THEFT Carbon Engineering

Carbon Engineering

Management Team



Adrian Corless CEO



David Keith Exec Chair / Founder

Susan Koch CFO

P-Ca process

Air Contactor

8 patents + 22 pending:

Low-CI fuel manufacture

Intellectual Property



Headquarters

SQUAMISH

Canada

SPX

Bill Gates

Murray Edwards



Investors / Partners



Team

- 22 employees
- Target ~35 by end-2017

Recognition



\$25 M Virgin Earth Challenge Finalist

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DAC: Direct Air Capture of CO₂



Inputs: Air, water, energy. DAC Output: Pure CO₂

storage, industrial use, or fuel production

Strategic and Transformative Technology:

- Negative Emission Technology
 - Can locate anywhere
- Manages emissions from any source, including legacy coal emissions
 - Highly scale-able

Compared to CCS:

- Higher thermodynamic barrier
- Larger air volume to be processed.

CE's DAC Technology







CE Squamish DAC Pilot Plant 2014-2016

Hardware Development History





2005: Spray Tower



2008: Packed Tower



2010: Lab air contactor



2011: Pellet Reactor Tests



2011-2012: Air Contactor Prototype



2013: Calciner Tests



2014-2015: Full end-to-end pilot plant 6



Broke Ground: December 2014 First Capture: June 2015



Project Structure





Project Objectives – Tasks 2 & 3



Overall Project Objectives



Cultivate a dilute source CO_2 DAC technology that can be applied to re-capture legacy coal-based emissions directly from the atmosphere



Develop a better understanding of DAC performance

Capitalize on CE's DAC Pilot Research Platform, research program and technical expertise to achieve the above objectives – DOE Project Tasks 2 & 3

Technical Activities: Budget Period 1 (Task 2)



2: DAC Applied Research and Development



Pilot Operations:

- 2.1: Sensitivity Analysis and Testing
- 2.3: System and Component Stress Testing



DAC Development and Enhancement:

- 2.2: Technology Research and Development
- 2.4: Sub-system Optimization

What programs leveraging CE's DAC Pilot Research Platform are available to deliver the above learnings? Technical Activities: Budget Period 2 (Task 3)

Carbon Engineering

3: DAC Applied Research and Development



Pilot Operations and Testing:*3.2: Long term effects*



DAC Development and Enhancement:

- 3.1: Application and Implications
- 3.3: Alternative Technologies Investigation: Solids



Technology Optimization:

3.4: Data Analysis and Ongoing Development

3.5: Synthesis of Results and Recommendations

Project Objectives – Tasks 4 & 5



Overall Project Objectives



Advance technological readiness of direct air capture system by developing better understanding of system costs through TEA



Develop commercial-scale specifications for major equipment through engagement with vendors

Leverage results from CE's DAC research platform pilot in Tasks 2 & 3 to deepen understanding of costs at commercial scales



4: Engineering Input for Scale-up and Cost Projections



Engineering Inputs to Scale:

4.1: Define performance characteristics for commercial scale up activities



Techno-Economic Assessment:

4.2: Preliminary TEA based on existing engineering and data



Commercial Readiness of DAC:

4.3: Major Equipment Specification and Vendor Engagement Technical Activities: Budget Period 2 (Task 5)

5: Engineering Input for Scale-up and Cost Projections



Engineering Inputs to Scale: 5.2: Design Basis for Commercial Scale-up



Techno-Economic Assessment:

5.3: DAC Applicability to Coal – Technology Assessment



Commercial Readiness of DAC: 5.1: Core engineering: 1st order commercial plant design 5.4: Gap and Deficiency Identification, Path Forward

Project Budget (BP1)



		Budget Period 1 2016/09/19 - 2017/09/30			
Project Schedule					
	Q1	Q2	Q3	Q4	
Task 1.0 - Project Management					
1.1 - Management					
1.2 - Reports					
1a - Annual Report					
Task 2.0 - DAC R&D, Ops, Testing, Optimization					
2.1 - Sensitivity Analysis & Testing					
2.2 - DAC Technology R&D					
2.3 - Stress Testing					
2.4 - Sub-System Optimization					
2a - Synthesis Data Log Complete			٥		
2b - R&D Results ready for Pilot Plant Input			٥		
Task 4.0 - Engineering for Scale-Up					
4.1 - Key Engineering Inputs					
4.2 - Preliminary TEA					
4.3 - Vendor Engagement					
4a - Updated PFDs and Vendor RFQs					

Project Budget (BP2)



Project Schedule		Budget Period 2			
	2017/10/07 - 2018/09/18				
	Q1	Q2	Q3	Q4	
Task 1.0 - Project Management					
1.1 - Management					
1.2 - Reports					
1b - Final Report					
Task 3.0 - Applied R&D, Testing, Analysis, Optimization					
3.1 - Enhancement Applications and Implications					
3.2 - Long Term Effects					
3.3 - Solids Research					
3.4 - Data Analysis and Ongoing Development					
3.5 - Data Preparation for Final Report					
3a - Identify Feasible Alternatives Path Forward	٥				
3b - Complete Long Term Effects Research					
Task 5.0 - Cost Projections and Applicability to Coal Stream					
5.1 - Technology Cost Projections					
5.2 - Commercial Scale-Up Design Basis					
5.3 - DAC Applicability to Coal - Technology Assessment					
5.4 - Gap and Deficiency Identification					
5a - Major Equipment Specs and Cost Model		٥			
5b - Engineering Assessment, Full Plant Cost Model					





More information is available at:

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