

PELLETS
'Wood as Fuel'-an essential guide

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Preview of world's first Ash2Salt plant

HEAT & POWER
Phasing out the last coal in Odense

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Running gas turbines on renewable diesel

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feature:
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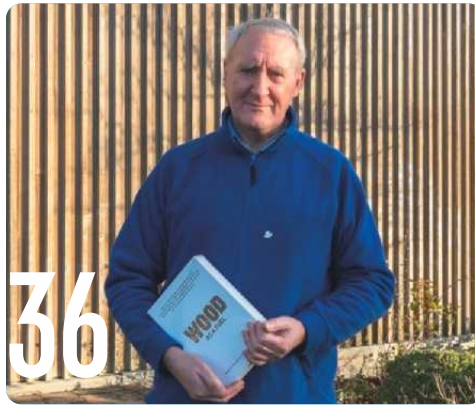
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Biomass XL Heat & Power

In October 2020, Nordic energy provider Värmevärden AB (now Adven/Värmevärden) broke ground on a SEK 280 million (≈ EUR 28 million) state-of-the-art waste-fired heating plant in Säffle, Sweden. Despite challenges posed by the pandemic, the plant was operational on schedule and in time for Christmas 2021.



Forest

Wood as Fuel is the self-explanatory title of a recently published book in five volumes.



Liquid Biofuels

In Sweden, a combined heat and power (CHP) plant in Gothenburg has been operated using a liquid biofuel instead of natural gas.



Biomass XL Heat & Power

In Odense, Denmark’s third-largest city, the city’s district energy plant Fjernvarme Fyn is fast-tracking the national 2025 coal phase out target by three years. By the end of 2022, it will have phased out coal by deploying “a wide palette of both new and well-known climate-friendly and future-proof technologies”.



VÄRMEVÄRDEN SÄFFLE COMMISSIONS NEW RDF-FIRED HEAT PLANT

In October 2020, Nordic energy provider Värmevärden AB (now Adven/Värmevärden) broke ground on a SEK 280 million (≈ EUR 28 million) state-of-the-art waste-fired heating plant in Säffle, Sweden. Despite challenges posed by the pandemic, the plant was operational on schedule and in time for Christmas 2021.

BIOENERGY INTERNATIONAL WAS KINDLY GIVEN a preview as the plant went into the final stages of hot commissioning in November 2021. But first a short background. Säffle is a small municipality in Värmland County and is located on the north western shores of Sweden's largest freshwater body, Lake Vänern. With almost 16 000 inhabitants in the municipality, Säffle is also the country's youngest city, being the most recent town to get city privileges – in 1951.

In 1998, the district heat company Säffle Fjärrvärme AB was formed as a joint venture with Säffle municipality and Värmevärden AB (then Gullspång Värme AB, now Adven/Värmevärden). Situated adjacent to Nordic Paper Seffle's pulp and paper mill within walking distance of downtown Säffle, the company supplies district heat to public buildings, apartments and a number of businesses in and around the city centre.

Future-proof heat supply

In 2017, Värmevärden acquired full ownership of the district heating company renaming it Värmevärden Säffle. In 2019 it announced that it would invest some SEK 280 million in a new 10 MW refuse-derived fuel (RDF) fired boiler plant at the existing site in order to future-proof heat supply.

Up until now, the primary source of heat for Värmevärden Säffle had been biomass-derived residual heat from Nordic Paper Seffle's production processes, along with two 5 MW pellet-fired boilers as well as two oil-fired peak-and reserve boilers. On an annual basis, Värmevärden Säffle supplies around 55 GWh of heat of which fossil fuels (2018) accounted for under 6 percent.

– The demand for district heating in Säffle is relatively stable. We connect new properties while at the same time there is ongoing energy

efficiency improvements at existing customers' properties. Thus, the overall demand has been at about the same level in recent years, said Håkan Andersson, CEO of Värmevärden Säffle.

However, the long-term outlook suggested that significantly less residual heat will be available and during 2021 Nordic Paper decided to close the pulp mill. While the paper machines remain in production, there is much less heat available to be recovered. At the same time, Värmevärden Säffle wanted to be in a position to expand its heat supply business while increasing its fuel flexibility.

– The declining supply of waste heat prompted us to look at future-proofing our position. Less waste heat becomes available to us as it simply remains at the mill, so we needed to rethink our baseload and peak-load priorities. We kept our pellet boilers, peak-load oil boilers and our waste heat collaboration with Nordic

Värmevärden Säffle's new 10 MW boiler plant adds a new landmark feature to Säffle.

Paper. Recycled fuels will be the primary source, then waste heat and pellets for peak loads with the oil boilers kept as back-up and reserve explained Håkan Andersson.

A Belgian multi-national "first-of-its-kind"

The heart of the new heat plant is a Steprate boiler from Belgian solid biomass and waste combustion technology specialists, Vyncke NV.

– Vyncke was selected as they best met our requirements from both a technical and economic point of view and the requested environmental performance. An important parameter for us is the turn-down ability of the boiler in relation to variable load, said Håkan Andersson.

On paper, the Värmevärden Säffle project seems to be a "first-of-its-kind" project in Sweden for Vyncke. While the company has supplied biomass-fired boiler plants to Sweden – for instance Dala Energi in 2016 – this plant uses solid recovered fuels (SRF) or refuse-derived fuels (RDF). As Diederik Dumon, CFO at Vyncke explains although being a "rather new fuel for us, it comes very close to the many projects we have built in the past burning demolition wood."

– Practically all of our boiler deliveries are "waste" fired, the waste being biomass residues in some shape or form. The difference with RDF is that it typically contains both post-consumer biomass-based materials, such as recycled wood, paper and cardboard, as well as fossil-derived plastics. And, as such, this boiler delivery must comply with the EU Waste Incineration Directive (WID), for example, combustion gas temperature and residence time in the boiler, explained Diederik Dumon.

Swedish multi-fuel burner specialists and Vyncke subsidiary, Petro Bio AB, is the provider of the all-important start- and auxiliary load burner system for the boiler. Petro Bio also acted as the local partner for Vyncke in its dealings with local third-party contractors and service providers, which by all accounts has worked well despite practical challenges caused by the pandemic. The fuel conveying system and bottom ash handling system is supplied by Italian bulk material handling and storage solutions provider Trasmec s.r.l, yet another Vyncke subsidiary.

– This project has been quite unusual in the sense that three Vyncke subsidiaries have deliverables – boiler, burners, fuel conveying and bottom ash handling. But I am sure that we will see more of these internal joint projects in the future, remarked Diederik Dumon.

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In compliance with the EU Waste Incineration Directive (WID), the boiler is equipped with a 5 MW retractable auxiliary load burner lance to ensure that the temperature of the combustion gases after the final injection of combustion air remains above 850 °C.

– The auxiliary burner lance is fully automated and retractable. Bio-oil is used as fuel, said Johanna Lindén, CEO, Petro Bio.

FACT BOX SUPPLIERS

Boiler: **Vyncke**
 Auxiliary burner: **Petro Bio**
 Bottom-ash and fuel handling: **Trasmec**
 Flue gas treatment: **Luehr Filter**
 Pre-shredder: **M&J Recycling/Metso**
 Crane grab system: **Danish Crane Building (DCB)**
 Construction contractor: **Brixley**
 Truck scale system: **Flintab**
 Hot water storage tank: **Stålab**
 RDF supply: **Geminor**

ABOUT ADVEN/VÄRMEVÄRDEN

Formed from the merger of Adven Oy and Värmevärden AB in 2020, Adven/Värmevärden is a Nordic sustainable energy group that supplies district energy to commercial, municipal, and residential properties as well as steam, heating, cooling, and related infrastructure solutions to industries. The Group operates an "energy as a service" business model and currently has around 1.9 GW of installed capacity spread across 350 sites in the Nordic and Baltic countries.

>> Norwegian RDF

The RDF is delivered by truck to the plant which is directly accessible from the E45 motorway, Sweden's longest road that cuts through Säfte. On arrival, the truck passes a truck-scale supplied Flintab before self-unloading into a receiving bunker. A fully-automated crane grab from Danish Crane Building A/S (DCB) is used to move material from the receiving bunker into a storage bunker, or in the event of oversized material, feed an M&J Recycling pre-shredder. The crane grab also ensures bunker blending and loads the boiler in-feed chute.

A contract was signed with Norway-headed waste-derived fuel supplier, Geminor AS, as the sole supplier of around 18 000 tonnes per annum of RDF for the first year.

– We know Geminor well from a long-term collaboration with other energy plants operated by Adven/Värmevärden. Being the sole supplier to this plant is a big responsibility, and a good partnership is required for us to succeed with the heat delivery to Säfte. We fully trust Geminor on delivering to this project, said Björn Söderberg, VP Business Development at Adven/Värmevärden.

Comprehensive flue gas treatment

On the topic of emissions, Vyncke also integrated a comprehensive post combustion flue gas cleaning system supplied by German air pollution control specialists Luehr Filter. The system consists of flat-bag filters, sorption processes, and selective catalytic reduction (SCR) treatment. The flat-bag filters remove dust and, according to Luehr, are characterized by long filter fabric service lives, low space and maintenance requirements. Using sodium bicarbonate (NaHCO_3), Luehr's "Conditioning Rotor - Recycle Process" neutralises acidic pollutant gases such as hydrochloric acid (HCl), hydrogen fluoride (HF), and sulphur dioxide (SO_2) (chemisorption), and removes dioxins and mercury (adsorption) by means of activated carbon. Finally, for nitrogen oxide (NO_x) abatement, selective catalytic reduction (SCR) using ammonia (NH_3) is deployed.

Fuel flexibility key

Being located in a forest industry heartland known as the "Paper Province", one may have expected Värmevärden Säfte to invest in a (presumably) less expensive biomass heat plant with woody biomass as the fuel of choice. However, according to Adven/Värmevärden, as interest in fossil-free fuels increases, so do fuel prices. This

means that many district heating companies need to look at alternative recycled fuels such as industrial waste and sewage sludge.

– One of the strengths of district heating is that it enables us to utilize fuels based on what is best for society, the environment, and economy. Which recycled fuel is best tends to change over time – the law of supply and demand, Björn Söderberg said.

The new plant in Säfte can handle several types of biomass and recycled fuels while complying with ever-stricter environmental regulations. This is down to Vyncke's Dynamic Water-cooled Stepgrate (DWS) multi-fuel grate firing system known as DWS-Hybrid grate. This hybrid grate is a combination of the semi-water-cooled (SW) grate used for high moisture content fuels and the fully water cooled (FW) grate used for dry fuels. According to Vyncke, its DWS Hybrid grate is the world's most fuel-flexible combustion system.

– The new boiler in Säfte is robust and flexible enough to handle many different types of renewable and recycled fuels. This is an important future-proofing parameter as who knows what the market will be like ten years' time. What we can be more certain of though is that regulations concerning emissions will get tighter, explained Björn Söderberg.

A replicable project

Typically, recycled and waste-derived fuels are used in significantly larger, technically complex facilities that place high demands on operator competencies and owner balance sheets. With its sizeable investment in Säfte, Adven/Värmevärden is demonstrating that it is both possible and feasible to future-proof smaller heat facilities using recycled fuels without compromising on emissions.

– Previously, it has been difficult to build small heat plants that are flexible on fuel, but in the future, we will be able to build more efficient plants of this size in several of our district heating networks. We are willing to invest heavily in our facilities to ensure long-term sustainable district heating in the locations where we operate and to supply heat/steam and other services to industrial customers. Furthermore, our solution for Säfte can be replicated and applied in other municipalities or industries that have difficulty in making the investment without a good partner. We would like to be that partner, ended Björn Söderberg.

*Text & photos: Alan Sherrard
BI121/6871/AS*



The heart of the new plant is a multi-fuel Vyncke Stepgrate boiler with a DWS Hybrid grate. Diederik Dumon (left), CFO VYNCKE Sam Gantois, Commissioning Engineer; Johanna Lindén, CEO Petro Bio; and Annelies Seynaeve, Legal Officer, VYNCKE.



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