
Janfire	Provides complete heating solutions including pellet burners and boilers, pellet storage and combined units. Heating solutions for the domestic market and up to 600 kW	Sweden	www.janfire.com
Jernforsen Bioenergy Solutions AB	Manufactures biofuel plants from 200kWto20MWandcanbesuppliedascomponentsectionsfromfueldepotto chimney or as complete turnkey solutions via Järnforsen Energi Projekt AB	Sweden	www.jernforsen.com
Justsen Energiteknik A/S	Manufacturer of hot water and steam boiler systems and combustion equipment for biofuel from 1 MWto20MW	Denmark	www.justsen.dk
Kiv d.d	Producer of boilers and burning equipment for different biomass fuels – wastewood, household waste – from 50 kW to 25 MW	Slovenia	www.kiv.si
Kohlbach Group	Manufactures water, steam and thermal oil boilers and heating systems for biomass and more, e.g. residues from wood processing, from 400 kW to 18 MW	Austria	www.kohlbach.at
KPA Unicon Ltd	Offers a responsible energy solution for heat and steam production. Biomass boiler capacity from 3 MWth to 25 MWth, power plant capacity from 1 MWe to 10 MWe and oil and gas solution from 1 MWth to 400 MWth	Finland	www.kpaunicon.com
KWB - Kraft und Wärme aus Biomasse	Manufactures boilers and heating systems for biomass – pellets, woodchip, firewood – from 10kWto300kW. Heating technology for firewood, shavings, pellets and woodchips from 4 kW to 1.7 MW	Austria	www.kwb.at
Köb Holzfeuerungen GmbH	Heating technology for firewood, shavings, pellets and woodchip from 4 kW to 1700 kW	Austria	www.kob.cc
L. Solé S.A.	Provides turnkey biomass plant. Manufactures wood-drying kilns and biomass boilers	Spain	www.lsole.com
Laatukattila Oy	Manufactures boilers, district heating plants and waste burning equipment for burning wood, chips, sawdust, bark, pellets, sod peat, coal, oil, gas, and solid waste from 10 kW to 8 MW	Finland	www.laka.fi
Lambion Energy Solutions GmbH	Builds biomass power plants at the highest technical standard in the capacity range 1-30MWth for safe and reliable production of heat, steam and electricity	Germany	www.lambion.de
Leroux & Lotz Technologies	Provides biomass boiler islands up to 100MWth and industrial boilers for virgin and recycled wood, as well as municipal and industrial wastes. Supplies multifuel pellets burners for large power co-firing	France	www.lltcom.com
Lin-Ka Maskinfabrik A/S	Manufactures fully-automatic firing systems for agriculture, industry and district heating plants. Systems based on biofuels from 25 kW to 10 MW	Denmark	www.linka.dk
Mawera Holzfeuerungsanlagen	Manufactures wood combustion systems, firebox boilers	Austria	www.mawera.com
Metro Therm A/S	Provides boilers, accumulators, district heating units, and also Naturenergi Iwabo pellet heating	Denmark	www.metrotherm.dk
Müller SA Chauffages Au Bois	Wood furnaces for wet and dry fuel and special heating systems for pellets with low-particle concept, combustion optimisation and high efficiency control, from 100 kW to 5 MW	Switzerland	www.mueller-holzfeuerungen.ch
Nakkila Boilers	Produces heating plants in the range 1-10MWth. Delivering mainly prefabricated modulated plants, the majority of all installations and test runs are made prior to delivery	Finland	www.nakkilagroup.fi/en
Nexterra Systems Corporation	Provides gasification technology for lower costs, higher reliability, lower emissions and greater fuel flexibility compared to conventional biomass systems. Typical systems from 2-40MWth thermal energy, or 2-12MWe for power systems	Canada	www.nexterra.ca
Nolting Holzfeuerungs-technik GmbH	Specialchipofstumpwoodboilerwithoutputof45kWto134kW. Otherbiomassboilers, usinge.g.woodchips, chippings and bark, with output of 215 kW to 2.5 MW	Germany	www.nolting-online.de
Passat Energi A/S	Manufactures biofuel plants, supplies boilers both to the private consumer and smaller industry as well as district heating	Denmark	www.passat.dk
PELLAS X Sp. z o.o. Sp. k.	Pellet burners from 5 kW to 350 kW	Poland	www.pellasx.eu

First industrial "dual-pellet" boiler commissioned

Lithuania based biomass combustion technology specialist Enerstena has announced successful commissioning of its new "dual-pellet" steam boiler in Klaipėda, Lithuania. The 2 MW plant is specifically designed to use straw and/or wood pellets as fuel. Installed at Philip Morris Lietuva, a tobacco processing facility, the boiler reduces the use of fossil gas. Operating at 10 bar pressure, the boiler has a nominal capacity of 3 tonnes per hour of dry, saturated steam with an output adjustment of the nominal capacity from 30 percent upwards.

Available in the 1 to 5 MW thermal capacity range the straw pellet boiler is, according to Enerstena, 10 to 15 percent more expensive than a wood only version but can use wood pellets as well enabling fuel flexibility depending on availability.

– This is another of our Lithuanian innovations we are proud of. The use of biomass such as straw for industrial energy production is completely feasible and cost effective, said Virginijus Ramanauskas, CEO for Enerstena in a statement.

BI81/4940/AS

WoodRoll on a roll in Japan?

Swedish biomass gasification technology developers Cortus Energy AB has announced it has signed a Letter of Intent (LoI) with an unnamed Japanese company to supply its proprietary WoodRoll technology to a proposed biomass power project. The Japanese client has secured a permit to build a 2 MW electric output biomass power plant and supply green electricity to the grid with a 20-year feed-in tariff (FiT). According to Cortus the client has visited its test plant in Sweden and was impressed by the high efficiency and its potential for future hydrogen applications in Japan. In a first step, the company and its Asian partners will study possible cost reductions that can be achieved by local production or purchase of selected parts of the technology and peripheral systems. A decision on a possible project with Cortus Energy is expected no earlier than the first quarter of 2016. The total value of such a project, if it were fully implemented, is in excess of SEK 10 million (≈ EUR 940 000).

– We are very pleased with this interest from Japan, a country with a pressing need to replace fossil and nuclear energy while it is also the global leader in fuel cell technology and applications. The high hydrogen content of WoodRoll means a unique position for the future to create the next generation of competitive renewable energy solutions based on WoodRoll and fuel cells, said Rolf Ljunggren, CEO of Cortus Energy, in a statement.

BI81/4986/AS

Company	Comments	Country	Website
PolytechnikLuft-undFeuerungstechnik	Supplies biomass fuel combustion plants with an approximate range of performance of 300 kW to 30 MW	Austria	www.polytechnik.com
Reka A/S	Boilers for burning straw and wood. Provides design and installation of complete district heating plant	Denmark	www.reka.com
Rentech Boiler Systems, Onc	Designs, builds and installs boilers in a variety of sizes to meet unique requirements	USA	www.rentechboilers.com
Renewa Oy	Offers advanced combustion solutions for local energy production using biofuels in heat and power plants	Finland	www.renewa.fi
Schmid AG, Energy Solutions	Wood-firing systems for family homes to large-scale systems up to 25 MW	Switzerland	www.schmid-energy.ch
Sonnys Maskiner AB	Boilers up to 450 kW for burning different kind of biomass	Sweden	www.sonnys.se
Sugimat S.L.	Designandconstructionofcompleteplantsaswellascombustionunits,burners,furnaces,boilers,gascleaning devices, dryers and more	Spain	www.sugimat.com
Swebo Bioenergy AB	Suppliesbioenergysolutionsforalltypesofsolidfuels:sizesfrom4kWto4MW.ProductBioThermcanburnmore demandingfuels,suchashorsemanure.Providesturnkeyheatingplants100–1000kWandmobileheatingunits	Sweden	www.swebo.com
Säätötuli	Woodboilers30kWand150kW,biomassburners20kWto1.5MWforwoodchips,peat,woodandpeatpel-lets, heating containers 50 kW up to 1.5 MW, hot air systems from biofuels 300 to 500 kW	Finland	www.saatotuli.fi
Talbotts Biomass Energy Systems Ltd	Biomass boilers range from 25 kW to 1 MW	UnitedKingdom	www.talbotts.co.uk
Thermax	Providing a range of engineering solutions to the energy and environment sectors	India	www.thermaxglobal.com
UAB "Kalvis"	Boilers and stoves for biomass, fueled by wood and pellets, up to 5 MW	Lithuania	www.kalvis.lt
Uniconfort S.r.l	Manufacturer of heating systems including compatible boilers, air generators, and grinders	Italy	www.uniconfort.com
Urbas Maschinenfabrik Gmbh	Operatesinthefieldsofsteelconstruction,steelhydraulicengineeringandenergytechnology.Establishedover1000 plants throughout Europe with power ratings ranging from 500 kW to 15 MW	Austria	www.urbas.at
Valmet Corporation	Developer and supplier of services and technologies for the pulp, paper and energy industries	Finland	www.valmet.com
VAS Energy Systems GmbH	Plans,buildsandmaintainssystemsforheatingandpowersystemsintheregionof2-25MWforprivate,industrialand public customers	Austria	www.vas.co.at
Veljekset Ala-Talkkari Oy	Manufacture of heating boilers and solid-fuel feeding devices for bioenergy heating from 30 kW to 1 MW	Finland	www.ala-talkkari.fi
VEÅ	Developsandmanufacturesoilandgas-fired,exhaustandpellet-firedboilersupto30MW,offeringservicesthrough the entire product life cycle	Sweden	www.vea.se
Viessman	Offersawidevarietyofcustomisedheatingsolutionswithefficientsystemsandoutputsfrom1.5kWto120MWforall application areas and all fuel sources	Germany	www.viessmann.com/com/en
Vyncke N.V.	DesignsandbuildscleanenergyplantsburningbiomassandSRFtoproducesteam,hotwater,thermaloilandhotgas, withorwithoutelectricalpowergeneration-thermalenergyfrom1–100MWthandelectricalpowerfrom0.5–15MWe.	Belgium	www.vyncke.com
WeissKesselAnlagenundMaschinenbau	Constructionofboilersandcombustionsystemsforsolidfuels,especiallywoodwastesfrom500kWto60MW	Germany	www.weiss-kessel.de
Wellons FEI Corp	Designsandmanufacturesafullrangeofproductsandcanprovideintegratedpackagescombiningwood-firedboiler systems and lumber dry kilns	Canada	www.wellonsfei.ca
WTS AB / VärmeTeknisk Service AB	Wood powder burners 2-50 MW	Sweden	www.wtsab.com
Xuzhou Orient Industry Co. Ltd	Tiannong biomass burner and boiler, 250 kW to 3 MW	China	www.orient-biofuel.com
Zhengzhou Boiler Co., Ltd	Experienced in boiler and pressure vessel design and manufacture	China	www.zgindustrialboiler.com