

## An Innovative Process for the Direct Utilization of CO<sub>2</sub> in Solid Synthetic Pozzolan Production | IEDO

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# Project Outline

**Innovation:** An innovative process for direct utilization of CO<sub>2</sub> in solid synthetic pozzolan production

**Project Lead:** Solidia Technologies, Inc.

**Timeline:** July 1, 2021 - March 31, 2023 (100% complete)

**Budget:**

	Budget Period 1			Budget Period 2			Total Planned Funding	
	FY21	FY22		FY23				
	<i>Jul - Sep</i>	<i>Oct - Dec</i>	<i>Jan - Mar</i>	<i>Apr - Jun</i>	<i>Jul - Sep</i>	<i>Oct - Dec</i>		<i>Jan - Mar</i>
<b>DOE Funded</b>	\$ 249,415	\$ 133,582	\$ 266,803	\$ 215,777	\$ 587,731	\$ 345,459	\$ 268,391	\$ 2,100,000
<b>Solidia Cost Share</b>	\$ 63,135	\$ 33,814	\$ 67,537	\$ 54,620	\$ 148,774	\$ 87,447	\$ 67,939	\$ 532,626

**End Project Goal:**

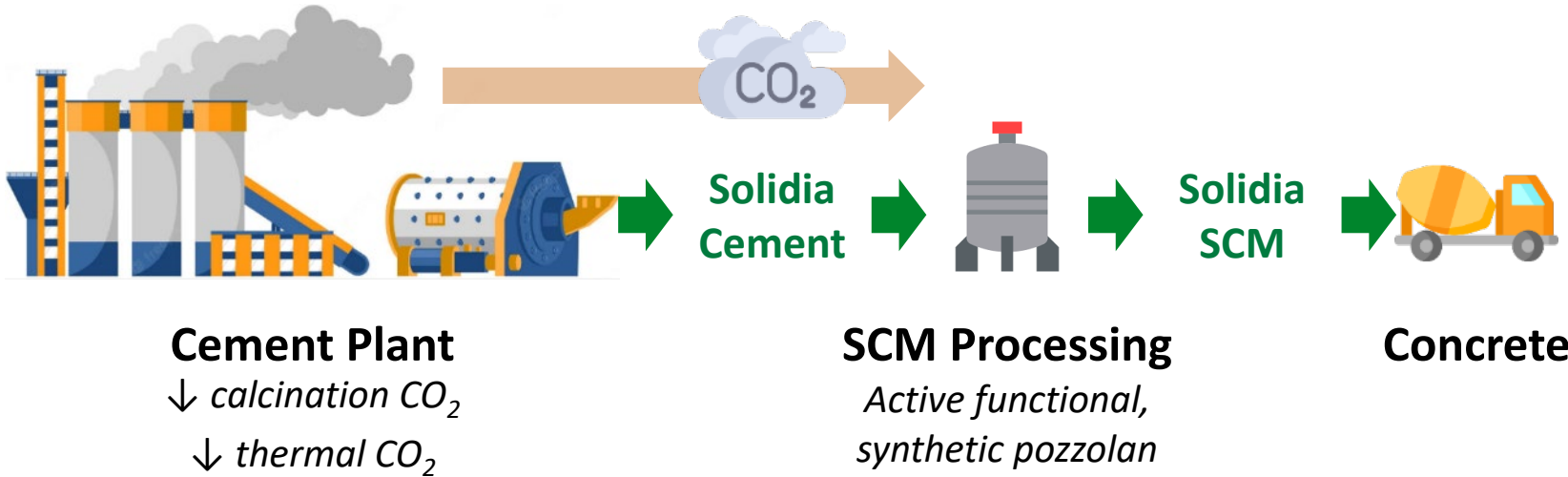
1. Develop a process for producing a solid synthetic pozzolan through direct capture, utilization, and storage of CO<sub>2</sub> from the flue gas stream of an operating cement plant through reaction with Solidia Cement®, a non-hydraulic cement, without any disruption to the clinker production process
2. Use the carbonated Solidia Cement as a supplementary cementitious material (SCM) in concrete with comparable or superior performance to concrete with traditional SCMs such as fly ash and slag cement

# Strategic Approach

**REDUCE** CO<sub>2</sub> Emissions

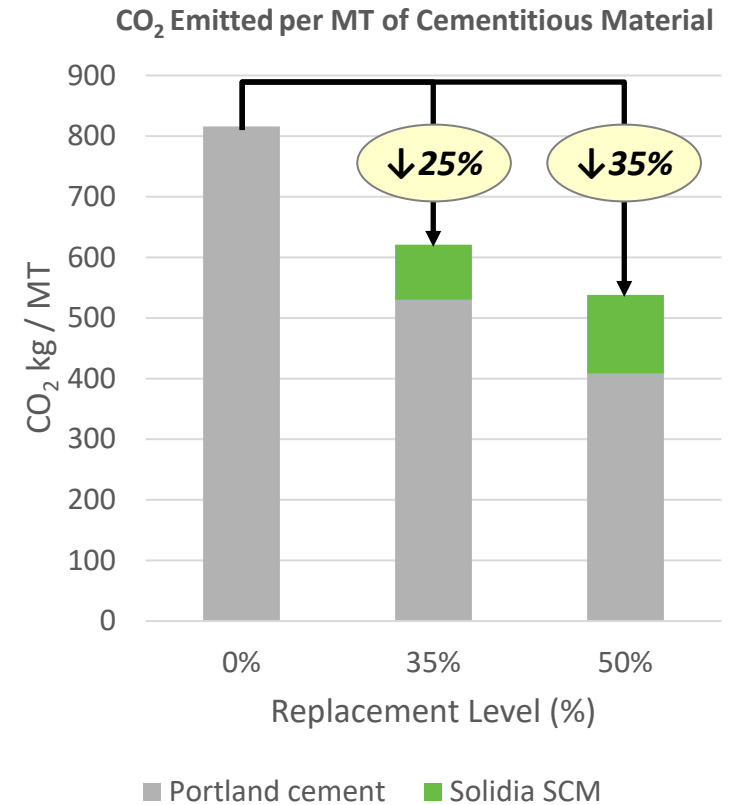
**USE & STORE** Waste CO<sub>2</sub>

**AVOID** high embodied CO<sub>2</sub>



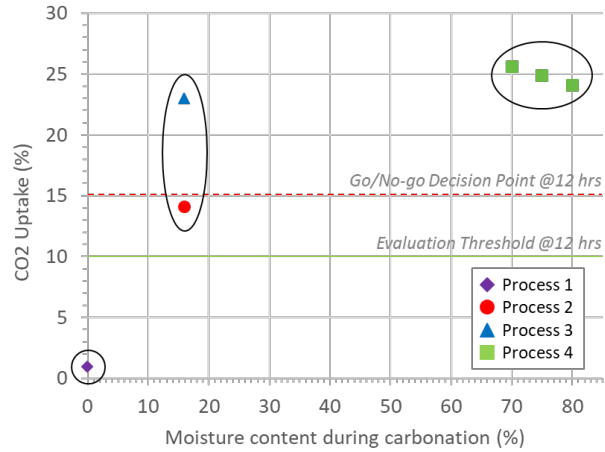
- Fundamental process development**
- carbonation
  - flue gas utilization

- Product Performance Validation**
- workability
  - strength & durability

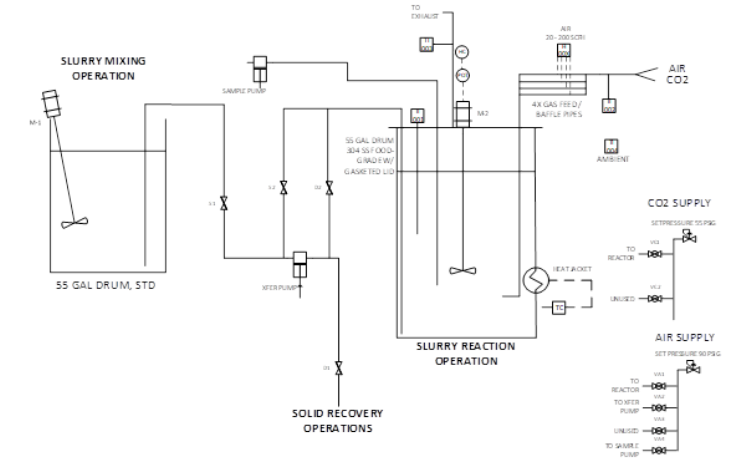


# Results and Achievements

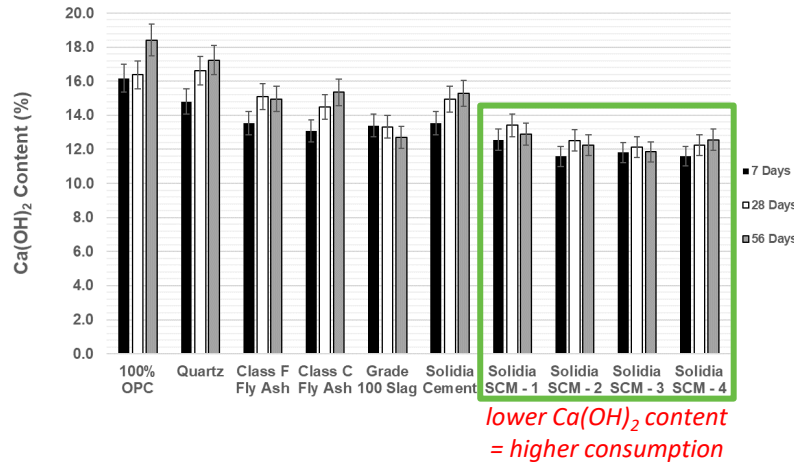
**Carbonation:** Two methods meet CO<sub>2</sub> uptake and time thresholds



**Process:** Designed a slurry reactor



**SCM Viability:** The resulting product has high pozzolanic activity

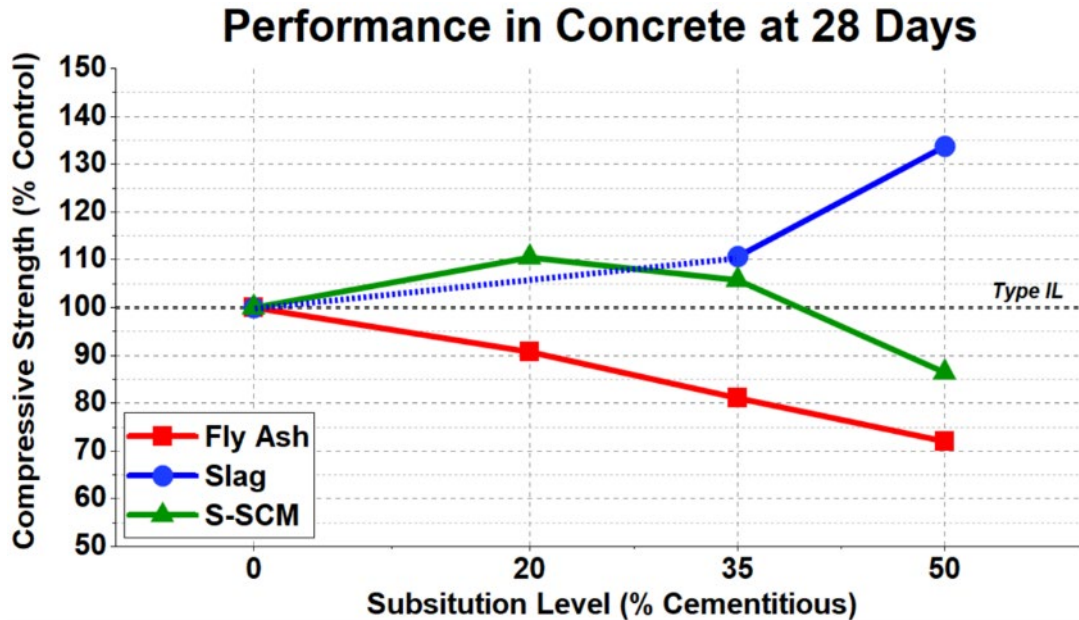


**Production:** Built the batch reactor



# Results and Achievements

Comparable performance to traditional SCMs



**Type II Cement**  
Lean mix 460 lbs/yd<sup>3</sup>  
Concrete W/C = 0.45  
Slump target 6 ± 1 inch

**Compressive Strength  
of Control**  
1 day : 2500 psi  
7 days: 4390 psi  
28 days 4860 psi

Confidence following suite of ASTM tests

- ASTM C1567: Alkali-Silica Reactivity (ASR)
- ASTM C1202: Chloride Permeability
- ASTM C1157 & C595: Sulfate Expansion
- *completing all tests per ASTM C1709*

# Future Work, Technology Transfer, & Impact

## Future Work:

- Commission large lab line at HQ to produce 1,000 MT per year of Solidia SCM to seed market (material qualification and trial pours with DOTs and ready-mix producers)

## Technology Transfer:

- Build pilot line at a cement kiln for direct utilization of flue gas CO<sub>2</sub> to produce and deliver Solidia SCM into the market
- Extend technology application to waste streams to reduce CO<sub>2</sub> footprint and expand market access (remove supply chain constraints)

## Impact:

- Grant provided access to critical resources (people, equipment, labs) necessary to conduct experiments, measure impact, and develop repeatable process and product
- Accelerated development to prove viability and instilled confidence in next phases of investment