DE-FE-0031595
Project Overview

• “ION Engineering Commercial Carbon Capture Design & Costing”

• Project Period of Performance:
  May 30, 2018 – November 29, 2019

• Funding
  – DOE-NETL: $2,797,961
  – ION & Partners: $699,500
Budget Directive & Overall Project Objective

• **2017 Omnibus Appropriations Bill:**
  
  “The agreement provides $6,000,000 to support a new solicitation for initial engineering, testing, and design-related work for a commercial-scale, post-combustion carbon dioxide capture project on an existing coal-fueled generating unit. Within available funds, the Department shall provide to the Committees on Appropriations of both Houses of Congress an estimate of the costs required to fully retrofit such a unit.”

• **C3DC Project:**
  
  The overall objective of the project is to provide a detailed design and cost estimate for a commercial scale carbon dioxide capture facility retrofitted onto an existing coal-fueled power station. The project team will design and cost a 300 MWe slipstream capture facility for retrofit onto Nebraska Public Power District’s Gerald Gentleman Station’s Unit 2 (GGS).
ION’s CO₂ Capture Technology Development

ION is developing its technology by leveraging existing research facilities.

- **2010**
  - ION Engineering Lab-pilot
  - 0.01 MWe, $4M
  - Boulder, CO, USA

- **2012**
  - Univ. of N. Dakota EERC
  - 0.1 MWe, $2M
  - Grand Forks, ND, USA

- **2015**
  - National Carbon Capture Center
  - 0.5 MWe, $10M
  - Wilsonville, AL, USA

- **2016 - 2017**
  - CO₂ Technology Centre Mongstad
  - 12 MWe, $15M
  - Mongstad, Norway

- **2018 - 2019**
  - Design & Costing Commercial Retrofit
  - 300 MWe
  - Sutherland, NE, USA
Nebraska Public Power District

*Host Site – Gerald Gentleman Station*

- Located in Sutherland, Nebraska
- Largest generating station in Nebraska
- Two coal-fired units with total capacity of 1,365 MW
  - Unit 1 – 1979 – 665 MW
  - Unit 2 – 1982 – 700 MW
    - C3DC will be focused on Unit 2
- Fueled by Powder River Basin Coal
C3DC Project Team

External Stakeholders

U.S. DEPARTMENT OF ENERGY

NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

Koch Modular PROCESS SYSTEMS

Nebraska Public Power District

Always there when you need us

Sargent & Lundy LLC

TRI-STATE Generation and Transmitter Association, Inc.
ION Project Personnel

Principal Investigator (CEO)
Buz Brown

Project Manager
Jenn Atcheson

Chief Technology Officer
Erik Meuleman

Technical Lead (Sr. Director, Process Engineering)
Andy Awtry

Operations Engineer
Greg Staab

Process Engineering Analyst
Tyler Silverman
Project Overview

Summary of SOPO Tasks

• Task 1 – Project Management
• Task 2 – CO₂ Capture Island Design
• Task 3 – Balance of Plant (BOP) & Integration of Capture Island
• Task 4 – Supplemental Studies & Investigations
• Task 5 – Cost Estimating
• Task 6 – Reporting
Task 1 – Project Management

*Primary Organization: ION*

- **Subtask 1.1** – Monitor, Control & Communicate Project Status
- **Subtask 1.2** – Revision and Maintenance of the Project Management Plan
- **Subtask 1.3** – Financial, Administrative and Legal Management
- **Subtask 1.4** – Environmental, Health & Safety
- **Subtask 1.5** – Briefings and Technical Presentations
Task 2 – CO$_2$ Capture Island Design

Primary Organizations: ION & KMPS

- **Subtask 2.1** – Preliminary Design – ION & KMPS
  - Basis of design
  - Process Flow Diagrams
  - System description

- **Subtask 2.2** – Detailed Design – ION & KMPS
  - Process equipment design
  - Process control description
  - P&IDs
Task 3 – Balance of Plant & Integration of CO₂ Island

Primary Organizations: ION, S&L, NPPD

- **Subtask 3.1** – Preliminary Design
  - Overall Project Design Basis
  - Overall PFDs
  - BOP System Design Description

- **Subtask 3.2** – Critical Design
  - Overall Material & Heat Balances
  - Overall control description & architecture
  - Overall equipment list
  - BOP P&IDs
  - Foundation, sitework, ductwork, structural steel, pipe rack design
  - Overall General Arrangement Drawings
Task 4 – Supplemental Studies & Investigations

Primary Organizations: ION, S&L, NPPD

- **Subtask 4.1** – Steam and Electric Sourcing Study
- **Subtask 4.2** – Heat Rate Improvement Study
- **Subtask 4.3** – Solvent Disposal Investigation
- **Subtask 4.4** – Waste Water Treatment Study
- **Subtask 4.5** – Permitting Study & Review
- **Subtask 4.6** – Hazard and Operability Review (HAZOP)
- **Subtask 4.7** – Constructability Review
Task 5 – Costing

*Primary Organizations: ION, S&L, KMPS*

- **Subtask 5.1** – CO$_2$ Capture Equipment Pricing
- **Subtask 5.2** – Balance of Plant Equipment Pricing
- **Subtask 5.3** – Construction Costing
- **Subtask 5.4** – Project Indirect Costs
- **Subtask 5.5** – Operating & Maintenance Costs
Task 6 – Reporting

*Primary Organizations: ION, S&L, NPPD, KMPS*

- **Subtask 6.1** – Technology Maturation Plan
- **Subtask 6.2** – Techno-Economic Analysis
- **Subtask 6.3** – Final Detailed Design and Cost Estimate for a Commercial-Scale, Post-Combustion CO₂ Capture System
# Project Schedule

## C3DC Project Schedule

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
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<tbody>
<tr>
<td>Task 1</td>
<td>Project Management</td>
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<tr>
<td>Task 2</td>
<td>CO2 Capture Island Design</td>
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<tr>
<td>2.1</td>
<td>Preliminary Design</td>
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<td>2.2</td>
<td>Critical Design</td>
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<tr>
<td>Task 3</td>
<td>Balance of Plant (BOP) and Capture Island Integration</td>
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<td>Preliminary Design</td>
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<td>Critical Design</td>
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<td>Task 4</td>
<td>Supplemental Studies &amp; Investigations</td>
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<tr>
<td>4.1</td>
<td>Steam &amp; Electric Sourcing Study</td>
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<td>4.2</td>
<td>Heat Rate Improvement Study</td>
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<td>Hazard and Operability Review (HAZOP)</td>
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<td>4.7</td>
<td>Constructability Review</td>
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<td>Costing</td>
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<td>CO2 Capture Equipment Pricing</td>
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<td>Balance of Plant Equipment Pricing</td>
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<td>Operating &amp; Maintenance Costs</td>
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<td>Task 6</td>
<td>Reporting</td>
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<tr>
<td>6.1</td>
<td>Technology Maturation Plan</td>
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<td>6.2</td>
<td>Techno-economic Analysis</td>
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<td>6.3</td>
<td>Final Detailed Design &amp; Cost Estimate (Class 3)</td>
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Note: MI = Milestone, DM = Design Milestone, SS = Safety Study, MS = Management Study.
## Project Overview

### Deliverables

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<th>Corresponding Task/Subtask</th>
<th>Title/Description</th>
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<td>Update Project Management Plan</td>
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<td>D2</td>
<td>4.6</td>
<td>HAZOP Review</td>
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<td>Technology Maturation Plan</td>
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<td>D5</td>
<td>6.2</td>
<td>Techno-Economic Analysis</td>
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<tr>
<td>D6</td>
<td>6.3</td>
<td>Final Detailed Design and Cost Estimate for a Commercial-Scale, Post-Combustion CO₂ Capture System – Class 3 Estimate</td>
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<tr>
<td>D7</td>
<td>6.3</td>
<td>Topical Report containing the Final Detailed Design and Cost Estimate for a Commercial-Scale, Post-Combustion CO₂ Capture System</td>
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### Project Overview

**Milestones**

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<th>Corresponding Task/Subtask</th>
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<td>M6</td>
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<td>Critical Design Review</td>
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<td>M7</td>
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<td>Final DOE Presentation</td>
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THANKS