



Press release

SkyClean opens in Vrå: The world's largest pyrolysis plant for CO₂ capture and green energy

Give, 7 October 2024

The pyrolysis plant in Vrå can capture and displace 42,000 tonnes of CO₂ annually. The plant is already in operation and supplies biochar for carbon storage and green energy to the local biogas plant. Today's inauguration marks an important step forward towards the national and international deployment of pyrolysis as a climate technology.

On 7 October, the SkyClean pyrolysis plant will open in Vrå in North Jutland. SkyClean is a pyrolysis technology that utilizes residues from agriculture to produce green energy and biochar for capture and storage of CO₂. At full capacity, the plant in Vrå can reduce Denmark's emissions by 42,000 tons of CO₂ per year.

A win for both agriculture and local communities

SkyClean pyrolysis can use many types of residual biomass from agriculture, including straw, grass, deep litter and residual fibres from biogas plants. The technology can also treat wood chips from forestry, garden/park waste, food scraps, etc. The technology provides biochar for capturing and storing carbon from the atmosphere and green energy to replace fossil energy.

For the Stiesdal Group's CEO, Jacob Nørgaard Andersen, the prospects are great, both locally and globally:

"Denmark is a pioneer in pyrolysis, and we can see that the world market is ready to start CO₂ capture and storage with biochar."

"At the same time, pyrolysis presents an opportunity for local success stories, as it is a relatively simple technology that can create and sustain jobs in rural areas. Agriculture supplies green carbon to local pyrolysis plants in the form of residual crops, and in return, they receive the carbon back in the form of biochar to spread on their fields. Biochar is an inexpensive and efficient method of CO₂ storage, making agriculture part of the climate solution rather than part of the problem. Additionally, numerous local jobs will be created in biomass supply, plant operations, and biochar distribution," says Jacob Nørgaard Andersen.

Valuable reuse of residual biomass

The SkyClean plant in Vrå utilises residual fibres from the nearby biogas plant Agri Energy Vrå and supplies two main products, namely biochar and green energy.

Capture and storage of CO₂ with biochar: The biochar produced at the plant can store carbon for a very long time. The actual storage can be done by spreading the biochar on agricultural land. At Danish soil temperatures, more than 90 percent of the carbon in SkyClean biochar will still be in the soil after 100 years. If the residual biomass were instead left in the field, the carbon in the biomass would quickly be converted to CO₂ and again released into the atmosphere.

Climate-neutral green energy: At the plant in Vrå, the pyrolysis gas is used for heat in the biogas plant. The pyrolysis gas can also be used in industrial processes or converted into green fuels such as bio-oil and aviation fuel. Common to all utilisations is that green energy replaces fossil energy sources.

Pyrolysis is an important element of Denmark's climate policy

In a recent government lead broad agreement, Denmark has set aside a pool of DKK 10 billion for carbon storage with biochar distributed over the years 2027-2045. The money is only paid out upon demonstrated and approved storage of carbon.

"This is exactly the kind of framework conditions that we and our colleagues in the pyrolysis industry need when we want to kick-start the expansion of pyrolysis in Denmark. We are very pleased with the approach chosen by the government and contributing parties, where work is now starting to prepare for a pyrolysis roll-out from 2027. On the other hand, the climate does not wait for us, as is clear from recent events both in Denmark and around the world, so we also need to get started, says Peder Nickelsen, CEO of Stiesdal SkyClean.

Funding from the Danish Energy Agency

Part of the funds to build the new SkyClean plant in Vrå comes from a grant in 2022 of DKK 124 million from the Danish Energy Agency's pyrolysis pool. Funding for this pool comes from the European Union's NextGenerationEU initiative. The grant went to the SkyClean Scale-up project, which, in addition to Stiesdal SkyClean, has participation from 14 partners from business and research.

Further information:

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See also:

- [2-pager, presentation of the technology and key figures](#)
- [Explainer video about biochar and CO₂ capture, produced by the CIP Foundation](#)
- [Questions and answers about pyrolysis and biochar as a climate policy](#)

Facts about SkyClean

Carbon-negative climate technology: SkyClean is a carbon-negative climate technology. This means that the process removes more CO₂ from the atmosphere than it emits, and that the technology aims to contribute to the removal of excess CO₂ from the atmosphere. It is a prerequisite for meeting the Paris Agreement's climate goals that we start removing some of the far too large amounts of CO₂ in the atmosphere as soon as possible. Here, the production of biochar by pyrolysis is a cheap and efficient solution.

Environmentally certified biochar: Biochar from SkyClean can be certified according to the voluntary European standard EBC. This certification is based on EU regulations and selected national legislations and ensures that biochar is produced and used in a way that protects health and the environment. The certification includes strict quality requirements for heavy metals and harmful substances such as PAHs, dioxins and PCBs.

Partners in the SkyClean Scale-Up project: Stiesdal SkyClean, BB Bioenergi, KK Wind Solutions, Aktiv Energianlæg, Topsoe, Vestjyllands Andel, SEGES, DTU Chemical Engineering, DTU Construct, Roskilde University Center, University of Copenhagen/Plan and Environment, Aarhus University/Environmental Science, Aarhus University/Agro, Energy Cluster Denmark, Food & Bio Cluster.

Capacity in SkyClean 20 MW plants like the plant in Vrå:

Wet feedstock, for example biogas residue fibers	Dry feedstock, for example straw
Feedstock processing capacity: <ul style="list-style-type: none">Hourly: 4.3–4.5 ton feedstock, dry basis.Yearly: 35.000-40.000 ton feedstock, dry basis.	Feedstock processing capacity: <ul style="list-style-type: none">Hourly: 4.3–4.5 ton feedstock, dry basis.Yearly: 35.000-40.000 ton feedstock, dry basis.
Energy production: 6-7 MW heat at 150 °C.	Energy production: 8-10 MW heat at 150°C – 1.000°C.
CO ₂ storage 22.000–25.000 ton CO _{2e} per year.	CO ₂ storage: 19.000–23.000 ton CO _{2e} per year.
Biochar production: 12.700-13.300 ton biochar per year, dry basis.	Biochar production: 8.500-9.500 ton biochar per year, dry basis.
Power consumption: 1 MW.	Power consumption: 600 kW.
Availability: 8.000 hours per year.	Availability: 8.000 hours per year.
Facility footprint: 2.000-3.000 m ² .	Facility footprint: 1.000-1.500 m ² .

Range values are influenced by variations in the calorific value of feedstock, moisture content, certification scheme, plant layout, and other factors.

About Stiesdal SkyClean: Stiesdal SkyClean builds pyrolysis plants that convert residues from agriculture, forestry and industry into biochar and bioenergy. Stiesdal SkyClean is part of Stiesdal, a climate technology group with activities in floating offshore wind, Power-to-X hydrogen production and production of green fuels combined with capture and storage of CO₂.

Read more at <http://www.stiesdal.com/skyclean>.