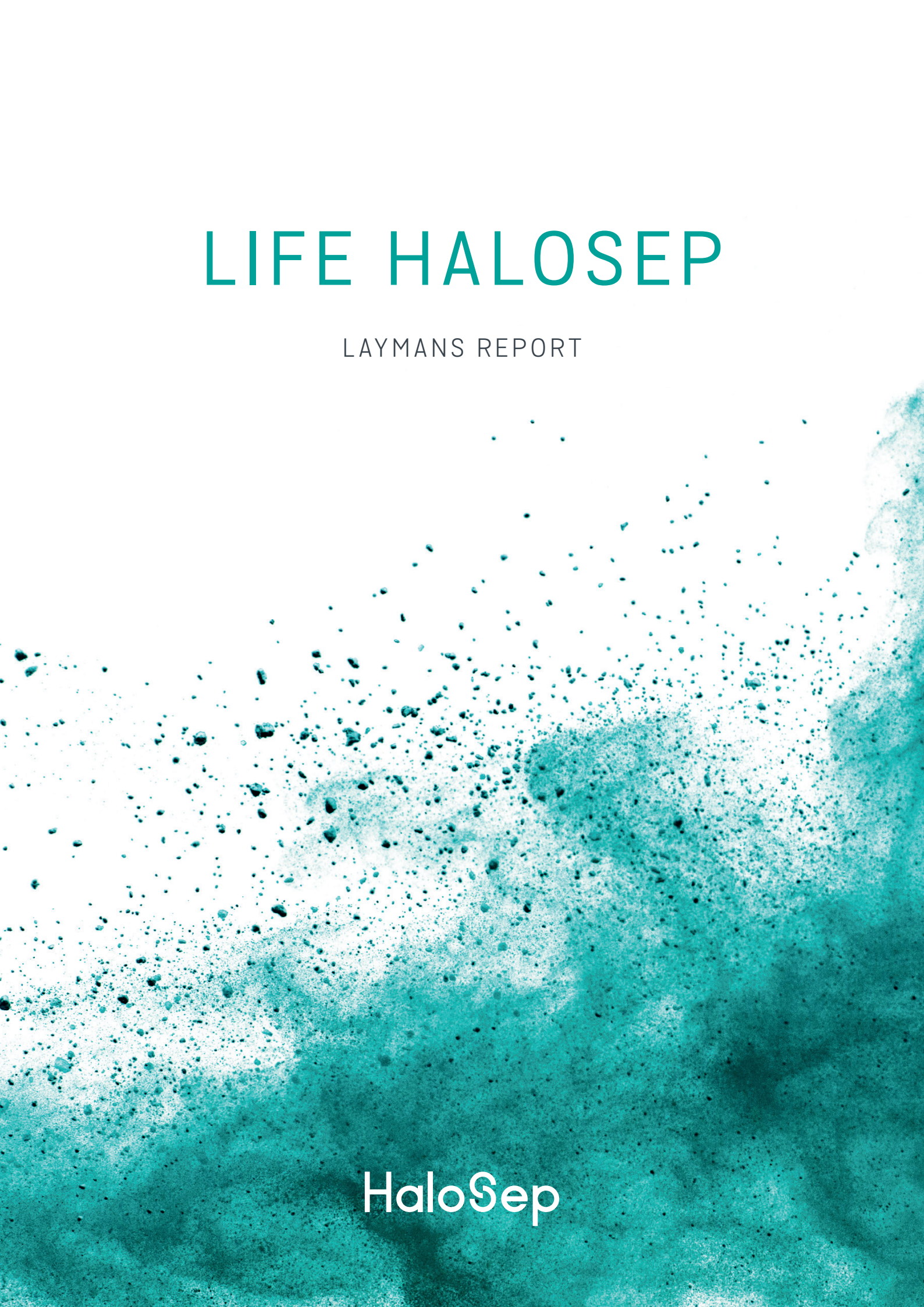
LIFE HALOSEP

LAYMANS REPORT



HaloSep

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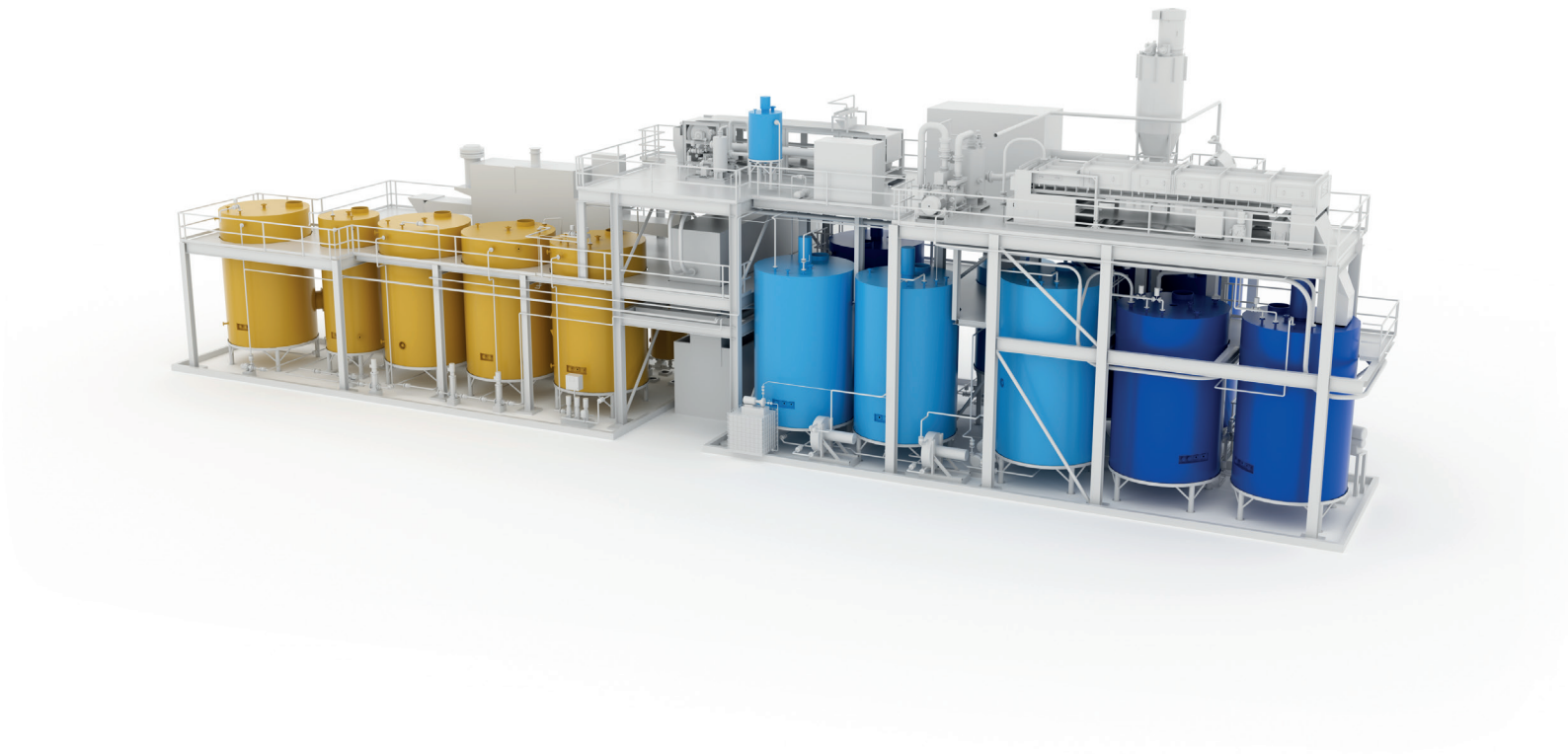
PROJECT DATA

Project number: LIFE15 ENV/SE/000265
Project localization: Vestforbrænding I/S
Total budget: 5,444,693 Euro
EU financing: 2,275,399 Euro
Duration: 2016-07-01 to 2022-09-30
Website: www.lifehalosep.eu



PROJECT BENEFICARIES

All inquiries regarding the LIFE HaloSep project and the HaloSep process is referred to HaloSep AB at www.halosep.com

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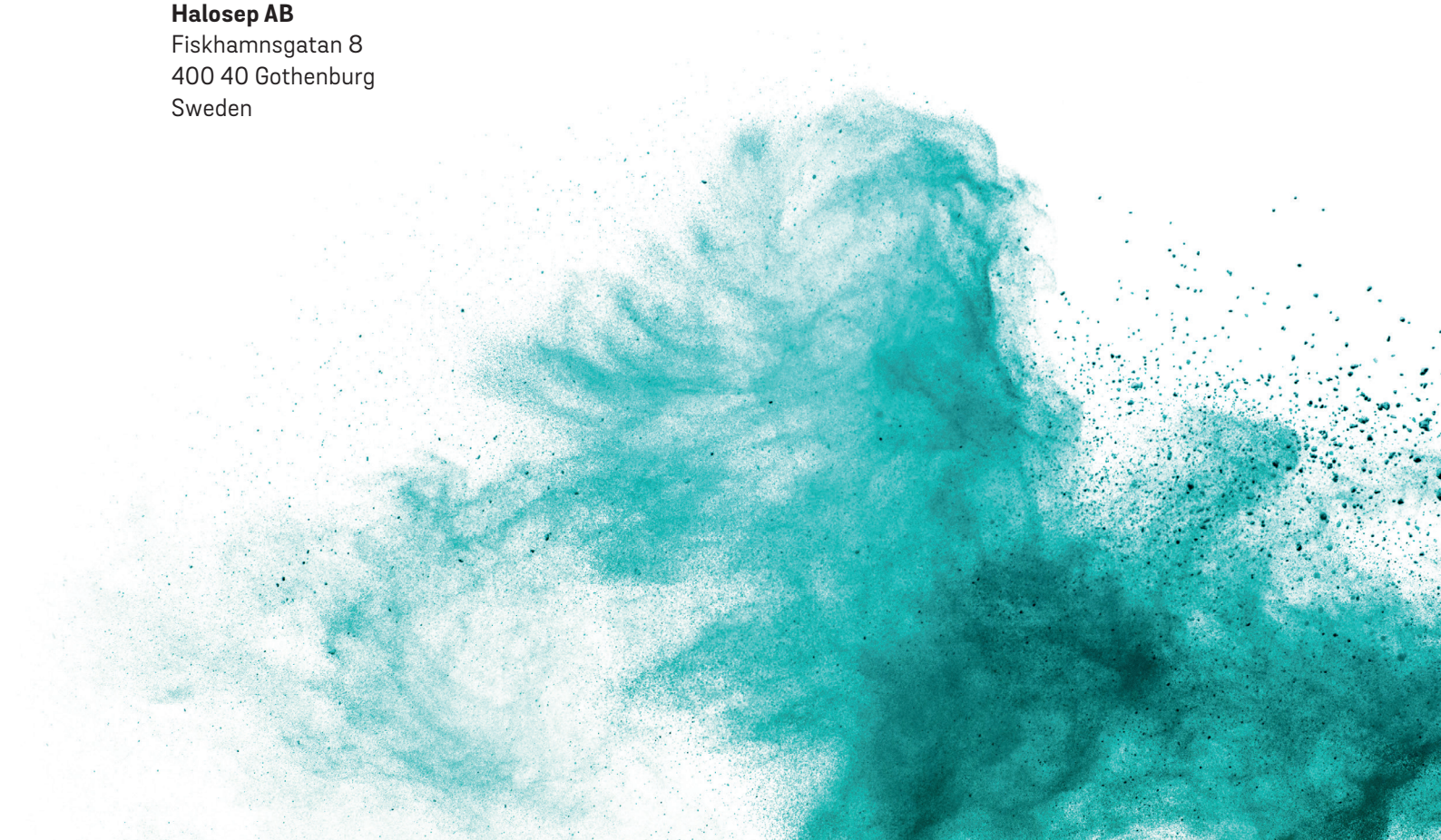

FIGURE 1 - UNTREATED HAZARDOUS FLY ASH

INTRODUCTION

Every year, some 3 billion tons of waste are produced in the EU and this figure is rising steadily. Although incineration of the waste in dedicated Waste to Energy (WtE) plants is preferable to landfills according to the Waste hierarchy, it creates specific environmental issues.

Incineration of household and industrial waste generates new waste streams produced during flue gas treatment. The waste streams from the flue gas treatment may be in the liquid form, scrubber liquid or in the solid form, fly ash (Figure 1). Fly ash from waste incineration contain salts and heavy metals which make it classified as hazardous waste by the European Waste Catalogue.

The amount of flue gas waste in Europe is estimated to about 4.5 million tons, produced at over 500 WtE plants. Standard practice today is that fly the ash from EU countries is sent to special hazardous waste landfill sites in e.g. Norway or Germany where this hazardous waste is left indefinitely and no resources are recovered.

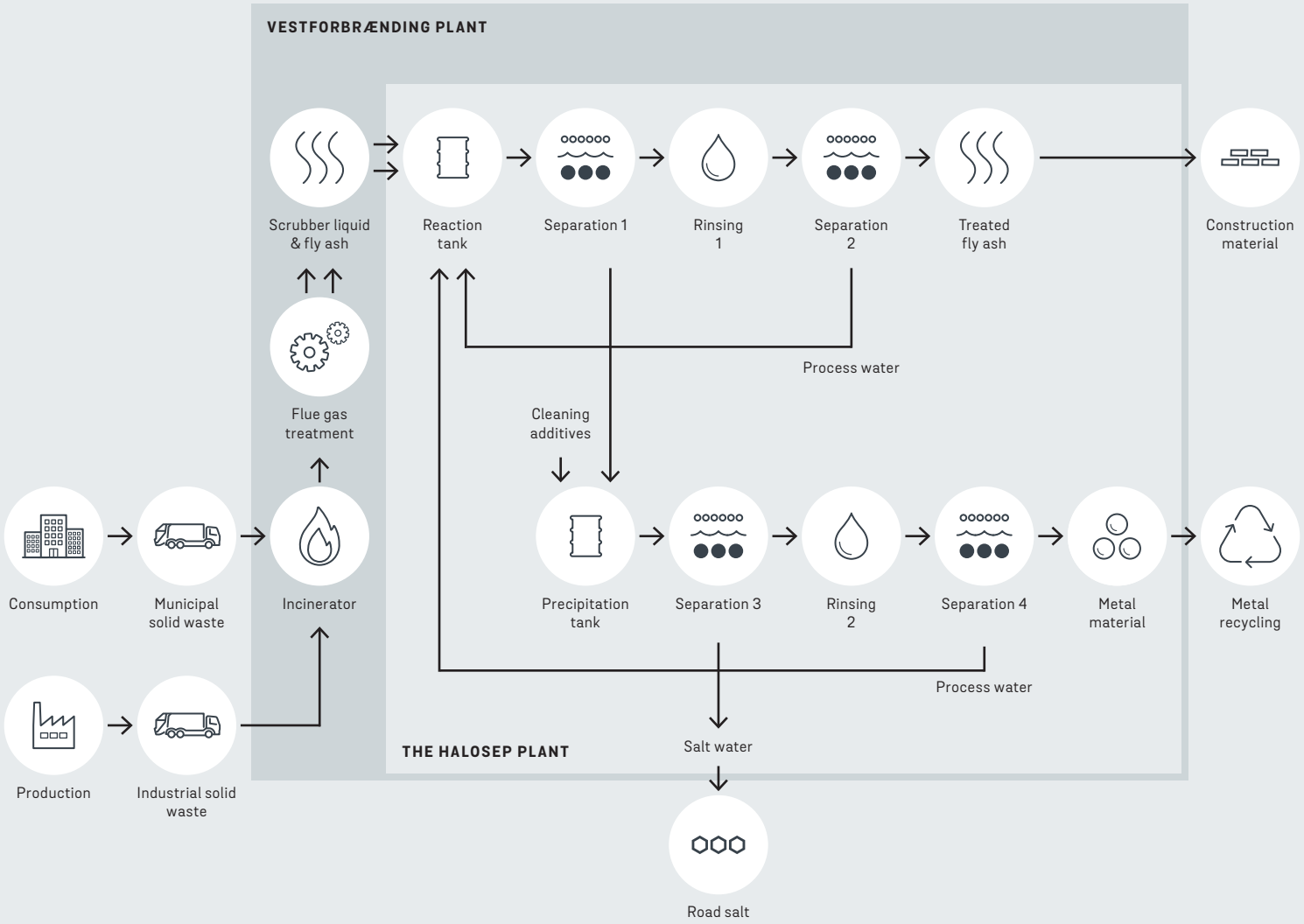

FIGURE 2 - SCHEMATIC OF THE HALOSEP PROCESS

INTRODUCTION OF THE HALOSEP

The introduction of the HaloSep process has the potential to substantially change the current treatment practices of fly ash and acid scrubber liquid from waste incineration. The HaloSep process is a wet physiochemical treatment process, where these two hazardous waste streams are introduced, and the output material can be re-introduced into the society (Figure 2). The treated fly ash is classified as non-hazardous which allows it to be used as construction material, and thus also ensuring significant cost savings through the HaloSep process.

THE MAIN OBJECTIVE OF
THE LIFE HALOSEP PROJECT WAS:

To successfully demonstrate how two waste streams from incineration plants, fly ash and scrubber liquid, can be co-treated leading to a reduction of waste going to landfills by approximately 40-60%

THE EXPECTED HIGH-LEVEL
RESULTS FROM THE PROJECT WAS:

A shift from 100% disposal of fly ash on dedicated landfills to material recycling and a reduction or elimination of disposed amounts

Up to 30-40% cost savings compared to standard landfill practice

Less material is landfilled, decreased transportation, increased material recycling, less chemicals consumption and resource savings compared with standard landfill practice

OBJECTIVES

The LIFE Halosep project is expected to play a significant part in the EU to minimise environmental challanges stemming from waste incineration. This has been done by the full scale demonstration of the innovative HaloSep flue gas waste treatment process.

FIGURE 3 - THE LIFE HALOSEP DEMONSTRATION PLANT

METHODOLOGY

A new full scale design a was established for the LIFE HaloSep demonstration plant. The HaloSep plant was installed in an existing flue gas treatment building at Vestforbrænding waste to energy plant in Copenhagen, Denmark (Figure 3). The capacity of the LIFE HaloSep demonstration plant is to treat the full 13,000 tons of fly ash and 35,000 tons of scrubber liquid annually generated at the Vestforbrænding WtE plant.
The project has demonstrated how HaloSep can be integrated into existing incineration plants, so that it subsequently can be implemented trough out the EU waste incineration industry. It has been important to demonstrate the technology in full scale to verify the throughput, cost, and environmental performance of the process.

During the 15 months after final installation, process parameters have been monitored, analysed and evaluated to confirm the expected results and benefits of the HaloSep process.

FIGURE 4 - THE TREATED FLY ASH FROM HALOSEP

The baseline settings of the HaloSep process showed that the treated fly ash will be about 60% of the incoming fly ash. The remaining fractions from the LIFE HaloSep plant constitutes of about 28% salt fraction, and about 3% metal fraction.

The treated fly ash from the HaloSep process is in the form of a moist filter cake, now free of salts and hazardous heavy metals (Figure 4). The metal fraction, which is mostly zinc, is dried in an oven where it exits the HaloSep process as a white flaky material ready for transport to a zinc processor for further refinement (Figure 5). The salt fraction comes out of the HaloSep process as a brine with 6-10% salinity. The salt meets the EU Standard requirements to be used as a de-icing or dust control agent.

FIGURE 5 - THE DRIED METAL FRACTION FROM HALOSEP

ENVIRONMENTAL BENEFITS

The environmental benefits from the LIFE HaloSep process are to ensure that the fractions from the HaloSep process finds industrial use in our society and that the HaloSep process has a low environmental footprint. Figure 6 present different possible options for usage of the fractions from the HaloSep process.

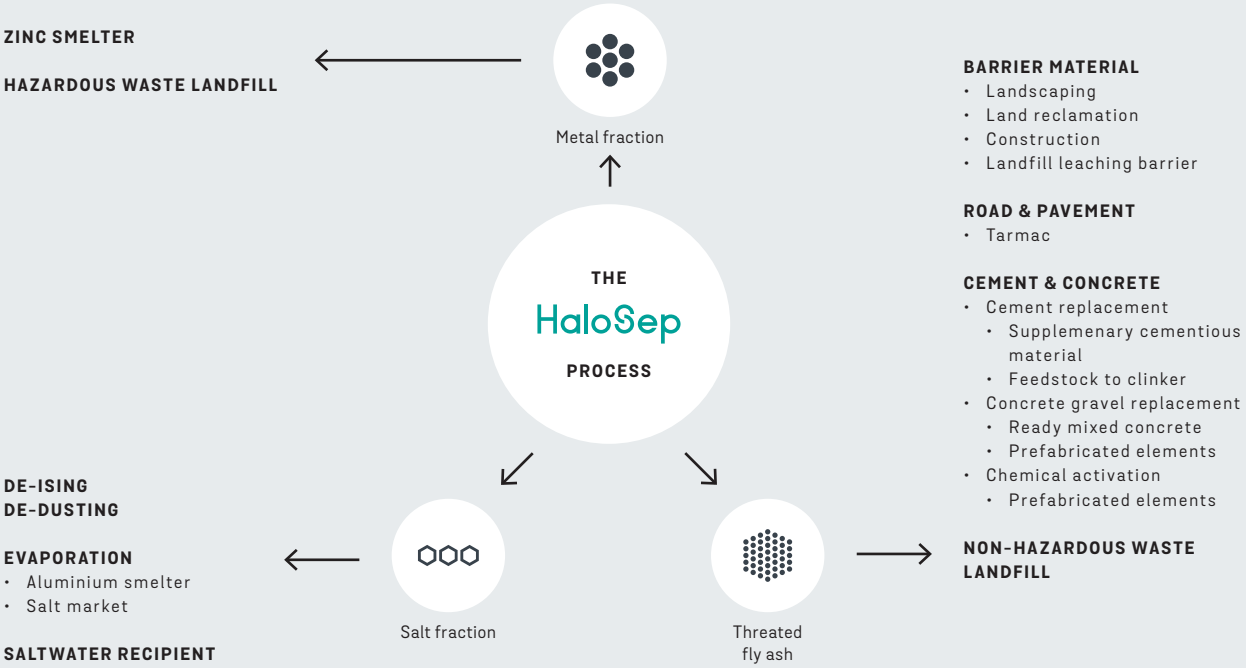

FIGURE 6 - THE INDUSTRIAL OPTIONS FOR THE FRACTION FROM THE HALOSEP PROCESS

The main impact of LIFE HaloSep plant is that hazardous waste is not being exported to other countries where it is merely landfilled. All resources from the fly ash can be kept within the community to avoid other imports. One of the major milestones of the LIFE HaloSep project has been that the Municipality of Glostrup has approved the classification of the treated fly ash produced from the LIFE HaloSep plant as non-hazardous waste. This means that the treated fly ash fullfills the criteria to be considered as an end-of-waste material which can be re-introduced back into the society locally. There are ongoing collaborations with local stakeholders, such as producers of concrete paving blocks, to identify the most efficient industrial use for the materials from the HaloSep process. A major result from the LIFE HaloSep project is that a shift from 100% disposal of fly ash on dedicated landfills to 100% material recycling of the treated fly ash is feasible.

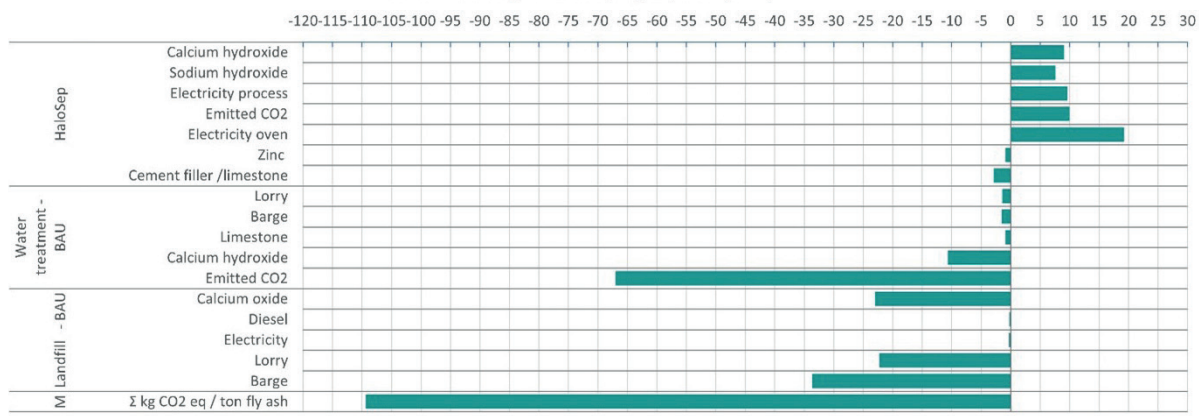

FIGURE 8 – A SUMMARY OF THE LCA RESULTS, WHERE CONTRIBUTIONS FROM HALOSEP ARE COMPARED TO STANDARD PRACTICE FOR WATER TREATMENT OF SCRUBBER LIQUID AT VESTFORBRÆNDING AND THE STANDARD PRACTICE OF DISPOSAL OF FLY ASH AT A HAZARDOUS WASTE LANDFILL SITE.

An LCA study summary is presented in Figure 8 above. The total annual reduction in CO2 emissions is estimated to 1,400 ton CO2,eq per year. The positive climate impact of shifting to the HaloSep process is attributed to less material is being landfilled, transportation need is reduced, increased material recycling, reduced chemical consumption and resource savings compared with today's standard practice.

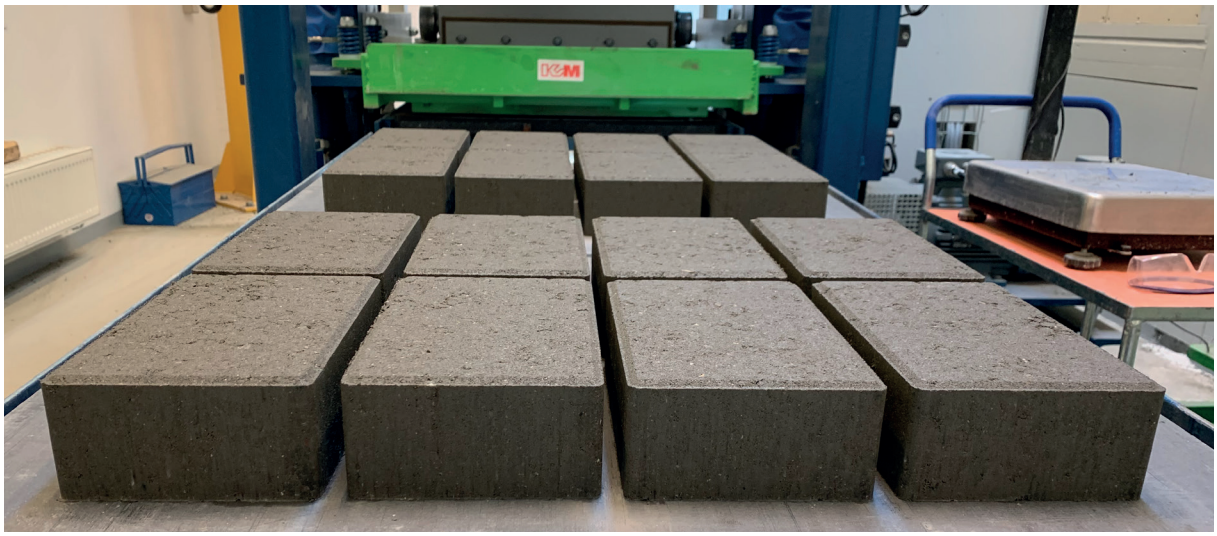

FIGURE 7 – CONCRETE PAVING BLOCKS WITH HALOSEP TREATED FLY ASH

COST BENEFIT

The technical data forms the basis for an economic overview of the HaloSep demonstration plant. It has been compared with standard practice for hazardous waste disposal of fly ash from WtE plants. In Table 1 two scenarios are presented, one where the treated fly ash is put on a non-hazardous landfill and one where the treated fly ash is used as replacement for construction materials. In the case where treated fly ash can be reused along with recycling of the metal fraction and the salt fraction there will be a reduction in cost of around 60% compared to the standard practice.

STANDARD PRACTICE OF FLY ASH AND SCRUBBER LIQUID	Cost(€/ton FA)
Hazardous waste landfill	161
Scrubber liquid treatment	44
STANDARD PRACTICE TOTAL COST	**205**

HALOSEP TREATMENT OF FLY ASH AND SCRUBBER LIQUID	Cost (€/ton FA)
Landfill Scenario: Disposal cost at non-hazardous waste landfill	120
Reuse Scenario: Transport cost for reuse	15.2
Operating costs HaloSep plant	74
Income from metal fraction and salt recycling	–15.6
TOTAL COST LANDFILL SCENARIO	**178**
TOTAL COST REUSE SCENARIO	**74**

TABLE 1 – ECONOMIC DATA FOR STANDARD PRACTICE DISPOSAL OF FLY ASH ON A SPECIAL HAZARDOUS WASTE DISPOSAL SITE COMPARED WITH THE 10–15 KTON HALOSEP DEMONSTRATION PLANT.

EUROPEAN ADDED VALUE

The long-term objective for Vestforbrænding is to decrease the waste generated from its own production, to recover more valuable resources from the waste and to increasing its contribution to a circular economy. The long-term objective for the Stena Metall Group is to commercialize and make the technology available across the EU and globally.

The project results have shown that the HaloSep technology could be applied to waste incineration facilities across the EU, and globally. We also expect to influence policy and legislation to reach a consistent, EU-wide legislation that facilitates the use of recycled materials from HaloSep, in e.g. construction materials. The HaloSep technology, now demonstrated, can continue to be developed and applied to solve numerous waste problems, leading to decreased landfilling and increased recovery of resources. Long term effects will also be to improve the general perception of waste incineration plants, and to create job opportunities in many countries now that HaloSep is made commercially available via the new company HaloSep AB, see Figure 9.

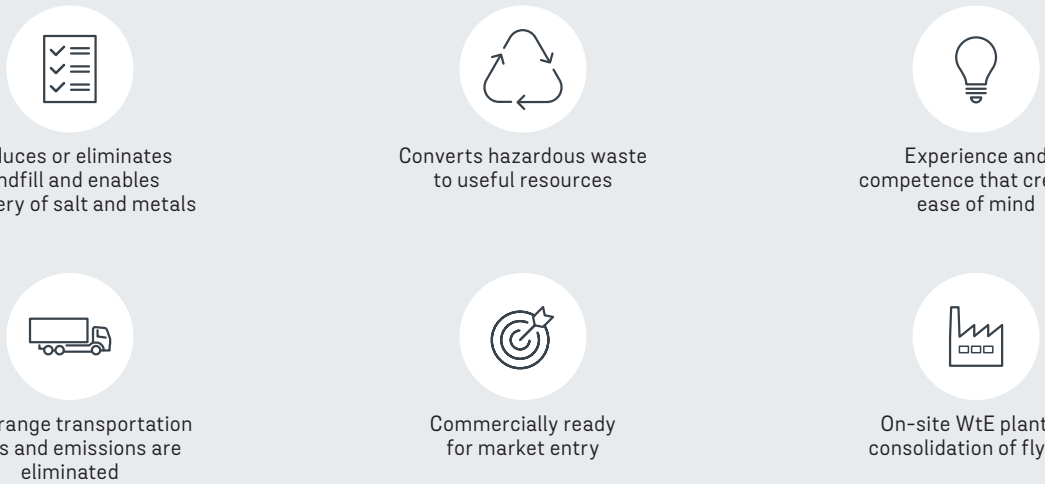

FIGURE 9 - THE HALOSEP AB MARKETING STRATEGY