DISCLAIMER

NorthStar Clean Energy

Final Scientific/Technical Report

Filer City Biomass Carbon Removal and Storage (BiCRS) Net-Negative Study

DE-FE0032262

Award:	DE-FE0032262
Lead Recipient:	NorthStar Clean Energy
Project Title:	Filer City Biomass Carbon Removal and Storage (BiCRS) Net-Negative Study
Program Director:	Lisa Kuzniar
Principal Investigator:	Tim Gehring
Contract Administrator:	Emily Johnson
Date of Report:	May 30, 2025
Reporting Period:	August 1, 2023 – October 31, 2024

The information, data, or work presented herein was funded in part by the U.S. Department of Energy under Award Number [DE- FE0032262]. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This material is based upon work supported by the Department of Energy under Award Number DE-FE-0032262.

product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

This Report contains no Protected Data.

Public Executive Summary

NorthStar Clean Energy Company (NorthStar) conducted the Filer City Biomass Carbon Removal and Storage (BiCRS) Net-Negative Study to develop a conceptual design and cost estimate for retrofitting the TES Filer City Station with post-combustion carbon capture technology. TES Filer City Station (Filer City) is an existing 70 MW coal-fired generating station located near Manistee, Michigan. The proposed Filer City BiCRS Project would include the conversion of Filer City's two solid-fuel boilers to burn 100% sustainable biomass, as well as the addition of a post-combustion carbon capture system and all necessary balance of plant equipment and compression to allow for pipeline transportation and permanent off-site sequestration of the CO_2.

For the Filer City BiCRS Net-Negative Study, Babcock & Wilcox (B&W) was selected as the carbon capture technology vendor, and they developed a conceptual process design utilizing their SolveBright™ Post-Combustion Carbon Capture technology. Sargent & Lundy (S&L) served as the Front End Engineering Design (FEED) Study engineer, and they developed conceptual designs for the required material handling modifications, cooling water system, and utility connections to the proposed carbon capture system. In addition to the technical team, GTI Energy assisted NorthStar with community benefits planning.

The Filer City BiCRS Net-Negative Study confirmed the converted boilers at Filer City would be capable of supporting the steam loads of a post-combustion amine-scrubbing carbon capture system and could achieve CO_2 capture rates greater than 95% depending on biomass fuel quality. In addition, the study determined Filer City could maintain a net generation output of up to 25 MW while capturing over 70 metric tons of carbon dioxide per hour. An Association for the Advancement of Cost Engineering (AACE) Class 4 cost estimate was developed for the Filer City boiler conversion and carbon capture addition, which will be used to generate a business case and support a final investment decision for the proposed project.

In summary, the Filer City BiCRS Net-Negative Study allowed NorthStar and team to confirm the commercial feasibility of a post-combustion carbon capture system applied to biomass-fired boilers. At the time of the study, there were no operating facilities in the world with carbon capture applied to flue gas from woody biomass as proposed for Filer City. Due to the solvent-agnostic nature of B&W's SolveBright™ technology, the team determined that multiple amines, both traditional and proprietary, would be capable of 95% CO_2 capture efficiency with the steam available from Filer City's existing boilers after modifications to burn 100% biomass. Based on the cost estimates produced, NorthStar can now confirm the Filer City BiCRS Project is economically viable with a combination of tax credits available from the Inflation Reduction Act of 2022 and high-quality Carbon Dioxide Removal Credits sold on the Voluntary Carbon Market. The Filer City BiCRS project is uniquely positioned to become one of the first

projects to capture and sequester large volumes of CO_2 from a biogenic source, removing existing CO_2 from the atmosphere.

Acknowledgements

NorthStar would like to acknowledge the U.S. Department of Energy's financial support of this research and the technical guidance provided by the Department of Energy's National Energy Technology Laboratory. In addition, NorthStar would like to highlight the financial and development support of our general partner in the TES Filer City Station, Tondu Corporation. Finally, NorthStar would like to recognize the expertise of our FEED study technology vendor, Babcock & Wilcox, our engineering consultant, Sargent & Lundy, and our community benefits consultant, GTI Energy.

Table of Contents

List of Tables

List of Figures

Accomplishments and Objectives

This award allowed NorthStar to demonstrate a number of key objectives. The focus of the project was on building a Biomass Carbon Removal and Storage facility at the existing Filer City Generating Station near Manistee, Michigan.

A number of tasks and milestones were laid out in award Attachment 2, the Statement of Project Objectives, at the beginning of the project, and they are summarized in the table below.

Table 1: Key Milestones and Deliverables

Tasks	Milestones and Deliverables
1.1 Project Management Plan 1.2 Technology Maturation Plan 1.3 Workforce Readiness for Technology Development	1.1 Submit Project Management Plan (PMP) 30 days after award 1.2 Submit Technology Maturation Plan describing the technology readiness level (TRL) 90 days prior to project completion. 1.3 Submit Workforce Readiness Plan 90 days prior to project completion.
2.1 Project Design Basis/Design Criteria 2.2 Initial Scope Definition Studies	2.1 Develop a Project Design Basis by 10/02/2023. 2.2 Perform studies to address site specific project considerations and submit with Final Engineering Design Package due 04/15/2024.
3.1 Initial Engineering Design 3.2 Process Engineering Design 3.3 Overall Project Engineering Design	3.1 Develop Preliminary Design Package (PDP) due 180 days after award. 3.2 Develop Process Design due 180 days after award. 3.3 Develop Design Documents required as inputs to Cost Estimate due 90 days prior to project completion.
4.1 AACE Class 4 Cost Estimate 4.2 Operating Cost and Cost of Capture	4.1 Develop Capital Cost Estimate with Accuracy of -30%/+50% due 90 days prior to project completion. 4.2 Develop Operating Cost and Cost of Capture Estimates due 90 days prior to project completion.
5.1 Project Planning Documents	5.1 Develop Project Planning Documents due 90 days prior to project completion.

Task 1: Project Management and Planning

Table 2: Project Management and Planning Milestones and Deliverables

Task 1 Subtasks	Milestones and Deliverables
1.1 Project Management Plan	Submit Project Management Plan (PMP) 30 days after award

	Actual Performance: (09/06/2023) Project managed & directed in accordance with PMP.
1.2 Technology Maturation Plan	Submit Technology Maturation Plan describing the technology readiness level (TRL) 90 days prior to project completion. **Actual Performance:** (05/15/2024) Initial & final TMP provided characterizing a TRL-7.
1.3 Workforce Readiness for Technology Development	Submit Workforce Readiness Plan 90 days prior to project completion. **Actual Performance**: (05/15/2024) Workforce Readiness Plan submitted.

Subtask 1.1 Project Management Plan

The project was managed and directed in accordance with the Project Management Plan (PMP) submitted in September 2023. A No Cost Extension was requested by the Project Manager at the Department of Energy and the project completion date was extended until October 31 2024. Major milestones from the original PMP schedule are summarized below.

Table 3: Filer City BiCRS Study Milestones

Task/ Subtask	Milestone Title and Description	Planned Completion Date	Verification Method
1.1	Updated Project Management Plan	09/05/2023	Transmittal to DOE
1.0	DOE Kickoff Meeting	09/19/2023	Meeting Held
2.1	Basis of Design for Project Finalized	10/02/2023	Interim Progress Report to DOE
3.1	Preliminary Process Design Review	11/20/2023	Meeting Held and Interim Progress Report to DOE
3.1	Initial Engineering Design Package	12/29/2023	Engineering Drawings
4.0	Overall Cost Estimate and Cost of Capture Review	04/01/2024	Interim Progress Report to DOE
5.0	Final Engineering Design Package	04/15/2024	Engineering Drawings
1.2	Technology Maturation Plan (TMP)	05/02/2024	Final Plan
1.3	Workforce Readiness Plan	05/02/2024	Plan
5.0	Life Cycle Analysis - Final	05/02/2024	Final Report
5.0	Justice 40 Initiative Plan (Final)	05/02/2024	Final Plan
5.0	Community and Stakeholder Engagement Plan	05/02/2024	Final Plan
5.0	Final DOE Report & Presentation	7/12/2024	Presentation

Subtask 1.2 Technology Maturation Plan

Babcock & Wilcox developed a Technology Maturation Plan, which predicts their SolveBright™ Post-Combustion Carbon Capture system would reach a Technology Readiness Level of 8 at the completion of the Filer City BiCRS Project.

Subtask 1.3 Workforce Readiness for Technology Development

NSCE intends to utilize the experienced workforce at Filer City Generating Station to operate and maintain the new technology. Babcock & Wilcox will provide extensive on-site training to the operators and technicians shifting from the existing station to operate and maintain the carbon capture system. Existing station staff will be backfilled with local talent, and Filer City Station's existing operations training and qualification process will support the development of these new employees. It is anticipated 8 additional operators will be required at Filer City Station to cover all shifts after the carbon capture system installation. Collaborations with local education and workforce development stakeholders, such as West Shore Community College, Manistee Area Public Schools, and Michigan Works! Association, will also aid in workforce readiness.

Task 2: Study Planning and Definition

Table 4: Study Planning and Definition Milestones and Deliverables

Task 2 Subtasks	Milestones and Deliverables
2.1 Project Design Basis / Design Criteria	Develop a Project Design Basis by 10/02/2023. **Actual Performance:** (09/06/2023) Design basis document specifying design criteria created & utilized as a project reference.
2.2 Initial Scope Definition Studies	Perform studies to address site specific project considerations and submit with Final Engineering Design Package due 04/15/2024. **Actual Performance:** (04/15/2024) Biomass Supply, Material Handling, Boiler Modification, Steam & Electric Souring, Cooling Water, and Wastewater Studies completed.

Subtask 2.1 Project Design Basis

At the inception of the FEED study, Babcock & Wilcox created a design basis document for the carbon capture system defining the flue gas conditions at the terminal point to their proposed SolveBright system, as well as the site data and target CO_2 capture rate. From this starting point, Sargent & Lundy developed comprehensive design criteria detailing the applicable codes, site conditions, flue gas conditions, CO_2 product quality, and engineering standards.

Figure 1: Filer City Biomass Flue Gas Conditions

Flue Gas Flow to Carbon Capture Island:		-	
Flue Gas Source (from each boiler)	-	Existing Plant Flue Gas	
Temperature	°F	193.7	
Pressure	inwc-g	1.0	
Mass Flowrate	lb/hr	436,100	
Actual Volumetric Flowrate	acfm	129,291	
Flue Gas Composition to Carbon Capture Island:	-	-	
Nitrogen (N_2)	lb/hr - vol%(wet)	258,120	57.06
Oxygen (O_2)	lb/hr - vol%(wet)	20,176	3.96
Water (H_2O)	lb/hr - vol%(wet)	76,216	26.65
Carbon Dioxide (CO_2)	lb/hr - vol%(wet)	81,534	11.63
Sulfur Dioxide (SO_2)	lb/hr	1.0	
Sulfur Trioxide (SO_3)	lb/hr	0.001	
Hydrochloric Acid (HCl)	lb/hr	0.02	
Nitrogen Oxides (NOx)	lb/hr	52.0	
Fly Ash	lb/hr	0.8	

Figure 2: Filer City Carbon Dioxide Specifications

CO_2 Product Quality:		Pipeline
CO_2 Product State		Supercritical
Expected CO_2 Utilization		EOR or Geological storage
Temperature	°F	< 120
Pressure [Note 1]	psig	1,350 (Pipeline Pressure)
CO_2 Stream Parameters		
Carbon Dioxide (CO_2) [Note 2]	vol.%	≥ 95
Nitrogen (N_2)	vol.%	< 4
Methane (CH_4)	vol.%	0.7
Total Hydrocarbons [Note 3]	vol.%	< 5
Oxygen (O_2)	ppmw	< 10
Sulfur	ppmw	< 30
Hydrogen Sulfide (H_2S) [Note 4]	ppmw	0.0
Water (H_2O)	lbs/MMSCF	≤ 25

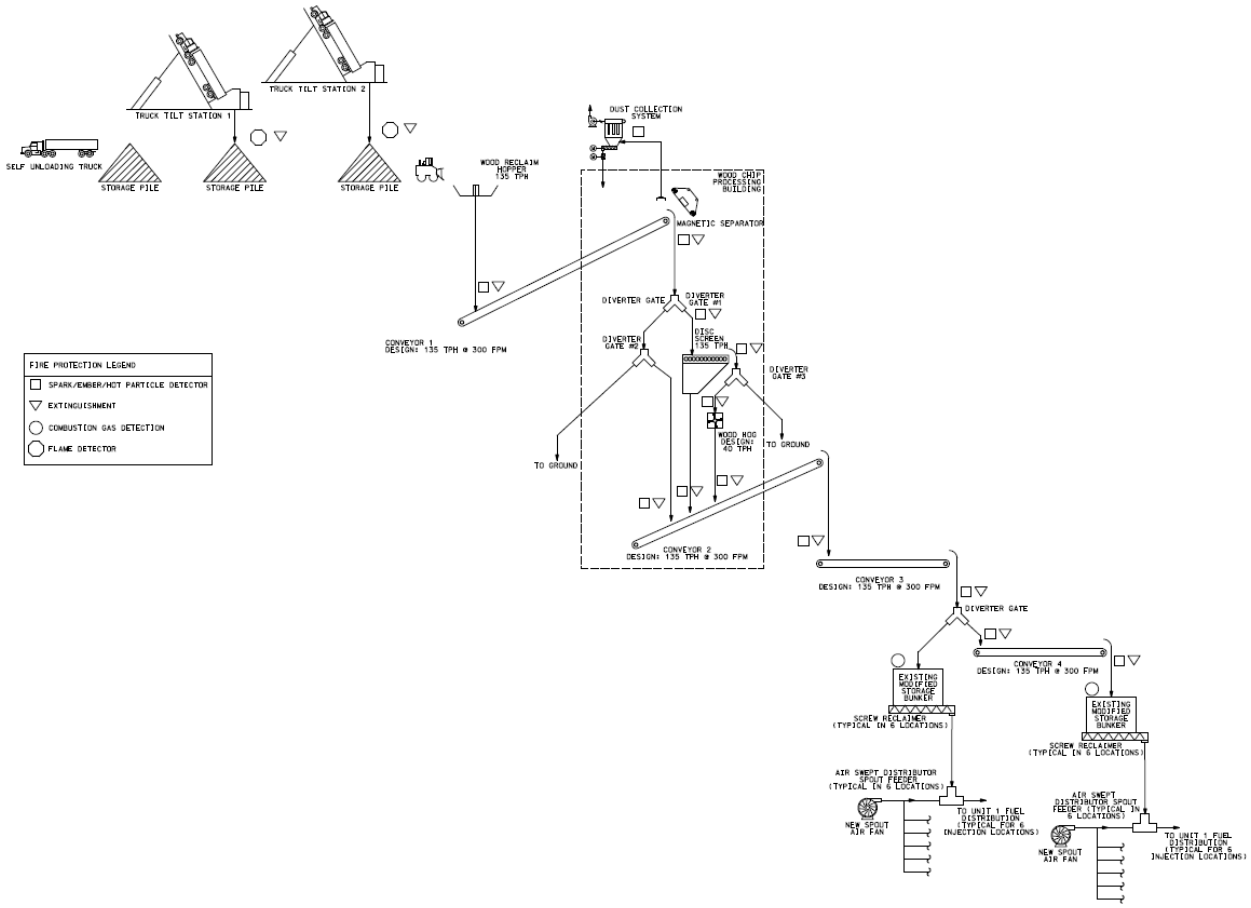
Subtask 2.2 Initial Scope Definition Studies

Michigan State University conducted a study to assess the availability of sustainable biomass supply and associated supply chains in Michigan and the Great Lakes region. This study estimated over 60 million green tons of biomass are available within the procurement zone around Filer City, while the project will require an estimated 680,000 green tons annually. Northern Michigan's forests have an average growth-to-removal ratio of 2.47, meaning only 41% of annual growth is removed and utilized.

Babcock & Wilcox completed a boiler study based on existing station data, operations and maintenance input, and prior analyses by ESI. Recommended boiler modifications include installing new fuel feeders, increasing the over fire air, removing sections of the superheater and economizer, adding selective non-catalytic reduction (SNCR), and adding a bottom ash handling system.

Sargent & Lundy evaluated the balance of plant systems on site and completed a series of studies detailing the scope of the carbon capture integration and identifying areas requiring further design attention. The material handling study provided recommendations for a new fuel handling system, complete with whole-truck tippers, reclaim, wood hogging, screening, and conveyors. The material handling process flow diagram is shown in the figure below.

Figure 3: Filer City Biomass Handling System Process Flow Diagram



Sargent & Lundy's steam and electric sourcing study detailed the carbon capture system's steam extraction requirements for the existing turbine, which was estimated at 285,000 lb/hr or less depending on the solvent selected.

The cooling water study prepared by Sargent & Lundy evaluated several cooling tower options and recommended a hybrid tower to minimize the plume near Filer City residences. After the completion of this study, the project team determined the new cooling tower would be better located near the northeast corner of the site to comply with noise limits at the site boundary. This new location allows for the use of a traditional wet tower.

Sargent & Lundy also completed a water & wastewater study in conjunction with a water balance for the site. This water study confirmed that the existing lake water, potable water, and demineralized water systems at the station are capable of supporting the proposed carbon capture system. The increase in cooling tower blowdown will likely require revisions to the current wastewater discharge agreement.

Figure 4: Filer City Water Supply & Wastewater Discharge Requirements

Scope	Water Supply			Wastewater Discharge		
Current Operations	Lakewater	1017	gpm	General Wastewater	150-200	gpm
	Well Water	197	gpm	Cooling Tower Blowdown	176	gpm
	Total Water Supplied	**1214**	**gpm**	**Total Wastewater Discharged**	**326-376**	**gpm**
Current Operations Plus Biomass and Carbon Capture Conversion	Lakewater	1512	gpm	General Wastewater	141-191	gpm
	Well Water	199	gpm	Cooling Tower Blowdown	308	gpm
	Total Water Supplied	**1711**	**gpm**	Balance of Plant	10	gpm
				Maintenance and Cooling Tower Blowdown[1]	664	gpm
				Total Wastewater Discharged	**459-509**	**gpm**

Task 3: Engineering and Design Package

Table 5: Engineering and Design Package Milestones and Deliverables

Task 3 Subtasks	Milestones and Deliverables
3.1 Initial Engineering Design	Develop Preliminary Design Package (PDP) due 180 days after award. **Actual Performance:** (12/01/2023) Process Flow Diagrams, Heat & Material Balances, Equipment List, and Overall Arrangement Drawing submitted and reviewed with DOE NETL.
3.2 Process Engineering Design	Develop Process Design due 180 days after award. **Actual Performance:** (12/01/2023) Process Piping & Instrumentation Diagrams (P&IDs), Equipment List, Instrument List, and Electrical Load List developed.
3.3 Overall Project Engineering Design	Develop Design Documents required as inputs to Cost Estimate due 90 days prior to project completion. **Actual Performance:** (04/30/2024) Project Site Plan, General Arrangement Drawings, BOP Process Flow Diagrams, Project Water Balance, BOP P&IDs, Equipment List, Electrical Load List, Terminal Point List, Single Line Diagrams,

	Permitting Matrix, and Project Execution Plan developed. HAZID Study completed.

Subtask 3.1 Initial Engineering Design

The initial engineering design package produced by Babcock & Wilcox included an overall process flow diagram, heat and material balances for both monoethanolamine (MEA) and diglycolamine (DGA) solvents, an equipment list, and general arrangement drawings. The heat and material balances confirmed the SolveBright™ system is capable of capturing over 95% of the CO_2 present in the biomass flue gas. Based on the general arrangement drawings, the carbon capture system will have a footprint of approximately 250' by 150' and can be laid out in the most efficient location on the site, just west of the existing stack, minimizing the length of connecting ductwork and utilities.

Subtask 3.2 Process Engineering Design

The process engineering design packages included process and instrumentation drawings (P&IDs) for both the carbon capture system and all the connecting balance of plant systems. In addition to the P&IDs, equipment lists, instrument lists, and electrical load lists were also developed. Based on the electrical load lists and steam requirements determined in the steam and electric sourcing study, the project team estimates Filer City Station will have a net output of approximately 25 MW when operating at full capacity on biomass with 95% carbon capture.

Subtask 3.3 Overall Project Engineering Design

The overall project engineering design built on the process design described above and included critical documents for cost estimating and further project development. Sargent & Lundy developed an overall site plan, terminal point list, and a single line diagram. Power for the new equipment will be supplied from the existing station with a tap off the generator side of the main power transformer. From this tap off the generator bus, power will be routed to a new unit auxiliary transformer feeding the new 4160V switchgear and 480V electrical equipment. This electrical design information allowed the required unit auxiliary transformer to be competitively bid and ordered during the FEED study. In addition, instrument lists were compiled and reviewed by Filer City's current distributed control system (DCS) provider to confirm the existing station DCS could be upgraded and expanded to encompass the new carbon capture system control points.

NorthStar created a permit matrix as well as an execution plan for the project. In addition to the execution plan, Babcock & Wilcox created a construction site plan which the team reviewed to identify constructability issues. The existing dock structure, biomass delivery truck routing, and crane placement were all identified as requiring further design attention during project development.

The entire team worked together to complete a hazard identification (HAZID) study, with results compiled by Sargent & Lundy. The HAZID study had 46 recommendations for further study, 10 during the FEED and another 36 during detailed design. Some of the critical concerns included hazardous waste disposal methods, carbon capture shutdown sequences, sound levels exceeding local requirements, wastewater disposal during outages, and alternatives to anhydrous ammonia as a refrigerant.

Task 4: Project Cost Estimate

Table 6: Project Cost Estimate Milestones and Deliverables

Task 4 Subtasks	Milestones and Deliverables
4.1 AACE Class 4 Cost Estimate	Develop Capital Cost Estimate with Accuracy of -30%/+50% due 90 days prior to project completion. **Actual Performance:** (05/15/2024) Overall Cost Estimate developed based on inputs from B&W, S&L, and equipment suppliers.
4.2 Operating Cost and Cost of Capture	Develop Operating Cost and Cost of Capture Estimates due 90 days prior to project completion. **Actual Performance:** (05/15/2024) Operating Costs estimated based on known labor and fuel rates, chemical consumption & waste production estimates, and maintenance estimates. Cost of Capture calculated using DOE NETL guidelines.

Subtask 4.1 AACE Class 4 Cost Estimate

The project cost estimate was compiled based on inputs from Babcock & Wilcox, Sargent & Lundy, and NorthStar. B&W provided estimates for the boiler modifications, carbon capture system, and compression system. S&L provided estimates for the BOP items: cooling tower, water treatment, material handling, and utility connections. NorthStar gathered estimates for the steam turbine upgrades, distributed control system modifications, equipment overhauls, development costs, and management fees. In total, the project was estimated to cost approximately $420 million in 2024 dollars. This estimate does not include sales tax, escalation, nor allowance for funds during construction. Carbon dioxide transportation and storage costs for pipeline installation and well construction are also not included.

Subtask 4.2 Operating Cost and Cost of Capture

The operating cost of the carbon capture system was estimated by Sargent & Lundy based on consumption rates provided by Babcock & Wilcox. NorthStar estimated the additional fuel, fuel handling, and labor costs associated with the project. The total annual O&M cost was estimated at nearly $60 million in 2024 dollars. Based on this, the cost of capture was estimated to be $95/metric ton, excluding transportation and storage costs.

Task 5: Project Planning Documents

Table 7: Project Planning Documents Milestones and Deliverables

Task 5 Subtasks	Milestones and Deliverables
5.1 Project Planning Documents	Develop Project Planning Documents due 90 days prior to project completion. **Actual Performance:** (05/15/2024) Life Cycle Analysis, Environmental Justice Questionnaire, Economic Revitalization and Job Creation Outcomes Questionnaire, Justice40 Plan, Community Stakeholder Engagement Plan, and Technology Environment Health and Safety Analysis completed.

Subtask 5.1 Project Planning Documents

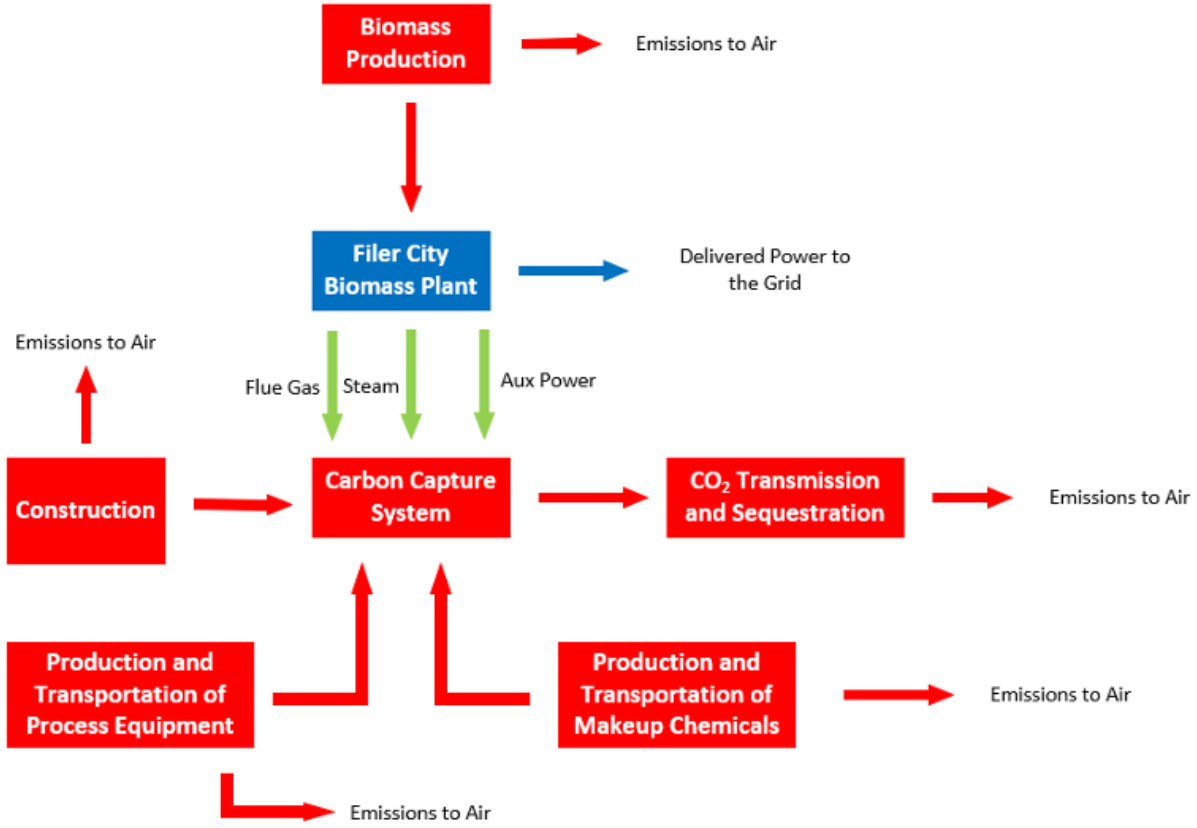
In addition to the design, NorthStar worked with GTI Energy to develop community benefits plans, including an Environmental Justice Questionnaire, an Economic Revitalization and Job Creation Outcomes Questionnaire, a Justice40 Plan, and a Community Stakeholder Engagement Plan. The Economic Revitalization and Job Creation Outcomes Analysis determined the project would generate an additional $100 million into the Michigan economy annually and create 220 direct, indirect, and induced jobs. During the study, NorthStar held initial meetings with the local tribe, the Little River Band of Ottawa Indians, and the local Boilermakers Union; both stakeholder groups are supportive.

Based on Tondu and NorthStar's internal financial model, Sargent & Lundy prepared a Business Case Analysis for the project. This Business Case Analysis assumed the project would receive a significant grant from the State of Michigan and be financed by a low interest rate loan with a 20-year term from the DOE's Loan Programs Office. The resulting economic model indicated an adequate internal rate of return with the Inflation Reduction Act's 45Q tax credits as the primary revenue source.

S&L also performed a Technology Environmental, Health, and Safety Assessment with data inputs from B&W and NorthStar environmental personnel. The Technology Environmental, Health, and Safety Assessment identified potential air emissions, water emissions, and solid wastes produced from the proposed technology and their safety, regulatory, and compliance implications. Sodium hydroxide, DGA, MEA, and ammonia were noted, along with their toxicological effects and safe handling requirements.

Finally, Sargent & Lundy prepared a life cycle analysis for the project, summarizing its overall emissions of -3,164 kg CO_2e per delivered MWh. A diagram of the project boundary is included in Figure 7 below.

Figure 5: Filer City BiCRS Project Boundary



Project Activities

The Filer City BiCRS Net-Negative Study's primary objective was to design a cost-effective carbon capture system for the existing TES Filer City Station. This carbon capture system must maximize energy efficiency while maintaining reliable power output from the station and capturing 95% of the CO_2 emissions. Over the course of the Study, the team developed a basis of design and conceptual process design for the carbon capture system, as well as a conceptual balance of plant design. Using these design documents, the team was able to generate estimates for the overnight capital costs, annual operating expenses, cost of capture, and global warming potential of the proposed project. The team confirmed that the Filer City boiler conversion and carbon capture conceptual design would be capable of capturing 95% of the station's CO_2 emissions while still generating an estimated 25 MW net power to the grid.

Project Outputs

A. Journal Articles

No journal articles focused on the Filer City BiCRS Net-Negative Study were written or published in the course of or under this contract.

B. Papers

Filer City BiCRS Net-Negative Study, technology paper, National Energy Technology Laboratory, U.S. Department of Energy

Powering the Future: Assessing feedstock availability and economic impacts of converting a coal-fired power plant to a biomass facility in Michigan, Raju Pokharel, Greg Latta, Jagdish Poudel, Emily Silver, and Shivan Gc

C. Status Reports

Filer City BiCRS Net-Negative Study, 2023 Carbon Management Research Project Review Meeting, August 2023

Research Performance Progress Report (RPPR) for Q1, Filer City BiCRS Net-Negative Study, Quarterly Progress Report, October 31, 2023

Filer City BiCRS Net-Negative Study - Community Benefits Plan, Initial Assistance and Validation Meeting, December 2023

Filer City BiCRS Net-Negative Study, Preliminary Design Review Meeting, December 2023

Research Performance Progress Report (RPPR) for Q2, Filer City BiCRS Net-Negative Study, Quarterly Progress Report, January 31, 2024

Filer City BiCRS Net-Negative Study - Community Benefits Plan, Interim Assistance and Validation Meeting, March 2024

Research Performance Progress Report (RPPR) for Q3, Filer City BiCRS Net-Negative Study, Quarterly Progress Report, April 30, 2024

Research Performance Progress Report (RPPR) for Q4, Filer City BiCRS Net-Negative Study, Quarterly Progress Report, July 31, 2024

Filer City BiCRS Net-Negative Study - Community Benefits Plan, Final Assistance and Validation Meeting, August 2024

Filer City BiCRS Net-Negative Study – Project Update, 2024 Carbon Management Research Project Review Meeting, August 2024

Filer City BiCRS Net-Negative Study, Project Closeout Meeting, October 2024

Research Performance Progress Report (RPPR) for Q5, Filer City BiCRS Net-Negative Study, Quarterly Progress Report, December 4, 2024

D. Media Reports

Babcock & Wilcox Signs Agreement to Proceed with Work for Coal-to-Biomass Power Plant Conversion and Carbon Capture Project in Michigan, June 3, 2024

Michigan Coal Plant Eyes BECCS Retrofit: Could Become First U.S. Facility with "Carbon-Negative" Power, POWER Magazine, Sonal Patel, June 6, 2024

Lakeshore coal plant to get new life with clean energy, carbon capture, Crain's Grand Rapids Business, Andy Balaskovitz, June 6, 2024

Tondu plant to convert to $300M biomass fuel facility, Manistee News, Scott Fraley, July 24, 2024

Carbon-capture advocates press for bills to launch industry in Michigan, Crain's Detroit, David Eggert, November 26, 2024

E. Invention Disclosures

No inventions or discoveries were made or conceived in the course of or under this contract.

F. Patent Applications

No patent applications were prepared or submitted in the course of or under this contract.

G. Licensed Technologies

No new technologies were developed or licensed in the course of or under this contract. The existing SolveBright™ Post-Combustion Carbon Capture technology by Babcock & Wilcox was applied to the Filer City Generating Station.

H. Networks/Collaborations Fostered

Numerous relationships and collaboration opportunities were fostered by public presentations of the Filer City BiCRS Net-Negative Study at multiple Department of Energy National Energy Technology Laboratory (NETL) conferences. Examples include:

1. Alternative post-combustion carbon capture technology providers, such as Carbon Clean, Capsol Technologies, Honeywell UOP, and SLB Aker.
2. Alternative equipment fabricators and installation contractors, such as Enerflex Energy Systems.

3. Carbon Dioxide Removal Credit standards organizations and consultants, such as American Carbon Registry and South Pole.
4. Carbon Dioxide Removal Credit marketers, platforms, and buyers.
5. Geological experts and other carbon dioxide sequestration partners, such as Rocklocker.
6. Knowledge sharing with fellow post-combustion carbon capture projects, such as SaskPower's Boundary Dam.

I. Websites Featuring Project Work Results

Biomass Carbon Removal and Storage (BiCRS), Projects page, northstarcleanenergy.com

J. Other Products (e.g. Databases, Physical Collections, Audio/Video, Software, Models, Educational Aids or Curricula, Equipment or Instruments)

No other publicly-available products were created in the course of or under this contract.

K. Awards, Prizes, and Recognition

No awards, prizes, or recognitions were received by the Filer City BiCRS team in the course of or under this contract.

Follow-On Funding

Not Applicable.