Innovation challenge

Flue gas as a resource – From cleaning to recovery

Industry faces major challenges: emissions must be reduced further, while material loops need to be closed. This transition is also central to EEW Energy from Waste Delfzijl. At its Delfzijl facility, EEW processes approximately 550,000 tonnes of waste and 150,000 tonnes of sewage sludge each year, converting these streams into energy for the regional industrial cluster. As an inherent consequence of combustion, this process generates large volumes of flue gas — on the order of 600,000 m^3 annually. The flue gas is treated to a very high standard, enabling EEW to comfortably meet — and deliberately exceed — the most stringent European and Dutch environmental regulations. EEW's ambition is to become the cleanest and most circular waste-to-energy operator in the Netherlands, to lead within its own group, and to serve as a benchmark for the wider sector. Achieving this ambition requires a next step: moving beyond flue gas cleaning alone towards the recovery of valuable chemical components.

The current situation: strong emission control, limited circularity

In the existing flue gas cleaning system, components such as sulphur compounds, fluorine compounds and heavy metals are removed using sorbents including sodium bicarbonate (15,000 tonnes per year), lime (1,000 tonnes per year) and activated carbon (approximately 10–20 tonnes per year). While these sorbents are high-quality feedstocks at the point of input, they are used only once and subsequently discarded. After interaction with the flue gas, the sorbents bind the contaminants and together form a residual stream that is currently disposed of in underground storage facilities in Germany. This approach is highly effective from an emissions perspective, but it comes with clear drawbacks:

- Disposal routes are becoming more costly and increasingly complex.
- Market options for these residues are narrowing.
- Both the sorbents and the captured substances are permanently lost from the circular value chain.

A shift in perspective: From endpoint to starting point

Historically, EEW operates at the end of the value chain: waste is treated and emissions are cleaned. EEW now aims to transform this endpoint into a new starting point by recovering valuable chemical components from the flue gas before they are bound to sorbents and removed.

This transition has already begun. At the Delfzijl site, pilot projects are in operation for the capture of NOx and CO_2, upstream of the flue gas cleaning system. These pilots demonstrate that isolating specific components early in the process is technically feasible. At the same time, EEW acknowledges that valuable innovations may also be realised within the existing flue gas cleaning line or downstream of it. In that context, EEW distinguishes three potential solution pathways:

- **Upstream of flue gas cleaning (preferred pathway):** At this point in the process, components are present at their highest concentrations, offering the greatest potential for effective recovery and for significantly reducing — or potentially avoiding — the use of sorbents altogether.
- **Within the flue gas cleaning system:** Integration with existing cleaning steps, for example through regeneration and reuse of sorbents, or recovery of valuable components from sorbent-derived residues.
- **Downstream of flue gas cleaning:** Although concentrations are expected to be low at this stage, EEW does not exclude this route.

EEW is already working with a ReNaBi process — a regeneration loop for sodium bicarbonate — which illustrates the type of circular process innovation the company values and intends to further scale. However, the core focus of this challenge is not sorbent recycling as such, but the development of technologies that make sorbent use largely redundant, or that significantly reduce sorbent demand by recovering valuable components earlier in the flue gas cleaning process.

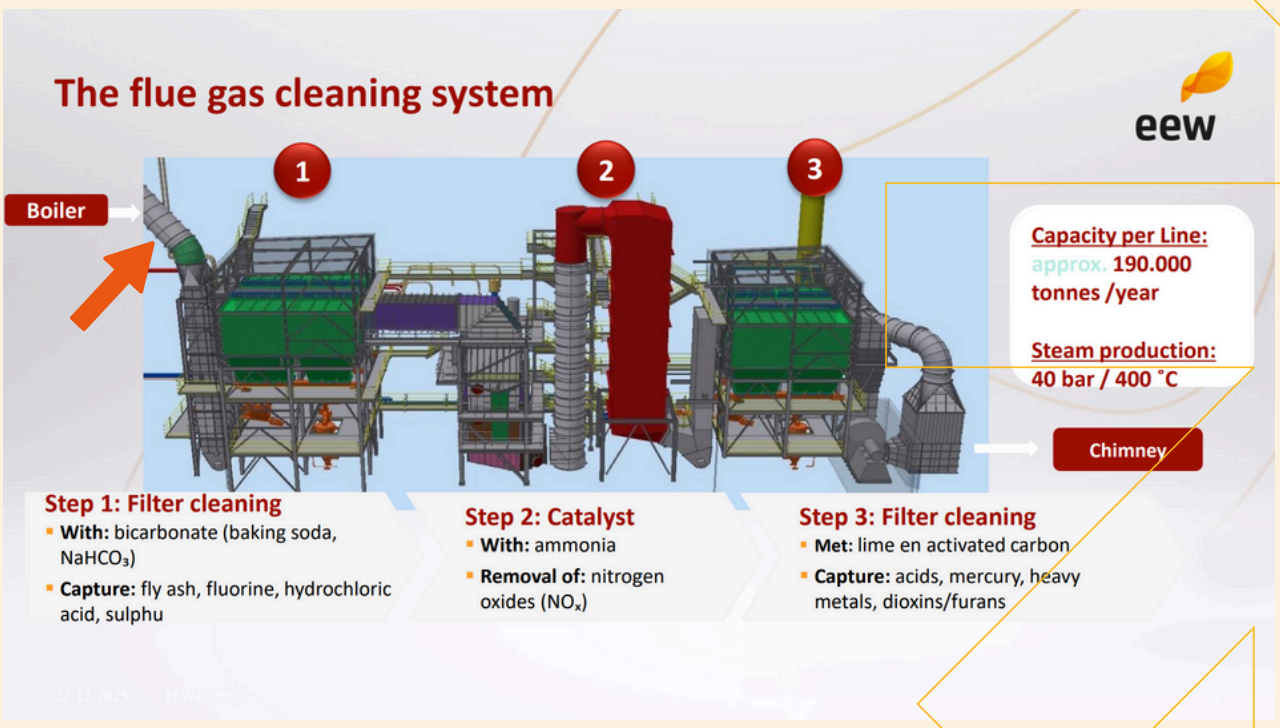
The challenge

Develop a technology that enables the recovery of valuable chemical components — such as sulphur-, fluorine- and metal-containing compounds — from EEW's flue gas, preferably upstream of the existing flue gas cleaning installation.

The figure below shows the flue gas composition after the current flue gas cleaning system. The values shown represent the stack emissons. Raw process data upstream of flue gas cleaning are only shared with selected parties under NDA. As noted earlier, pilot projects for NOx and CO_2 capture are already in place; this challenge therefore focuses on the recovery of the other components indicated in the diagram.

Component	National limit*	Limits for EEW Delfzijl	Measured value 2023
Total dust	< 5 mg/Nm³	< 3 mg/Nm³	0,02 mg/Nm³
TOC (total organic carbon / C_xH_y)	< 10 mg/Nm³	< 10 mg/Nm³	0,14 mg/Nm³
HCl (hydrochloric acid)	< 8 mg/Nm³	< 4 mg/Nm³	2,73 mg/Nm³
HF (hydrogen fluoride)	< 1 mg/Nm³	< 0,5 mg/Nm³	< 0,1 mg/Nm³
SO_2 (sulphur dioxide)	< 40 mg/Nm³	< 20 mg/Nm³	2,86 mg/Nm³
~~**NO_X** (nitrogen oxides)~~	~~< 70 mg/Nm³~~	~~< 70 mg/Nm³~~	~~33,53 mg/Nm³~~
~~**CO** (carbon monoxide)~~	~~< 30 mg/Nm³~~	~~< 10 mg/Nm³~~	~~9,65 mg/Nm³~~
NH_3 (ammonia)	< 5 mg/Nm³	< 5 mg/Nm³	1,65 mg/Nm³
Hg (mercury)	< 50 µg/Nm³	< 10 µg/Nm³	5 µg/Nm³
Cd & Tl (cadmium and thallium)	< 0,05 mg/Nm³	< 0,05 mg/Nm³	< 0,01 mg/Nm³
Total heavy metals	0,5 mg/Nm³	< 0,5 mg/Nm³	0,02 mg/Nm³
PCCD /PCCF (dioxins and furans)	< 0,1 ngTEQ/Nm³	< 0,03 ngTEQ/Nm³	Not detectable

* at 11 vol% O_2



Important: The proposed technology must be capable of integrating with the existing flue gas cleaning system, preferably at a feed-in point upstream of the current cleaning stages (see orange arrow).

Evaluation criteria

EEW operates continuous, large-scale industrial processes that must comply with strict safety, environmental and permitting requirements. Any proposed innovation therefore needs to go beyond technical feasibility alone: it must be robust, scalable, and demonstrably safe to operate within an existing waste-to-energy facility. EEW actively seeks to collaborate with innovative partners who, like EEW itself, recognise that sustainability and economic performance must go hand in hand. Small-scale pilots can be decisive in this context: technologies that prove themselves under real operating conditions and have a credible pathway towards full-scale deployment. A strong solution for this challenge meets as many of the following criteria as possible:

Circular impact and local applicability

EEW aims to strengthen local value cycles wherever possible. Materials recovered on site should, preferably, be reused within the regional industrial cluster.

- The solution either converts residual streams into usable raw materials or significantly reduces the consumption of auxiliary materials such as lime, sodium bicarbonate or activated carbon.
- It contributes to reducing transport movements and external disposal of residues, such as the current underground storage of flue gas cleaning residues.
- Reuse within the regional industrial ecosystem is a strong advantage: the closer the loop, the greater the value.

Technically robust and scalable

EEW is looking for solutions that can operate reliably under industrial conditions and that are scalable to the size and throughput of the Delfzijl installation.

- **Separation and recovery capability:** The technology is capable of demonstrably recovering one or more valuable components from flue gas streams, such as sulphur compounds, fluorine compounds and/or metal fractions.
- **Process integration:** The solution can be integrated into the existing flue gas cleaning system, or connected to it, preferably at a point upstream of the current cleaning stages.
- **Industrial operating conditions:** The technology performs under demanding operational conditions, including high flue gas volumes and continuous operation.

- **Technology readiness:** The solution has reached at least Technology Readiness Level (TRL) 5 — demonstrated in a relevant environment — or can credibly reach this level within the pilot phase.
- **Test location:** The technology can be tested on site at EEW Delfzijl, within the constraints of an operating industrial plant and in full compliance with safety procedures and site regulations.

Economically viable

EEW is looking for partners who can substantiate realistic business cases and who are able to align with a phased investment approach.

- **Pilot-based approach:** The trajectory starts with a pilot at the Delfzijl site, allowing validation of the technology under real operating conditions. A clear and realistic roadmap is provided, outlining the transition from pilot to demonstration and ultimately full-scale industrial application, including indicative timelines and resource requirements.
- **Phased investment:** EEW does not work with a fixed development budget. Investments are made step by step and depend on technical performance, feasibility, and evaluation outcomes.
- **Return expectations:** A single-digit return on invested capital (ROIC) is considered acceptable during the pilot phase, given the innovative and sustainability-driven nature of the investment.
- **Market perspective:** Proposals should clearly describe how recovered materials or intermediate products will generate economic value — preferably through direct use within the regional industrial cluster. Potential off-takers, quality specifications and distribution routes should be outlined where possible.

Safe and compliant

EEW operates under stringent safety, environmental and permitting regimes. Any proposed technology must fit seamlessly within these frameworks.

- The solution complies with all relevant European and Dutch environmental legislation and safety standards, including SEVESO requirements where applicable.
- The technology can be accommodated within existing permits or can realistically be integrated without unnecessarily increasing the regulatory classification of the installation.

Collaboration and knowledge sharing

EEW values open, professional collaboration within a clear framework.

- **Co-creation:** EEW seeks partners who are willing to engage in co-creation and structured knowledge exchange, supported by a phased approach and NDAs where appropriate.
- **Data sharing:** Information exchange follows a stepwise process: general information during the challenge phase, with confidential data shared only after selection and under NDA.
- **Intellectual property:** Intellectual property remains, in principle, with the technology developer. EEW acts primarily as a user and is not seeking to commercialise IP. Joint ownership may be considered only in exceptional, strategic cases.

Join the challenge

Do you have the technology, expertise, or know-how to drive innovation in the circular economy? Take part in this challenge and work with EEW to create solutions that make waste management truly more sustainable.

After an initial selection, the most promising parties will be invited to an on-site visit at EEW in Delfzijl. This is your chance to present your proposal and gain deeper insights into EEW's requirements and expectations.

The top submission will be selected for a pilot at the Delfzijl facility, with potential to scale up to demonstration and full-scale implementation. If successful, your innovation could eventually be rolled out across EEW's international network of 17 facilities, creating impact on a larger scale.

Apply by **Friday, 27 February 2026**.