CSLF PROJECT SUBMISSION FORM

PROJECT TITLE:

Richmond CO2MENT Project

PROJECT LOCATION:

Richmond, British Colombia, Canada

PROJECT GOAL:

The project goal is to capture carbon from a hard-to-abate sector and reutilize the CO_2 in a circularly economic form.

Essentially, the project separates the CO_2 from the cement facility flue gas using a customized-for-cement version of Svante's carbon capture technology.

PROJECT OBJECTIVES AND ANTICIPATED OUTCOMES:

Phase I: 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 II: CO_2 Capture

- Separate the CO_2 from the flue gas using a customized-for-cement version of Svante's carbon capture technology

Phase III: 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. The phase III focuses on demonstrating different options of utilization and plans to use all the CO_2 captured in those processes.

PROJECT DESCRIPTION AND RELEVANCE (non-technical):

Project CO2MENT is utilizing Svante's CO_2 capture system and will be testing a selection of CO_2 utilization technologies such as CO_2-injected concrete and fly ash at Lafarge's Richmond, British Columbia (BC), Canada cement plant over a four-year period of 2020-2023. The project, led by Svante, is a partnership with Lafarge Canada Inc., a member of the global building materials group, LafargeHolcim, CCP and TOTAL, all leading global energy companies.

The CO2MENT project will tackle the main challenges of flue gas contaminants pretreatment, CO_2 capture, and CO_2 reuse. Svante will develop and demonstrate a customized-for-cement version of Svante's carbon capture technology at pilot scale and accumulate learnings leading to large scale implementation; contaminants and particulates management, CO_2 capture and reuse as cement flue gas also approximates Fluid catalytic cracking (FCC) and Steam methane reformer (SMR) flue gases.

The project will add to the global body of CCUS knowledge by enabling a hard-to-abate sector to transition to a net-neutral carbon future. The project intends to provide the cement industry a commercially viable way to capture large-scale CO_2 emissions from existing infrastructure at half the capital cost of traditional solutions and thus, making industrial-scale carbon capture a reality today.

PROJECT DESCRIPTION (technical):

The CO2MENT project has been operational since late 2019 on the Lafarge Canada cement facility in Richmond capturing CO_2 from the actual cement flue gas, using Svantes's VeloxoThermTM CO_2 capture technology. This technology is based on intensified rapid cycle Temperature Swing Adsorption (RC-TSA) using a rotary machine to enable continuous flows. Svante developed and built the world's first VeloxoThermTM 1TPD unit, using a Metal Organic Framework (MOF) sorbent material CALF20for the CO2MENT project.

This demonstration project has enabled Svante to collect data to adjust and refine its technology. Therefore, the CALF-20 MOF sorbent has been qualified through different tests and demonstrations in an operational environment, raising the readiness level of the Svante's technology (TRL) to 8.

NOVEL ASPECTS OF PROJECT

Svante built the world's first VeloxoThermTM 1TPD unit for the CO2MENT project. For the first time, a Metal Organic Framework sorbent material CALF20 was successfully developed and used. This MOF is robust with regards to steam, O_2 and acidic contaminant gases (such as NOX/SOX) which make it an ideal candidate for the cement CO_2 capture application.

The CO_2 capture technology used on the Lafarge Canada cement facility has already been scaled-up to 10 000 tones per year (TPY) of CO_2 captured for an application on a natural gas boiler. To this day, Svante has demonstrated over 4.5 years (almost 9 000 hours) of operation at the 30 tons per day CO_2 Capture Plant at Cenovus Energy's Once Through Steam Generation (OTSG) in Saskatchewan.

Furthermore, a second CO2MENT project is currently under studies at the LarfargeHolcim cement facility. LH CO2MENT COLORADO would accelerate the implementation of a 1.5 million TPY and a first-of-a-kind (FOAK) at world scale, Svante VeloxoTherm^{TM} carbon capture plant. This project represents a quantum leap to a large-scale facility that will launch Svante's carbon capture technology into the next era of accomplishments and market acceptance. By completing the Front-End Loading (FEL) Feasibility Study Report (FEL-2) for a fit-for-purpose design at the LafargeHolcim (LH) cement plant, located near Florence Colorado in the USA, this technology can be proven as the future of large-scale deployment for carbon capture and storage.

The different regulatory framework in place in Canada's provinces and the carbon tax imposed by the federal government is acting as incentives for the industries emitting CO_2 to equip themselves with such a technology. Combined with different funding coming both from the public and private space, it enables Svante's business case in Canada. Investment tax credit is available for carbon capture utilization and storage (CCUS) projects to the extent that the CO_2 captured is permanently stored in geological storage or stored in concrete. This means using the CO_2 for enhance oil recovery (EOR) is not included for in the tax credit. The incentives tax credit rates are set at 60% for investment in equipment to capture CO_2 in direct air capture (DAC) projects, at 50% for all other CCS projects and 37.5% for investment in equipment for transportation, storage, or use of the CO_2.

In the United State, there is a law provision under section 45Q that provides industries that are reducing there CO_2 emission a tax credit. Currently the tax credits are set at $35 to $50 per ton for CCUS but there are proposed revisions that would increase the credit structure up to $60-$85 per ton for CCUS and $130-$180 per ton for DAC projects.

PROJECT TIMELINE:

- Phase 1: started in November 2019, a combination of liquid scrubber and solid structured adsorbent are used to remove most of the Nox/Sox from the cement flue gas in order to protect the CO_2 capture adsorbent from possible poisoning and reduce Sox/Nox release to environment.

- Phase 2: started in Q4 2020, Svante fabricated and installed a VeloxoTherm™ Rapid cycle TSA field testing unit (200 Series model) to capture 1 tonne of CO_2 per day from cement flue gas.

- Phase 3: starts in Q2 2022, industrial partners will use all the captured CO_2 as a raw material for transformation into useful products such as injection into concrete. It is of prime importance when CO_2 is captured in a region where CO_2 storage is not viable or is limited.

INFORMATION AVAILABILITY:

Project results and updates are being published through publications in conferences and books.

For instance, we have presented our technology and the project's results at the 15th International Conference on Greenhouse Gas Control Technologies, at the GHGT-15 that was held in late March 2021, at Abu Dhabi UAE we presented the Rapid Cycle Temperature Swing Adsorption Process Using Solid Structured Sorbent for CO_2 capture from Cement Flue Gas

Svante will also be attending the 16th International Conference on Greenhouse Gas Control Technologies, GHGT-16 conference this October 2022 in Lyon, France.

Finally, our technology update will be featured in *Carbon Dioxide Capture for Storage in Deep Geological Formations*, Volume 5 Chapter X PROJECT CO2MENT: CO2 CAPTURE FROM A CEMENT PLANT

PROJECT CONTACTS:

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Project site visits are possible but have to be scheduled by Svante.
All costs will be assumed by the visitor.

OTHER PROJECT PARTICIPANTS:

Svante : Carbon Capture Technology provider for carbon capture
Lafarge Canada: Host site, Cement factory.
Total Energies: Sponsor
CCP: partnership of major energy companies working to advance CO2 capture and storage (CCS) development for the oil & gas industry. The members are BP, Chevron, and Petrobras

Multiple utilization companies are in discussions to come on site including technologies that cure concrete with CO2, inject CO2 into fly ash, and use CO2 combined with hydrogen to create liquid fuels.

PROJECT WEBSITES:
https://svanteinc.com/2019/11/30/lafarge-canada-closer-to-canadas-most-carbon-efficient-cement-plant/

PROJECT NOMINATORS:
Delegates from at least two CSLF Member countries must inform the CSLF Secretariat (cslfsecretariat@hq.doe.gov) that they support the nomination of the project for CSLF recognition.

CSLF Project Elements Checklist

(Please check all of the following areas that your project will address.)

GENERAL

Project Scale	
Feasibility	√
Pilot	√
Demonstration	√
Commercial	√

CAPTURE TECHNOLOGIES

Capture Type	
Pre-combustion capture	
Post-combustion capture	√
Oxyfuel combustion	
Industrial applications	√
Technology	
Advance the capture technology	√
Advance plant design for capture efficiency (e.g., boiler, turbine design)	√
Improved fuel handling and air separation processes technology	
Improved combustion and flue gas science	
Advance purification and compression technology	√
Polygeneration optimization	

TRANSPORT

General	
Tanker Transport	
Pipeline Transport	
Ship transport	
Specifications for impurities from various processes	
Regulations, standards and safety protocols, including response and remediation	

STORAGE AND MONITORING

Storage Complex Type	
Saline formations	
Unconventional reservoirs (e.g., basalt, shale)	
Unmineable coal formations	
EOR and/or EGR	
Depleted oil and gas fields	
Storage complex characterization	
CO_2-water-rock (or coal) interactions	
Impact of the quality of CO_2 on storage	
Improved modeling of complex	
Effects of CO_2 rock/water interactions and induced changes in temperature, pressure and stress on permeability, injectivity, migration, trapping and capacity.	
Pressure management (e.g. production of formation water)	
Monitoring the storage complex including risk assessment	
Development of new or improved CO_2 monitoring technologies	
Improve baseline monitoring and distinguish between natural and anthropogenic CO_2	
Development of risk minimization/mitigation methods and strategies, including leakage	
Improve well integrity, well abandonment practices, and/or remediation of existing wells	

CSLF Project Elements Checklist

(Please check all of the following areas that your project will address.)

CARBON UTILIZATION TECHNOLOGIES (MUST PROVIDE A VALID LCA INDICATING ACTUAL NET REDUCTION COMPARED TO A BASELINE)

Utilization Type	
Thermochemical	
Electrochemical	
Mineralization	
Biological	
Technology	
Advance catalysis	
Advance electrochemistry	
Process intensification	
Mineralization-building materials	
Mineralization-novel designs	
Mineralization-increased CO2 uptake	
Biological-Algae-open system	
Biological-Algae-closed system	

CARBON DIOXIDE REMOVAL TECHNOLOGIES (MUST PROVIDE A VALID LCA INDICATING ACTUAL NET REDUCTION)

CDR Type	
Direct air capture (DAC)	
Bioenergy with CCS	
Mineralization (Surficial and Ex Situ)	
Technology	
DAC-solid sorbent	
DAC-solvent	
DAC-Novel or hybrid	
BECCS-power	
BECCS-fuels and chemicals	
Mineralization-mine tailings and wastes	
Mineralization-minerals	
Mineralization-Improved kinetics	
Mineralization-processing	
Mineralization-products	