Svante

Techno-economic evaluation of electrified carbon capture in cement production

PCCC-8 Conference

Mania Neisiani, Bhurisa Thitakamol

Agenda

Introduction to Svante Technology

Cement Integration Option

Case Study

Key Takeaways

Svante

Svante is a Leading CO_2 Capture Technology Developer

Leader
in solid sorbent CO_2 capture technology

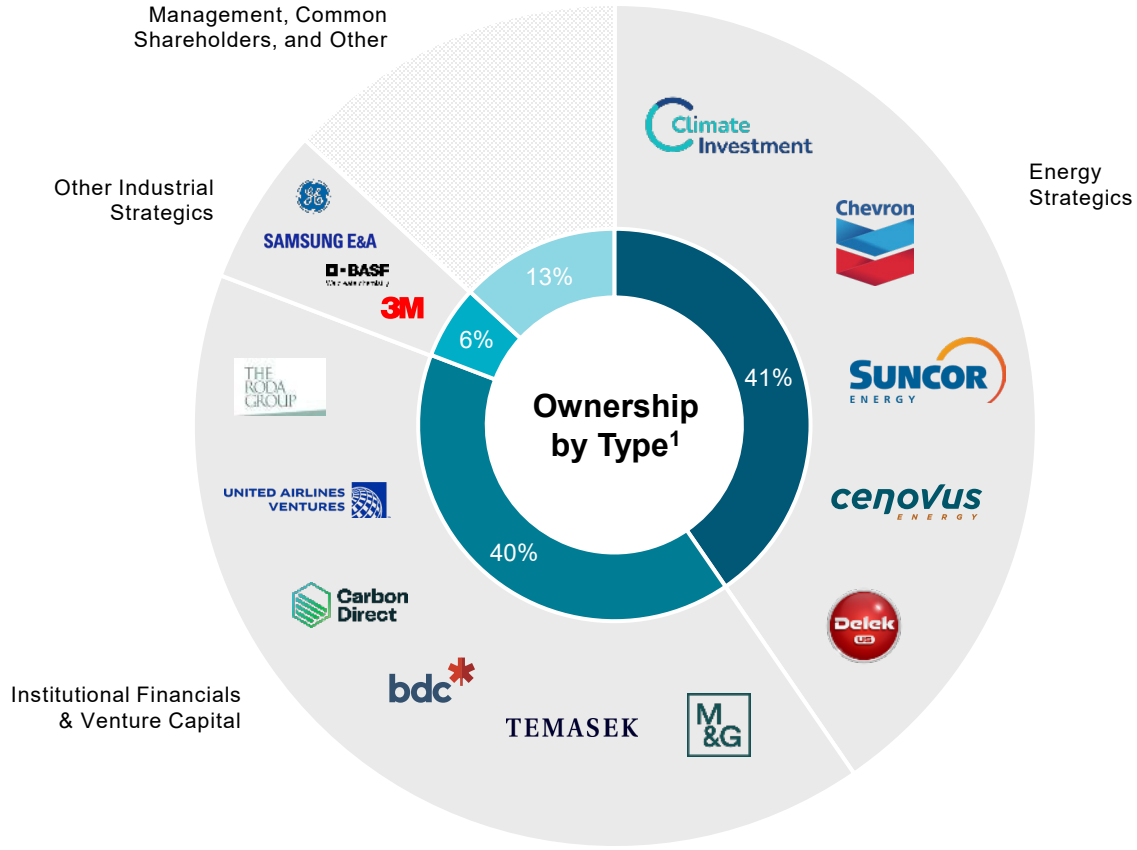
Applicable
to 84% of CO_2 capture and removal market

16+
years of R&D

Located
in Vancouver, Canada

$600M+
raised to date (USD)

~140
patents/applications



Svante is a journey that has been more than 16+ years in the making.

The Svante Group Business Units

Svante

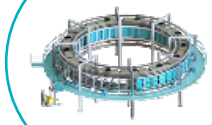
OEM & Design

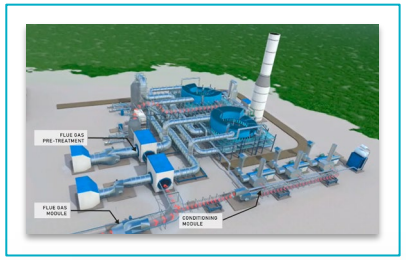
Solutions & Digital Services

Svante Development*

Filters

Industrial Contactors

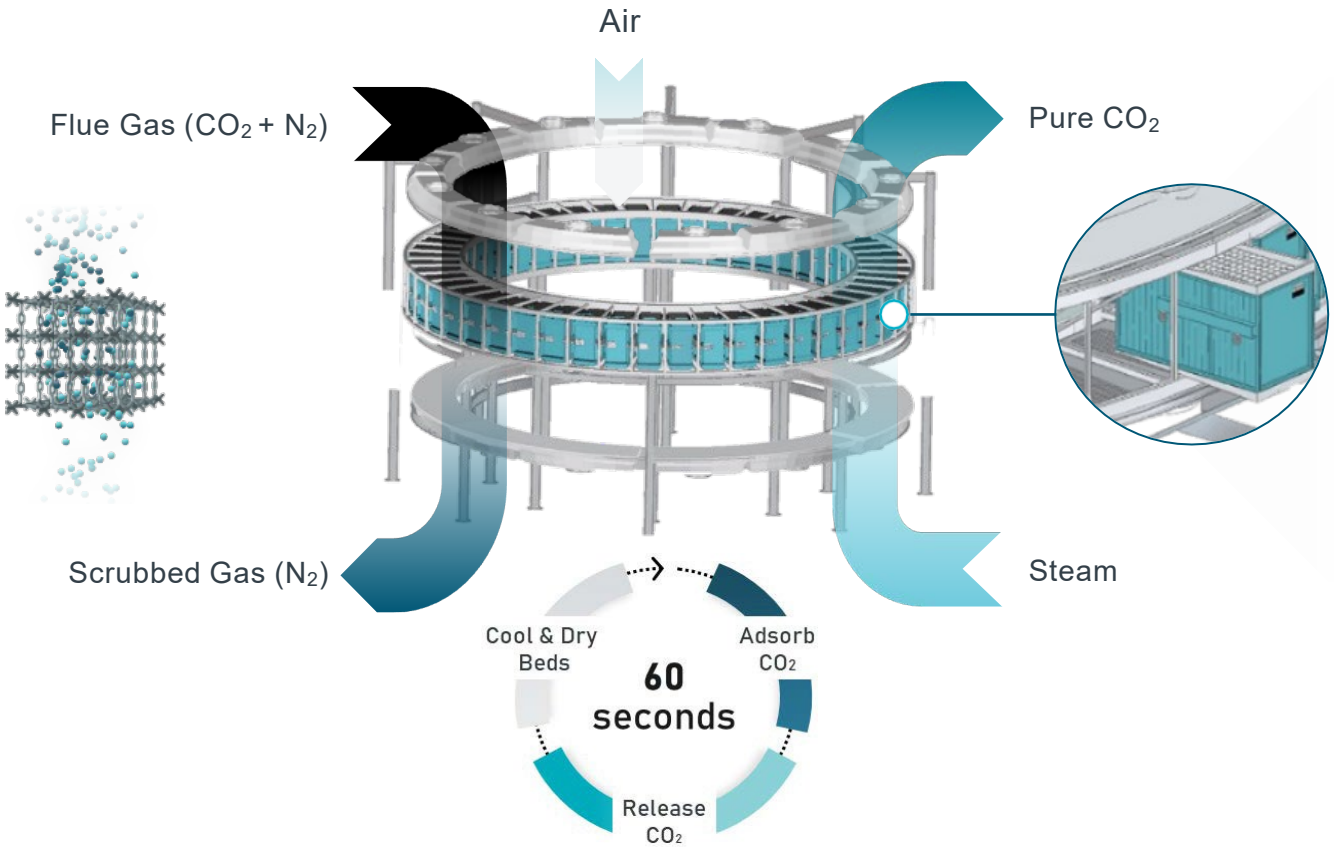




Manage, optimize, and execute across complex stakeholder landscape

Svante's Industrial CO_2 Capture System

Industrial Contactor



Filter

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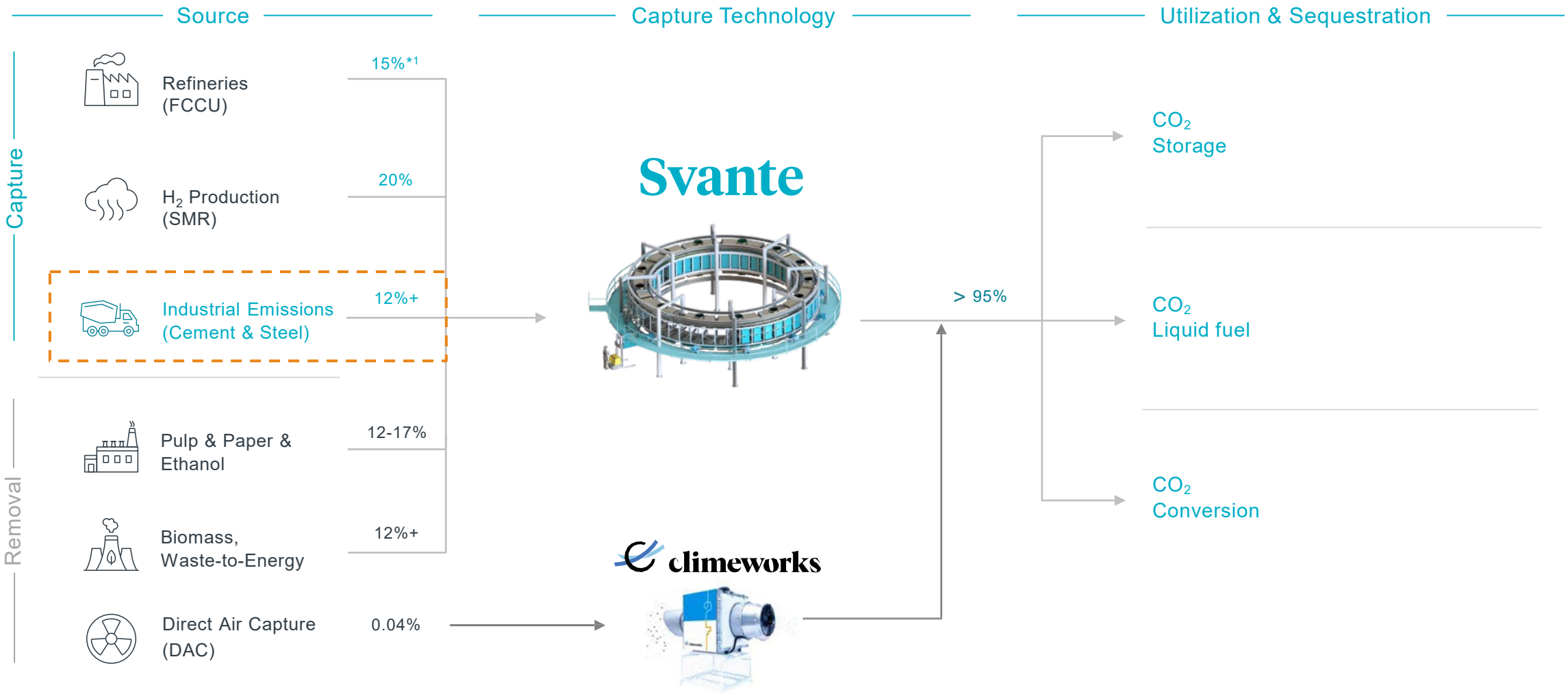
Svante's Core Business is Industrial Point Source Carbon Capture

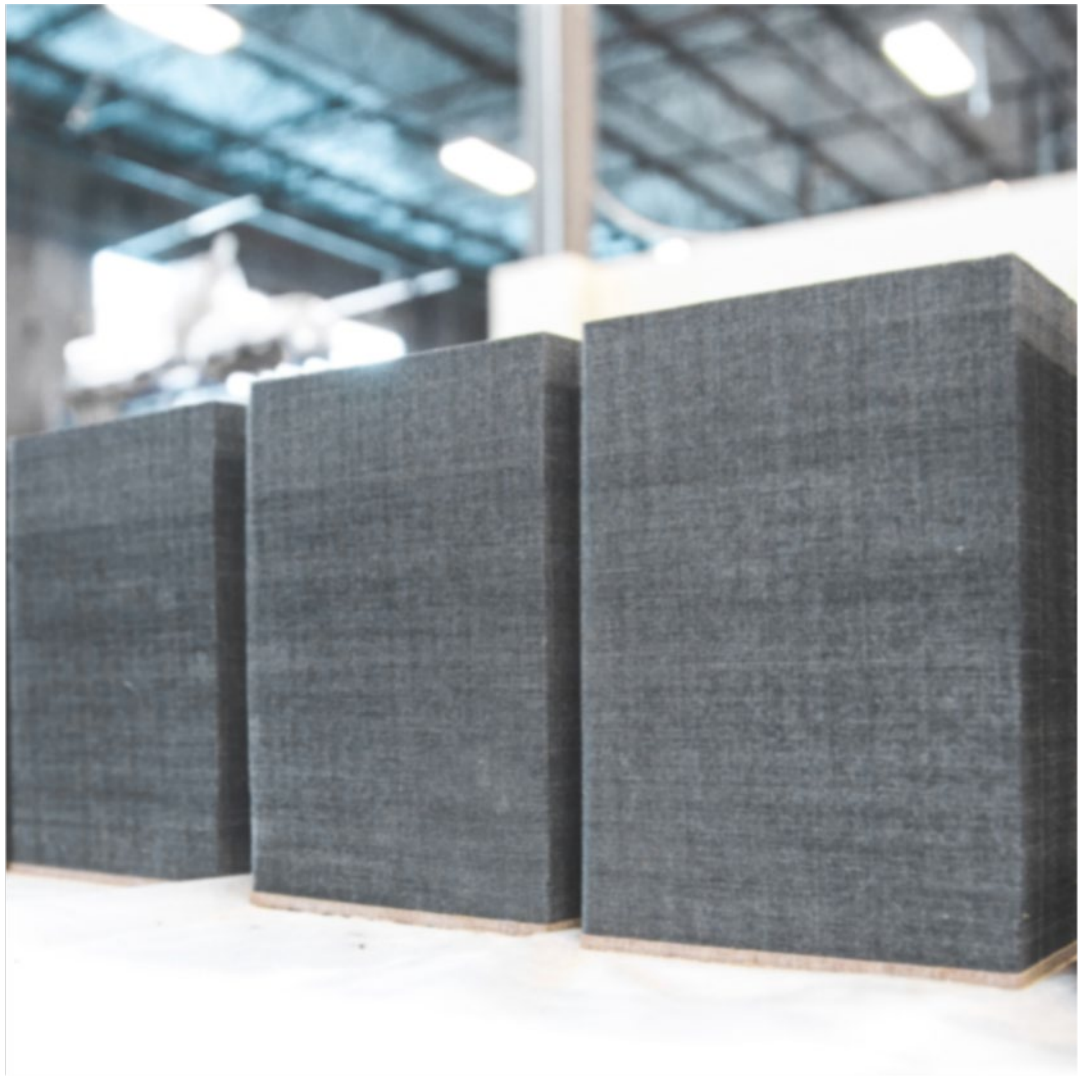


Note: [1] Refers to CO_2 concentration
*3-8% concentration in development
**NGCC applications in development

Benefits of Solid Sorbents

Metal-Organic Frameworks (“MOFs”)
are a step change for the carbon capture industry

- ✓ Energy efficient
- ✓ Resistant to SOx, NOx, O_2 & H_2O in flue gas
- ✓ Captures up to 95% of total CO_2 emitted
- ✓ High CO_2 capacity means smaller inventory of adsorbent required
- ✓ Filters are designed to be recyclable



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Svante's Pathway to Commercial Readiness

1 Production:
Solid Sorbent-Lined Filters

Adsorbent manufacturing scale up with BASF

SAB (Filter) Manufacturing facility in Svante HQ @ Burnaby

2 Design:
Industrial Contactor
(Carbon Capture Machine)

In-house operation of full-sized industrial contactor

Continuous improvement and optimization

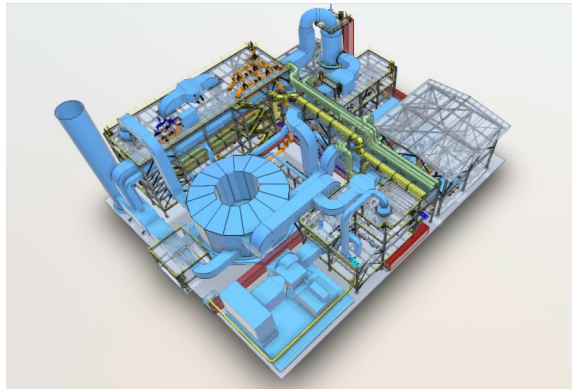
3 Testing & Optimizations:
Tracking, Measuring & Optimizing Performance

Rapid temperature swing adsorption (RTSA) cycle optimization & enhancements

Validation of KPIs via in-house and external units

4 Plant:
Carbon Capture Plant Design

Optimized for waste heat recovery and integration with industrial host site (brownfield and greenfield).

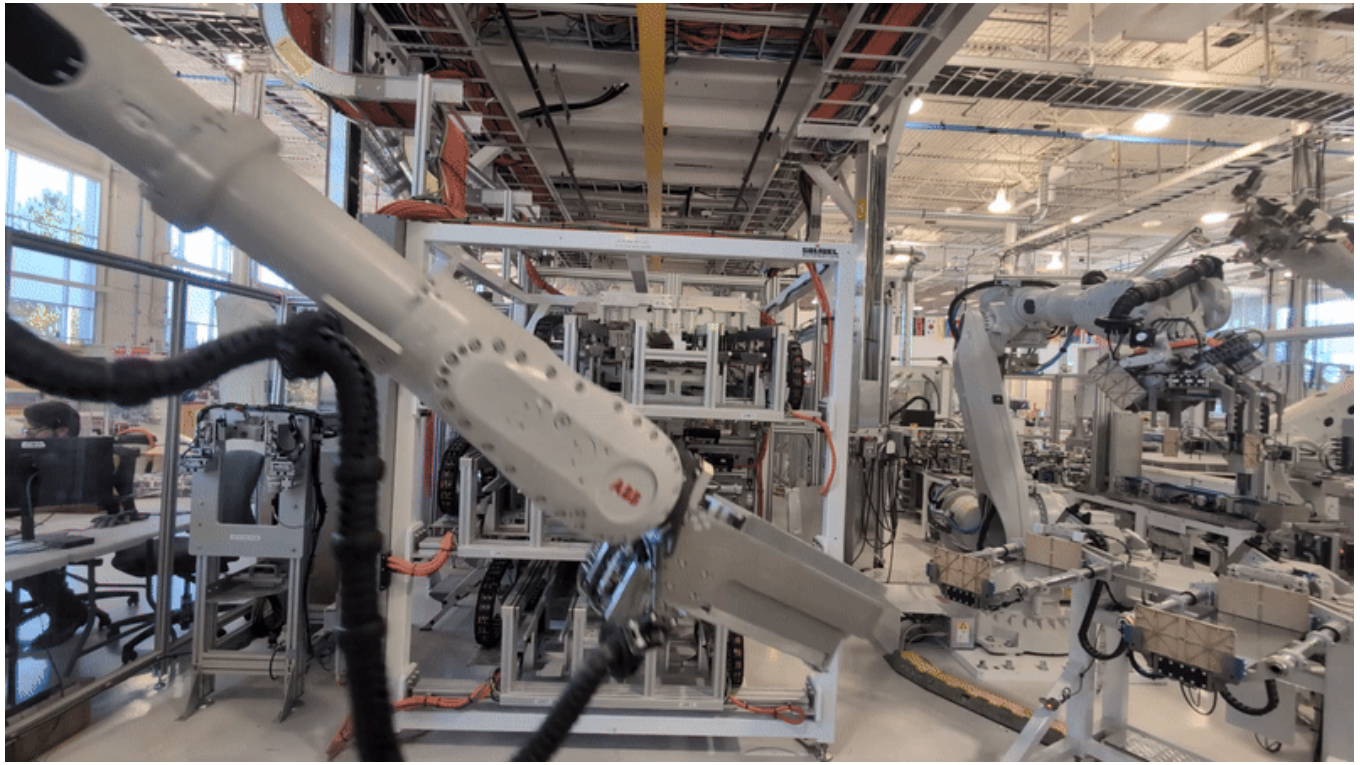


Filter Manufacturing Plant Commissioned Q2 2025

Sorbent Slurry Room

Filter Manufacturing Floor

Filter Module Assembly Line



Annual filter manufacturing capacity = 10 commercial carbon capture plants
capturing 1 million tonnes of CO_2 per year. That's enough filters to capture 10 million tonnes annually.

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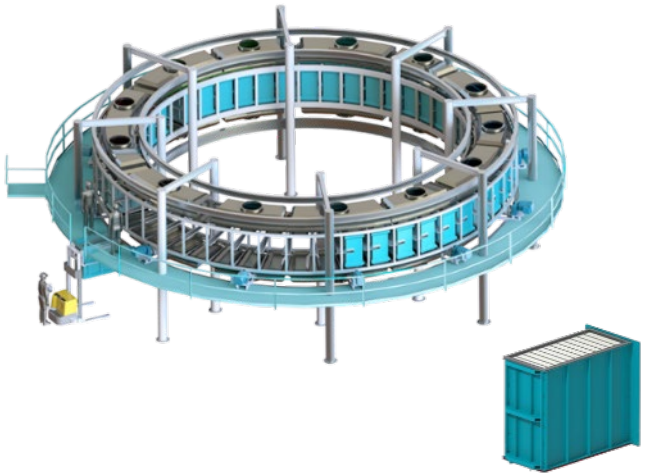
Standardized Contactor Product Approach

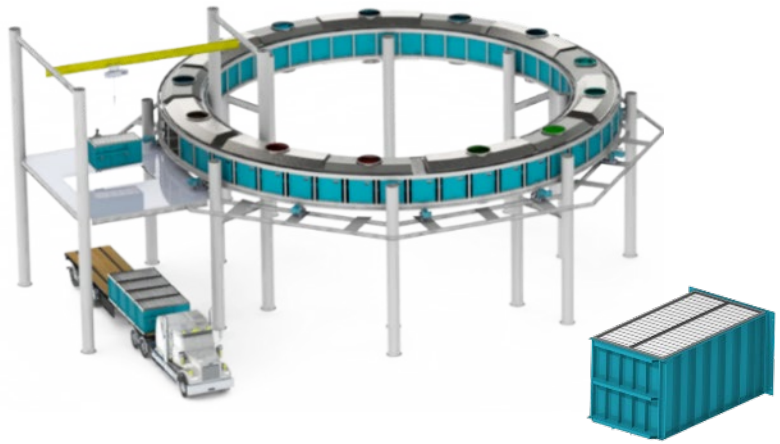
Ursa 1000

~500 tpd / ~182,500 tpa



Ursa 2000

~2,000 tpd / ~730,000 tpa



Svante produces commercial units at two predetermined scales.

RAM Prototype Buck Design Validation

- Svante has commissioned a full-size prototype Ursa-1000 for in-house operation since Nov 2023
- Design validation and optimization ongoing according to developed processes and test plans
- Testing at higher design targets than normal operation conditions to confirm margins

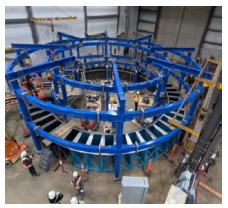
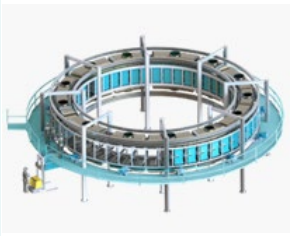
Ursa 1000 – 500 TPD

Key Takeaway

Our CO_2 contactor operates as a simple, modular and mechanical solution, not as a complex chemical operation attached to your cement facility.

Testing & Optimizations:
Development & Scale-Up Roadmap for MOF-based Technology Deployment

* The Technology Readiness Level (TRL) is defined according to the DOE TRL levels. This is a metric to assess the maturity of evolving technologies. The goal of TRL is to illustrate the technology development status.

Year By	2016	2020	2020-Present	2019-2024	2023-2026				2028
TRL Level	**TRL 4** Validation in Lab	**TRL 5** Lab scale validated in relevant env.	**TRL 6** Pilot scale in relevant env.	**TRL 6** Demo scale in relevant env.	**TRL 7** Prototype demo in plant env.				**TRL 8** System validated via plant testing and demo
Phase	• VTS Stationary Test Station	• Process Demonstration Unit 100 Series	• Pilot Plant 200 Series, Cement Kiln Flue Gas	• FOAK Plant 400 Series, OTSG flue gas in plant env.	• SOAK Plant 400 Series, OTSG flue gas in plant env.	• Full Scale Machine Design Validation	• MDU1 at TCM FCCU flue gas/ Cement flue gas in plant env.	• MDU2 at Recovery Boiler flue gas in plant env.	• Large-Scale Ursa 1000 and 2000
Plant Scale									
Location	**Svante** BC, Canada	**Svante** BC, Canada	**Lafarge** BC, Canada	**Cenovus** SK, Canada	**Chevron** CA, USA	**Svante** BC, Canada	**TCM** Norway	**Pulp and Paper Plant** Q4 2025	**TBD**
CO_2 Capacity	<0.1 TPD	~ 0.1 TPD	1 TPD	25 TPD	25 TPD	~500 TPD	~ 0.1 TPD	~ 0.1 TPD	~ 500 - 2000 TPD

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Svante's Extensive Experience in Cement

Over 32,0000 hours of pilot operation in various plants

Chevron SOAK 400 Series Plant

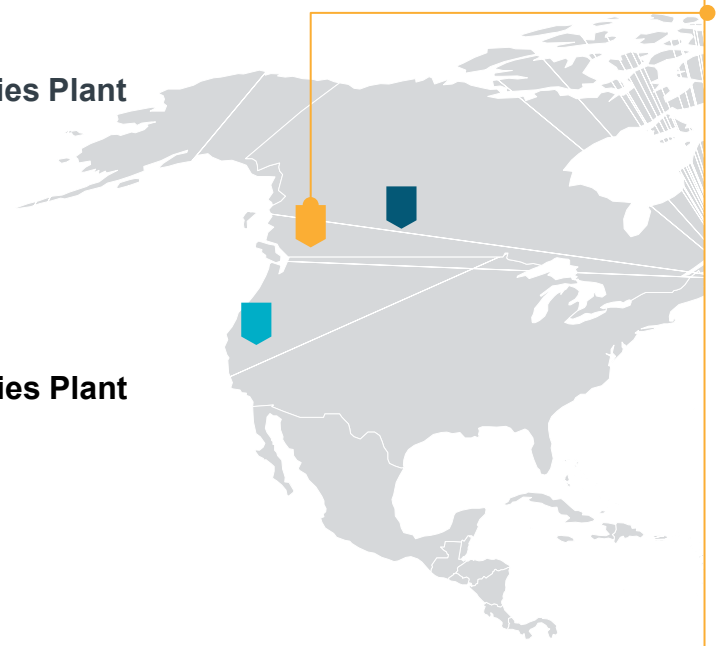
Source: Industrial Boilers
Status: Operational
Owner: Chevron

9,125 tpa

Cenovus FOAK 400 Series Plant

Source: NG Boiler
Status: Completed
Owner: Cenovus

10,000 tpa



Svante's Cement Pilot Performance

Lafarge 200 Series Demo Unit

Source: Cement Kiln | **Status:** Operational

365 tpa

Started up in 2019
Over 8,000 hrs of operation

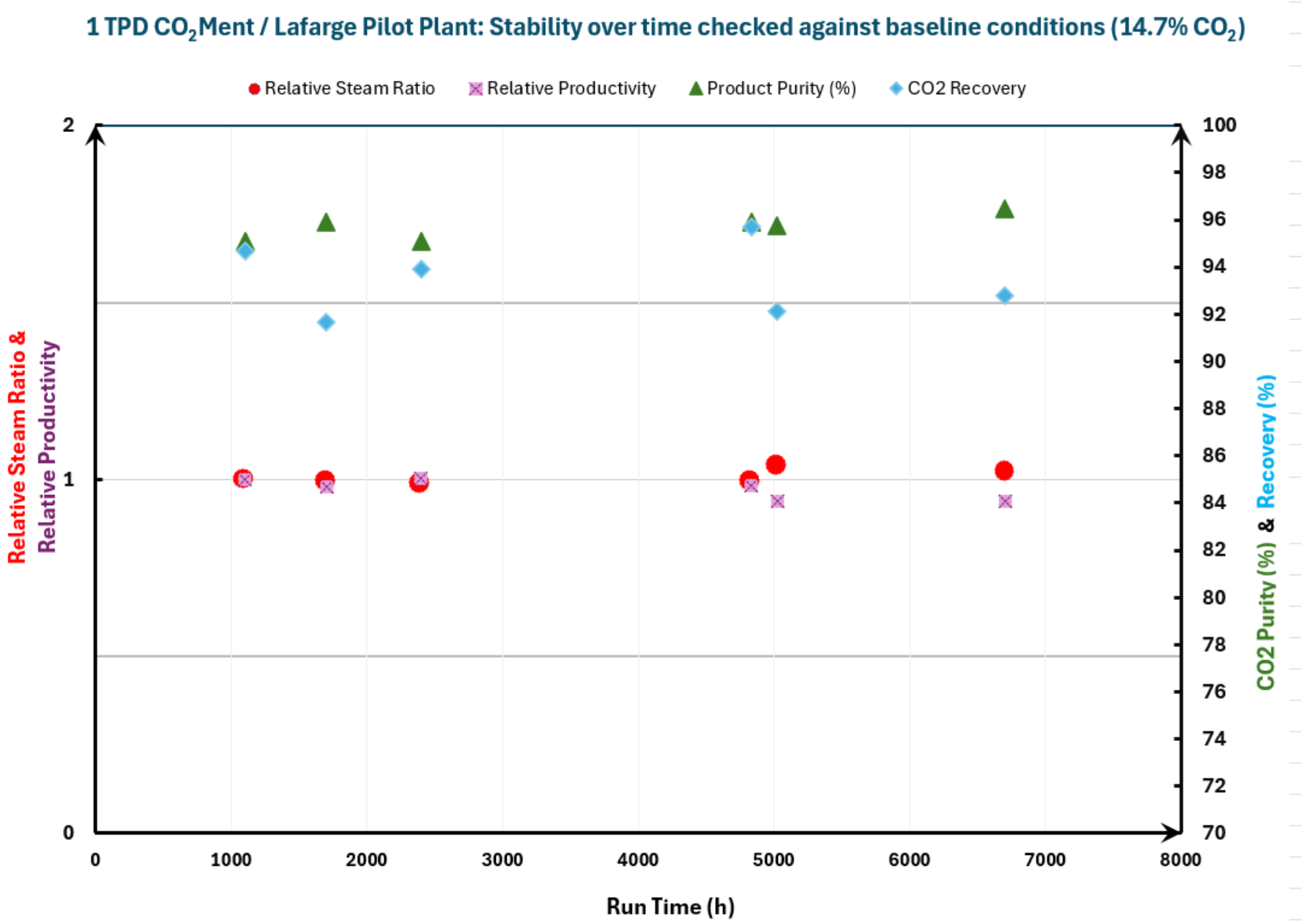
Value Supported by Data

- Validated technology KPIs in Cement Operations
- Proven process optimizations drive further value and industry leading performance
- Stability of Sorbent proven in actual Cement operations
- Operational experience leveraged for commercial project design

LAFARGE

Svante Mobile unit is currently in operation at a cement plant in the EU.

Lafarge stability data



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MDU-1 Mobile Demonstration at TCM successfully completed

Key Results

- Demonstrated *no secondary emissions* from Svante's Technology
- Validated *stability* of CALF-20 filters with contaminated **RFCC flue gas and simple pretreatment** (contaminants containing particulate, NO_x/SO_x, and aerosols)

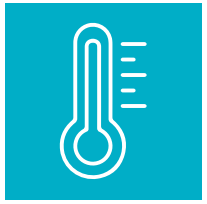
- The mobile test unit has moved to a cement plant in the EU and is in operation.
- The unit will be available for technology demonstrations at customer facilities in the near future

Technology Center Mongstad (TCM) in Norway is the world's largest, and reputable facility for testing and development of Carbon Capture technologies

The test campaign ran from Oct 2024 to April, 2025

Case Study:
Svante's CCS Applications in Cement Plant

Svante Advantages for Cement Applications



Low-Grade Heat Utilization:

Svante can use low-grade heat due to the steam being under slight vacuum, down to 90 C

Minimal Impact on the Environment:

Svante materials are free from aerosols, volatile emissions and toxic degradation byproducts – uniquely recyclable sorbent filter beds

Operational Simplicity & Flexibility:

Svante's rapid capture process can quickly respond to intermittent operations – no requirement onsite liquid solvent storage & make-up

Electrification:

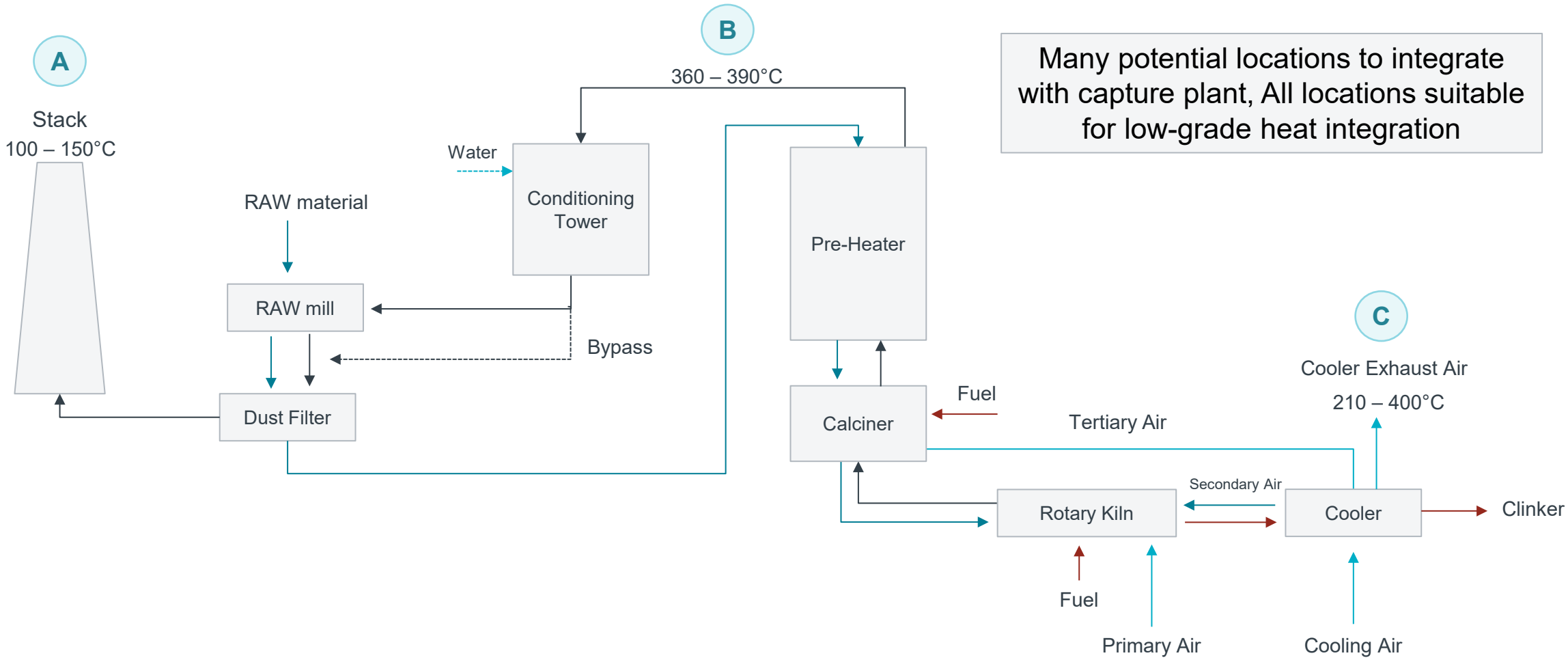
Svante's low-grade heat capability extends to being able to use MVR to fully electrify certain the carbon capture plant for certain processes

Robustness to Contaminants:

Svante's structured filter beds are more robust to particulates found in hard-to-abate industries, compared with liquid solvent technologies. Svante doesn't require a separate pretreatment for Sox Nox PM for cement plant

Emission free, chemical free, fully electrified Svante capture plant, simple and flexible with rapid response to flue gas fluctuations

Cement Integration Option



Many potential locations to integrate with capture plant, All locations suitable for low-grade heat integration

A	At Stack for CO_2 Capture
B	After Preheater for CO_2 Capture
C	Clinker Cooler Air

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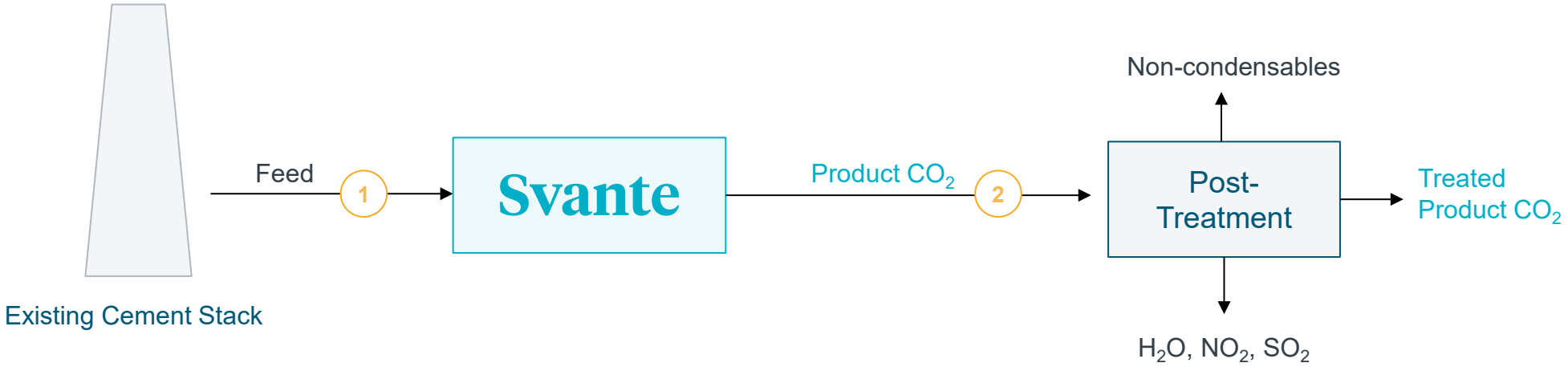
Flue Gas Pre-/Post-Treatment



1 No additional flue gas pre-treatment unit is required for Svante's carbon capture plant.

2 Single CO_2 post-treatment unit is used to meet the Northern Lights Specifications.

A more optimized CAPEX/OPEX solution

Case Study basis

Svante Capture Plant Capacity:

~3,500 TPD

Process Design:

Full Electrification

CO_2 Concentration:

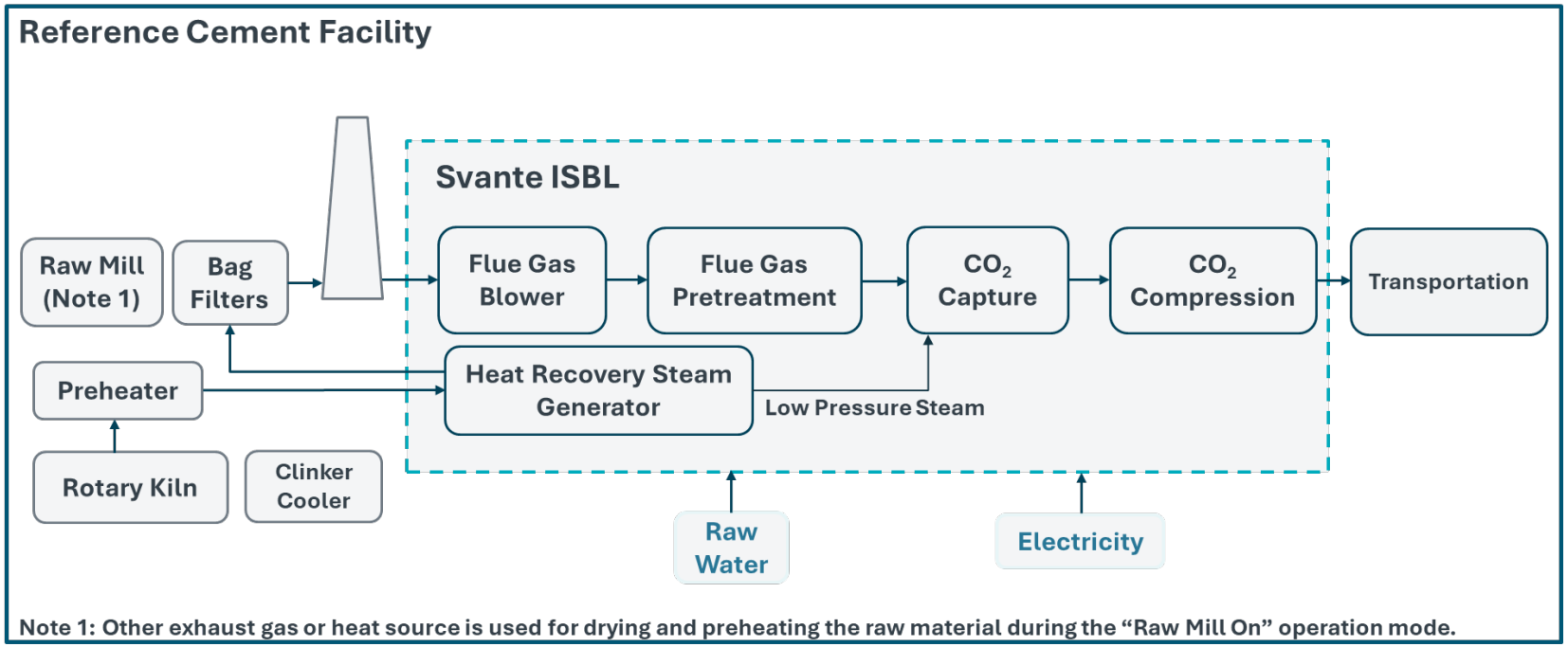
22 - 27%mol CO_2 Concentration on dry basis

CO_2 Recovery Rate:

95% Recovery

CO_2 Purity:

>97% in gaseous phase at 30 bar



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Case Study Result

Electricity Power:

Capture plant: 0.8 GJ/tCO_2
Compression: 0.4 GJ/tCO_2

Heat Integration from different sources
(% of thermal energy requirement)

High-grade heat from cement plant (temp >250 C)~21%
Svante's capture plant heat integration (temp >70C) ~79%

The available heat from cement plants vary from site to site

There is a tradeoff between capex/electricity consumption and level of heat integration with cement plant so further optimization of the system configuration is possible – capture plant 0.8 GJ/tCO_2 can be further decreased.

It is possible for Svante's capture plant to be fully electrified and be independent of the host site.

Any available process heat above 70°C from host site can be used to maximize ISBL heat integration.

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Key Takeaways

Svante's process is suitable for cement flue gas decarbonization and validated with years of operating experience at the Lafarge Richmond cement plant

Svante's process does not require chemicals, corrosion inhibitors or activators resulting in a simple, robust and environmentally friendly process fitting well the current operational experience of cement operators

Svante's mobile test unit is available in the EU to be used at your facility to demonstrate its performance

Any carbon capture project will be a ***team*** effort with several partners. It's key that the ***right*** partners are in place to realize the carbon capture, transportation and storage components. Svante can support your project with the right partners in place.

Svante can support you and your team with EU Innovation fund applications.

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Let’s tackle your emission reduction targets together.

Mania Neisiani
Vice President, Technology Deployment , Svante Solutions and Digital Services
mneisiani@svanteinc.com

www.svanteinc.com