

Of the eleven EU Member States that already achieved their 2020 renewable energy targets in 2016, five are found in the Baltic Sea Region (BSR). Looking at it from a heat and power perspective the lion's share is derived from biomass and waste. And while EU's 2020 targets already have been met, for some the race is on to reach 100 percent renewable in which biomass and waste have much yet left to offer.

BALTIC SEA REGION POWERS AHEAD

IN BIOENERGY INTERNATIONAL no. 1/2017 we presented an overview of some of the major biomass heat and power investments in the Baltic Sea Region (BSR) and below follows an update on some projects that have come since.

Denmark – new tech & green gas

Like Finland and Sweden, district heating is well developed in Denmark and energy majors such as Ørsted (previously DONG Energy) that has committed to phase out coal by 2023 continues on it energy plant conversions with its Asnæs facility in Kalundborg next on the list. In Aarhus, Affaldvarme Aarhus commissioned its 110 MW straw- and woodchip-fired Biomassfyret Kraftvarmeværk, which is integrated the existing 225 000 tpa Lisbjerg WtE CHP plant.

In Billund, a novel thermal hydrolysis pretreatment process retrofitted at a wastewater treatment plant (WWTP) enables the WWTP to go from energy consumer to energy exporter while improving the nutrient removal process whereas in Brønderslev, the world's first CHP plant to integrate a 16.6 MWth capacity concentrated solar power (CSP) with a biomass boiler and Organic Rankine Cycle (ORC) has come underway. The solar heating system can alternate between providing CHP at peak price periods, or exclusively deliver heat.

Fossil gas is widely used for district heat and the focus, from both industry and government is now on a transition of the gas grid. According to a recent assessment by Grøn Gas Danmark, the potential is there for a 100 percent green gas transition by 2035.

Estonia – industry-led fuel switch

In Tallinn, Utilitas Energy Group inaugurated a 76.6 MWth/21.4 MW biomass CHP plant that is currently the largest of its kind in the country. It will account for around 20 percent of the heat supply to the Estonian capital. Built by Axis Technologies, a subsidiary of Lithuanian-headed Axis Industries Group with the boiler from Finland-based Renewa (now KPA Unicon), the plant will complement Enefit Green's existing 250 000 tpa 50 MWth/ 17 MWe WtE CHP Iru plant commissioned in 2014 that supplies almost 15 percent Tallinn's heat demand.

The Utilitas project aside, it seems that industry is leading the energy switch. Graanul Invest, the world's third largest wood pellet producer continues on its path of building biomass CHP plants supplying excess power to the grid at its production facilities. The company had already

four operating, three in Latvia and one in Estonia. During 2017, two new facilities were commissioned in Imavere and Osula respectively. Each are 27 MWth/10 MWe "black-start" units and were supplied by Austria-headed Urbas Energietechnik. Urbas also supplied an 18 MW process steam boiler to UPM's Otepää plywood mill and a 30 MWth/4.3 MWe CHP to Horizon Pulp & Paper, the latter the company's first delivery to a kraft paper mill.

Finland – phasing out coal

While most towns and cities across central and northern Finland use biomass and peat in heating plants, the larger cities in southern and coastal Finland still use a lot of coal and fossil gas. That is changing at a rapid pace.

In Naantali, a EUR 260 million district energy project is being commissioned by Turun Seudun Energiantuotanto (TSE), a joint venture owned by Fortum, Turku Energia and the cities of Raisio, Turku and Naantali. NA4 is a 250 MWth/146 MWe multi-fuel CHP unit that will replace NA1 and part of NA2 at Naantali. The plant is expected to use 60 - 70 percent biomass along with coal and peat. Valmet, Siemens and Raumaster are the suppliers of boiler, turbine and fuel handling system respectively.

In Helsinki, Helen has fired up a 100 MW pellet fuelled heat only plant at Salmisaari – currently the largest pellet-fired boiler in Finland, also supplied by Valmet. Helen is replacing district heating from its 440 MW coal-fired Hanaholmen plant in downtown Helsinki, which will be decommissioned and demolished by 2024, with at least three biomass heat plants in Vuosaari, Patola and Tattarisuo one of which may become a CHP.

In Oulu, Oulun Energia is investing around EUR 200 million in a new 175 MWth/70 MWe multi-fuel CHP to replace its aging 150 MWth/65 MWe biomass-fired Topila 1 CHP unit. To be built in the Laanila industrial area of the city and for completion for the 2020/2021 heating season, Valmet will supply the boiler.

In Vantaa, Japan-headed Sumitomo SHI FW (previously Foster Wheeler) is busy reconfiguring Vantaan Energia's 120 MW coal-fired Martinlaakso plant to run on biomass and peat. In Lahti, Lahti Energia is building Kymijärvi III, a 190 MWth "power ready" heat plant to replace its coal-fired Kymijärvi I unit by 2020 with the boiler, a circulating fluidised bed (CFB) also being supplied by Sumitomo

SHI FW.

In Tampere, Tampereen Sähkölaitos commissioned its EUR 111 million 160 000 tpa WtE CHP plant. SBG supplied the single-line 58.5 MW fuel boiler whereas in Pori, Pori Energia is investing around EUR 50 million in a new biomass boiler to replace a coal-fired boiler unit at its Aittaluoto 206 MWth/55 MWe CHP by 2020. Andritz was awarded the fluidised bed boiler contract.

Several smaller district heat projects commissioned or neared completion during 2017 – in Rantasalmi, Suur-Savon Sähkö's 5 MWth plant and Turku Energia's Artukainen plant consisting of a 12 MWth fluidised bed steam boiler and a 10 MWth liquid gas boiler that will supply process steam and district heat were all supplied by KPA Unicon whereas in Keuruu, Keuruun Lämpövoim's 8 MWth plant and in Urjala, Airanteen Energia's 1.5 MW plant both supplied by Nakkila Boilers, a Lithuania-headed Enerstena Group company.

In addition a number of industrial heat and power projects fired up during 2017, the largest being Metsä Fibre's Äänekoski bioproduct mill in Äänekoski. Valmet supplied the recovery boiler and bark gasifier for the lime-kiln. The former enables a 260 MWe installed capacity at the pulp mill, which is 1.4 times more than needed by the mill thus the excess is sold to the grid.

Latvia sees first larger plants

According to figures from Central Statistical Bureau (CSB), Latvia had 198 active CHP plants in 2016 with almost 1.3 GW of installed electrical capacity. Of these four were in the 5 MWe - 20 MWe capacity range and four were larger than 20 MWe whereas the vast majority, 135 CHP plants, were in the 500 kW to 5 MWe installed power capacity range. Fossil gas is the main fuel, 88 percent in terms of installed electrical capacity by fuel type in 2016 whereas biomass, waste and biogas made up the balance.

In the capital city Riga, Axis Technologies has completed the country's largest bioenergy project to date – a 48 MW district heat plant for Rīgas BioEnergijas. Built together with Latvian company VELVE, the EUR 15 million project features two 20 MWth woodchip-fired boilers and two 4 MW flue gas condensing economizers.

In Salaspils, just outside Riga, a 20 MWth/4.5 MWe woodchip-fired CHP for district heating was also commissioned. This time, Netherlands-based HoSt supplied the >>

For the map we have included the larger cities and selected some of the biomass combined heat and power (CHP) plants around the Baltic Sea (hence why Norway is excluded). Heat and power is also produced in biogas plants and in industries. Grey circle denotes cities that use a lot of fossil energy.

SWEDEN

The country has 90 biomass-fired CHP plants. The greater Stockholm area uses around 9 TWh of biomass and waste for heat and power. Fortum Värme is to phase out remaining coal in its CHP plants by 2022. New plants are being planned and built in other cities such as Borås and Västerås.

DENMARK

The city of Copenhagen aims to be carbon dioxide (CO2) neutral by 2025. Høfor is building a 500 MW fuel woodchip-fired plant in Copenhagen whereas Ørsted has converted its Avedøre facility. In Helsingør, Forsyning Helsingør is building woodchip-fired CHP plant.

GERMANY

Apart from feed-in tariffs (FIT) for biogas power, the country provides support only for small biomass-fired installations. In Berlin, Vattenfall has opted to build a fossil gas-fired plant whereas the city of Hamburg is planning a waste-to-energy (WtE) plant as well as a 20 MW biomass plant.

POLAND

In Połaniec southern Poland, Enea operates a 205 MWe dedicated biomass power unit at its 1.8 GWe coal-fired Elektrownia Połaniec power plant – the CFB type boiler is one of the world’s largest dedicated biomass units. With its 162 MWth and 68 MWe capacity PGE’s Elektrownia Szczecin facility in Szczecin is the country’s largest biomass CHP plant.

FINLAND

The country has around 50 biomass-fired CHP plants. Prior to Helen’s start-up of its 100 MW pellet boiler in Salmisaari, Helsinki used around 12 TWh of coal and fossil gas. Uleåborg has plans for a 215 MW biomass-CHP plant and both Björneborg and Tampere have plans too. Finland’s largest biomass CHP plant is the Alholmen 240 MWe facility in Jakobstad.

ESTONIA

Fortum has biomass CHP plants in Tartu and Pärnu whereas Tallinn Elektriijaam has a facility in Tallinn. Estonian Cell operates the country’s largest biogas plant at the pulp mill’s wastewater treatment plant (WWTP). Producing 7.7 million Nm3 of biogas per annum it replaces over one-third of the mill’s fossil gas consumption.

LATVIA

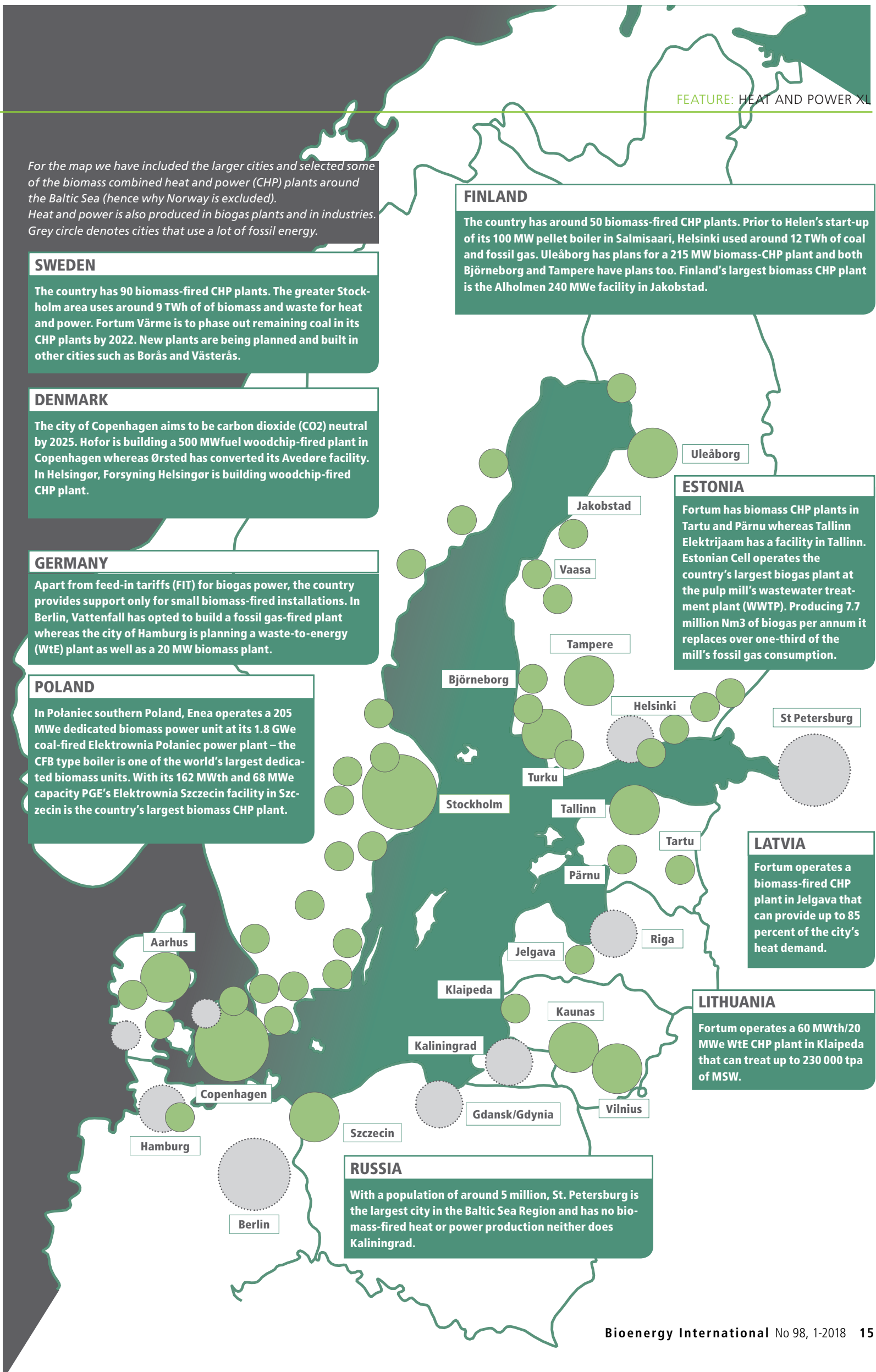
Fortum operates a biomass-fired CHP plant in Jelgava that can provide up to 85 percent of the city’s heat demand.

LITHUANIA

Fortum operates a 60 MWth/20 MWe WtE CHP plant in Klaipeda that can treat up to 230 000 tpa of MSW.

RUSSIA

With a population of around 5 million, St. Petersburg is the largest city in the Baltic Sea Region and has no biomass-fired heat or power production neither does Kaliningrad.



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boiler, its largest to date in Latvia. The company also supplied a 14.5 MWt/3.3 MWe biomass CHP plant for the Awoti furniture component and pellet plant in Lizums that was commissioned during 2017.

Lithuania – waste and biomass

The Lithuanian heating sector has seen a remarkable shift from fossil fuels, predominately gas, to biomass over the last decade. The trend continues although there has been a move towards waste with construction of large waste and biomass-fired CHP plants taking place in the capital city Vilnius and in Kaunas.

In the former, Vilniaus kogeneracinė jėgainė, a subsidiary of state-owned energy company Lietuvos Energija is investing around EUR 350 million in a 227 MWth/88 MWe plant with a waste boiler line and two biomass boiler lines. A consortium led by Germany-based Steinmüller Babcock Environment (SBE), part of Japan-headed Nippon Steel & Sumikin Engineering, won the Lot 1 contract for the waste-to-energy line – 53 MWth/18 MWe. Funding for Lot 2 in the project consisting of two biomass-fired fluidized bed (FB) boilers providing a combined total of 174 MWth/70MWe was finalized in October 2017. Once completed in 2020, the Vilnius CHP will account for around 40 percent of the city's district heat demand.

Also in Vilnius, private equity and venture capital investor BaltCap signed an engineering, procurement and construction (EPC) contract with Axis Technologies to develop a 48 MW biomass heat plant. To be operational in 2019, the plant would provide around 10 percent of the city's district heat demand.

In Kaunas, Kauno Kogeneracinė Jėgainė (KKJ), jointly owned by Lietuvos Energija and Fortum Heat Lietuva, is building a 70 MWth/24 MWe waste-fired CHP. Germany-based Baumgarte – since merged with Standardkessel to become Standardkessel Baumgarte (SBG), a subsidiary of Japan-headed JFE Engineering – was awarded the single line boiler contract. The plant is scheduled to begin operations in 2020.

Poland – focus on WtE capacity

Like its Nordic and Baltic neighbours, district heating is used – Warsaw has one of Europe's largest DH networks, one of the more positive post-WWII Soviet era legacies. However, as Europe's largest coal producer and user, biomass has yet to become a significant fuel source in the Polish district heat or power mix.

There is though a clear focus on reducing municipal solid waste (MSW) going to landfill in a bid to reach compliance with EU's Landfill Directive and Circular Economy Package ambitions for 2030. A challenging task given that over 60 percent of Poland's MSW still goes to landfill. Thus the emphasis has been on increasing WtE capacity rather than biomass heat and/or power with several of the larger municipalities

procuring WtE projects under "design and build" or Public Private Partnership (PPP) model. The municipal WtE capacity build-out is quite remarkable – in 2015 there was only one municipal WtE plant operational in Poland treating 40 000 tpa – the 9 MWth/2.4 MWe Zakład Unieszkodliwiania Stalych Odpadów Komunalnych (ZUSOK) facility in Warsaw built in 2001 by Poland-based Budimex Group. During 2016/2017 six more municipal WtE plants began construction and/or commissioning with at least another eight projects in some form of planning, proposal or tendering stage: Katowice (2 x 250 000 tpa), Koszalin (120 000 tpa), Łódź (250 000 tpa), Olsztyn (120 000 tpa), Radom (110 000 tpa), Warsaw (360 000 tpa) and Wrocław.

In Białystok, PUHP LECH Spółka invested around PLN 410 million (≈ EUR 99 million) in a 17.5 MWth/8.7 MWe CHP plant delivered by a consortium of Budimex Group, Belgium-based Keppel Seghers NV, part of Singapore-headed multinational conglomerate Keppel Corporation and Spain-headed Cespa Compania Española de Servicios Públicos. The single-line plant has a capacity to treat 120 000 tpa of MSW.

In Kraków, Krakowski Holding Komunalny (KHK) invested around PLN 797 million (≈ EUR 192 million) in a 35 MWth/11 MWe WtE CHP plant with the capacity to treat 220 000 tpa MSW. The two-line plant was built and supplied by South Korea-headed Posco E&C.

In Poznań, Suez subsidiary SITA Zielona Energia commissioned a 34 MWth/15 MWe WtE CHP. The PLN 925 million (≈ EUR 223 million) project consists of two lines that will use around 210 000 tpa of MSW and light commercial waste. The plant was supplied by Switzerland-headed Hitachi Zosen Inova (HZI) and is the company's first project in Poland.

In Bydgoszcz, Miedzogminny Kompleks Unieszkodliwiania Odpadów ProNatura commissioned a 30 MWth/8.7 MWe WtE CHP plant that supplies district heat to both Bydgoszcz and Torun. Using two lines, the PLN 436 million (≈ EUR 105 million) plant can treat up to 180 000 tpa. The plant was built by an Italian consortium – Astaldi and Termomeccanica Ecologia (T.M.E), its first WtE project in Poland.

In Gdańsk, EEW Energy from Waste Polska, a subsidiary of Germany-headed EEW Energy from Waste (EEW) was awarded the contract to build and operate a single-line WtE CHP plant with a capacity to treat 160 000 tpa MSW by the city's waste management company Zakład Utylizacyjny (ZUT). The PLN 625 million (≈ EUR 151 million) Port Czystej Energii project is anticipated to be operational in 2020. As part of the PPP, EEW Polska has a 25-year O&M contract for the plant.

In Szczecin, a Polish consortium had won the original tender to build a 32 MWth/13 MWe WtE CHP plant for the municipality owned company Zakład Unieszkodliwiania Odpadów (ZUO). The consortium began construction of two-line plant 150 000 tpa plant only to with-

draw from the project. Following a retendering process during 2016, Italian T.M.E was awarded the contract to complete the plant marking its third WtE project in Poland.

In Konin, Miejski Zakład Gospodarki Odpadami Komunalnymi (MZGOK) invested PLN 364 million (≈ EUR 88 million) in a 28.3 MWth/7.5 MWe WtE CHP plant. The 94 000 tpa single-line plant uses a boiler from MARTIN and was built by an Austrian-Polish consortium consisting of Integral Engineering und Umweltechnik, Erbud and Introl.

In Rzeszów, PGE Gornictwo Konwencjonalna Energetyka, a subsidiary of Poland's largest energy utility PGE Group, is building a 7.9 MWth/4.8 MWe WtE CHP plant. The facility will process up to 180 000 tpa and is being delivered by the Astaldi-T.M.E consortium.

In Zabrze, Fortum Silesia (previously Fortum Zabrze now merged with Fortum Bytom) is investing PLN 870 million (≈ EUR 210 million) in a 145 MWth/75 MWe multi-fuel CHP plant in Zabrze together with new district heating line connecting the facility to Bytom. Scheduled to be operational by end of 2018, the plant will use biomass, coal and refuse derived fuel (RDF) as fuel and will replace existing coal-fired units in Zabrze and Bytom respectively. The CFB-type boiler is being supplied by Sumitomo SHI FW.

In Oświęcim, chemical industry major Syntos Group operates a 150 000 tpa facility and in Tarnów, chemical industry compatriot Grupa Azoty ZAK operates a 220 000 tpa facility.

Sweden – final fossil countdown

In Malmö, E.ON plans to spend up to SEK 2 billion (≈ EUR 206 million) in transitioning the city's district energy to 100 percent renewable by 2025 through a variety of actions including biogas and residual heat recovery. In Norrköping, E.ON plans to convert an oil-fired peak plant to bio-oil and build a new 2 x 70 MWth heat plant to replace two other peak plants that use oil and coal respectively – the last 5 percent of fossil remaining in the city's district energy system.

In greater Stockholm, E.ON is investing around SEK 2.5 billion (≈ EUR 263 million) in a closed-loop waste recycling and energy plant at Högbypörp. The investment includes a biogas plant and a 100 MWth WtE "power ready" CHP plant to be built adjacent to a recycling depot at the site. SBE will supply the single line WtE plant and HZI will supply a dry fermentation biogas plant, its first project to Sweden. The project is part of a merger of three district heat networks and will result in the closing of smaller heat plants.

In Uppsala, Vattenfall plans to invest up to SEK 3.5 billion (≈ EUR 309 million) in the city's district energy system as part of the municipality's goal to be carbon neutral by 2030. Plans include converting oil boilers to bio-oil, a peat-fired unit to pellets and a possible new power ready heat plant.

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B198/6025/AS*