Svante has a 15-year first mover advantage

Business snapshot

- **15+ Years of research and development creating a commercially viable way to capture CO₂ for hard-to-abate industries using tailor-made nano-materials**
- **84% Of the broader carbon capture and removal market targeted through “Picks and Shovels” business model**
- **50% Targeted capital cost advantage of Svante contactor versus equivalent liquid amine carbon capture equipment**
- **122 Global patents providing strong IP protection on technology and design**
- **160 Best-in-class team of experts led by Mr. Claude Letourneau**

World renowned customers
- climeworks
- CHEVRON
- TEMASEK
- bdc
- holcim
- Cenovus

“Thought leader” investors
- “Thought leader” investors
- “Thought leader” investors

Best-in-class partners
- TEN
- Kiewit
- BASF
- Chart
- THE RODA GROUP

Notes: 1 Removal refers to DAC and BECCS and excludes nature-based solutions

Business snapshot

- **World renowned customers**
- **“Thought leader” investors**
- **Best-in-class partners**

Capture plants

- **Lafarge 200 Series Demo Unit**
  - Richmond, B.C., Canada
  - Capacity: 365 tpa
  - Status: Operational
  - Source: Cement Kiln
  - Owner: Lafarge

- **Cenovus Pilot Plant**
  - Lloydminster, SK, Canada
  - Capacity: 10,000 tpa
  - Status: Operational
  - Source: NG boiler
  - Owner: Cenovus

- **Chevron SOAK 400 Series Plant**
  - San Joaquin, CA, USA
  - Capacity: 9,125 tpa
  - Status: Detailed Engineering and Execution
  - Source: Industrial boilers
  - Owner: Chevron

Facilities

- **Current manufacturing and R&D centres**
  - Burnaby, B.C., Canada
  - Capacity: 40,000 tpa
  - Size: 39,000 sq ft
  - Status: Operational
  - Staff: 150+

- **HQ, Engineering and Manufacturing Facilities**
  - Burnaby, B.C., Canada
  - Capacity: 10 mmtpa
  - Size: 140,000 sq ft
  - In-service: Q4 2022
  - Staff: 250+
Svante’s innovative process

**Powerful Nano-Filter**
Tailored solid adsorbent with very high CO₂ capacity, robust to industrial emissions

**Structured Adsorbents**
Optimize mass and heat transfer, maximizing loading of active adsorbent per unit volume

**Rapid Cycle**
Structured Adsorbents switches between adsorbing and releasing CO₂ in 60 seconds - high productivity with low pressure drop

**Low Cost Equipment**
Rotary Adsorption Machine allows Rapid Cycle to take place as a continuous process in compact, low cost industrial equipment

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Svante’s capture system highly productive, scalable, and low cost
Svante is the “Picks and Shovels” for carbon capture and removal

**Source**
- Industry
- H$_2$ Production
- BECCS
- DAC

**Utilization and Sequestration**
- Offshore storage
- Saline aquifer
- Depleted oil reservoirs and EOR
- Salt dome storage
- Jet fuel (SAS)
- Methanol
- Gasoline
- Diesel
- Cured concrete
- CO$_2$ to fuel/biomass
- CO$_2$ to chemicals
- Producing a food-grade CO$_2$
- Mineral carbonation

**CO$_2$ Storage**
- Industry
- H$_2$ Production
- BECCS
- DAC

**CO$_2$ Liquid fuel**
- Industry
- H$_2$ Production
- BECCS
- DAC

**CO$_2$ Conversion**
- Industry
- H$_2$ Production
- BECCS
- DAC

**Note:** 1 Refers to CO$_2$ concentration
Svante has a significant advantage over traditional solvent technologies

<table>
<thead>
<tr>
<th>Technology Description</th>
<th>Svante’s Solid Adsorbent</th>
<th>Liquid Solvents (conventional carbon capture)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Separation relies on adsorption of CO₂ onto a solid surface</td>
<td>Separation relies on chemical reaction of CO₂ with a liquid solvent</td>
</tr>
<tr>
<td></td>
<td>Regenerated using direct steam in an intensified temperature/concentration swing process that enables very rapid cycles</td>
<td>CO₂ regenerated by reversing chemical reaction/liquid absorption through use of indirect heating in regenerator/stripper column</td>
</tr>
</tbody>
</table>

| Modularization and Scalability | Adaptable and cost efficient at all scales due to the repeatability of the modular design | Difficult to modularize large towers, restricts scalability and deployment |
| Ability to Deal with Intermittency of Emitters | High | Low |
| Toxic Fugitive Emissions | None – solid sorbent | Amines, nitrosamines, nitramines |
| Capital Intensity¹ | ~$200 / annual tonne (nameplate) | $300 – $400+ / annual tonne (nameplate & built) |
| Near Term Operating Costs | $20 - $30 / tonne of CO₂ captured (lower in future) | $20 - $30 / tonne of CO₂ captured |
| Potential for Further Cost Reduction | New solid-state technology poised for significant cost reduction learning curve | Established liquid chemical plant technology, limited room for further cost improvements |

**System comparison**

Note: ¹ Capital intensity calculated as total installed capital cost divided by annual CO₂ capture assuming 100% of nameplate capacity and 365 days of operations.
Manage **harmful organic and inorganic** substances in the cement flue gas by **measuring and qualifying** the effect of a contaminant mitigation system.

**PHASE 1**

**Pre-treatment**

**PHASE 2 - CURRENT**

**CO₂ Capture**

Separate the CO₂ from the flue gas using a **customized-for-cement version** Svante’s carbon capture technology.

**PHASE 3**

**CO₂ Utilization**

Prepare CO₂ for reuse and support the demonstration of CO₂ conversion technologies on-site such as low-carbon fuels and CO₂-injected concrete and fly ash.
Cement flue gas – Challenges with CO₂ capture

Cement flue gas has relatively high O₂ content (8-12%) which increased oxidation and could decrease some sorbent lifetime.

High amount of contaminants (SOx and NOx) which could significantly decrease the sorbent lifetime and increase the cost of capture if contaminant pre-treatment at very low level is required (< 2 PPM).

Particulates that can contaminate or block the active adsorbent material.
Metal Organic Framework (MOF)

Calf-20 – Zinc 1,2,4-Triazolate Oxalate

- Structure from Rietveld – crystals have never grown
- 3-D channels comprising 38% of the volume, ~500 m²/gm surface area.
- Pores (vdW radii) of 2.73 × 2.91, 1.94 × 3.11, 2.74 × 3.04 Å ([100], [011], [0-11])

Taylor, Vaidhyanathan, Lin, Mah, Dawson, Iremonger, Deakin, Shimizu
Patent awarded and licensed for post-combustion and air capture.

This MOF has very special properties:
High volumetric and gravimetric CO₂ capacity
Stable to water (liquid, steam)
Stable to O₂ up to 140C
Easily scalable (low cost)
Easy to process in a laminate
More stable to NOx and SOx
Metal Organic Framework (MOF) – Oxidation stability

Dry Air cyclic test at 110°C (each cycle: 1hr at 110°C, followed by measuring CO2 uptake at 50°C, at 15% CO2)

- Typical advanced amine-immobilized solid adsorbent
- Svante MOF

This MOF material is showing complete stability to dry O₂ up to 150°C
Svante’s technology uses low pressure steam to directly regenerate the adsorbent due to a fast temperature increase of the bed.

Short cycle time increases the productivity of the process decreasing the required adsorbent and makes CO₂ capture more economical.
Project CO$_2$MENT – Phase 1 Operational

**PHASE 1**
in operation since Nov. 2019

**Contaminants Pre-treatment System (CPS)**

- Understand and measure cement plant flue gas
- Assess Svante's guard bed performance
- Provide controlled contaminants to Phase 2 for sensitivity analysis

**Flue gas from Lafarge**

**Pre-treated gas**

**Chemical scrubber system**

**FTIR Analyzer**

**Guard bed skid**

**Chemical storage**

**Wastewater storage**

16.5 m

8.5 m
Project CO₂MENT – SO₂ and NO₂ before & after liquid scrubber

It was possible with this liquid scrubber to decrease the SO₂ < 2 PPM.
Project CO₂MENT – Guard Bed Scrubbing

Guard Bed NOx/SOx Breakthrough Test Curve

Svante proprietary guard beds will be used to control the amount of NO and NO₂ going to capture plant liquid scrubbers will be used for SO₂ control.
Project CO₂MENT – 1TPD Phase 2 MOF Capture Plant

PHASE 2
start-up in December 2020

CO₂ Capture
~1TPD skid unit

- Test new Metal Organic Framework adsorbent
- Test new Rotary Adsorption Machine (RAM) design
- Test new Waste Heat Recycle process cycle
- Assessment of plant efficiency and durability

Flue gas from Phase 1

Svante's RAM
BoP
Steam Generator

12.2 m
3.3 m
2.5 m
Project CO$_2$MENT – 1TPD Phase 2 MOF Capture Plant

Pre-Treatment System & Capture Plant

RAM
Major Improvements Over Time

- Adsorbent stability has improved dramatically through adsorbent and cycle development
  - Better stability to liquid water
  - Less sensitive to oxidation
  - Cycle development designed to avoid/minimize degradation conditions

- Bed autopsy after testing provides feedback for adsorbent development, bed build, mechanical, etc.

Improvement of Adsorbent Stability Over Time

Change in KPIs over Time (Compared to First Day Performance)
Testing of CALF-20 SAB filter beds in a full 48-bed configuration and with a waste-heat recycle cycle implemented began on May 4, 2022, after ~100 hours of cycle tuning and run-in.

The Richmond field demonstration has demonstrated the 2022 performance KPI targets of a simultaneous achievement of a steam ratio of <1.5, CO₂ purity >95% and CO₂ recovery >90%.
Richmond Cement CO2 Utilization Options

- The vision for Richmond is to establish an innovation hub, to scale Svante’s capture technology and trial a small cohort of promising utilization technologies to ensure long term removal or displacement of the CO2 from the atmosphere in alignment with Lafarge’s Sustainability Goals.

- Ideal technologies would provide a long term commercial benefit for Lafarge

- The CO2MENT Project has advanced at Richmond to consistently capture 1 tonne/CO2 day. Over the course of the last year, a variety of clean technologies for CO2 utilization have been assessed considering captured CO2 as a feedstock. Capture remains a priority to achieving net-zero.

- Demonstration of technologies in an industrial environment will enable future investment decisions in support of net-zero goals and decarbonization of the cement manufacturing process. This approach will also open doors for strategic partners and government funding applications.
## Summary of Technologies

<table>
<thead>
<tr>
<th>Company</th>
<th>Proposal</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Upcycling</td>
<td>Reactor (200t/day) to use flue gas CO2</td>
<td>&gt;6 months</td>
</tr>
<tr>
<td>Dimensional Energy</td>
<td>Pilot at RMD to produce syncrude, to transfer to Parkland for production of diesel and sustainable aviation fuel</td>
<td>6-12 months</td>
</tr>
<tr>
<td>Windset Farms</td>
<td>Utilize captured CO2 at Greenhouses in Delta (*requires liquefaction trailer)</td>
<td>6 months</td>
</tr>
<tr>
<td>Svante</td>
<td>*Liquefaction Trailer</td>
<td>5 months</td>
</tr>
<tr>
<td></td>
<td>Scoping Study for increased capture</td>
<td>6 months</td>
</tr>
<tr>
<td>Blue Planet</td>
<td>*Liquefaction Trailer - Providing liquefied CO2 from Lafarge for testing</td>
<td>6 months</td>
</tr>
</tbody>
</table>