

TERMS OF SALE



Sale of Continuous Bench Scale 1 (CBS1) HTL pilot plant

1. Introduction

Aalborg University (Hereafter AAU) sells its pilot plant for hydrothermal liquefaction (HTL). The facility, which was originally established in May 2013, has been continuously modified, maintained and improved over the approx. 11 years it has been in operation. The plant has been the cornerstone of several research projects and has supplied HTL oil to research institutions all over the world.

2. Brief technical information about the plant

Plant operation description:

The plant is primarily operated from the central control room. From here, the desired operating parameters are controlled and monitored (process pressure, preheater temperature, HTL reactor temperature, processing flow rate, cooling water temperature, etc.).

In pretreatment, the desired composition of the biomass slurry is prepared and homogenized in a screw mixer, after which it can be pumped into a holding tank or directly to the high-pressure pump.

The biomass slurry is pressurized by the high-pressure pump, after which it is heated in a two-stage induction preheater, after which it flows into the HTL reactor. In the reactor the biomass slurry is converted into a bio-crude oil, gas and the water that is present in the biomass slurry. The residence time in the reactor will depend on the processing flow rate. After the reactor, the process products are cooled down before they run through a high-pressure filter and a system of capillary tubes that lower the pressure before they flow into the separation system. By connecting or disconnecting capillary tubes, the flow rate in the system can be controlled.

In the separation system, the process products are separated into three phases: water, bio-crude oil and gas, after which the liquid phases are collected in containers and the gas is blown off.

During operation of the plant, it is pressurized and heated with water until there are stable operating conditions, after which the switch is made to feeding in biomass. At the end of a test, it is switched again so that only water is fed into the process and the plant can be cooled and shut down.



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Plant construction:

The facility is built in 5 free-standing containers (see pictures below),

Container 1: Control room + Utility.

Container 2: Pretreatment.

Container 3: HTL-Process.

Container 4: Separation system.

Container 5: Heating-oil plant for separation system.

The containers are connected by piping and cables, and stairs and platforms have been built around the containers.

Operations parameters for plant:

Maximum process temperature: 450°C Maximum process pressure: 350 bar Processing flow rate: 20-50 kg/hour Process medium: Wet biomass (<30% dry matter) Heating preheater: Induction Heating reactor + piping: Heat tracing Note: The plant's operation depends on the biomass material and dry matter percentage.

External supplies needed:

The plant requires an external electrical supply (currently running on three-phase 63A, but main switchboard is rated for 250A), an external cooling water system and a fresh water supply for making RO water.



Other equipment:

Included is a repurposed diet feeder for handling biomass, as well as a hammer mill for grinding biomass. See pictures below.

Technical documentation:

There is partial technical documentation on the facility, which is partly in physical form and partly digital. The documentation can be accessed in connection with the inspection.

3. Schedule/deadlines

Possibility of inspection by appointment (see contact persons under section 6):	26 August, 2024 to 18 September, 2024
Deadline for submitting offer:	25 September, 2024 at 12 p.m
Decision on offer:	No later than week 40
Accetance/collection of equipment:	Between weeks 40 and 49, 2024

4. Terms for submitting an offer

- The plant is sold to the highest bidder.
- Estimated value: 5 million. DKK.
- Bids must be stated excl. VAT.
- Removal and transport is at the buyer's expense.

The buyer must send the offer via e-mail to the contact person specified under section 6.

The buyer's offer must be without reservation. However, the seller reserves the right to negotiate away any conditions that may be contained in received offers.

It is possible to inspect the facility. The time is agreed with contact persons under section 6 and can take place during the period shown in the schedule.

The buyer bears his own expenses in connection with any demonstration.

When submitting an offer, the offeror is bound by his offer for eight weeks from the seller's receipt of the offer.

5. Terms for entering into an agreement

The following terms apply to the conclusion of the agreement:

• The offered objects are sold as used, without responsibility for damages, errors or defects of any kind.



- The offered items are sold without manufacturers' guarantees and without service obligations. The buyer must therefore contact the manufacturers themselves for an agreement on possible service.
- The offered items are sold without guarantee of fulfillment of the buyer's intended purpose.
- The offered items are sold without guarantee that the items can deliver a specific performance, effect, efficiency, capacity or turnover.
- The offered items are sold EX works for collection at the location designated by the seller and for removal and removal at the buyer's own expense and risk. The buyer undertakes to remove and include all associated installations for the facility to the extent that the installations are above ground, i.e. blue. removal of fences, pipes, wires, lighting, bollards, etc. The obligation to dismantle does not include cast foundations and installations belonging to the seller's utility company.
- At the time of the sale, the seller disclaims responsibility for any damage that the sold items may cause to persons or material, regardless of whether the sold items have been used in accordance with the seller's or manufacturers' guidelines.
- The buyer cannot otherwise invoke special conditions for the purchase, unless these are explicitly stated in the purchase agreement.
- The buyer has no right of withdrawal.
- Each party bears its own expenses in connection with the purchase.
- Danish law applies to the purchase. Any disputes are settled at the seller's place of jurisdiction (Court in Aalborg)
- The seller is not responsible for any taxes or charges incurred by the buyer in connection with the purchase.
- The attached purchase agreement applies to the purchase.

6. Contact information

Regarding wuestions about sales process and submitting offers:

 Tender Consultant, Anne Kielgast Andersen, e-mail <u>anneka@adm.aau.dk</u>, phone +45 99402630.

Regarding inspections:

- Anders Høndrup Andersen, e-mail: ahan@energy.aau.dk, phone +45 2098 9120
- Thomas Helmer Pedersen, e-mail: thp@energy.aau.dk; phone +45 9940 3811





Overview: CBS plant. Note: The 2 containers on the far right are not part of the installation and are not part of sale.



Overview: CBS plant – continued. Note: The 2 containers on the far left are not part of the installation and are not part of sale.





Container 1: Control room.

PC for controlling and monitoring the plant, as well as the main switch board for the HTL process plant.



Container 1: Utility room.

Various auxiliary systems for the plant: Compressed air compressor, RO water system and tank, cooling water system, control units for HTL process induction preheaters.





Container 2: Pretreatment.

Screw mixer for mixing biomass for feeding into the plant. Weighing scales and various electrical control cabinets.



Container 3: HTL Process. Holding tank for biomass. Screw pump for feeding biomass to high-pressure pump.





Container 3: HTL Process.

High-pressure pumps (2 pcs. for water, 1 pcs. for biomass) for HTL process, assorted valves and induction preheaters.



Container 3: HTL Process - continued. Induction preheaters, pressure let-down (capillary tubes), high pressure filter, product cooling and various sensors for process monitoring.





Container 3: HTL Process - continued. Externally mounted process reactor, heat tracing and various sensors for plant monitoring.





Container 4: Separation system.

Three-phase product separator (oil, water and gas), gas condenser, scales and various sensors to control the separation system.



Container 4: Separation system – continued. Product collection and main electrical cabinet for separation system.





Container 5: Heating-oil plant for separation system. Electric oil heater and electrical control cabinets.



Other equipment: Repurposed diet feeder with stainless tank and pump for handling biomass, for example sewage sludge, bio pulp and similar.





Other equipment - continued: Hammer mill.



Other equipment - continued: Hammer mill.