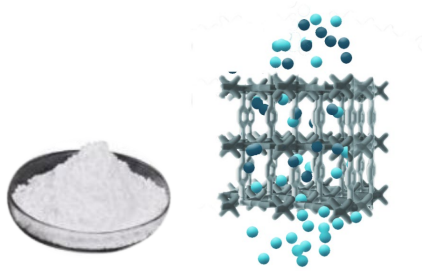
Svante

Introduction to Svante

DOE Cement and Lime Decarbonization Workshop

19-07-2023

Meet the Svante Carbon Capture Ecosystem

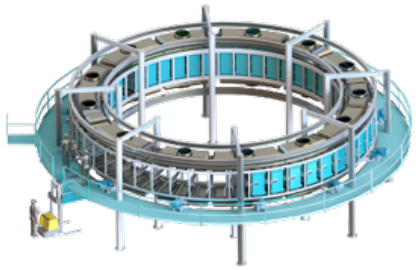


Solid Sorbents

Engineered to have high selectivity over water & high capacity for CO_2.

Carbon Capture Filters

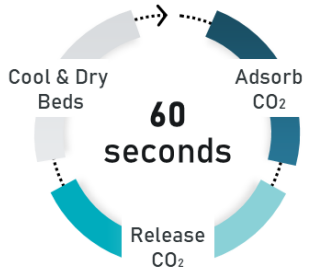
Solid sorbents laid onto thin sheets of film & stacked to create a filter.



Rotary Adsorption Machines

Compact, low-cost rotary contactor equipment

Modular, repeatable filter design enables mass scalability



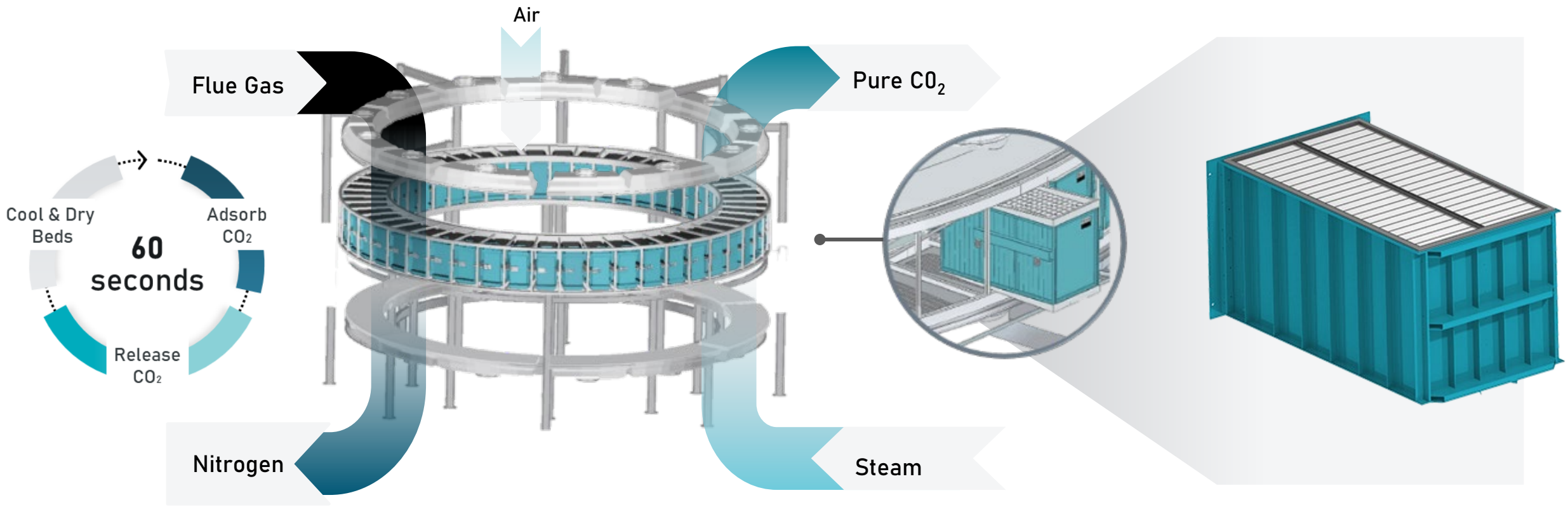
VeloxoTherm™ Process

Continuous process captures CO2, releases it with low pressure steam & prepares filters to capture CO2 again.

Svante

Rotary Adsorption Machine (RAM) & Carbon Capture Cycle

Svante CO_2 Capture System (Exploded View)



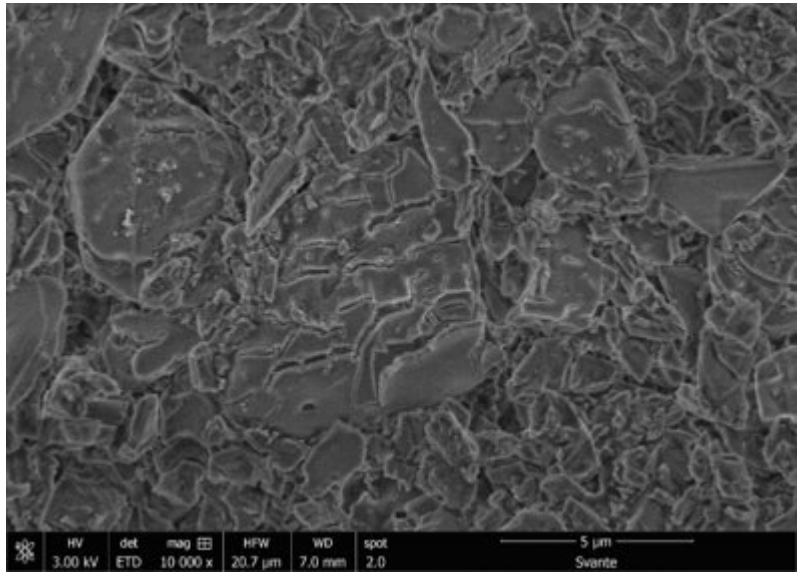
Svante

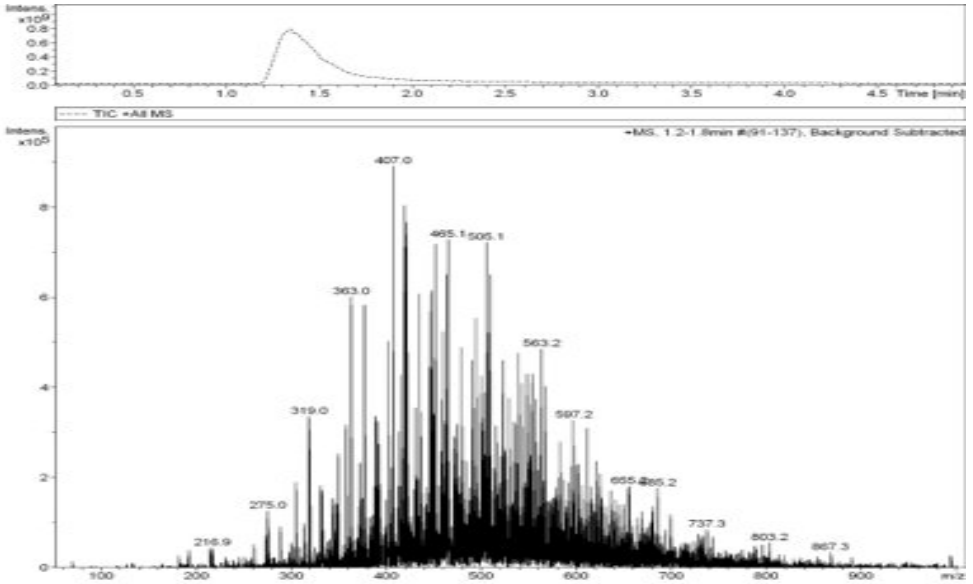
Svante

Environmental impact testing results on Svante technology

Degradation of CALF-20, fundamentals

- **Chemical stability of CALF-20 makes the creation of secondary emissions highly unlikely**
- **To investigate the potential emission of nitramine and nitrosamine compounds from the matrix of the highly NOX-exposed laminate, a suitable organic solvent (MeOH) was used to extract these compounds.**
- **The analysis of the extractives using ESI-MS and FTIR did not reveal any detectable nitramine or nitrosamine compounds**





Svante

Lafarge Richmond CO2MENT Pilot Plant

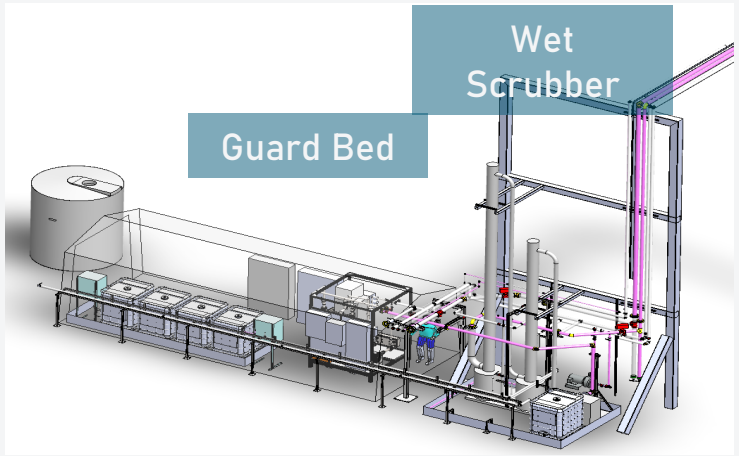
Overview

Capacity – 250 tpa **Source** – Cement Kiln **Partners** – Lafarge Canada – TotalEnergies **Status** – In Operation

PHASE 1

Pre-treatment

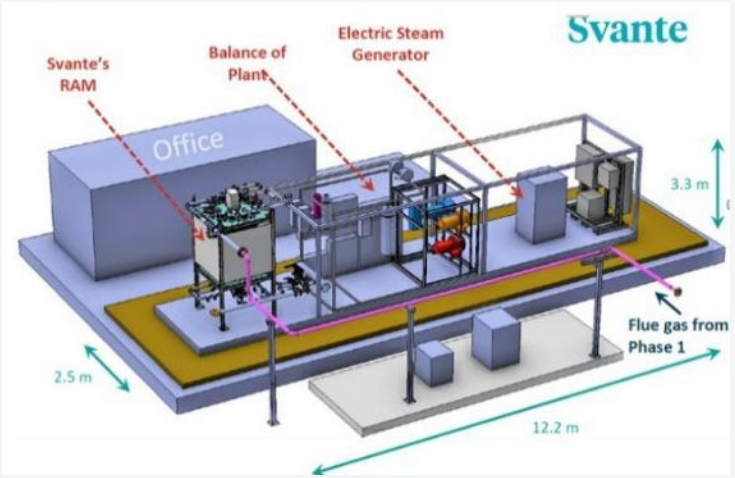
Manage **harmful organic and inorganic** substances in the cement flue gas by **measuring and qualifying** the effect of a contaminant mitigation system.



PHASE 2 - CURRENT

CO_2 Capture

Separate the **CO_2 from the flue gas** using a customized-for-cement version of Svante's carbon capture technology. Three major components: **RAM, BOP and Boiler**



PHASE 3

CO_2 Utilization

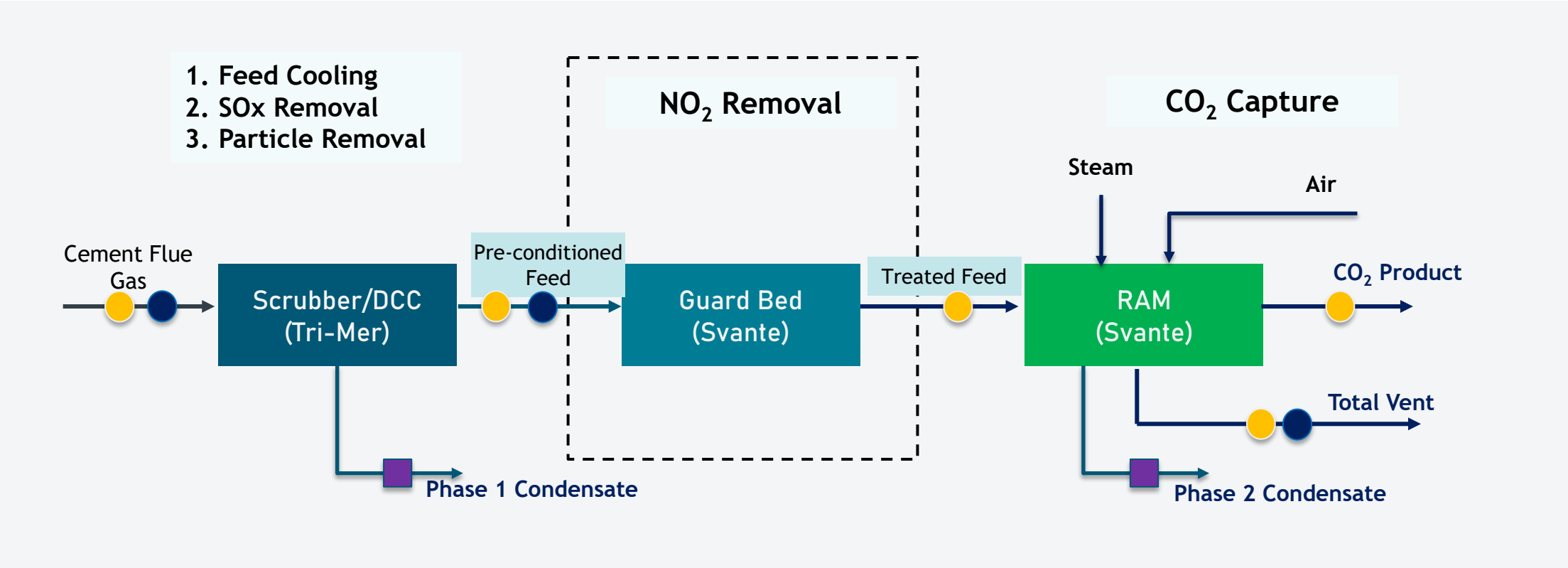
Prepare **CO_2 for reuse** and support the demonstration of **CO_2 conversion technologies** on-site such as **low-carbon fuels** and **CO_2-injected concrete and fly ash**

Dimensional Energy

Svante

CO2MENT – Contaminate Monitoring During Normal Operation

Emission Analysis for MOF adsorbent for Cement flue gas

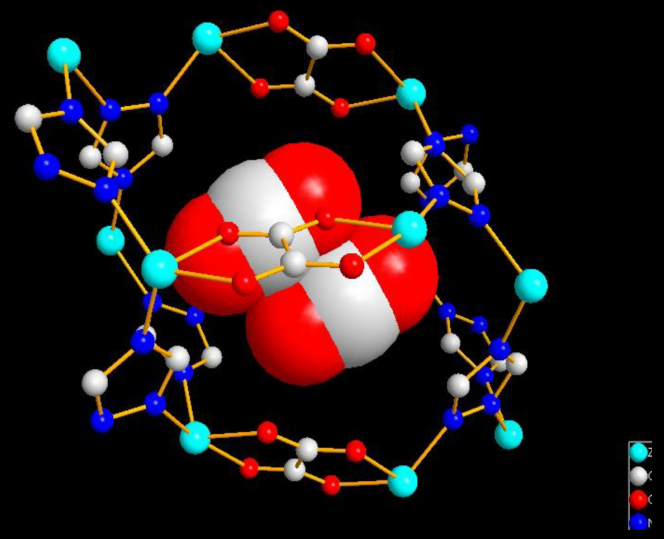


Svante

Environmental impact testing results Svante technology

CALF-20 MOF

Metal framework (Zn)
Organic ligand (oxalate)
Not amine based (physisorption)



At 1.00 atm pressure, the main CO_2 binding site is between the oxalate groups.

- More than 4000 operating hours testing done at Lafarge Richmond CO2MENT Pilot Plant
- Process doesn't involve additional chemicals or hazardous material; only steam and ambient air are used
  - No new components detected in the CO_2 product or total vent streams
- Svante's adsorption filters can allow fine particles to pass through without damaging or degrading CO_2 capture process. Further characterization is ongoing.
- Additional testing taking place at Chevron Demonstration Plant

No secondary emissions measured in any of the test campaigning on Cement Flue Gas

Svante

LH Portland Cement Scoping Study

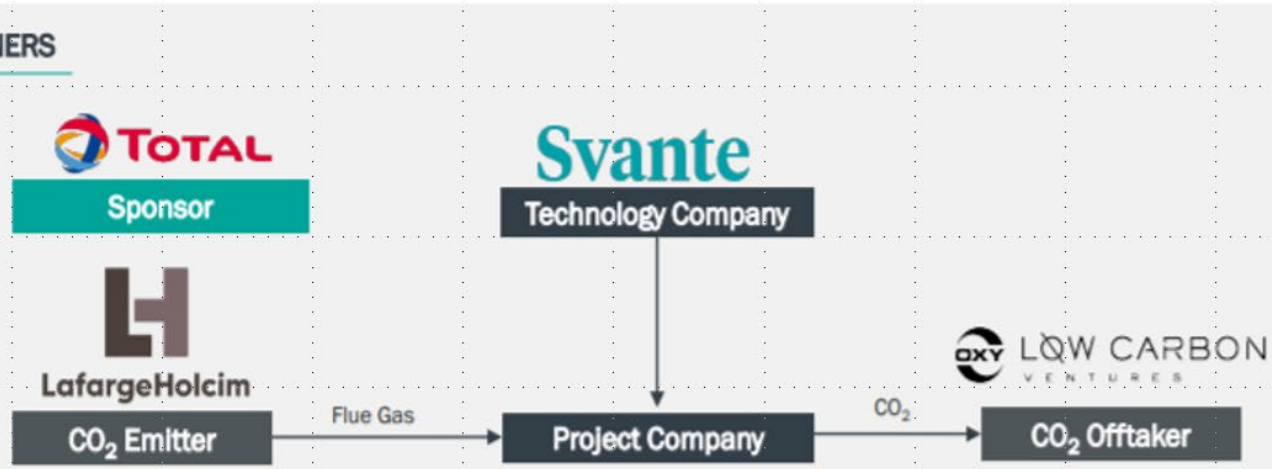
DOE “LH CO2MENT Colorado Project”

Scoping Study Consortium

Joint study to assess the viability and design of a commercial-scale carbon capture facility

Plant Scale:	~5000 tonnes/day ~1,500,000 tonnes/yr
Source & Location:	Cement Kiln flue gas, LH Portland Plant Florence, Colorado, US
Scope:	Capture Plant, utilities, compression and product tie-in, pipeline

PARTNERS



TECHNOLOGY COMPANY
SVANTE

Role Developer of the second generation carbon capture technology Project Delivery

SPONSOR
TOTAL S.A.

Role The learnings from this study will help pursue their commitment to the commercial development of CCUS

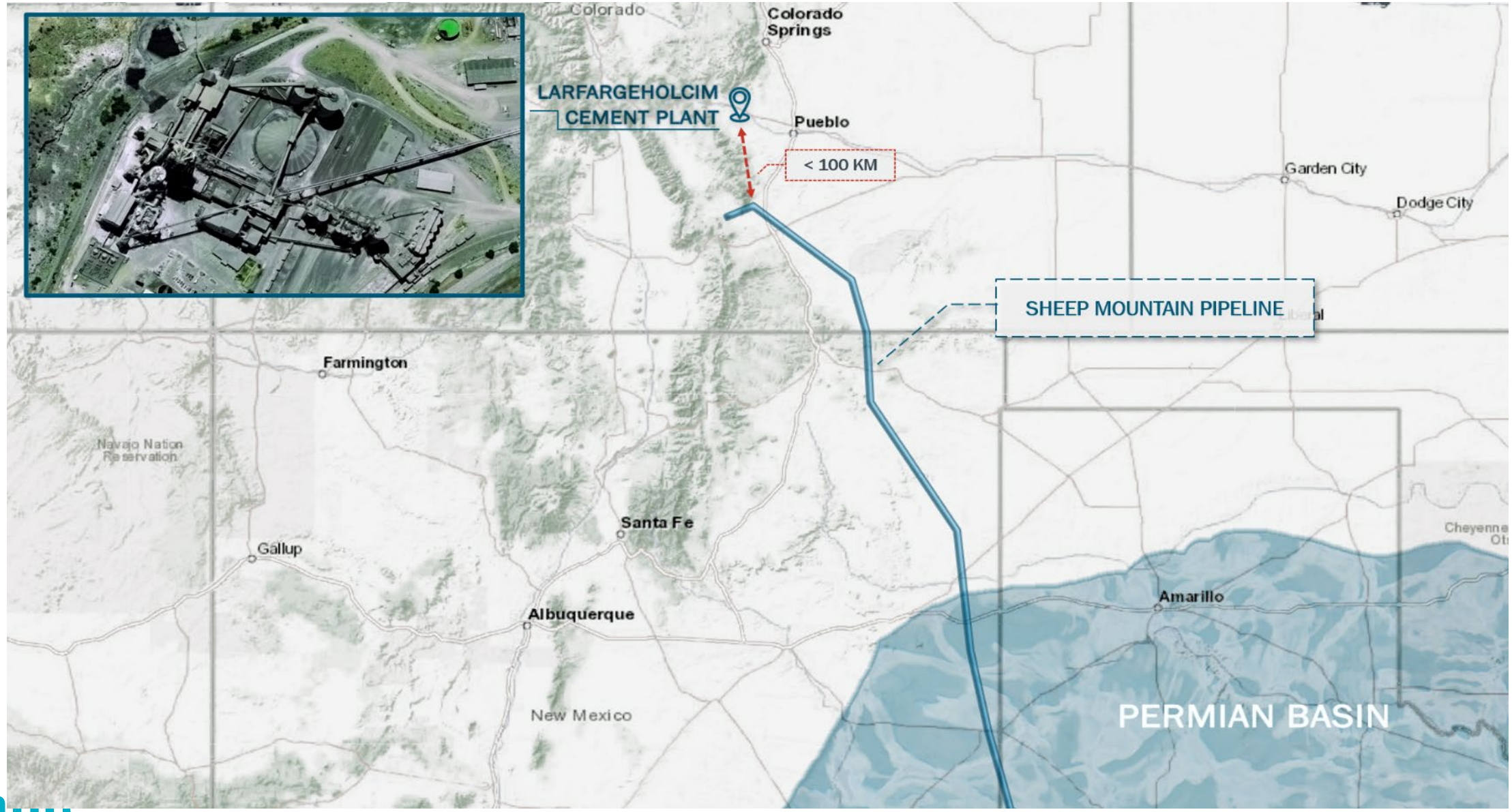
CO_2 EMITTER
LAFARGEHOLCIM

Role As the CO_2 emitter, the project will reduce CO_2 emission from its cement plant

CO_2 OFFTAKER
OXY LOW CARBON VENTURES

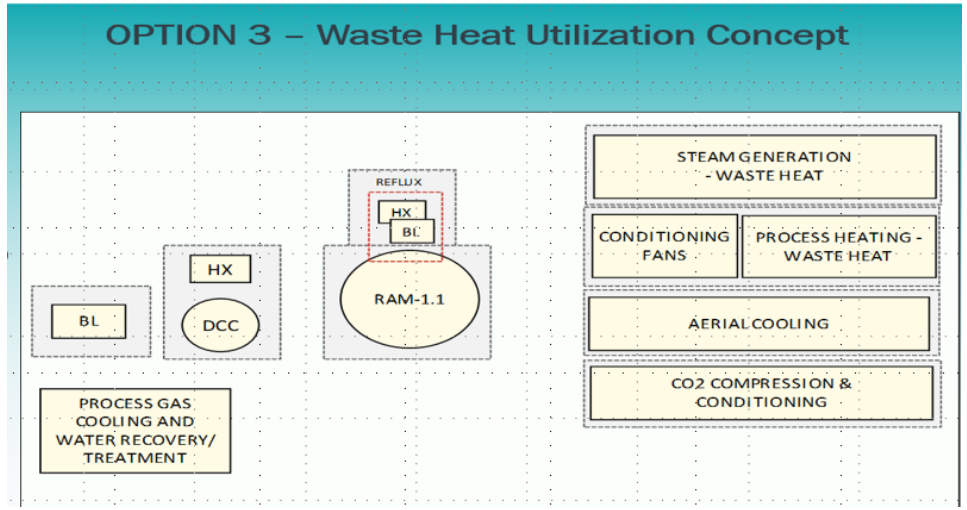
Role The industry leader in CO_2 management and storage. Transport and sequester the CO_2.

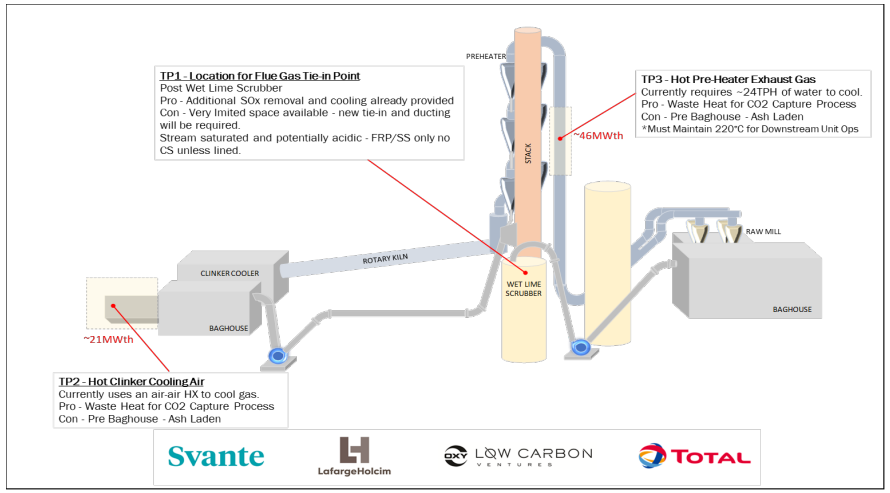
Background – **Pipeline, Permian Basin & Aerial Photo**



Option 3, Basic concept

- Only use identified heat integration possibilities at Holcim Portland Plant
- Thermal Heat integration options included
  - Pre-Heater Exhaust Gas (at 375°C)
  - Clinker Cooling Air (at 245°C)
- Use of Vacuum regeneration concept allow use of low heat value streams
  - Integration ISBL reduces the Energy requirement by up to 20 %
  - Integration with hot condensate streams from OSBL can decrease the required steam even further





Summary Concept 3 Slipstream capture

- Results of Portland Cement Scoping Study Concept 3

	CO2 Capture [tpd]
Original Line-Up	550
Vacuum Concept	920

- No requirement for any additional natural gas burning therefore no additional emissions

- Current Svante state-of-the-art line-up as operated at Chevron Demonstration plant allows for the capture of 20 % of CO2 emissions at Portland Cement without the need of additional steam, providing positive IRR under 45Q-only scenario, even at small scale

SUMMARY PROJECT RESULTS	
Project Perspective | Equity Basis with Est. Tax Benefits	
Levered NPV (After Tax, 8.00% @ 1-Jan-25)	$6.2
IRROE (levered IRR)	8.8%
Simple Payback Period	9.0 yrs

Svante

Svante Update and follow up work

- Chevron's Kern River Svante Pilot (25 TPD CO2) has started up successfully and optimization of operations is currently taking place (Cooperative Agreement No. DE-FE0031944) with the aim to:
  - Proof of scale up for Rotary Adsorption Machine (RAM)
  - Demonstration of performance parameters and validity of process simulation models
  - Proof of heat integration and vacuum regeneration

- Testing of 14 m BUCK in Edmonton Kiewit facility completing scale-up de-risking of Ursa 1000

Svante