

Flexibility in bio-based district heating

Kjell Andersson
kjell.andersson@svebio.se

What is flexible bioenergy?

Task 44 definition

a bioenergy system than can provide multiple services and benefits to the energy system under varying operating conditions and/or loads

Examples:

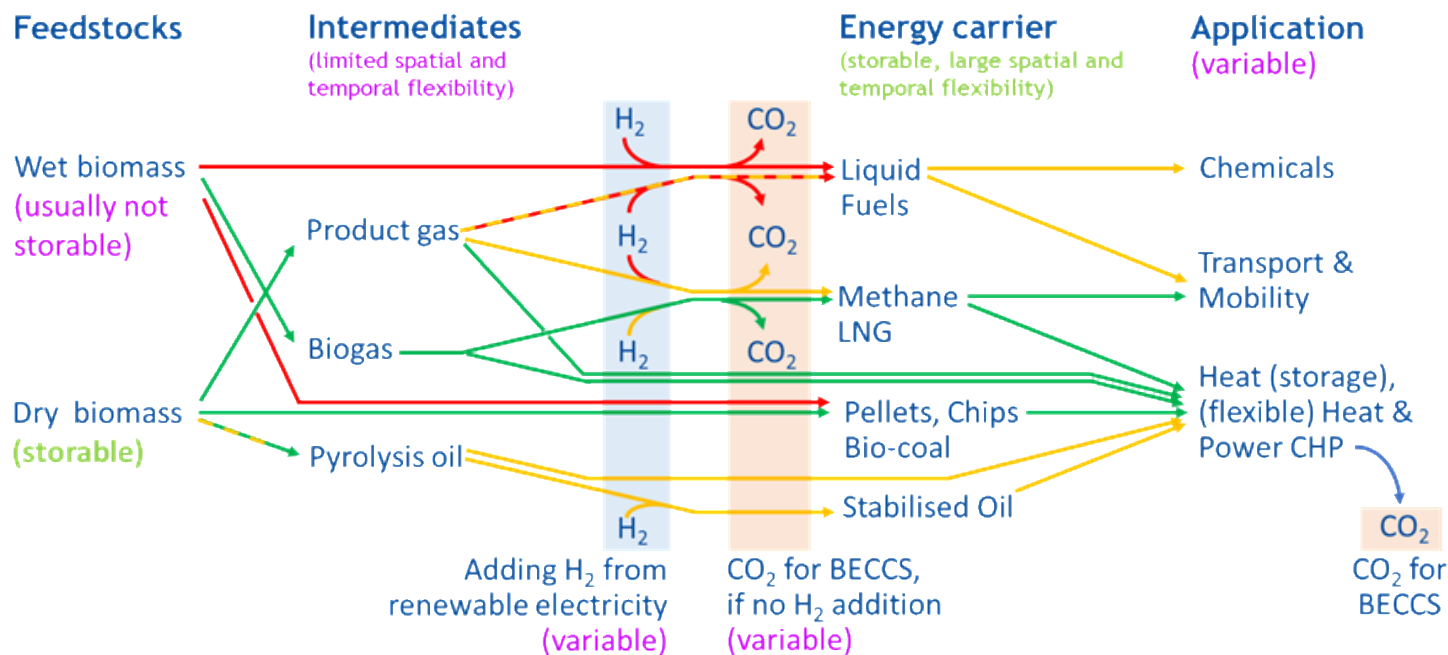
- technologies and concepts providing grid stability for a power system with large amounts of variable wind and solar energy;
- dispatchable production of energy and other products according to market demand;
- integrated polygeneration systems combining the production of heat, power, fuels and/or chemicals;
- long-term storage options such as biofuels and biochemicals; or
- ancillary services to support system reliability.

Source: IEA Bioenergy Task 44 - Flexible Bioenergy and System Integration

From seconds
to seasons



The network of flexible technologies in biomass related energy conversions



*Technology already applied
Technology demonstrated technically, but does not yet have a working business case*

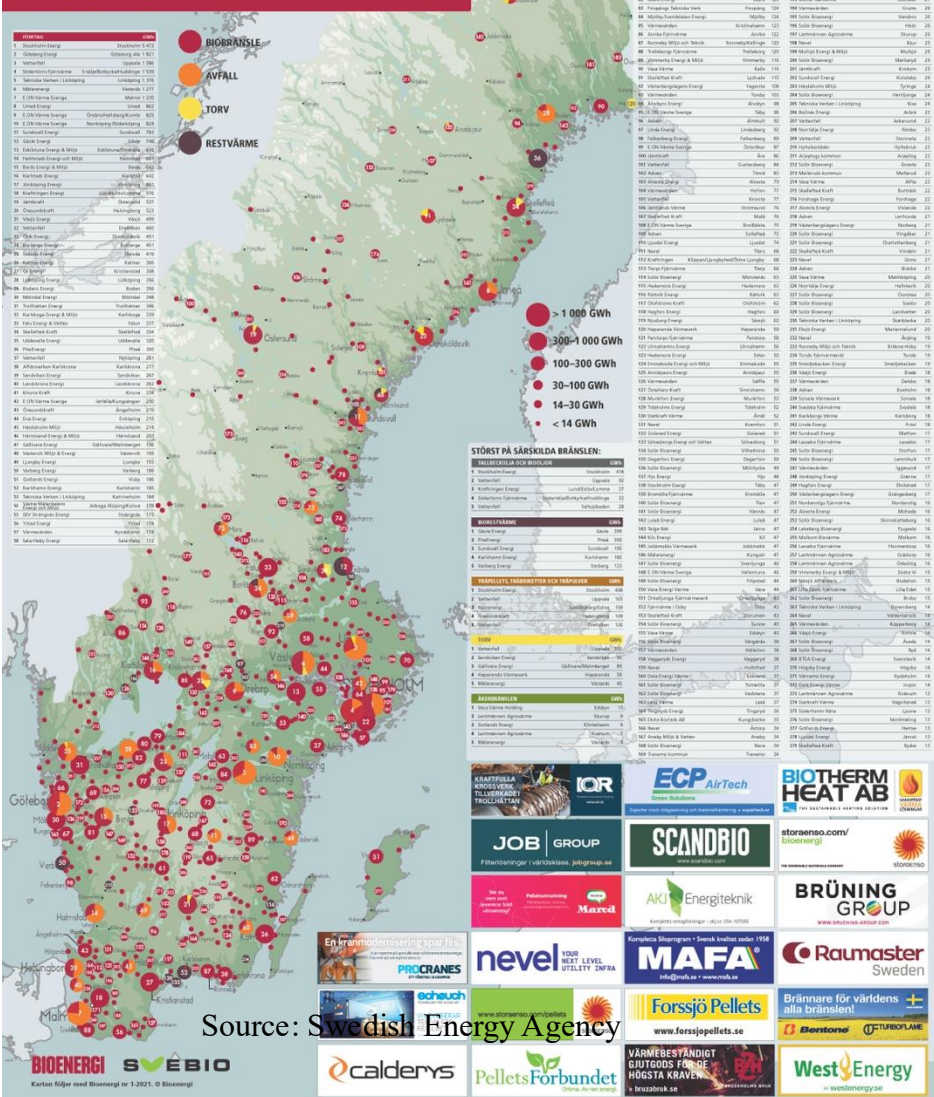
Technology under development

BIOVÄRME 2021

Bioenergi presenterar Biovärmekartan 2021 med fjärrvärmnät i Sverige som levererar biovärme, det vill säga fjärrvärme som producerats med biobränsle, avfall och torv. Vi räknar också med biobaserad restvärme från skogsindustrier och pelletsfabriker. De största näten har vi märkt ut med en siffra på kartan och listat med namn, ort och tillförd mängd biobränsle. De mindre näten vi markerade på kartan med en prick. Totalt har vi markerat 556 fjärrvärmnät med biobränsle i Sverige. Data gäller för 2019.

Biobränsletillförsel redovisas per nät och inte per anläggning. För de större näten redovisar vi fördelning på bränslen: avfall, torv och biobränslen (inkluderar träbränslen, pellets, biogas, åkerbränslen m.m.) samt biobaserad restvärme. Övriga nät har vi färglagt efter vad som är huvudbränsle. Det kan alltså förekomma användning av torv, avfall eller biobaserad restvärme även i flera av de medelstora eller mindre näten.

Källor: Energitestagen i Sverige, Energimarknadsinspektionen samt egna kontakter



Source: Swedish Energy Agency

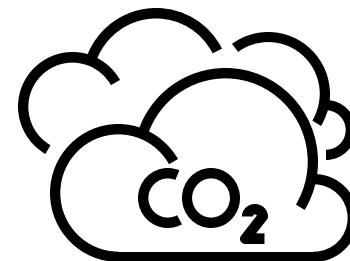
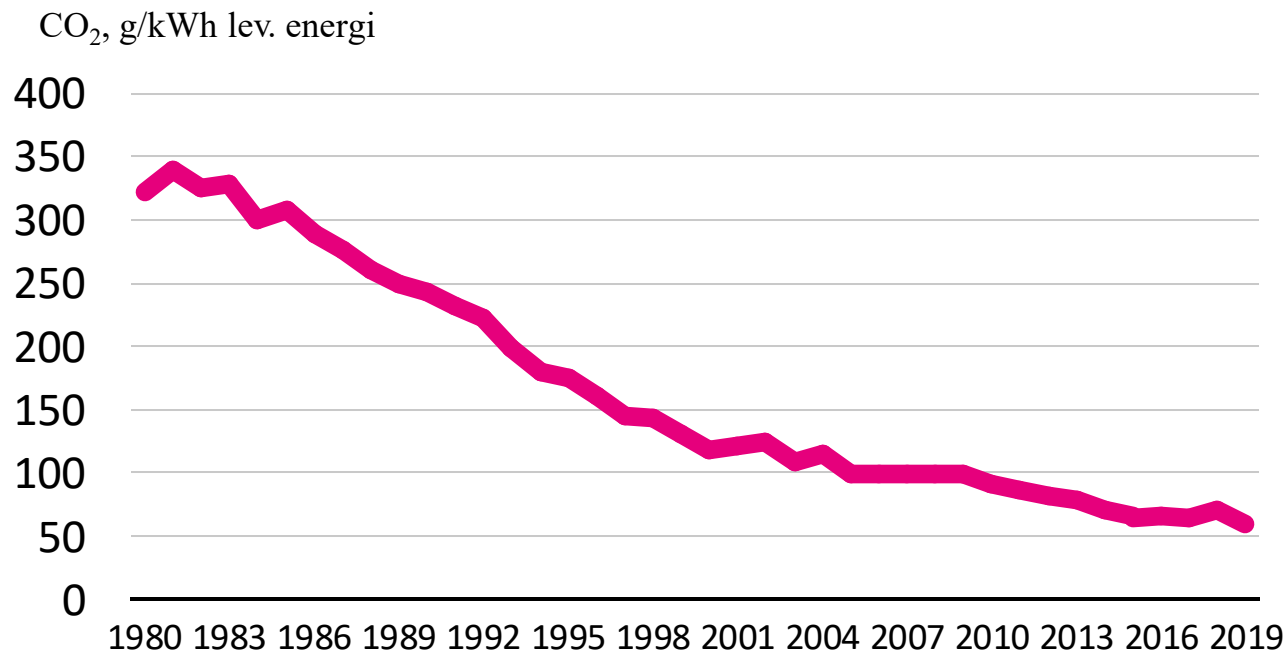
Biobased district heating in almost all municipalities in Sweden

560 heat plants using biomass or biogenic waste.

Biomass accounts for 70 percent of the fuel supply

More than 90 of these heat plants are CHP producing electricity - 4 300 MW installed power capacity.

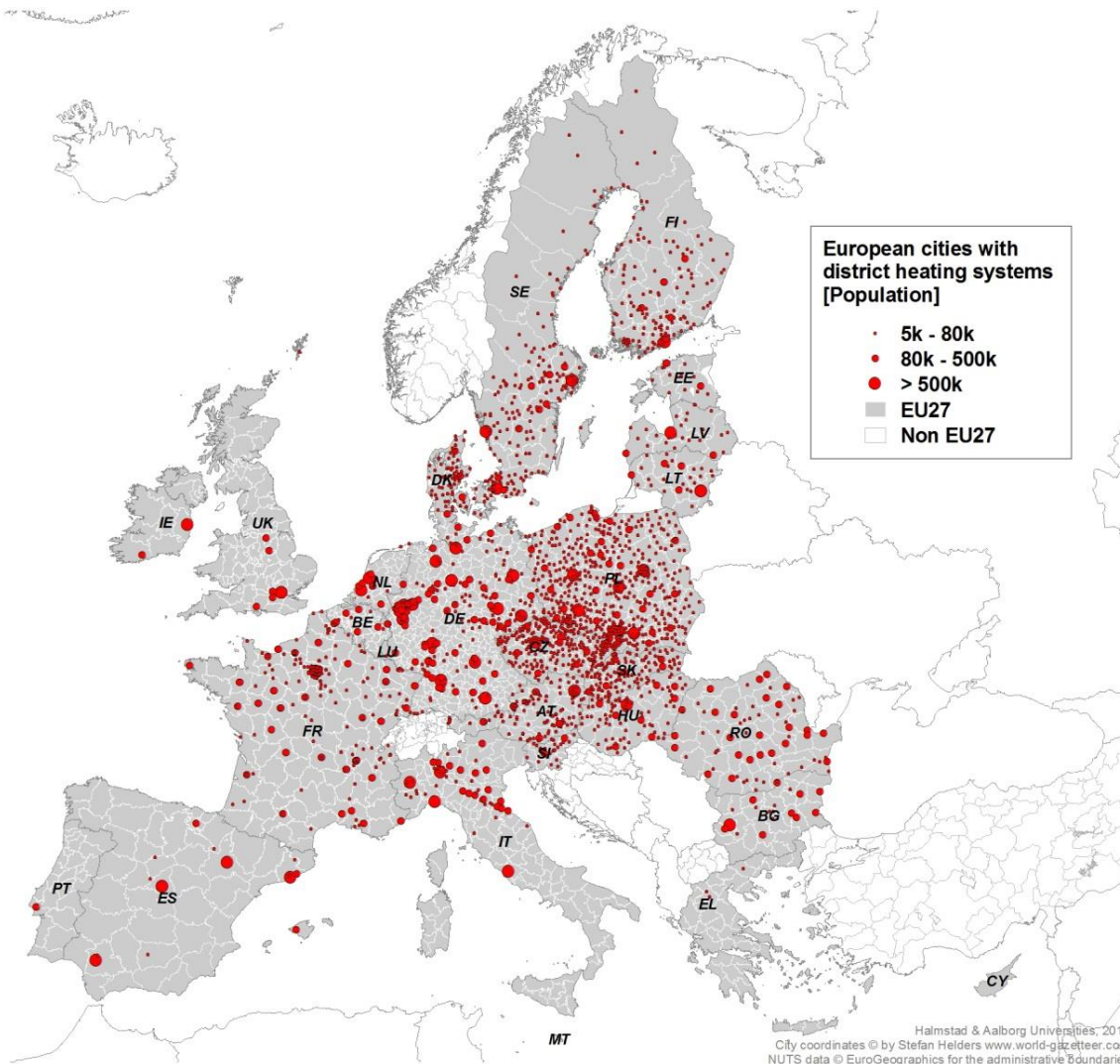
CO₂- emissions from district heating in Sweden - reduction 85% per delivered kWh of heat



Uppdaterad 2020

Källa: Energiföretagen Sverige

District heating in EU27

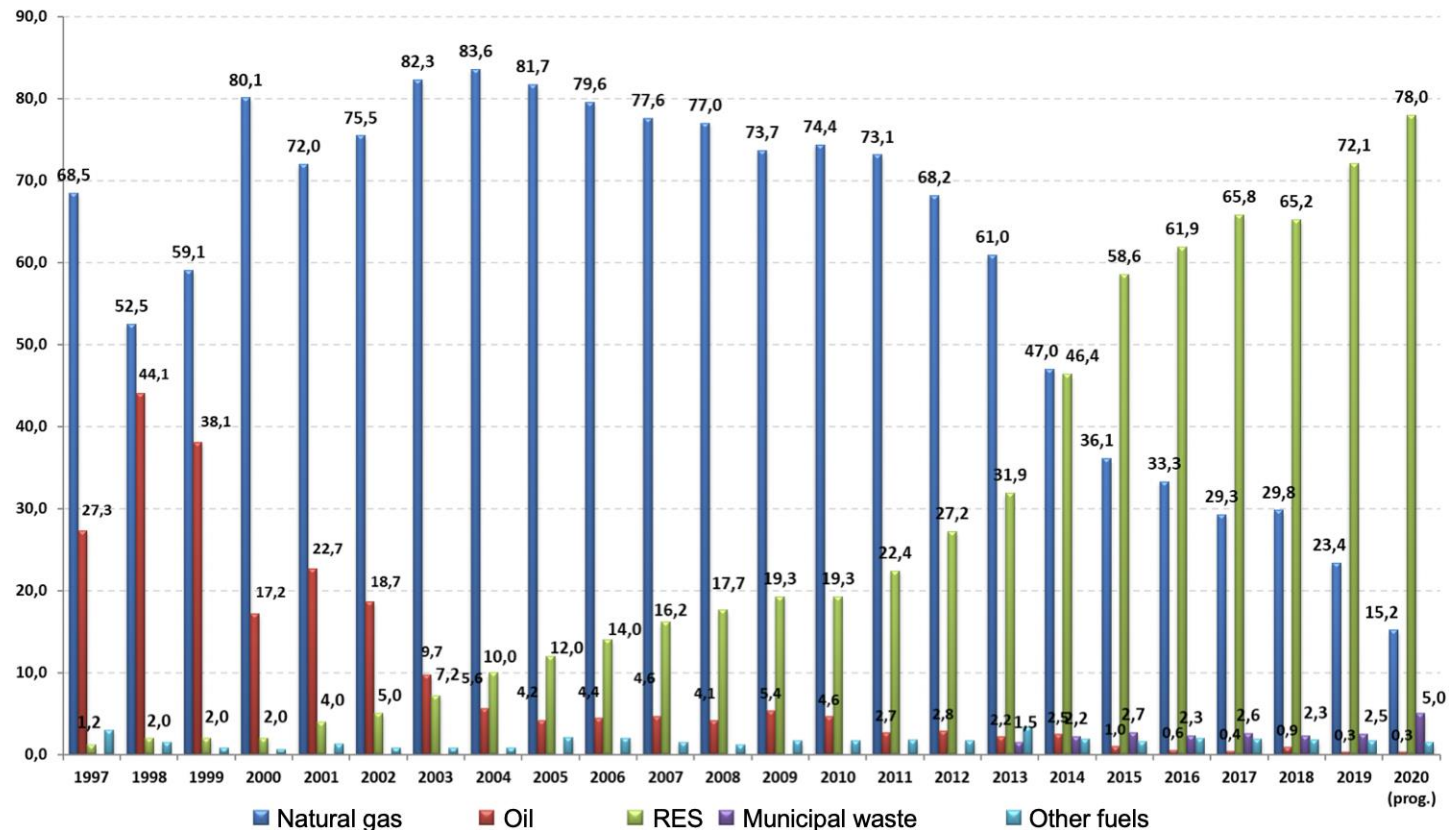


- More than 6000 grids
- Accounts for 13% of all residential heating.
- Potential for growth up to 50% until 2050.

Multiple ways to provide flexibility in biomass based district heating

- With combined heat and power (CHP), the district heating plants can provide both electricity and heat on demand, and in response to price changes.
- Electricity can be provided to the grid for balancing and peak load. The power output can be increased using a gas turbine.
- Using hot water accumulators, energy (heat) can be stored for days, and the boilers can be used in an optimal way.
- Seasonal storage is possible, but still not cost-effective. Can be combined with solar energy.
- Other forms of energy can be produced, like pyrolysis oil, methane, pellets, steam or high temperature water for industry.
- Surplus heat from industries can be used.

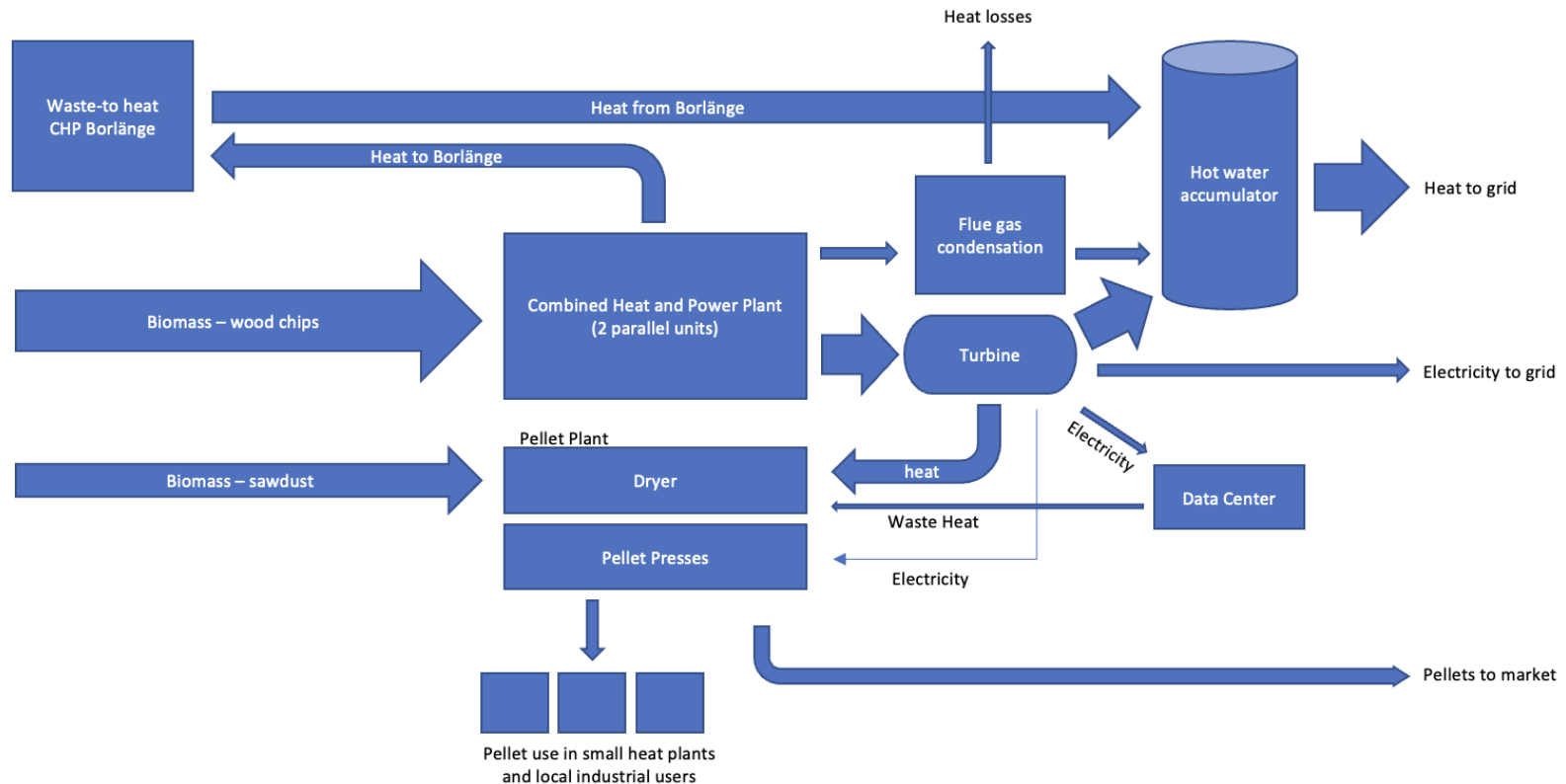
The use of biomass for energy production in the DH sector (%)



CHP combined with pellet production



Falun DH system with production of heat, electricity and woodpellets

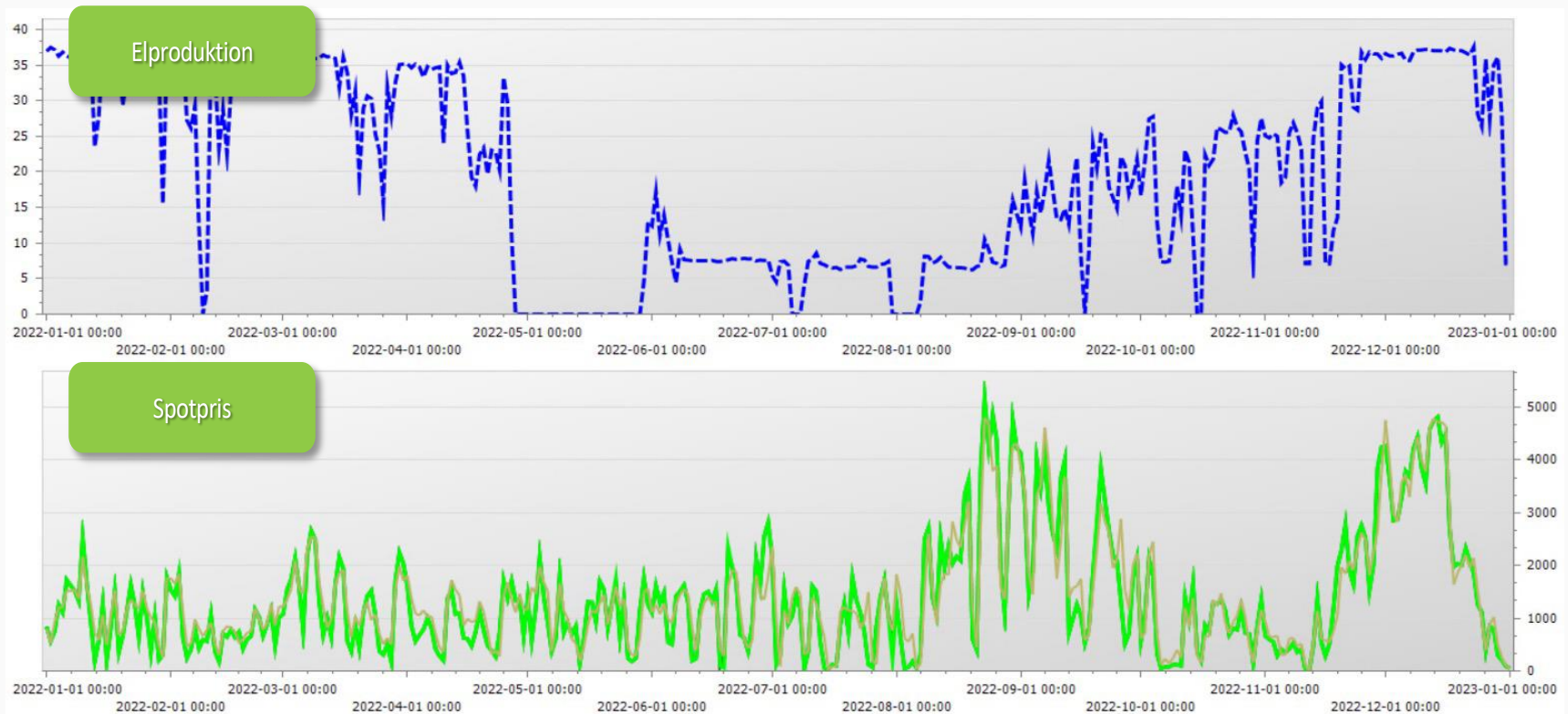


Hot water accumulator



New hot water accumulator in Linköping. The accumulator will have an energy capacity of 1.4 GWh. It holds 30 000 m³ water. It has an inner diameter of 33 meters, and is 45 meters high. The in-load capacity is 40 MW and the out-load capacity 60 MW, with a maximum temperature of 98°C.

Using a CHP for flexible power production



Eskilstuna – CHP using woodchips