

Special Report (sample) Front Runners in CO_2 Utilization (CO_2 -to-x) Technologies



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Source:pbs.org

INTRODUCTION

About this report:

- \checkmark Carbon utilization includes various pathways to convert carbon dioxide (CO₂) into valuable and economic products (also known as CO₂-to-x) to bring CO2 back in the loop in a sustainable manner.
- This report aims at providing a comprehensive overview of leading players (either service providers or product manufacturers) active in CO₂ utilization technologies. These players can be start-ups and middle scale companies having their proprietary CO2-to-x technology. Well established companies, conglomerates, research institutions and laboratories have not been captured in this report.
- \checkmark Scope of the report covers products such as fuel and gases, chemicals, plastics, cement and concrete, and textiles utilizing CO₂ as feedstock.
- ✓ Each company profile outlines the technology, financials, targeted market and intellectual property of the player. Further, a 20-point assessment within Aranca 5 Factor Assessment Framework has been provided for each player.

Relevant audience:

- ✓ Established companies and conglomerates willing to explore and acquire certain start-ups.
- ✓ Venture capitalists (VCs), institutional and individual investors.
- ✓ In general, companies looking at commercialized CO2-to-x technologies

Customization:

Report contents can be customized based on user requirements. Accordingly, report coverage shall be reduced or expanded to the specific areas of interest.

REPORT OVERVIEW

40 companies actively working in the domain of sustainable material technologies since 2007



Comprises of novel carbon dioxide utilization pathways to curb the CO_{2} footprint



Holistic assessment in terms of IP, technology, financial, ecosystem and organization



Technology developers and manufacturers range from start-ups to potential disruptors*



In depth analysis and key observations for each company based on Aranca's 5 factor assessment framework



Information covered on each company

Company information

- ✓ Website, year of establishment, headquarters, key personnel, etc.
- ✓ Size (employee count, revenue, funding, etc.)
- ✓ Awards and recognition

Technology

- ✓ Technology readiness level (TRL)
- ✓ Feedstock, conversion process and output
- ✓ Patents and research collaborations

Commercialization

- ✓ Applications and markets
- ✓ Product details (form, chemistry, trade name, etc.)
- ✓ Business partnerships, investments

*Players with diversified business portfolio are excluded.

HIGHLIGHTS



RESEARCH METHODOLOGY

Methodology

- A comprehensive search was performed on various platforms to map the relevant technology developers. Mapped entities were scrutinized for relevancy based on technology and product offerings.
- Corporate players and entities having diversified portfolios with partial focus on direct application of CO₂ were excluded.
- Focused secondary research was conducted for the relevant players in order to capture relevant information. In order to fill the gaps existing after this, primary research was conducted wherever necessary.
- Entities with establishment year 2005 onwards have been considered, however, this has not been considered strictly in order to capture all significant players.
- Each relevant player was evaluated on five important factors namely intellectual property, technology, financials, ecosystem and organization (refer Aranca 5 Factor Framework for more details).

Information Sources

Following paid and public sources of information were referred (not exhaustive):

- Company websites, product brochures and news/media sections
- Specific publications/magazines on carbon dioxide utilization pathways
- Other commercial databases such as Factiva, Crunchbase, Pitchbook, Bloomberg and EMIS to capture/validate companyspecific information
- Patents on databases such as Questel Orbit
- Scientific literature published on databases such as ScienceDirect, ResearchGate, Scopus, SpringerLink and Wiley Online
- Aranca internal knowledgebases and industry experts

ARANCA 5 FACTOR ASSESSMENT FRAMEWORK

Factor	Parameter	Score (1−5); higher is better	Min	Max	
Intellectual Property	No. of Patents Forward Citations Patent Status		3	15	Notes: Total score is obtained by
Technology	Novelty Scope Scalability Competitiveness TRL		5	25	 adding the individual factor scores. For uniform representation, final score is normalized on a 0-100 scale and factor scores are adjusted accordingly.
Financials	Total Funding Funding Rounds Type of Investor No. of Investors Revenues		5	25	
Ecosystem	Target Industry Size Policies & Regulations Environmental Impact		3	15	
Organization	Global Presence Employee Size Active Years Awards/Recognition		4	20	

adding the individual factor scores.

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Product-wise List of Companies (Illustrative; overall 40 companies are covered)



Sample Company Profile



Solidia Technologies developed a scalable technology to manufacture sustainable construction and building materials (such as cement and concrete) with atmospheric carbon dioxide. The products are sustainable, cost effective and provide performance at par with conventional ones.



Technology

- Feedstock: CO₂, water, minerals
- Process: Low Temperature Solidification (LTS)
- Key products: Concrete and cement
- TRL: Matured



Financials

- Total revenue: \$ 10 mn to \$ 50 mn
- Total invested amount: \$ 27 mn
- Investors: Venture capitals and major players from same domain



Operating locations

- R&D center in New Jersey, USA
- Manufacturing facilities in USA and Europe



Applications

Building and construction industry

Note: Scores have been normalized on a 0-100 scale. Detailed analysis has been provided in the next slide.

Aranca 5 Factor Assessment

Organization

100 90

60

40

20

0

80

Financial

Ecosystem 85



86/100

Technology

90

Intellectual

Property

94

Aranca View

- > The company has developed strong expertise in eco-friendly cement and concrete manufacturing over the years in conjunction with IP, financial and collaborations aspects
- > Its technology has been hailed as game-changing for the building and construction sector and has won many awards.

Sample Company Profile



Aranca 5 Factor Assessment



<u>ه</u> د		Criteria	Low	2	Score	High	Total
Intellectual Property	Strong IP portfolio with 35 patentsStrong geographical coverage	No. Of Patents Forward Citations Patent Status					14
Technology	 Backed with mature technology Technology allows the use of waste CO₂ for manufacturing of cement having lower emissions which then can be modified in to affordable concrete 	Novelty Scope Scalability Competitiveness TRL					21
Financial	 Funding received from Venture Capitalists in Series C rounds 	Total Funding Funding Rounds Type of Investor No. of Investors Revenues					20
Ecosystem	 Solidia has attracted many companies from building and construction domain since the products are benefiting the environment and are cost effective 	Target Industry Size Policies & Regulations Environmental Impact					12
Organization	 Received many awards since inceptions Increasing activities in European and USA markets 	Global Presence Employee Size Active Years Awards/Recognition					19



Backed by its innovative technology, Solidia has recorded significant growth through its business collaborations in the construction industry

Patents		 Total 35 novel patents families, mostly granted Significant geographical protection Patents relate to curing systems and methods to incorporate carbon dioxide for manufacturing of various products
Financial		 Received funding from US Department of Transportation's Federal Highway Administration, EU LIFE Program, Concrete Industry Research Centre (CERIB), etc. Supporting universities like Rutger's University, Purdue University, Ohio University, etc.
Research and Development	5	 The company produces Solidia Concrete[™] and Solidia Cement[™] The current research emphasis are optimizing the complicated process with artificial intelligence algorithm and advance machine learning tools
Collaborations		 LafargeHolcim, a Swiss building materials manufacturer, collaborated with Solidia Technologies to lower the CO2 emission and to develop innovative solutions for sustainable materials production EP Henry, the leading manufacturer of unit concrete products in North America, collaborated with Solidia to manufacture ow-

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Joint Ventures and Partnerships







BUSINESS RESEARCH & ADVISORY



INVESTMENT RESEARCH & ANALYTICS



VALUATION ADVISORY



TECHNOLOGY INTELLIGENCE & IP RESEARCH



PROCUREMENT & SUPPLY CHAIN INTELLIGENCE