Exh. SWM-5
Docket UG-240008
Witness: Scott W. Madison

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, Complainant, v. CASCADE NATURAL GAS CORPORATION, Respondent.	DOCKET UG-240008

CASCADE NATURAL GAS CORPORATION

FOURTH EXHIBIT TO THE
DIRECT TESTIMONY OF SCOTT W. MADISON

March 29, 2024

505 Nicollet Mall
PO Box 59038
Minneapolis, MN 55459-0038

June 28, 2023

Mr. Will Seuffert
Executive Secretary
Minnesota Public Utilities Commission
121 East Seventh Place, Suite 350
St. Paul, MN 55101-2147

PUBLIC DOCUMENT
Trade Secret Data Has Been Excised

Re: Petition by CenterPoint Energy for Approval of its First Natural Gas Innovation Plan
Docket No. G-008/M-23-215

Dear Mr. Seuffert:

CenterPoint Energy Resources Corp. d/b/a CenterPoint Energy Minnesota Gas ("CenterPoint Energy" or the "Company") respectfully submits its first Natural Gas Innovation Act ("NGIA") innovation plan.

CenterPoint Energy has designated certain information in Exhibits J, P, and T as TRADE SECRET. The identified trade secret information meets the definition of trade secret information in Minn. Stat. § 13.37, subd. 1(b), as follows:

1) The information was supplied by CenterPoint Energy, the affected organization;

2) CenterPoint Energy has taken all reasonable efforts to maintain the secrecy of the information, including protecting it from disclosure in this proceeding; and

3) the protected information includes sensitive commercial data provided by respondents to a request for information issued by CenterPoint Energy; a memorandum forecasting future renewable natural gas prices prepared by CenterPoint Energy consultant, ICF; and a data analysis tool developed by ICF, that have not been previously released to the public and which derive independent economic value, actual or potential, from not being generally known to, and not being readily ascertainably by proper means by other persons who can obtain economic value from their disclosure or use.

The Company thanks the Commission for its consideration of this filing.

Sincerely,

/s/

Emily Suppes
Director, Regulatory Affairs

C: Service List

STATE OF MINNESOTA
BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION
121 Seventh Place East, Suite 350
St. Paul, MN 55101-2147

Katie Sieben	Chair
Valerie Means	Commissioner
Matt Schuerger	Commissioner
Joseph Sullivan	Commissioner
John Tuma	Commissioner

In the Matter of a Petition by CenterPoint Energy for Approval of Its First Natural Gas Innovation Plan

Docket No. G-008/M-23-215

PETITION

Introduction

CenterPoint Energy Resources Corp. d/b/a CenterPoint Energy Minnesota Gas, ("CenterPoint Energy" or the "Company") respectfully submits this Petition to the Minnesota Public Utilities Commission ("Commission") for approval of its first Natural Gas Innovation Plan ("Plan") pursuant to the Natural Gas Innovation Act ("NGIA").[1]

This filing is organized into the following sections, with supporting Exhibits as summarized below:

- *Sections I – IV:* Required miscellaneous filing information;
- *Section V:* Overview of CenterPoint Energy's proposed Plan;
- *Section VI*: Overview of the process by which CenterPoint Energy developed its proposed Plan including engagement with interested parties during the Plan development process;
- *Section VII:* CenterPoint Energy's proposal for research and development ("R&D") as part of its Plan including seven R&D pilots CenterPoint Energy proposes to support in the first two years of the Plan;
- *Section VIII:* CenterPoint Energy's proposal for recovery of Plan costs including a discussion of expected impacts on customer's bills and a request for variance from any Commission Rules that would be violated by the recovery proposal;
- *Section IX:* A walkthrough of the criteria listed in the NGIA statute for Commission approval of an innovation plan with support for how the Plan satisfies each criterion;
- *Section X:* Proposed cost-effectiveness objectives for the Plan; and
- *Section XI*: A discussion of proposed timing for the Plan.

[1] Minnesota Laws 2021, 1st Special Session, Chapter 4, Article 8, §§ 20, 21 and 27, partially codified at Minn. Stat. §§ 216B.2427-2428.

The Company submits the following Exhibits in support of its Petition:

Exhibit A: One Page Summary of Filing

Exhibit B: Non-Technical Summary

Exhibit C: Compliance Matrix

Exhibit D: Full Pilots Detailed Descriptions

Exhibit E: Pilot Utility Cost Estimate Details and Gas Cost Sensitivities

Exhibit F: Lifecycle GHG Calculation Details

Exhibit G: ICF Letter Endorsing GHG Emission Calculations

Exhibit H: IMPLAN Modeling Details

Exhibit I: CIP/NGIA Coordination Information

Exhibit J: Research and Development Pilots Detailed Descriptions

Exhibit K: Interested Party Materials

Exhibit L: Summary of RFI Responses and Other Pilots Considered

Exhibit M: Commission Cost-Benefit Framework Chart

Exhibit N: Pilot Assumptions Spreadsheet

Exhibit O: Pilot Qualitative Details

Exhibit P: Pilot Quantitative Calculations

Exhibit Q: Draft RFP for RNG

Exhibit R: Cost Recovery Proposal Details

Exhibit S: Draft Tariff Pages

Exhibit T: Utility System Report and Forecast

Exhibit U: Service Quality Metrics

Exhibit V: Alternative Portfolios

Exhibit W: Tracking and Verification Plan

I. Summary of Filing

A one-page summary of filing is attached as Exhibit A pursuant to Minn. R. 7829.1300, subp. 1. Note that a non-technical summary has also been included as Exhibit B.

II. Service on Other Parties

Pursuant to Minn. R. 7829.1300, subp. 2, the Company has served a copy of this filing on the Department of Commerce, Division of Energy Resources and the Office of the Attorney General – Residential Utilities Division. This filing has also been served on all parties on the enclosed service lists.

III. General Filing Information

Pursuant to Minn. R. 7829.1300, subp. 3, the Company provides the following information.

A. Name, Address, and Telephone Number of Utility

CenterPoint Energy Resources Corporation, doing business as CenterPoint Energy Minnesota Gas, a Delaware Corporation
505 Nicollet Mall
PO Box 59038
Minneapolis, Minnesota 55402
(612) 372-4664

B. Name, Address, Electronic Address, and Telephone Number of Utility Attorney

Jason Loos, Associate General Counsel – Regulatory Legal
505 Nicollet Mall
PO Box 59038
Minneapolis, Minnesota 55402
(612) 321-4410
Jason.Loos@centerpointenergy.com

C. Date of Filing and the Date the Proposed Rate or Service Change Will Take Effect

Date Filed: June 28, 2023
Effective Date: Upon Commission Approval

D. Statute Controlling Schedule for Processing the Filing

CenterPoint Energy is unaware of any statute that controls the timeframe for processing this filing. The Company respectfully requests that the Commission consider this petition by July 2024 to allow the Company to move forward with several pilots with partners and customers that are operating on timelines for their projects.

Under Minn. R. 7829.0100, subp. 11, this petition is a "miscellaneous" filing because no determination of CenterPoint Energy's general revenue requirement is necessary. Comments on a miscellaneous filing are due within 30 days of filing, with replies due 10 days thereafter.[2]

E. Signature, Electronic Address, and Title of Utility Employee Responsible for Filing

/s/ Emily Suppes
Emily Suppes
Director, Regulatory Affairs
(612) 321-5363
Emily.Suppes@centerpointenergy.com

F. Description of the Filing, Its Impact on Rates and Services, Its Impact on Any Affected Person, and the Reasons for the Filing

In this filing, the Company proposes its first Plan under the NGIA. Under the Plan, the Company would deploy innovative resources that reduce or avoid greenhouse gas ("GHG") emissions from the use of geologic gas by the Company's customers. This filing includes details on proposed pilot programs and a proposal for the recovery of the Company's incremental costs for developing and implementing the Plan. The Company is filing this plan to help customers reduce their GHG emissions and assist the state of Minnesota in reaching its GHG and renewable energy goals.

IV. Miscellaneous Information

CenterPoint Energy requests that the following employees be included on the service list for this proceeding.

Emily Suppes
Director, Regulatory Affairs
505 Nicollet Mall
PO Box 59038
Minneapolis, Minnesota 55402
(612) 321-5363
Emily.Suppes@centerpointenergy.com

[2] *See* Minn. R. 7829.1400, subps. 1, 4.

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Melodee.CarlsonChang@centerpointenergy.com

V. Plan Overview

CenterPoint Energy is pleased to present its first NGIA Plan for Commission review. CenterPoint Energy, Inc., CenterPoint Energy's parent company, was the first electric and natural gas utility with its own generation assets to announce net zero GHG emissions goals for Scopes 1 and 2 by 2035. CenterPoint Energy, Inc. has also set a Scope 3 emissions reduction goal across its entire multi-state footprint, committing to help our customers reduce the GHG emissions attributable to natural gas end uses by 20-30 percent by 2035 as compared to a 2021 baseline. Furthermore, CenterPoint Energy supports Minnesota's goal to reduce economy-wide GHG emissions to net zero by 2050 and recognizes that it has an important part to play in helping the state achieve that goal..[3]

[3] Minn. Stat. § 216H.02, subd 1. Note that this goal was increased from 80 percent to net zero this year with the enactment of H.F. 2310.

However, the path to decarbonizing industry and buildings that currently rely on geologic gas remains uncertain in Minnesota and throughout the country. Minnesota has no silver bullet, no single technology that can be relied upon to decarbonize all natural gas end uses. Instead, there is a mixture of possible solutions, largely reflected in the eight innovative resource options listed in the NGIA. As was reflected in the G21 Report, the path to decarbonizing buildings and industry in Minnesota will require some mixture of these innovative resources.[4] But selecting the optimal balance between these resources is not realistic at this time given the limited experience Minnesota and the rest of the country have with deploying these different technologies.

The historic passage of the NGIA made Minnesota a national leader in natural gas decarbonization policy, and importantly, this bi-partisan law does not assume a technological winner. Instead, the NGIA is designed to allow gas utilities and Minnesota to implement a variety of pilots to gain experience and gather additional data on the various innovative resource options and ramp up our natural gas decarbonization efforts based on the data as our knowledge deepens and our path to decarbonization becomes clearer.

It is in this spirit of data-driven results that CenterPoint Energy has selected to include a broad array of innovative resources and pilot designs in its first innovation plan. The eighteen full pilots included in the Plan would result in deployment of at least six, and potentially seven, of the eight innovative resources identified in the NGIA.[5] CenterPoint Energy also proposes to further explore the potential of the final innovative resource, power-to-ammonia, through R&D pilots. The proposed pilots will make GHG reduction technologies available to all customer segments—residential, multi-family, commercial, and industrial—and CenterPoint Energy is proposing an objective for its Plan that would particularly focus its efforts on reaching low-income customers for relevant pilots.

CenterPoint Energy's proposed Plan satisfies all applicable statutory and regulatory requirements, including those identified below. Exhibit C provides a compliance matrix identifying where required items are addressed in the Plan.

- 50 percent or more of the proposed costs are for the procurement and distribution of renewable natural gas, biogas, hydrogen produced via power-to-hydrogen, and ammonia produced via power-to-ammonia.[6]
- District energy represents less than 20 percent of proposed costs.[7]

[4] Decarbonizing Minnesota's Natural Gas End Uses: Stakeholder Process Summary and Consensus Recommendations, July 2021, https://e21initiative.org/wp-content/uploads/2021/07/Decarbonizing-NG-End-Uses-Stakeholder-Process-Summary.pdf.

[5] Biogas is not necessarily represented by the proposed pilots but could be a measure implemented under the Industrial and Large Commercial GHG Audit pilot. Power-to-ammonia is not represented in the full pilot list but is the subject of two proposed R&D pilots.

[6] Minn. Stat. § 216B.2427, subd. 2(d)(1).

[7] Minn. Stat. § 216B.2427, subd. 2(d)(2).

- R&D pilots represent less than ten percent of proposed costs.[8]
- The Plan includes a pilot program to provide thermal energy audits to small- and medium-sized businesses in order to identify opportunities to reduce or avoid GHG emissions from natural gas use.[9] Namely, the Small/Medium Business GHG Audit pilot described below.
- The Plan includes a pilot program to provide innovative resources to industrial facilities whose manufacturing processes, for technical reasons, are not amenable to electrification.[10] Namely, the Industrial or Large Commercial Hydrogen and Carbon Capture Incentives pilot described below.
- The Plan includes a program that facilitates deep energy retrofits and the installation of cold climate electric air-source heat pumps in existing residential homes that have natural gas heating systems.[11] Namely, the Residential Deep Energy Retrofits and Electric Air Source Heat Pumps pilot described below.
- The Plan includes a pilot program to facilitate the development, expansion, or modification of district energy systems in Minnesota.[12] Namely the New Networked Geothermal Systems and New District Energy Systems pilots described below.

Brief descriptions of each of the eighteen full pilots are as follows. Full descriptions are provided in Exhibit D.[13]

Pilot A. **RNG Produced from Hennepin County Organic Waste:** CenterPoint Energy proposes to purchase renewable natural gas ("RNG") from Hennepin County's anaerobic digestion facility, which is currently under development. This new anaerobic digester facility will process source-separated food waste from Hennepin County's organics recycling program and a smaller quantity of yard waste.

Pilot B. **RNG Produced from Ramsey & Washington Counties Organic Waste:** CenterPoint Energy proposes to purchase RNG from Ramsey and Washington Counties' anaerobic digestion facility, which is currently under development. This new anaerobic digester facility will process source-separated food waste from Washington and Ramsey Counties' organics recycling program and a smaller quantity of yard waste.

Pilot C. **Renewable Natural Gas Request for Proposal ("RFP") Purchase:** CenterPoint Energy proposes to issue an RFP to purchase an additional amount of RNG to complete its RNG portfolio.

[8] Minn. Stat. § 216B.2427, subd. 3(g).

[9] Minn. Stat. § 216B.2427, subd. 6.

[10] Minn. Stat. § 216B.2427, subd. 7.

[11] Minn. Stat. § 216B.2427, subd. 8.

[12] Minn. Stat. § 216B.2427, subd. 9.

[13] Note that some pilots in this list are a combination of multiple pilot concepts evaluated in the detailed analysis process. A table relating these full pilots to shortlisted pilot concepts is included in Exhibit D.

Pilot D. **Green Hydrogen Blending into Natural Gas Distribution System:** CenterPoint Energy proposes to own and operate a 1 MW green hydrogen plant at an existing Company facility in Mankato, Minnesota. CenterPoint Energy would install dedicated solar panels, an electrolyzer, a hydrogen storage system, and other necessary systems and equipment to generate, store, and blend hydrogen into the gas distribution system.

Pilot E. **Industrial or Large Commercial Hydrogen and Carbon Capture Incentives:** CenterPoint Energy will identify a small number of large commercial or industrial customers interested in installing either power-to-hydrogen or carbon capture demonstration projects and support their projects by providing financial assistance towards feasibility studies and project costs.

Pilot F. **Industrial Methane and Refrigerant Leak Reduction:** CenterPoint Energy will hire a vendor to conduct surveys of participating industrial and large commercial facilities for methane and refrigerant leaks behind the customer gas meter. CenterPoint Energy will also offer incentives to partially offset the cost of leak repair.

Pilot G. **Urban Tree Carbon Offsets:** CenterPoint Energy proposes to purchase carbon offsets from local non-profit, Green Minneapolis. Green Minneapolis works with local tree planting partners across the 7-county Twin Cities Metro area to plant trees in urban areas and funds their work by selling carbon offsets.

Pilot H. **Carbon Capture Rebates for Commercial Buildings:** CenterPoint Energy proposes to provide rebates to commercial customers that install CarbinX carbon capture systems manufactured by Canadian company CleanO2. These units connect to existing natural gas heating equipment, capture CO_2, and convert it into chemicals that are resold for commercial uses.

Pilot I. **New Networked Geothermal Systems:** CenterPoint Energy proposes to develop a new networked geothermal system to provide building heating and cooling for a neighborhood currently served by the Company. This pilot starts with a study phase to identify the location, technologies, and business model for the system.

Pilot J. **Decarbonizing Existing District Energy Systems:** CenterPoint Energy proposes to help existing district energy systems that currently use geologic gas to identify opportunities to reduce the lifecycle GHG impact of their systems via funding for feasibility studies and financial support for following through with study recommendations.

Pilot K. **New District Energy System:** CenterPoint Energy proposes a pilot to help current natural gas customers considering developing district energy systems by providing funding for feasibility studies and financial support to follow through with feasibility study recommendations.

Pilot L. **Industrial Electrification Incentives:** CenterPoint Energy would support industrial customers to electrify low-to-medium heat processes using heat pump technologies. This pilot begins with a study phase to identify promising heat pump technologies and potential industrial applications.

Pilot M. **Commercial Hybrid Heating:** CenterPoint Energy proposes to provide support for small-to-medium commercial buildings interested in replacing Heating, Ventilation, and Air Conditioning ("HVAC") systems with hybrid systems using electric heat pumps and gas backup.

Pilot N. **Residential Deep Energy Retrofits and Electric Air Source Heat Pumps:** CenterPoint Energy would provide support for residential customers interested in retrofitting their homes to significantly improve energy efficiency and installing air source heat pumps with gas back-up. This pilot starts with a study phase to identify appropriate measures and home characteristics for deep energy retrofits.

Pilot O. **Small/Medium Business GHG Audit:** CenterPoint Energy proposes to expand its existing Conservation Improvement Program ("CIP") Natural Gas Energy Analysis ("NGEA") project to include identification of non-CIP GHG reducing opportunities for small and medium-sized businesses.

Pilot P. **Residential Gas Heat Pumps:** CenterPoint Energy proposes to fund the development and testing of a small number of 'combi' space and water heating gas heat pump systems in Minnesota homes.

Pilot Q. **Gas Heat Pumps for Commercial Buildings:** CenterPoint Energy proposes to fund the development and testing of a small number of gas heat pump systems in in commercial buildings.

Pilot R. **Industrial and Large Commercial GHG Audit:** CenterPoint Energy proposes to expand its existing CIP Process Efficiency and Commercial Efficiency projects to include identification of non-CIP GHG reduction measures and payment of incentives for the installation of identified non-CIP measures.

The eighteen pilots are projected to reduce or avoid approximately 1.2 million metric tons of carbon dioxide equivalent ("CO_2e") emissions, equivalent to the energy use of approximately 150,000 homes for one year.[14] This level of emissions reduction is equivalent to approximately 14 percent of total emissions from natural gas supplied to CenterPoint Energy's sales-service customers in 2020.[15] In addition, it is projected that the pilots will create approximately 3,000 full-time equivalent jobs in Minnesota.[16] Table 1 below shows statistics for each proposed pilot.

[14] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

[15] This figure is provided in compliance with Minn. Stat. § 216B.2427, subd. 2(a)(4). CenterPoint Energy calculates that total emissions from natural gas supplied to CenterPoint Energy sales-service customers, not including NGIA exempt customers, was 8,317,369 metric tons. Savings that will be achieved in year 5 from measures installed during the Plan are equivalent to one percent of total emissions from natural gas supplied to CenterPoint Energy's sales-service customers in 2020.

[16] As calculated using the IMPLAN model, see Exhibit H. Measured in terms of full-time equivalent ("FTE") jobs or the work that can be performed by one person in one year. This includes jobs directly related to the pilots, upstream indirect jobs created in the supply chain, and downstream induced jobs created in local industries due to increased consumption expenditures associated with direct and indirect jobs. Note that CenterPoint Energy will be required to report on economic impacts of the plan, including job creation, in annual NGIA status reports. Minn. Stat. § 216B.2427, subd. 2(f). CenterPoint Energy will be unable to track and confirm creation of some of the jobs estimated by the IMPLAN model where jobs are created

Additional details on estimated pilot costs are detailed in Exhibit E. Additional details on estimated lifecycle GHG reductions are included in Exhibit F and a letter from ICF endorsing the GHG calculations is included as Exhibit G.[17] Additional details on estimated net job creation are included in Exhibit H. For pilots that include energy efficiency or strategic electrification, discussion of CIP/ECO/NGIA coordination is included in Exhibit I.

Table 1: Summary Quantitative Metrics for Proposed Pilots

Pilot	Estimated Lifetime Utility Cost[18]	Cost Counting Against NGIA Budget[19]	Estimated Lifecycle GHG Reductions (Metric Tons CO2e)	Estimated Net Job Creation (FTEs)[20]
RNG Produced from Hennepin County Organic Waste	$7,675,137	$2,856,759	28,221	88
RNG Produced from Ramsey & Washington Counties Organic Waste	$27,356,579	$10,160,058	147,863	244
Renewable Natural Gas RFP Purchase	$66,970,724	$32,368,811	359,884	547
Green Hydrogen Blending into Natural Gas Distribution System	$22,961,186	$5,073,067	27,993	148
Industrial or Large Commercial Hydrogen and Carbon Capture Incentives	$2,720,057	$3,793,770	107,196	459
Industrial Methane and Refrigerant Leak Reduction	$1,132,471	$1,247,651	33,763	21
Urban Tree Carbon Offsets	$299,909	$329,301	4,500	1

by entities not directly contracted with by CenterPoint Energy. Accordingly, the confirmed job creation total reported in annual NGIA status reports will be smaller than the IMPLAN total job creation estimate.

[17] NGIA requires that for any pilot program not previously approved as part of the utility's most recent innovation plan, CenterPoint Energy provide a third-party analysis of the lifecycle GHG intensity of proposed resources and forecasted lifecycle GHG emissions that will be avoided or reduced. 216B.2427, subd. 2(a)(7).

[18] This represents the expected net cost impact to customers over the lifetime of each pilot. Many pilots will require continued investment by CenterPoint Energy after the end of the five-year term of this NGIA plan. For example, the new networked geothermal system is expected to operate, and require maintenance, for decades. These figures are also net of expected savings due to reduced need to purchase gas and other avoided operations and maintenance costs, which results in certain pilots having negative utility costs, or a lifetime utility cost that is lower than costs counting against the NGIA budget. Participant costs are not included.

[19] This represents project costs that count against the budget cap described in the NGIA. These costs only include utility costs expected to be incurred during the five-year plan and are net of certain savings, including savings due to reduced need to purchase gas, during the term of the five-year plan. Participant costs are not included.

[20] Includes direct, indirect, and induced estimated FTE employed in Minnesota for one year over lifetime of each pilot.

Pilot	Estimated Lifetime Utility Cost[18]	Cost Counting Against NGIA Budget[19]	Estimated Lifecycle GHG Reductions (Metric Tons CO2e)	Estimated Net Job Creation (FTEs)[20]
Carbon Capture Rebates for Commercial Buildings	$23,256	$1,303,022	55,150	195
New Networked Geothermal Systems	$42,223,212	$11,625,764	107,355	430
Decarbonizing Existing District Energy Systems	($3,422,215)	$597,909	124,030	315
New District Energy System	($784,412)	$215,644	40,882	125
Industrial Electrification Incentive	$112,392	$503,821	11,896	23
Commercial Hybrid Heating	$5,542,472	$7,067,270	25,609	88
Residential Deep Energy Retrofits and Electric Air Source Heat Pumps	$10,584,092	$13,616,532	66,760	171
Small/Medium Business GHG Audit	$1,897,769	$2,291,206	6,570	36
Residential Gas Heat Pumps	$343,818	$380,759	235	4
Gas Heat Pumps for Commercial Buildings	$635,083	$749,442	2,154	8
Industrial and Large Commercial GHG Audit Pilot	($242,844)	$950,286	35,560	46
Total	**$186,028,684**	**$95,131,071**	**1,185,620**	**2,947**

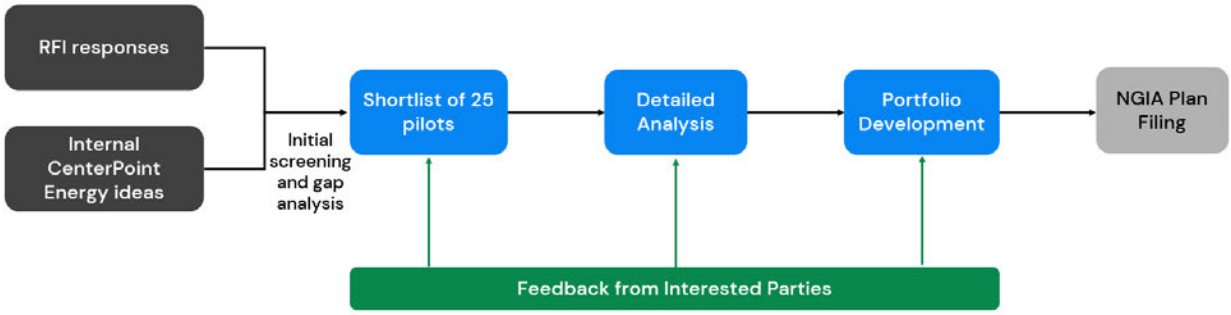
In addition to the eighteen full pilots above, CenterPoint Energy's Plan includes seven R&D pilots. As described further below, CenterPoint Energy proposes to identify additional R&D opportunities in future NGIA annual report filings and has reserved additional budget for future R&D projects not proposed in this plan's initial filing. Brief descriptions of each R&D pilot are provided in Section III below. More detailed descriptions are included in Exhibit K.

CenterPoint Energy requests some flexibility with actual spending to allow it to reallocate funding from pilots with lower-than-expected expenditures, due to low participation or other factors, to pilots with higher-than-expected expenditures. Specifically, CenterPoint Energy requests that it be allowed to spend up to 25 percent more than budgeted for pilots with higher-than-expected expenditures without seeking any additional approval from the Commission, provided that the increase does not cause the Plan, as a whole, to exceed its statutory cost cap or fail to satisfy any other statutory requirements. This flexibility proposal is similar to the flexibility allowed in CIP, where utilities may spend up to 25 percent more in any segment (i.e. residential, low-income, or commercial/industrial) without notifying or seeking approval from the Department. Providing for this flexibility also allows for pivots based on data-driven results.

VI. Plan Development and Engagement with Interested Parties

CenterPoint Energy's overall plan development process is summarized below in Figure 1.

Figure 1: CenterPoint Energy NGIA Plan Development Process



Each step shown in Figure 1 is further described below.

Request for Ideas, Internal CenterPoint Energy Ideas, and Initial Screening and Gap Analysis

CenterPoint Energy began its Plan development by issuing a request for ideas ("RFI") in April 2022. The RFI is included in Exhibit K and a summary of responses received is included in Exhibit L.[21] The purpose of the RFI was to gather ideas and information to assist in development of the Plan and to serve as a starting point for further evaluation of pilot ideas. CenterPoint Energy sought to identify individuals and organizations interested in receiving the RFI by: providing advance notice of the upcoming RFI to a broad group of existing CenterPoint Energy contacts, including vendors, community organizations, local governments, and other partners that have been engaged in CIP/ECO and/or the NGIA legislative and regulatory processes; encouraging those individuals to share the RFI opportunity with others that may be interested in responding; and promoting the RFI through industry groups and trade organizations relevant to innovative resources underrepresented in CenterPoint Energy's existing network including the American Biogas Council, RNG Coalition, Green Hydrogen Coalition, and Great Plains Institute's Hydrogen Economy Collaborative and Bioeconomy Coalition. The RFI was initially distributed to 228 individuals at 152 organizations. CenterPoint Energy also developed ideas internally. Altogether, CenterPoint Energy considered 108 ideas from RFI respondents and internal sources. The responses varied in level of detail from fully formed pilots to higher-level concepts. CenterPoint Energy is grateful to all of the submitters for taking time to provide ideas and insight in response to the RFI. Most of the pilots included in the final plan are informed by ideas or information provided by RFI respondents.

[21] CenterPoint Energy distributed the spreadsheet provided as Exhibit L to interested parties at its first interested parties meeting in September 2022. The Company has not updated this spreadsheet since that time to reflect a handful of additional ideas received after September 2022, final pilot names, or ultimate decisions on incorporation of ideas into final pilots. Accordingly, the spreadsheet reflects the Company's thinking at a specific point in time as of September 2022.

After distribution of the RFI, CenterPoint Energy engaged ICF as technical consultants to support development of the Plan. ICF assisted CenterPoint Energy in evaluating and, where appropriate, combining similar RFI responses. ICF also conducted a "gap analysis" and suggested additional pilot ideas.

Shortlist of 25 Pilot Concepts

Considering the full list of pilot ideas received through the RFI, from CenterPoint Energy employees, and through ICF's gap analysis, the Company worked with ICF to identify 25 pilot concepts to be analyzed in detail by ICF. CenterPoint Energy also identified certain pilot concepts to be considered for R&D funding in CenterPoint Energy's Plan.[22] Exhibit L contains brief information for each idea, identifying whether it was included in one of the shortlisted pilot concepts, included as a potential R&D pilot to be considered, or not included, along with a brief explanation.

Engagement with Interested Parties

CenterPoint Energy engaged Great Plains Institute ("GPI") to facilitate engagement with interested parties. The Company worked with its consultants to develop an engagement plan including three sets of public meetings to occur at the following junctures in Plan development:

1) Following development of a draft pilot concept shortlist, prior to shortlist finalization and detailed analysis of the shortlisted pilot concepts.
2) Following detailed analysis of the shortlisted pilot concepts, prior to any final pilot selections.
3) After development of a draft portfolio of selected final pilots.

At each juncture, the Company held two sets of meetings. The first meeting was open to any interested person. The second meeting in each set was designed specifically for parties self-identifying as planning to engage in the regulatory process following Plan filing and focused on more in-depth discussion of technical issues and regulatory considerations. Exhibit J contains all materials distributed to interested parties attending the meetings and GPI's notes summarizing the discussion in each meeting. GPI reached out to all known interested parties by email and notice of each meeting was filed in Docket Nos. G-999/CI-21-565 and G-999/CI-21-566. CenterPoint Energy also engaged in numerous additional meetings and email conversations with smaller groups of interested parties around topics of particular interest for those parties.

To encourage robust feedback from historically underrepresented groups, CenterPoint Energy offered a participation stipend for groups representing low-income, environmental justice, racial equity, and other perspectives historically underrepresented in energy development proceedings. Four individuals from four organizations or community groups took advantage of the stipends. CenterPoint Energy will continue to engage historically underrepresented groups

[22] The NGIA allows utilities to spend up to 10 percent of the proposed total incremental costs related to innovation plans on R&D. Minn. Stat. § 216B.2427, subd. 4(g).

as it further develops, implements, and evaluates its Plan, as described further under the "Equity, Diversity and Community Engagement" section below.

Detailed Analysis

During this step, CenterPoint Energy and ICF worked together to provide further definition to each of the 25 short-listed pilot concepts. Each pilot concept required CenterPoint Energy and ICF to make certain assumptions about pilot design, participation, and costs. Based on assumptions developed with CenterPoint Energy, ICF estimated lifecycle GHG reduction or avoidance impacts of the shortlisted pilots and, using the IMPLAN model,[23] economic impacts in Minnesota including net job creation. ICF and CenterPoint Energy also considered qualitative costs and benefits of the pilots such as potential improvements to water quality, specific benefits or costs for disadvantaged communities, impacts on Minnesota's energy resiliency, and scalability and potential roles for various resources in a decarbonized energy system. All costs and benefits considered are summarized in Exhibit M for pilots included in the proposed portfolio. For each pilot, ICF and CenterPoint Energy considered three potential pilot sizes, developing detailed estimates for each size. CenterPoint Energy's assumptions for each of the shortlisted pilot concepts are shown in Exhibit N. Qualitative considerations for shortlisted pilot concepts are shown in Exhibit O and quantitative costs and benefits are shown in Exhibit P. Results and discussion of GHG lifecycle assessment for each of the shortlisted pilot concepts are in Exhibit F. Results of the IMPLAN modeling are shown in Exhibit H.

During the detailed analysis phase, CenterPoint Energy determined that two of the pilot concepts originally shortlisted should be moved to the list of R&D projects for consideration. As discussed further in Section VIII, there was substantial uncertainty about the estimated lifecycle GHG emissions reduction that could be achieved for these two pilots. One of these pilots (Weatherization Blitzes) is being proposed as an R&D pilot in the first two years of Plan implementation. It was determined that the other (Carbon Capture through Methane Pyrolysis at an Industrial Facility) could potentially be supported through the proposed Industrial or Large Commercial Hydrogen and Carbon Capture Incentives program and is not being included in the plan as an independent pilot.

Portfolio Development

Following detailed analysis, CenterPoint Energy worked with ICF to identify various combinations of pilots and pilot sizes that would satisfy statutory requirements. In selecting among possible portfolios, CenterPoint Energy used the following strategies:

- Target a balanced portfolio covering different innovative resource types.
- Maximize innovation and learning by including a wide variety of different pilots.

[23] IMPLAN is an economic input-output model that combines a set of extensive databases related to economic factors, economic multipliers, and demographic statistics with a refined and detailed system of modeling software.

- Prioritize funding for more innovative options that could help CenterPoint Energy evolve its business to support customers in reducing emissions and help the utility gain experience in these areas. For some pilots, potential learning opportunities were not increased by higher levels of spending so smaller sizes could be selected without sacrificing innovation.
- Produce a reasonable cost portfolio when considering investment per ton of GHG reduction, while not compromising on innovation for the sake of cost.
- Choosing larger sizes for pilots that are commercial technologies, highly scalable, and have high potential for long-term emissions reductions.

CenterPoint Energy's proposed portfolio strives to maximize innovation by employing six-to-seven of the eight innovative resources in full pilots and including the eighth in proposed R&D pilots.[24] The final plan includes eighteen pilots, incorporating twenty-two of the short-listed pilot concepts considered for plan inclusion.[25] Most of the pilots are included at a small scale with the exception of the three RNG pilots, Green Hydrogen Blending into Natural Gas Distribution System, New Networked Geothermal Systems, Commercial Hybrid Heating, and Residential Deep Energy Retrofits and Electric Air Source Heat Pumps pilots, which were prioritized for spending due to their high potential scalability and transformative potential for the gas distribution system. RNG and Green Hydrogen Blending into Natural Gas Distribution System were also prioritized for additional spending to satisfy statutory requirements.

Equity, Diversity, and Community Engagement

The Commission's June 1, 2022 Order Establishing Frameworks for Implementing Minnesota's Natural Gas Innovation Act ("Frameworks Order"),[26] Order Point 38(c), requires CenterPoint Energy to provide a discussion of how equity and diversity was or will be considered in the program design process and any utility vendor/supplier selection process. As described above, to encourage robust feedback from historically underrepresented groups in the series of public meetings, CenterPoint Energy offered a participation stipend for individuals or groups representing low-income, environmental justice, racial equity, and other perspectives historically underrepresented in energy development proceedings. Four individuals from four organizations or community groups took advantage of the stipends. CenterPoint Energy will continue to engage historically underrepresented groups as it further develops, implements, and evaluates its Plan. These activities are described in more detail in Exhibit D.

[24] Biogas is not necessarily represented by the proposed pilots but could be a measure implemented under the Industrial or Large Commercial GHG Audit pilot or the Decarbonizing Existing District Energy Systems pilot. Power-to-ammonia is not represented in the full pilot list but is the subject of two proposed R&D pilots.

[25] Some of the shortlisted pilots were combined in the final portfolio.

[26] *In the Matter of Establishing Frameworks to Compare Lifecycle Greenhouse Gas Emission Intensities of Various Resources, and to Measure Cost Effectiveness of Individual Resources and of Overall Innovation Plans,* Docket No. G-999/CI-21-566, Order Establishing Frameworks for Implementing Minnesota's Natural Gas Innovation Act (June 1, 2022).

Additionally, the Plan will create new job opportunities at CenterPoint Energy and support regional workforce development through contracted services. CenterPoint Energy recognizes the economic importance of diverse suppliers such as minority-owned, women-owned, veteran-owned, and all categories of small business to the community. We embrace the power of diversity because it enriches our work environment and provides social and economic benefits to the communities we serve. The Company plans to seek out contracting opportunities to employ diverse and qualified vendors and suppliers[27] as the Company implements the Plan. The Company commits to tracking and reporting on an annual basis the total and percent spend of Plan vendor services on diverse vendors or suppliers. These activities are described in more detail for relevant pilots in Exhibit D.

The Frameworks Order, Order Point 38(a), requires CenterPoint Energy to provide a summary of outreach/community workshops held for pilots designed to reach low- and medium-income customers. As described above, CenterPoint Energy sought to encourage feedback from a broad group of interested stakeholders in development of the Plan including historically underrepresented groups. Proposed pilots that are or will be designed to encourage participation by low- and medium-income customers include the Residential Deep Energy Retrofits and Electric Air Source Heat Pumps and the Weatherization Blitzes R&D pilots. As described in Exhibit D, the Residential Deep Energy Retrofits and Electric Air Source Heat Pumps pilot begins with feasibility and scoping studies, which will consider and make recommendations on community outreach and engagement. CenterPoint Energy will file these studies, as well as its community engagement plans, with the Commission prior to moving to the third phase of the pilot. The Weatherization Blitzes R&D pilot, which is further described below and in Exhibit J, includes a process for engagement with interested parties generally and with specific communities being considered for participation in the pilot initiative.

VII. Research and Development

The NGIA allows gas utilities to spend up to 10 percent of NGIA Plan total incremental costs on R&D;[28] however, the NGIA does not define the term R&D. CenterPoint Energy used two criteria to classify potential pilots as R&D:

1) The pilot is a research project or study that is relatively small in scale compared to other pilots being considered;
2) The lifecycle GHG benefits of the pilot are uncertain, difficult to quantify, or likely to be nominal (although learnings from the pilot may lead to significant future reductions).

It was somewhat challenging to develop a workable definition of R&D for Plan development. Since NGIA is intended to spur innovation and development of nascent resources, many standard definitions of R&D could be read to encompass even the most established resources

[27] CenterPoint Energy defines diverse suppliers per the guidelines of the National Minority Supplier Development Council, the Women's Business Enterprise National Council and the U.S. Small Business Administration.

[28] Minn. Stat. § 216B.2427, subd. 4(g).

eligible for inclusion in NGIA plans.[29] However, given the limitation in the statute on R&D spending under the Plan, it was clearly not the intention of the legislature to classify every potential NGIA pilot as R&D. The two criteria CenterPoint Energy developed do not create a bright line between R&D and other pilots, and CenterPoint Energy exercised judgment to classify pilots as R&D; however, CenterPoint Energy believes that these criteria produce a reasonable result.

In this filing, CenterPoint Energy proposes to utilize the full available budget for R&D over the five-year Plan term but proposes specific projects for only the first two years of the Plan. Additional R&D pilots will be proposed in annual NGIA status report filings. CenterPoint Energy received many promising R&D proposals in response to its RFI. The full list is included in Exhibit L. Accordingly, the Company believes that the full 10 percent of budget will be well-used on R&D opportunities. However, selecting the full list of R&D pilots for the next five years is not in the best interests of customers, given the rapidly changing landscape of GHG reduction technologies. Over the next several years CenterPoint Energy and the industry at large will learn a great deal about how best to deploy innovative resources. In particular, the recently enacted federal Inflation Reduction Act,[30] will likely spur innovation with respect to resources such as power-to-hydrogen, strategic electrification, and energy efficiency. At the same time, CenterPoint Energy expects to learn through implementation of its first innovation Plan, and better understand the specific R&D needs that best support future efforts to reduce our customers' natural gas GHG emissions. By deferring selection of R&D projects until future annual NGIA status report filings, CenterPoint Energy will be able to consider the most relevant R&D projects at those future dates that will best advance NGIA's objectives.

For the first two years, CenterPoint Energy has selected to focus its R&D efforts on (1) foundational studies that will help CenterPoint Energy target future decarbonization efforts using data-driven results and (2) innovative resources that are less represented in the proposed full pilots (specifically, power-to-ammonia). Below, CenterPoint Energy provides brief descriptions of the R&D pilots it proposes to begin implementation of in the first two years of the Plan. Additional details on these proposed R&D Pilots are included in Exhibit J.

1. **CenterPoint Energy Minnesota Net Zero Study**: CenterPoint Energy proposes to conduct a study to help it and interested parties better understand the different pathways for CenterPoint Energy Minnesota Gas to reach net zero emissions by 2050, including Scope 1, and 3 emissions. The estimated cost of this study is $220,000.
2. **Weatherization Blitzes**: CenterPoint Energy proposes to test intensive, novel, and community-based marketing and outreach approaches to increase participation in

[29] For example, Meriam-Webster defines "research and development" as "studies or tests that are done in order to design new or improved products." https://www.merriam-webster.com/dictionary/research%20and%20development. Because the purpose of NGIA is to develop new and better ways of serving Minnesota energy needs currently served by natural gas, arguably the entire Plan is intended to develop new, better, energy products for Minnesota customers.

[30] Inflation Reduction Act of 2022, Pub. L. 117-169, 126 Stat. 1818 (2022).

CenterPoint Energy's CIP/ECO weatherization offerings. The estimated cost of this effort is $800,000.

3. **High Performance Commercial New Construction Building Envelope Initiative**: CenterPoint Energy proposes to test a multi-prong strategy to address barriers to integrating high-performance commercial building envelopes in new commercial construction. The estimated cost of this proposal is $400,000.
4. **Assessing Next-Generation Micro-Carbon Capture for Commercial Buildings:** This proposed R&D pilot will investigate the carbon capture effectiveness and heat recovery efficiency of CleanO2's next generation CarbinX units (version 4.0). This pilot complements the full pilot Carbon Capture Rebates for Commercial Buildings which will incentivize installation of version 3.0 units. The estimated cost of this research is $275,000.
5. **Green Ammonia Novel Technology:** This pilot will support testing of a Modular One Vessel Ammonia Production System for green ammonia, which has potential to improve production efficiency and reduce costs for green ammonia production. The estimated cost for this pilot is $100,000.
6. **RNG Potential Study:** CenterPoint Energy will study three regions of the CenterPoint Energy Minnesota service territory for potential development of an RNG production facility. Regions will be selected based on potential for production of RNG feedstock and feasibility of accepting substantial quantities of RNG into CenterPoint Energy's system. The estimated cost for this study is $60,000.
7. **Utilization of Green Ammonia for Thermal Energy Applications:** CenterPoint Energy proposes to support research into how green ammonia may be used in industrial-scale burner applications. The primary goal is to determine operating ranges and burner concepts that can be applied to industrial burners used in grain drying and boilers used for district heating. The estimated cost for this research is $205,000.

VIII. Cost Recovery Proposal

Calculation of Cost Cap

The NGIA places a limit on the annual total incremental costs that CenterPoint Energy may propose and the Commission may approve for this Plan.[31] CenterPoint Energy calculates its annual cost cap to be $18,118,182. CenterPoint Energy's calculation of its cost cap is shown in Table 2 below.

[31] Minn. Stat. 216B.2427, subd. 3(a).

Table 2: Calculation of Cost Cap for CenterPoint Energy's First Plan Filing

1	CenterPoint Energy's Gross Operating Revenues from natural gas service provided in Minnesota at the time of plan filing	$1,209,096,803[32]
2	Line 1 x 1.75%	$21,159,194
3	CenterPoint Energy customers	905,924[33]
4	CenterPoint Energy CIP-exempt customers	15
5	Line 3 – Line 4	905,909
6	Line 5 x $20	$18,118,180
7	Lesser of Line 2 and Line 6	$18,118,180

In addition to the general cost cap described above, NGIA allows CenterPoint Energy to propose and the Commission to approve additional annual costs for the purchase of RNG produced from (i) food waste diverted from landfill; (ii) a municipal wastewater treatment system; or (iii) an organic mixture that includes at least 15 percent, by volume, sustainably harvested native prairie grasses or locally appropriate cover crops.[34] CenterPoint Energy calculates this additional amount to be equal to $3,022,742 for this Plan, as shown below in Table 3:

Table 3: Calculation of RNG Bonus Cost Cap for CenterPoint Energy's First Plan Filing

1	CenterPoint Energy's Gross Operating Revenues from natural gas service provided in Minnesota at the time of plan filing	$1,209,096,803[35]
2	Line 1 x 0.25%	$3,022,742
3	CenterPoint Energy customers	905,924[36]
4	CenterPoint Energy CIP-exempt customers	15
5	Line 3 – Line 4	905,909
6	Line 5 x $5	$4,529,545
7	Lesser of Line 2 and Line 6	$3,022,742

[32] *In the Matter of the Application of CenterPoint Energy Resources Corp., d/b/a CenterPoint Energy Minnesota Gas, for Authority to Increase Rates for Natural Gas Utility Service in Minnesota,* Docket No. G-008/GR-21-435, Settlement, Attachment 4, Schedule E-1(a) (Mar. 14, 2022).

[33] This represents the number of customer bills (10,871,089) divided by 12. The number of customer bills can be found in *In the Matter of the Application of CenterPoint Energy Resources Corp., d/b/a CenterPoint Energy Minnesota Gas, for Authority to Increase Rates for Natural Gas Utility Service in Minnesota,* Docket No. G-008/GR-21-435, Settlement, Attachment 4, Schedule E-2 (Mar. 14, 2022).

[34] Minn. Stat. 216B.2427, subd. 3(b).

[35] *In the Matter of the Application of CenterPoint Energy Resources Corp., d/b/a CenterPoint Energy Minnesota Gas, for Authority to Increase Rates for Natural Gas Utility Service in Minnesota,* Docket No. G-008/GR-21-435, Settlement, Attachment 4, Schedule E-1(a) (Mar. 14, 2022).

[36] This represents the number of customer bills (10,871,089) divided by 12. The number of customer bills can be found in *In the Matter of the Application of CenterPoint Energy Resources Corp., d/b/a CenterPoint Energy Minnesota Gas, for Authority to Increase Rates for Natural Gas Utility Service in Minnesota,* Docket No. G-008/GR-21-435, Settlement, Attachment 4, Schedule E-2 (Mar. 14, 2022).

Adding together the general cost cap and the bonus RNG cost cap results in a total combined cap of $21,140,922. Because the NGIA provides that limits on total incremental costs must be calculated as the average of the utility's forecasted total incremental costs over the five-year term of the plan,[37] CenterPoint Energy has found it most useful to think of the cost cap in terms of the full five-year Plan, or the annual cost cap multiplied by five. The general cap on CenterPoint Energy's five-year Plan is $90,590,900 and the additional RNG cost cap is $15,113,710. Summing those two figures, the total amount that CenterPoint Energy may propose and the Commission may approve is $105,704,610 for the entire five-year Plan.

Note that CenterPoint Energy has included two pilots that are fully eligible to count towards the additional RNG cost cap. Specifically, the RNG Produced from Hennepin County Organic Waste and the RNG Produced from Ramsey & Washington Counties Organic Waste pilots are both pilots through which CenterPoint Energy proposes to purchase RNG produced from food waste diverted from a landfill. As shown in Table 1 above, the estimated incremental cost for these two projects together, counting against the NGIA cost cap, is $13,016,824. RNG procured through the Renewable Natural Gas RFP Purchase Pilot may also be eligible to count towards the additional RNG cost cap. As discussed further in Exhibits D and Q, CenterPoint Energy plans to give a preference to RNG proposals that will satisfy the eligibility criteria to take full advantage of the additional RNG cost cap.

CenterPoint Energy Cost Recovery Proposal

The NGIA states that prudently incurred costs under an approved plan are recoverable either (1) through the utility's purchased gas adjustment ("PGA"); (2) in the utility's next general rate case; or (3) via annual adjustments.[38] CenterPoint Energy proposes to utilize all three of these mechanisms for different costs that it will incur under the Plan.

CenterPoint Energy proposes to recover certain fuel costs through the PGA mechanism. The PGA mechanism allows for the automatic adjustment of charges for, among other things, the direct costs for natural gas delivered and costs for fuel used in the manufacture of gas.[39] CenterPoint Energy proposes to include costs it incurs for the purchase of RNG in the PGA as a direct cost for natural gas delivered. CenterPoint Energy also proposes to include costs for purchased electricity under the Green Hydrogen Blending into Natural Gas Distribution System Pilot in the PGA as a fuel used in the manufacture of gas. As detailed below, CenterPoint Energy's proposed PGA recovery meets the standard for the Commission to grant rule variances to applicable PGA rules as necessary to allow for the recovery of such NGIA costs through the PGA mechanism.

[37] Minn. Stat. 216B.2427, subd. 3(e).

[38] Minn. Stat. 216B.2427, subd. 2(c).

[39] Minn. Stat. 216B.16, subd. 7, clause (2).

For the remainder of its costs, CenterPoint Energy proposes to utilize two recovery mechanisms similar to how CIP/ECO costs are recovered. First, CenterPoint Energy plans to include certain costs in its upcoming general rate case, expected to be filed in the fall of 2023, for inclusion in delivery charges (the "Innovation Act Charge" or "IAC"). This base rate recovery parallels the Conservation Cost Recovery Charge CenterPoint Energy utilizes to recover forecasted CIP/ECO expense through base rates. Specifically, CenterPoint Energy proposes to set the IAC to be included in base rates to recover Plan development costs incurred prior to rate case filing as well as projected costs through calendar years 2023, 2024, and 2025. CenterPoint Energy intends to file a multi-year rate case with test years 2024 and 2025, will include the before mentioned costs as a 2025 test year expense, and proposes to begin this charge when final rates are implemented following a final order in the rate case. Amounts recovered through the IAC included in base rates would be tracked in CenterPoint Energy's NGIA Tracker.

Second, CenterPoint Energy proposes an annual rider mechanism with true-up to match actual NGIA expenses with recoveries (the "Innovation Act Adjustment" or "IAA"). This is analogous to the Conservation Cost Recovery Adjustment used for CIP, which is computed to collect CenterPoint Energy's forecasted CIP/ECO Tracker balance over 12 months, accounting for CIP/ECO spending and recoveries through the base rate Conservation Cost Recovery Charge. With each annual NGIA status report, CenterPoint Energy would file an NGIA Tracker showing the differences, if any, between NGIA recovery and expenses and propose adjustments to the IAA so as to eliminate the disparity. CenterPoint Energy proposes that the first IAA would go into effect upon approval of the Company's first NGIA status report.

CenterPoint Energy proposes to include customer communications about the IAC along with other communications about the rate case. CenterPoint Energy also proposes to provide customer communications about the IAA when the first IAA goes into effect after approval of the Company's first NGIA status report.

The IAC and IAA will include the Company's rate of return, income taxes on the rate of return, incremental property taxes, incremental depreciation expense, and incremental operations and maintenance expenses as authorized by the NGIA, including incremental internal labor costs.[40]

Note that CenterPoint Energy has proposed to match cost recovery to the classes of customers receiving benefits from the proposed pilots. For example, only residential customers would be charged for residential-focused pilots. Additionally, as required by the NGIA, CenterPoint Energy proposes to exempt CIP-exempt customers from NGIA charges.

CenterPoint Energy has included a sample tracker for the NGIA Adjustment in Exhibit R and draft tariff pages implementing this cost recovery proposal as Exhibit S.

[40] Minn. Stat. § 216B.2427, subd. 2(c)(3).

Variance Request

CenterPoint Energy requests that the Commission grant variances to applicable PGA rules[41] pursuant to Minn. R. 7829.3200 to allow the Company to implement the proposed PGA recovery discussed above. CenterPoint Energy requests variances to Minn. R. 7825.2400 as well as any other rules necessary to implement the proposed cost recovery.

Minn. R. 7825.2400, subp. 12 and subp. 10 define the "cost of purchased gas" and the "cost of fuel consumed in manufacture of gas" by reference to certain accounts in the uniform system of accounts as provided in the Code of Federal Regulations, title 18, part 201, as amended through April 1, 1988.[42] CenterPoint Energy will not record its RNG purchases or its electricity purchases for the hydrogen electrolyzer to any of the listed accounts. RNG purchases will be charged to FERC account 804.2 and electricity costs will be charged to FERC account 735.0. The Company requests a variance to these definitions to allow it to recover these expenses through the PGA although they do not satisfy the definitions of commodity-delivered gas cost or cost of fuel consumed in manufacture of gas as set forth in the Commission's Rules.[43] As noted above, the costs proposed to be recovered through the PGA satisfy the statutory requirements for inclusion in the PGA as direct costs for natural gas delivered and costs for fuel used in the manufacture of gas.

Minn. R. 7829.3200 provides that the Commission shall grant a variance to its rules when it determines that the following requirements are met: A. enforcement of the rule would impose an excessive burden upon the applicant or others affected by the rule; B. granting the variance would not adversely affect the public interest; and C. granting the variance would not conflict with standards imposed by law. Each of these criteria is met here, as described below.

1. Enforcement of the Rule Would Impose an Excessive Burden

CenterPoint Energy's NGIA recovery plan uses each cost recovery mechanism authorized by NGIA in a reasonable way. Enforcement of the Commission's PGA rules in a way that would

[41] Minn. R. 7825.2390 – 7825.2920.

[42] Minn. R. 7825.2400, Ssubp. 10 provides "Cost of fuel consumed in the manufacture of gas" or "peak shaving gas volumes" is the withdrawals, during the heating season, from account 151 as defined by the Minnesota uniform system of accounts, class A and B gas utilities. All gas public utilities shall use this definition regardless of class. Minn. R. 7825.2400, Subp. 12 provides "Cost of purchased gas" is the cost of gas as defined by the Minnesota uniform system of accounts, class A and B gas utilities, including accounts 800, 801, 802, 803, 804, 804.1, 805, 805.1, 808.1, 809.1, 810, 854, and 858 for energy purchased, as provided by Code of Federal Regulations, title 18, part 201, as amended through April 1, 1988. These accounts are incorporated by reference. The cost of purchased gas also includes the normal and ordinary cost of injection and withdrawal of gas from storage at the time of withdrawal. All gas public utilities shall use this definition regardless of class.

[43] Furthermore, CenterPoint Energy requests a variance from the definition of commodity-delivered gas cost in Minn. R. 7825.2400, Subp. 6d, which cross references to the definition of cost of purchased gas in Subp. 12. Minn. R. 7825.2500 allows for automatic adjustments for changes in cost resulting from changes in the commodity-delivered gas cost for purchased gas and the cost of fuel consumed in the manufacture of gas or peak shaving gas volumes.

disallow recovery of costs through the PGA mechanism would impose an excessive burden on CenterPoint Energy and customers as recovery of the identified costs through the PGA mechanism most appropriately recognizes the nature of the identified costs and ensures timely recovery in a manner consistent with cost causation and the established PGA mechanism.

2. *Granting the Variance does not Adversely Affect the Public Interest*

CenterPoint Energy's proposed recovery structure is designed to recover costs in a similar manner to the ways like costs are already recovered from customers and does not seek to recover more costs than are reasonable or permitted by the NGIA statute. The public interest is not adversely affected by allowing reasonable cost recovery mechanisms for prudently incurred statutorily authorized costs.

3. *Variance does not Conflict with Standards Imposed by Law*

The proposed recovery structure outlined above does not conflict with law. Granting the requested variances will allow CenterPoint Energy to implement cost recovery in accordance with the NGIA statute, which expressly authorizes the recovery of costs incurred to implement an NGIA Plan under Minn. Stat. § 216b.16, subd. 7 via the utility's PGA. Further, the requested variance is consistent with Minn. Stat. § 216B.16, subd. 7, which permits PGA recovery for direct costs for natural gas delivered costs for fuel used in the manufacture of gas.

Expected Customer Impact

The following tables provide information about the estimated recovery from customers during the term of the Plan. Additional information is provided in Exhibit R. As described in Exhibit R, actual recovery is likely to vary based on the charge implementation timeline, actual expenses, and customer natural gas usage and is unlikely to equal the estimates provided.

Table 4: NGIA Cost Recovery by Mechanism (Millions)

Mechanism	2025	2026	2027	2028	2029	Total
PGA	$3.4	$9.2	$11.7	$11.8	$6.0	$42.0
IAC	$17.3	$17.3	$15.5	$15.3	$15.3	$80.7
IAA	$0.0	($2.0)	$0.0	$0.0	($6.8)	($8.8)
Total	$20.7	$24.5	$27.2	$27.1	$14.4	$113.9

Table 5: NGIA Recovery by Class (Thousands)

Class	2025	2026	2027	2028	2029	Total
Residential	$7,959	$10,054	$12,396	$14,328	$8,146	$52,883
Comm Firm A	$363	$412	$431	$368	$209	$1,783
Comm/Ind Firm B	$1,018	$1,170	$1,224	$1,053	$572	$5,036
Comm/Ind Firm C - Sales Service	$6,237	$7,384	$7,744	$6,754	$3,445	$31,564
Comm/Ind Firm C - Transport	$117	$105	$98	$75	$39	$433
Large General Firm Sales Service	$209	$256	$265	$235	$97	$1,062
Large Firm Transport	$365	$329	$305	$234	$120	$1,354
Small Dual Fuel A - Sales Service	$709	$824	$847	$737	$335	$3,452
Small Dual Fuel A - Transport	$44	$39	$37	$28	$14	$162
Small Dual Fuel B - Sales Service	$488	$582	$602	$530	$233	$2,434
Small Dual Fuel B - Transport	$67	$60	$56	$43	$22	$248
Large Volume - Dual Fuel Sales Service	$1,153	$1,422	$1,468	$1,312	$515	$5,869
Large Volume - Dual Fuel Transport	$1,056	$953	$883	$676	$348	$3,917
Large Volume-Transport-MR	$202	$183	$169	$129	$67	$750
Large Volume-Dual Fuel Sales Service-MR	$199	$246	$254	$227	$89	$1,014
Large Volume - Dual Fuel Transport-MR	$507	$458	$424	$325	$167	$1,881
Total	**$20,693**	**$24,477**	**$27,202**	**$27,053**	**$14,418**	**$113,843**

It is important to note that the NGIA cost cap is defined by reference to total *incremental* cost, which is defined to be certain utility expenses less certain savings estimated to be achieved by the plan.[44] The most significant source of savings included in the calculation of total incremental cost in this Plan is cost savings achieved through avoidance of purchases of natural gas

[44] Minn. Stat. § 216B.2427, subd. 1(r).

produced from geologic sources. These savings will accrue to customers via reduced PGA costs for geologic natural gas but are not reflected in the tables shown.

The total estimated annual bill impact for a typical residential customer[45] is shown in Table 7 below.

Table 6: Estimated Annual Bill Impact for an Typical Residential Customer

	2025	2026	2027	2028	2029
Annual Estimated Bill Impact	$9.55	$12.06	$14.87	$17.18	$9.77

While the bill increases for a residential customer during the course of the Plan are modest, CenterPoint Energy is sensitive to the burdens on our low and moderate-income customers. In each of the customer communications discussed above, CenterPoint Energy proposes to include information about how customers can learn more about payment plans and bill pay assistance options. In addition, as discussed further in Exhibit D, CenterPoint Energy plans to find ways to target or include low-and-moderate income customers in several of its proposed residential pilots so that low-and-moderate income customers receive the benefits of NGIA pilots. Specifically, CenterPoint Energy will seek to include low-or-moderate income customers in in the proposed Residential Deep Energy Retrofits and Electric Air Source Heat Pumps pilot and to target lower income neighborhoods with the Weatherization Blitzes R&D pilot.

Tracking NGIA Costs

The NGIA Tracker, as described above, will track all NGIA expenses and recoveries through the approved IAC and IAA mechanisms to ensure all actual reasonable and prudent costs are accounted for and trued up based on actual recoveries. CenterPoint Energy plans to set up accounting controls and processes to ensure all NGIA costs are tracked, reported, and recovered accurately and appropriately. CenterPoint Energy will set up accounting for each pilot program as well as the R&D portfolio and general NGIA expenses. Consistent with the Company's Conservation Cost Recovery Adjustment, CenterPoint Energy will adjust the true-up annually as part of the annual NGIA status report filing. Tracker information will include information on the current status of the tracker, as well as forecasted amounts for future NGIA spending and collections. The net over/under collection projected will be used to calculate the IAA rider rate to be applied to customer bills. In addition to the annual adjustment, CenterPoint Energy will include discussion in the Company's next rate case demonstrating that the utility is not double-recovering NGIA costs.

IX. Approval Criteria

The NGIA specifies certain criteria for the Commission's approval of an NGIA plan. CenterPoint Energy addresses each statutory criterion below. Note that CenterPoint Energy has also filed a Utility System Report and Forecast and its most recent Service Quality report, as required by

[45] The typical CenterPoint Energy residential customer uses approximately 89 Dth of natural gas annually.

the NGIA, to aid the Commission's review of the Plan in the context of CenterPoint Energy's system. These are included in Exhibits T and U.

a. The size, scope, and scale of the Plan produces net benefits under the cost-benefit framework established by the Commission.

The NGIA directs the Commission to take a broad view of cost effectiveness.[46] Consistent with this directive, the Commission, in the Frameworks Order, concluded it would consider cost effectiveness primarily from the NGIA societal perspective[47] and defined that perspective as "all costs and benefits of the resource, including all relevant societal impacts."[48] The Frameworks Order also expressly recognized that while some relevant costs and benefits are quantified, other important costs and benefits cannot be reduced to numbers.[49] To assist the Commission and interested parties in understanding the costs and benefits of a proposed NGIA plan, the Frameworks Order established a cost-benefit chart, which is designed to summarize key costs and benefits of the proposed Pilot programs.[50] CenterPoint Energy has attached this Chart for its Plan as Exhibit M. The Frameworks Order also requires utilities to provide detail on the quantification of any quantified costs and benefits and further discussion of any qualitative costs and benefits included on the cost-benefit chart.[51] This information for CenterPoint Energy's Plan is provided in Exhibits O and P.

Taken all together, CenterPoint Energy's proposed Plan has greater benefits than costs. The quantified costs of the plan exceed quantified benefits;[52] however, some of the most important aspects of the Plan are not quantified, as discussed below.

For this Plan, CenterPoint Energy focused particular attention on innovation-related benefits. The cost-benefit chart adopted in the Frameworks Order requires that the Company evaluate each pilot from the perspective of "direct innovation support" and "resource scalability and role in a decarbonized system." As the first innovation plan filed by CenterPoint Energy or by any Minnesota gas utility, the Company felt it was particularly important to use this plan to test a broad variety of innovative resources and pilot models in order to lay the groundwork for future natural gas decarbonization efforts.

[46] Minn. Stat. § 216B.2428.

[47] Frameworks Order, Order Point 27.

[48] Frameworks Order, Order Point 26(d).

[49] Frameworks Order, Order Points 31 & 32.

[50] Frameworks Order, Order Point 30.

[51] Frameworks Order, Order Point 33.

[52] Considering all costs and benefits that have been quantified over the lifetime of measures to be installed, monetized costs exceed monetized benefits by approximately $255M.

A handful of CenterPoint Energy's proposed pilots are cost-effective, considering only quantified costs and benefits. Specifically, the following proposed Pilots are cost-effective if only quantified costs and benefits are considered:

- Industrial Methane and Refrigerant Leak Reduction;
- Carbon Capture Rebates for Commercial Buildings;
- Decarbonizing Existing District Energy Systems; and
- Industrial and Large Commercial GHG Audit.

While CenterPoint Energy believes that these four pilots are valuable pieces of its proposed Plan, it is clear, looking at this list, that pursuing only quantifiably cost-effective pilots in this first plan would do little to assist CenterPoint Energy or the State in identifying pathways that could achieve deep decarbonization of end uses currently served by geologic gas. Specifically, none of the pilots listed above provide solutions for residential customers. But more generally, each of these pilots is likely to support partial decarbonization of the operations of certain customers but are unlikely to drive the kind of emissions reductions Minnesota needs to meet its GHG reduction goals. Instead, these pilots are best seen as compliments to more scalable resources, such as low-carbon fuels or strategic electrification, which are not currently cost-effective when only quantified costs and benefits are considered. It is also worth noting that these four pilots are insufficient to satisfy statutory requirements for this Plan.

CenterPoint Energy's goal with this plan is to explore a broad spectrum of innovative resources and pilot designs to identify and gain experience with the innovative resources that can be most cost-effectively combined and scaled up to meet the challenge of deep decarbonization. This Plan design is a major qualitative benefit of the selected pilots that warrants the size, scope, and scale of the proposed investment.

In addition to innovation benefits, the proposed Plan also carries many other qualitative benefits that must be taken into account. Some of the key qualitative benefits are:

- Net job creation of an estimated 3,000 full time equivalent positions in Minnesota;
- Increasing energy security by meeting energy needs with resources that can be produced in state or reducing the need for energy consumption;
- Capitalizing on new federal Inflation Reduction Act incentives;
- Supporting local industries and the development of local expertise in growing fields such as RNG, hydrogen, and strategic electrification;
- Supporting Minnesota businesses to be more competitive with sustainability focused customers by achieving their own GHG reduction goals; and
- Supporting Minnesota's goals to increase recycling and avoid landfilling.

A full discussion of these and many other qualitative costs and benefits CenterPoint Energy considered is included in Exhibit O. As required by the NGIA, CenterPoint Energy has also developed alternative portfolios of pilots, that if implemented, would provide approximately 50 percent, 150 percent, and 200 percent of the lifecycle GHG emissions reduced/avoided by the proposed Plan. These are shown in Exhibit V. CenterPoint Energy endeavored to satisfy all

statutory criteria with these alternative plans but could not satisfy budget constraints for the larger plans.

b. The Plan promotes the use of renewable energy resources and reduces or avoids GHG emissions without exceeding the cost cap.

As described above in Section IV, CenterPoint Energy has designed the Plan to meet the requirements of the statutory cost cap.

Most of the proposed pilots involve use of renewable energy resources. The only exceptions are carbon capture-only pilots (Industrial Methane and Refrigerant Leak Reduction, Urban Tree Carbon Offsets, and Carbon Capture Rebates for Commercial Buildings) and energy efficiency-only pilots (Residential Gas Heat Pumps and Gas Heat Pumps for Commercial Buildings). The strategic electrification pilots will increase the use of renewable resources, because Minnesota's electricity supply is partially and increasingly renewable.

All proposed pilots will reduce or avoid GHG emissions. As noted above, estimated total GHG reductions from the Plan are approximately 1.2 million metric tons of CO_2e emissions.

c. The Plan promotes local economic development.

As noted above, the Plan is expected to create approximately 3,000 direct, indirect, and induced jobs in Minnesota. In addition, Exhibit O describes several additional local economic benefits including:

- Several of the pilots, including the RNG Produced from Hennepin County Organic Waste, RNG Produced from Ramsey & Washington Counties Organic Waste, Green Hydrogen Blending into Natural Gas Distribution System, and New Networked Geothermal Systems will pay construction workers prevailing wages and seek to include apprentices in construction. It is likely that customers participating in the Industrial or Large Commercial Hydrogen and Carbon Capture Incentives and New District Energy System pilots will also pay prevailing wages and satisfy apprenticeship requirements to qualify for higher tax credits under the federal Inflation Reduction Act.
- The hydrogen pilots represent an opportunity for highly skilled workers to transition from traditional energy industries into a clean energy industry.
- The hydrogen and carbon capture pilots may help Minnesota take advantage of Inflation Reduction Act incentives that poise both industries for growth over the next decade.

d. The innovative resources included in the Plan have lower lifecycle GHG intensity than gas produced from conventional geologic sources.

As discussed in Exhibit F, all of the resources included in the Plan have a lower lifecycle GHG intensity than geologic gas.

e. The systems used to track and verify the environmental attributes of the innovative resources included in the Plan are reasonable, considering available third-party tracking and verification systems.

The Company demonstrates in Exhibits D and W how its tracking and verification plan for each pilot is reasonable.

f. The costs and revenues projected under the Plan are reasonable in comparison to other innovative resources the utility could deploy to reduce GHG emissions, considering other benefits of the innovative resources included in the Plan.

Section VI above describes and supports the reasonableness of CenterPoint Energy's selection of the portfolio of pilots proposed in this Plan. In brief, CenterPoint Energy endeavored to first identify the world of possibilities by engaging interested parties in an RFI, conducting internal outreach with CenterPoint Energy employees, and hiring ICF to complete a gap analysis. From there, CenterPoint Energy carefully categorized, combined, and eliminated various pilot options to arrive at a short-list of 25 pilots. CenterPoint Energy and ICF completed a detailed analysis of the short listed pilots upon which CenterPoint Energy based its final portfolio selection. CenterPoint Energy's process included evaluation of relative costs, lifecycle GHG emissions reductions, and other benefits identified by the Commission in the Frameworks Order.

g. The total amount of estimated GHG emissions reduction or avoidance to be achieved under the Plan is reasonable considering the state's GHG and renewable energy goals and customer cost.

As described above, CenterPoint Energy's Plan is designed to test a broad array of innovative resources and pilot designs so as to identify and gain experience with the innovative resources that can be most cost-effectively combined and scaled up to work towards Minnesota's GHG reduction goals. The total emissions reductions to be achieved under this first innovation Plan is 1.2 million metric tons of CO_2e emissions. This savings is achieved at a cost of approximately \$166/tonCO_2e.[53] This Plan is designed less to achieve the maximum amount of emissions reductions possible in the near-term and more to set Minnesota up for long-term success.

h. Any RNG purchased by the utility under the Plan that is produced from the anaerobic digestion of manure is certified as being produced at an agricultural livestock production facility that has not and does not increase the number of animal units at the facility solely or primarily to produce renewable natural gas for the Plan.

The only proposed pilot through which CenterPoint Energy may purchase RNG produced from the anaerobic digestion of manure is the RNG RFP Purchase Pilot. As shown in Exhibit Q, CenterPoint Energy proposes to require any bidder whose RNG is derived from an agricultural livestock production facility to certify that the agricultural livestock production facility has not and

[53] Viewed from the utility cost perspective.

will not increase the number of animal units solely or primarily in order to produce RNG for sale to CenterPoint Energy during the term of any RNG sales agreement.

i. 50 percent or more the utility's costs approved by the Commission for recovery under the Plan are for the procurement and distribution of RNG, biogas, hydrogen produced via power-to-hydrogen, and ammonia produced via power-to-ammonia.

As shown in Exhibit E, 50.33 percent of CenterPoint Energy's total incremental costs are for RNG, biogas, hydrogen produced via power-to-hydrogen, and ammonia produced via power-to-ammonia. This figure assumes that 15 percent of R&D spend over the five-year period of the plan will be for RNG, biogas, hydrogen produced via power-to-hydrogen, and ammonia produced via power-to-ammonia.

j. The utility's costs approved by the Commission for recovery for any pilot program to facilitate district energy systems represent no more than 20 percent of the total costs approved by the Commission for recovery under the Plan

As shown in Exhibit E, 11 percent of CenterPoint Energy's total incremental costs are for district energy pilots.[54] CenterPoint Energy is not currently proposing any district energy R&D pilots but will monitor proposed future R&D spend to ensure that the 20 percent cap is not exceeded during the course of the five-year Plan.

k. The expected quantitative and qualitative benefits of the proposed Plan are greater in total than the expected quantitative and qualitative costs of the Plan in total.

See discussion above in Section V(a).

X. Proposed Cost-Effectiveness Objectives for the Plan based on the Cost-Effectiveness Framework

The NGIA requires the Commission to establish cost-effectiveness objectives for the Plan based on the cost-benefit framework established in the Frameworks Order.[55] CenterPoint Energy proposes cost-effectiveness objectives below for the Commission's consideration. The

[54] The NGIA definition of district energy is "a heating or cooling system that is solar thermal powered or that uses the constant temperature of the earth or underground aquifers as a thermal exchange medium to heat or cool multiple buildings connected through a piping network." Minn. Stat. § 216B.2427, subd. 1(e). The only pilot that is guaranteed to include district energy, as that term is defined in NGIA is the New Networked Geothermal Systems pilot, which constitutes 11 percent of the proposed NGIA budget. As further discussed in Exhibit D, the Decarbonizing Existing District Energy Systems and New District Energy System pilots may support projects meeting the statutory criteria for district energy but may also support strategic electrification, energy efficiency, or other innovative resources. The three pilots combined still represent only 13 percent of the proposed budget.

[55] Minn. Stat. § 216B.2427, subd. 2(e).

Company developed these objectives based on the categories of costs and benefits identified in the Frameworks Order: Perspectives, Environment, Socioeconomic, and Innovation.

Perspectives

- Overall GHG savings achieved by all approved pilots is achieved at a cost of no more than $200/MTCO$_2$e.[56] For this objective, costs are measured on a lifetime basis using the utility cost test and GHG savings are also measured on a lifetime basis.
- 40 percent[57] of residential units served by the Residential Deep Energy Retrofit and Electric Air Source Heat Pump pilots and the Weatherization Blitzes R&D pilot qualify as low-income, as that term is defined in CIP/ECO or are located in a disadvantaged community, as that term is defined for the Inflation Reduction Act programs.[58]
- Over the course of the five-year Plan, CenterPoint Energy supports the development of four new sources of low-carbon fuels produced in Minnesota. This may include one or more anaerobic digesters that produces RNG, projects that produce hydrogen via power-to-hydrogen, biogas projects, or projects that create ammonia via power-to-ammonia.

In addition to the objectives for the Perspectives category, listed above, CenterPoint Energy proposes to track and report on residential, commercial/industrial, low-income, tribal, and urban vs. rural participation. While CenterPoint Energy does not believe it has an adequate baseline to propose an objective related to tribal participation, for example, the Company is interested in developing objectives for future plans based on increasing participation for certain customer types and seeks to establish sufficient baseline knowledge to make that possible in the future.

Environment

- The Plan achieves overall lifetime GHG emissions reductions equivalent to 14 percent of emissions from CenterPoint Energy's 2020 sales.[59] For purposes of this objective, CenterPoint Energy's 2020 sales include only sales to non-exempt customers and no transport volumes.

[56] This is based on the weighted average cost per ton, using the utility cost test, of the RNG Produced from Hennepin County Organic Waste and RNG Produced from Ramsey & Washington Counties Organic Waste pilots. Because NGIA requires CenterPoint Energy to make a significant investment in low-carbon fuels and provides additional budget for food waste derived RNG, CenterPoint Energy thought it was appropriate to look towards these two pilots to develop this metric. The remaining RNG pilot (the RNG RFP Purchase pilot), is less appropriate to include in developing this metric because it is not entirely eligible for additional budget and is based on assumptions about hypothetical projects that may respond to a future RFP.

[57] Selected to align with the federal government Justice40 initiative which aims to direct at least 40 percent of the benefits of certain federal investments towards disadvantaged communities.

[58] Disadvantaged communities are shown on an interactive map here: https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5

[59] Achievement of this objective would represent a total lifetime GHG reduction of approximately 1,185,000 tons CO$_2$e and is the expected total lifetime GHG emissions reductions from all pilots.

- Over the five-year term of the plan, the Plan achieves annual, first-year GHG emissions reductions[60] equal to one percent of emissions from CenterPoint Energy's 2020 sales. For purposes of this objective, CenterPoint Energy's 2020 sales include only sales to non-exempt customers and no transport volumes. Annual, first-year GHG emissions reductions are the sum of GHG reductions expected to be achieved by all projects implemented under the Plan in the first full year of their operation. [61]
- In year five of the Plan, CenterPoint Energy has reduced annual emissions from sales of natural gas by 53,000 metric tons as a result of low-carbon fuels included in the NGIA plan.[62] This goal includes reductions from RNG, power-to-hydrogen, biogas, and power-to-ammonia provided to non-exempt sales customers.
- To support the state's renewable energy goal,[63] CenterPoint Energy procures 602,000 Dth of sales gas from renewable resources.[64] This goal includes RNG, biogas, power-to-hydrogen, and power-to-ammonia provided to non-exempt sales customers.
- To support the state's economy-wide net zero GHG emissions goal,[65] CenterPoint Energy completes an analysis of pathways that would allow it to achieve net zero emissions by 2050. CenterPoint Energy anticipates satisfying this goal through the proposed R&D pilot, CenterPoint Energy Minnesota Net Zero Study.

Socioeconomic

- The Plan supports 4 projects that satisfy Inflation Reduction Act requirements around prevailing wages and support for apprenticeships.
- The Plan supports workforce development through trainings, tours, educational conferences, or similar supportive activities reaching 200 participants per year, or 1,000 participants over the five-year Plan period.

Innovation

- The Plan supports projects using at least six of the eight innovative resources.

[60] First-year GHG reductions is conceptually similar to first-year savings reported in CIP.

[61] Achievement of this objective would represent annual, first-year, GHG emissions reductions of approximately 86,000 metric tons and is the expected annual, first year reduction from all pilots.

[62] This is approximately the expected GHG emissions reductions from the RNG (Pilots A, B, and C). Achievement of this objective would represent approximately an 0.5 percent reduction in GHG intensity of supplied fuels, assuming total throughput (on a Dth basis) equal to 2020 sales gas to non-exempt customers.

[63] Minn. Stat. § 216C.05, subd. 2, clause (3).

[64] Objective is measured as renewable volumes procured or produced in program year 5 from RNG or hydrogen. Achievement of this objective would represent procuring renewable resources equivalent to approximately 0.5 percent of 2020 sales gas to non-exempt customers (on a Dth basis) and the figure proposed is based on the expected amount to be procured or produced from RNG (Pilots A, B, and C).

[65] Minn. Stat. § 216H.02, subd 1.

- 100 percent of completed R&D projects result in a report summarizing learnings and suggesting next steps that will be filed with the Commission.

The NGIA states that the utility's statutory budget cap will increase in subsequent NGIA plan filings if the Commission determines that the utility has successfully achieved the cost-effectiveness objectives established in its prior plan or plans.[66] CenterPoint Energy has proposed numerous objectives, reflecting the many different goals of the NGIA statute and the broad cost-effectiveness framework established in the Frameworks Order. However, some of these objectives are in tension with one another. For example, objectives to increase the use of renewable resources or deploy many different innovative resources may be in tension with objectives to maximize GHG reductions or the cost per ton reduced. While CenterPoint Energy will strive to satisfy each of these objectives, it would be an unreasonably high bar to require achievement of all of them before allowing additional funding for future NGIA plans. CenterPoint Energy proposes that the test for an increase in funding be achievement of the majority of these proposed objectives. If CenterPoint Energy achieves a majority of these objectives, it will have demonstrated substantial value to its customers and the state and it would be appropriate to begin increasing the scale of future NGIA plans.

XI. Plan Timing

In this section, the Company offers some thoughts about the timing for implementation of the Plan. Further discussion of Plan timing is provided in Exhibit R in relation to cost recovery.

The Company respectfully requests that the Commission consider this petition by July 2024 to allow the Company to move forward with several pilots with partners and customers that are operating on timelines for their projects. Assuming approval on or before July 1, 2024, the Company proposes the following would be considered the five program years of the first plan:

- Program Year 1: July 1, 2024 – June 30, 2025
- Program Year 2: July 1, 2025 – June 30, 2026
- Program Year 3: July 1, 2026 – June 30, 2027
- Program Year 4: July 1, 2027 – June 30, 2028
- Program Year 5: July 1, 2028 – June 30, 2029

Pursuant to Minn. Stat. § 216B.2427, subd. 2(h), CenterPoint Energy must file a subsequent innovation plan no later than four years after its first innovation plan is approved. According to this proposed schedule, CenterPoint Energy would file its next innovation plan no later than July 1, 2028.

Pursuant to Minn. Stat. § 216B.2427, subd. 2(f), CenterPoint Energy will be required to file annual status reports on work completed under the Plan. Although program years run from July through June under the Company's proposed schedule, the Company believes it would be administratively easier to have annual reports reflect calendar year achievements. In particular,

[66] Minn. Stat. § 216B.2427, subd. 2(c) & (d).

several proposed pilots are designed to coordinate with CIP/ECO projects and CIP currently operates on a calendar year reporting schedule. CenterPoint Energy proposes to file its annual report each year on June 1 and to have that report cover the achievements in the prior calendar year. Accordingly, the first report would be filed on June 1, 2025 and cover the period of July 1, 2024 - December 31, 2024. The second report would be filed on June 1, 2026 and cover January 1, 2025 – December 31, 2025 and subsequent reports would continue on a calendar year basis going forward.

XII. Conclusion

CenterPoint Energy is excited to propose this Natural Gas Innovation Plan, the first to be filed in Minnesota and requests approval of the Plan as described in this filing. The Company crafted the Plan to include a broad array of innovative resources and pilot designs to maximize the potential for learning and innovation. Innovation will be necessary for CenterPoint Energy and the state of Minnesota to achieve their ambitious GHG reduction goals. In addition, the Plan will achieve near-term GHG reductions, result in net job creation, and produce many other benefits for the state of Minnesota and our customers. CenterPoint Energy appreciates the meaningful input provided by stakeholders to date and looks forward to continued dialogue with stakeholders and the Commission as this proceeding moves forward.

In the Matter of
CenterPoint Energy Natural Gas Innovation Act (NGIA)
Innovation Plan

Petition of CenterPoint Energy

EXHIBIT A: SUMMARY OF FILING

Docket No. G-008/M-23-215

June 28, 2023

STATE OF MINNESOTA
BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION
121 Seventh Place East, Suite 350
St. Paul, MN 55101-2147

Katie Sieben	Chair
Valerie Means	Commissioner
Matt Schuerger	Commissioner
Joseph Sullivan	Commissioner
John Tuma	Commissioner

In the Matter of a Petition by CenterPoint Energy for Approval of its First Natural Gas Innovation Plan	Docket No. G-008/M-23-215

SUMMARY OF FILING

Please take notice that on June 28, 2023, CenterPoint Energy Resources Corp. d/b/a CenterPoint Energy Minnesota Gas ("CenterPoint Energy") filed with the Minnesota Public Utilities Commission a Petition for approval of a plan pursuant to the Natural Gas Innovation Act ("NGIA"), Minnesota Laws 2021, 1st Special Session, Chapter 4, Article 8, §§ 20, 21 and 27, partially codified at Minn. Stat. §§ 216B.2427-2428. The Petition includes descriptions of pilots that CenterPoint Energy proposes to implement to help its customers reduce their greenhouse gas emissions from natural gas and achieve other benefits. Each pilot would deploy "innovative resources," which under the NGIA include renewable natural gas, biogas, power-to-hydrogen, power-to-ammonia, carbon capture, district energy, energy efficiency, and strategic electrification. As set forth in the Petition, CenterPoint Energy proposes to recover its costs for implementing its NGIA plan in part through its purchased gas adjustment, in part through base rates through a future general rate case filing, and in part through a new rider.

In the Matter of
CenterPoint Energy Natural Gas Innovation Act (NGIA)
Innovation Plan

Petition of CenterPoint Energy

EXHIBIT B: NON TECHNICAL SUMMARY

Docket No. G-008/M-23-215

June 28, 2023

A. Overview of CenterPoint Energy and Our Sustainability Goals

CenterPoint Energy Minnesota Gas ("CenterPoint Energy" or the "Company") is the largest gas utility in Minnesota, serving approximately 900,000 customers across more than 260 communities in southern and central Minnesota. CenterPoint Energy and its predecessor companies have provided natural gas service to customers in Minnesota since 1870.

CenterPoint Energy's parent company, CenterPoint Energy, Inc. has a net-zero goal to reduce scope 1 and 2 greenhouse gas ("GHG") emissions by 2035. For a gas utility, scope 1 emissions include the Company's own use of geologic natural gas, leakage of natural gas from Company pipelines, and emissions from gasoline use in Company vehicles. Scope 2 emissions include emissions from the purchase of electricity for Company operations.

CenterPoint Energy, Inc. also has a goal to reduce its scope 3 emissions by 20-30 percent by 2035 compared to scope 3 emissions in 2021. Scope 3 emissions include things like emissions from customers using gas delivered by CenterPoint Energy. CenterPoint Energy's scope 3 emissions are much larger than either scopes 1 or 2, which is typical for gas utilities.

This Natural Gas Innovation Act ("NGIA") Plan ("Plan") will be a critical part of CenterPoint Energy's efforts to reduce scope 3 emissions by helping our customers reduce their use of geologically sourced natural gas.

B. Overview of the NGIA and Associated Commission Orders

The NGIA was passed by the Minnesota Legislature in 2021. It allows Minnesota gas utilities, such as CenterPoint Energy, to file innovation plans with the Minnesota Public Utilities Commission ("Commission") to pilot the use of innovative resources to replace, displace, or reduce the environmental impact of the use of geologic natural gas. Innovative resources include renewable natural gas ("RNG"), power-to-hydrogen, power-to-ammonia, biogas, district energy, energy efficiency, strategic electrification, and carbon capture. The lifecycle GHG intensity of all innovative resources included in a gas utility's plan must be lower than the lifecycle GHG intensity of geologic natural gas. This means that when an innovative resource is used instead of (or in the case of carbon capture, in addition to) geologic natural gas for a given purpose, less GHG emissions are produced.

The NGIA specifies the requirements for innovation plan filings and the criteria the Commission must consider in deciding whether to approve an innovation plan filing. In addition, there are certain requirements that apply only to CenterPoint Energy, as the state's largest gas utility, and only to the first innovation plan filed by a gas utility, such as this one. Some of the key requirements applicable to this innovation Plan filing include:

- The total incremental cost of the Plan over five years may not exceed $105,704,610;
- 50 percent or more of the of the costs approved by the Commission for recovery under the Plan must be for the procurement and distribution of RNG, power-to-hydrogen, power-to-ammonia, or biogas;
- The Plan must include a pilot that will provide deep energy retrofits and electric air source heat pumps to existing residential homes;

- The Plan must include a pilot to help industrial customers with processes that are technically difficult to electrify access innovative resources;
- The Plan must include a district energy pilot but that pilot must account for less than 20 percent of the total incremental costs of the plan;
- The Plan must include a pilot that will help small and medium sized businesses identify opportunities to reduce their GHG emissions and provide incentives to businesses to follow through on GHG reducing opportunities; and
- Research and development ("R&D") pilots may not represent more than ten percent of the proposed costs of the Plan.

If the Commission approves a utility innovation plan, the NGIA states that the gas utility may recover costs for carrying out the plan from its customers.

The NGIA also required the Commission to establish frameworks for evaluating the lifecycle GHG intensity of innovative resources and the costs and benefits of innovation plans. The Commission issued an Order Establishing Frameworks for Implementing Minnesota's Natural Gas Innovation Act on June 1, 2022 in Docket No. G-999/CI-21-566 ("Frameworks Order"). The Frameworks Order provides significant guidance to gas utilities regarding how to quantify the lifecycle GHG emissions of different innovative resources and the lifecycle GHG emissions of geologic natural gas for comparison.

The Frameworks Order also identifies costs and benefits that utilities must consider and describe for each pilot included in their innovation plan. Some costs and benefits can be quantified but others are qualitative. The costs and benefits that gas utilities must consider are quite expansive, ranging from monetary costs and benefits from various perspectives (e.g. the perspective of the utility or the perspective of a customer participating in a pilot program), to environmental costs and benefits, to socioeconomic impacts. In addition, utilities are required to consider the innovation value of different pilots or resources, both in terms of direct support for innovation and the scalability of selected resources and their potential role in a fully decarbonized energy system.

C. CenterPoint Energy's Proposed Innovation Plan

CenterPoint Energy's proposed Plan includes eighteen full pilots. Descriptions of each of these pilots are as follows:

1. **RNG Produced from Hennepin County Organic Waste:** CenterPoint Energy proposes to purchase renewable natural gas ("RNG") from Hennepin County's anaerobic digestion facility, which is currently under development. This new anaerobic digester facility will process source-separated food waste from Hennepin County's organics recycling program and a smaller quantity of yard waste.
2. **RNG Produced from Ramsey & Washington Counties Organic Waste:** CenterPoint Energy proposes to purchase RNG from Ramsey and Washington Counties' anaerobic digestion facility, which is currently under development. This new anaerobic digester facility will process source-separated food waste from Washington and Ramsey Counties' organics recycling program and a smaller quantity of yard waste.

3. **Renewable Natural Gas Request for Proposal ("RFP") Purchase:** CenterPoint Energy proposes to issue an RFP to purchase an additional amount of RNG to complete its RNG portfolio.
4. **Green Hydrogen Blending into Natural Gas Distribution System:** CenterPoint Energy proposes to own and operate a 1 MW green hydrogen plant at an existing Company facility in Mankato, Minnesota. CenterPoint Energy would install dedicated solar panels, an electrolyzer, a hydrogen storage system, and other necessary systems and equipment to generate, store, and blend hydrogen into the gas distribution system.
5. **Industrial or Large Commercial Hydrogen and Carbon Capture Incentives:** CenterPoint Energy will identify a small number of large commercial or industrial customers interested in installing either power-to-hydrogen or carbon capture demonstration projects and support their projects by providing financial assistance towards feasibility studies and project costs.
6. **Industrial Methane and Refrigerant Leak Reduction:** CenterPoint Energy will hire a vendor to conduct surveys of participating industrial and large commercial facilities for methane and refrigerant leaks behind the customer gas meter. CenterPoint Energy will also offer incentives to partially offset the cost of leak repair.
7. **Urban Tree Carbon Offsets:** CenterPoint Energy proposes to purchase carbon offsets from local non-profit, Green Minneapolis. Green Minneapolis works with local tree planting partners across the 7-county Twin Cities Metro area to plant trees in urban areas and funds their work by selling carbon offsets.
8. **Carbon Capture Rebates for Commercial Buildings:** CenterPoint Energy proposes to provide rebates to commercial customers that install CarbinX carbon capture systems manufactured by Canadian company CleanO2. These units connect to existing natural gas heating equipment, capture CO_2, and convert it into chemicals that are resold for commercial uses.
9. **New Networked Geothermal Systems:** CenterPoint Energy proposes to develop a new networked geothermal system to provide building heating and cooling for a neighborhood currently served by the Company. This pilot starts with a study phase to identify the location, technologies, and business model for the system.
10. **Decarbonizing Existing District Energy Systems:** CenterPoint Energy proposes to help existing district energy systems that currently use geologic gas to identify opportunities to reduce the lifecycle GHG impact of their systems via funding for feasibility studies and financial support for following through with study recommendations.
11. **New District Energy System:** CenterPoint Energy proposes a pilot to help current natural gas customers considering developing district energy systems by providing funding for feasibility studies and financial support to follow through with feasibility study recommendations.
12. **Industrial Electrification Incentives:** CenterPoint Energy would support industrial customers to electrify low-to-medium heat processes using heat pump technologies. This pilot begins with a study phase to identify promising heat pump technologies and potential industrial applications.

13. **Commercial Hybrid Heating:** CenterPoint Energy proposes to provide support for small-to-medium commercial buildings interested in replacing Heating, Ventilation, and Air Conditioning ("HVAC") systems with hybrid systems using electric heat pumps and gas backup.
14. **Residential Deep Energy Retrofits and Electric Air Source Heat Pumps:** CenterPoint Energy would provide support for residential customers interested in retrofitting their homes to significantly improve energy efficiency and installing air source heat pumps with gas back-up. This pilot starts with a study phase to identify appropriate measures and home characteristics for deep energy retrofits.
15. **Small/Medium Business GHG Audit:** CenterPoint Energy proposes to expand its existing Conservation Improvement Program ("CIP") Natural Gas Energy Analysis ("NGEA") project to include identification of non-CIP GHG reducing opportunities for small and medium-sized businesses.
16. **Residential Gas Heat Pumps:** CenterPoint Energy proposes to fund the development and testing of a small number of 'combi' space and water heating gas heat pump systems in Minnesota homes.
17. **Gas Heat Pumps for Commercial Buildings:** CenterPoint Energy proposes to fund the development and testing of a small number of gas heat pump systems in in commercial buildings.
18. **Industrial and Large Commercial GHG Audit:** CenterPoint Energy proposes to expand its existing CIP Process Efficiency and Commercial Efficiency projects to include identification of non-CIP GHG reduction measures and payment of incentives for the installation of identified non-CIP measures.

The Company is also proposing to implement seven R&D pilots during the first few years of the Plan. The Company plans to propose additional R&D pilots in future annual status reports in which the Company will report on its progress in implementing the Plan. The seven R&D pilots proposed in the filing are as follows:

1. CenterPoint Energy Minnesota Net Zero Study: CenterPoint Energy proposes to conduct a study to help it and interested parties better understand the different pathways for CenterPoint Energy Minnesota Gas to reach net zero emissions by 2050, including Scope 1, and 3 emissions. The estimated cost of this study is $220,000.
2. Weatherization Blitzes: CenterPoint Energy proposes to test intensive, novel, and community-based marketing and outreach approaches to increase participation in CenterPoint Energy's CIP/ECO weatherization offerings. The estimated cost of this effort is $800,000.
3. High Performance Commercial New Construction Building Envelope Initiative: CenterPoint Energy proposes to test a multi-prong strategy to address barriers to integrating high-performance commercial building envelopes in new commercial construction. The estimated cost of this proposal is $400,000.
4. Assessing Next-Generation Micro-Carbon Capture for Commercial Buildings: This proposed R&D pilot will investigate the carbon capture effectiveness and heat recovery efficiency of CleanO2's next generation CarbinX units (version 4.0). This

pilot complements the full pilot Carbon Capture Rebates for Commercial Buildings which will incentivize installation of version 3.0 units. The estimated cost of this research is $275,000.

5. Green Ammonia Novel Technology: This pilot will support testing of a Modular One Vessel Ammonia Production System for green ammonia, which has potential to improve production efficiency and reduce costs for green ammonia production. The estimated cost for this pilot is $100,000.
6. RNG Potential Study: CenterPoint Energy will study three regions of the CenterPoint Energy Minnesota service territory for potential development of an RNG production facility. Regions will be selected based on potential for production of RNG feedstock and feasibility of accepting substantial quantities of RNG into CenterPoint Energy's system. The estimated cost for this study is $60,000.
7. Utilization of Green Ammonia for Thermal Energy Applications: CenterPoint Energy proposes to support research into how green ammonia may be used in industrial-scale burner applications. The primary goal is to determine operating ranges and burner concepts that can be applied to industrial burners used in grain drying and boilers used for district heating. The estimated cost for this research is $205,000.

The costs and certain benefits of the proposed pilots are summarized in the following table:

Table 1: Summary Quantitative Metrics for Proposed Pilots

Pilot	Estimated Lifetime Utility Cost[1]	Cost Counting Against NGIA Budget[2]	Estimated Lifecycle GHG Reductions (Metric Tons CO2e)	Estimated Net Job Creation (FTEs)[3]
RNG Produced from Hennepin County Organic Waste	$7,675,137	2,856,759	28,221	88
RNG Produced from Ramsey and Washington Counties Organic Waste	$27,356,579	$10,160,058	147,863	244
Renewable Natural Gas RFP Purchase	$66,970,724	$32,368,811	359,884	547
Green Hydrogen Blending into Natural Gas Distribution System	$22,961,186	$5,073,067	27,993	148

[1] This represents the expected net cost impact to customers over the lifetime of each pilot. Many pilots will require continued investment by CenterPoint Energy after the end of the five-year term of this NGIA plan. For example, the new networked geothermal system is expected to operate, and require maintenance, for decades. These figures are also net of expected savings due to reduce need to purchase gas and other avoided operations and maintenance costs. Participant costs are not included.

[2] This represents project costs that count against the budget cap described in the NGIA. These only include utility costs expected to be incurred during the five-year plan and are net of certain savings, including savings due to reduced need to purchase gas, during the term of the five-year plan. Participant costs are not included.

[3] Includes direct, indirect, and induced estimated Full Time Equivalent ("FTE") positions employed in Minnesota for one year over lifetime of each pilot.

Pilot	Estimated Lifetime Utility Cost[1]	Cost Counting Against NGIA Budget[2]	Estimated Lifecycle GHG Reductions (Metric Tons CO2e)	Estimated Net Job Creation (FTEs)[3]
Industrial or Large Commercial Hydrogen and Carbon Capture Incentives	$2,720,057	$3,793,770	107,196	459
Industrial Methane and Refrigerant Leak Reduction	$1,132,471	$1,247,651	33,763	21
Urban Tree Carbon Offsets	$299,909	$329,301	4,500	1
Carbon Capture Rebates for Commercial Buildings	$23,256	$1,303,022	55,150	195
New Networked Geothermal Systems	$42,223,212	$11,625,764	107,355	430
Decarbonizing Existing District Energy Systems	($3,422,215)	$597,909	124,030	315
New District Energy System	($784,412)	$215,644	40,882	125
Industrial Electrification Incentives	$112,392	$503,821	11,896	23
Commercial Hybrid Heating	$5,542,472	$7,067,270	25,609	88
Residential Deep Energy Retrofits and Electric Air Source Heat Pumps	$10,584,092	$13,616,532	66,760	171
Small/Medium Business GHG Audit	$1,897,769	$2,291,206	6,570	36
Residential Gas Heat Pumps	$343,818	$380,759	235	4
Gas Heat Pump for Commercial Buildings	$635,083	$749,442	2,154	8
Industrial and Large Commercial GHG Audit Pilot	($242,844)	$950,286	35,560	46
Total for Full Pilots	$186,028,684	$95,131,071	1,185,620	2,947
R&D Pilots[4]	$10,570,462	$10,570,462	-	-
Total	**$196,599,146**	**$105,701,533**	**1,185,620**	**2,947**

D. Process and Analytical Techniques Used to Develop the Proposed Innovation Plan

CenterPoint Energy started its Plan development process by issuing a request for ideas ("RFI") seeking information and proposals for different pilot projects. The Company received over 100 responses proposing different kinds of pilots for the Company's consideration. CenterPoint

[4] Includes both pilots proposed in the initial filing and funding for pilots the utility will propose in future annual status reports.

Energy also developed some pilot ideas internally and our consultant, ICF, also contributed certain ideas.

CenterPoint Energy then worked to eliminate certain pilot ideas that seemed less promising from further consideration and combined similar ideas. This resulted in a "short-list" of 23 pilot concepts that CenterPoint Energy and its consultant ICF thoroughly analyzed for potential inclusion in the final portfolio. CenterPoint Energy and ICF developed three different sizes for each short-listed pilot[5] and identified all of the different Commission-required costs and benefits for each different pilot/size combination.

Some of the costs and benefits that required the most complicated analysis included:

Lifecycle GHG Emissions Reductions. The techniques used to quantify lifecycle GHG reductions were established to a significant extent in the Commission's Frameworks Order and the techniques used varied depending on the innovative resource.

- For RNG and power-to-hydrogen, CenterPoint Energy and ICF used the Greenhouse gases, Regulated Emissions, and Energy use in Technologies ("GREET") model developed by Argonne National Laboratory, with some adjustments for the context of CenterPoint Energy and NGIA.
- For energy efficiency, strategic electrification, and district energy, GHG reductions can be measured as the difference between the GHG emissions that would have resulted from natural gas use and any new emissions from increased electricity use.
- Carbon capture was perhaps the most difficult innovative resource for which to quantify GHG emissions reductions because the emissions depend a great deal on what is done with the carbon after it is captured. ICF and CenterPoint Energy relied on published studies on the emissions resulting from various potential uses for captured carbon and plan to conduct additional studies as part of the carbon capture pilots proposed in the Plan.

Net Job Creation. ICF evaluated net job creation by using the IMPLAN model. IMPLAN is an economic input-output model that examines the inter-industry relationships within an economy by combining a set of extensive databases related to economic factors, economic multipliers, and demographic statistics with a refined and detailed system of modeling software. There are three primary types of impacts in IMPLAN (1) Direct, which refers to the impacts on the industries that are directly related to the technologies implemented by the pilots; (2) Indirect, which refers to impacts on inter-industry purchases resulting from direct spending on materials, equipment, and construction; and (3) Induced, which refers to the downstream impacts created in local industries due to an increase in consumers' consumption expenditures caused by the direct and indirect impacts. CenterPoint Energy focused its IMPLAN analysis on net job creation in Minnesota.

[5] Except for the Green Hydrogen Blending into Natural Gas Distribution System pilot, where only two sizes were analyzed.

Monetary Costs and Benefits. CenterPoint Energy and ICF used their experience in running energy efficiency programs and developing or assisting in developing RNG, hydrogen, strategic electrification, and other programs involving innovative resources, as well as information provided in RFI responses and publicly available information, to develop cost estimates for each pilot. In Exhibit N, CenterPoint Energy has broken out the costs of each pilot into several categories and identified sources for the cost estimates where available.

In addition to the costs and benefits described above, CenterPoint Energy also evaluated the impact of pilots on other pollution beyond GHGs, waste reduction and reuse, whether the proposed pilot would support Minnesota state policy goals, and other socioeconomic costs or benefits beyond net job creation. Finally, CenterPoint Energy evaluated, and put significant focus on, the innovation value of each potential pilot and innovative resource. The Company evaluated the direct innovation benefits of each pilot, considering whether the pilot would lead to near term learnings for the Company or others, as well as the potential long-term role of evaluated pilots and resources in a decarbonized energy system.

In selecting a final portfolio of pilots, the Company adopted the following strategies:

- Target a balanced portfolio covering different innovative resource types.
- Maximize innovation and learning by including a wide variety of different pilots.
- Prioritize funding for more innovative options that could help CenterPoint Energy evolve its business to support customers in reducing emissions and help the utility gain experience in these areas. For some pilots, potential learning opportunities were not increased by higher levels of spending so smaller sizes could be selected without sacrificing innovation.
- Produce a reasonable cost portfolio when considering investment per ton of GHG reduction, while not compromising on innovation for the sake of cost.
- Choosing larger sizes for pilots that are commercial technologies, highly scalable, and have high potential for long-term emissions reductions.

CenterPoint Energy's proposed portfolio strives to maximize innovation by employing six-to-seven of the eight innovative resources in full pilots and including the eighth in proposed R&D pilots.[6] The final Plan includes eighteen pilots, incorporating twenty-two of the short-listed pilot concepts considered for plan inclusion.[7] Most of the pilots are included at a small scale with the exception of the RNG, Green Hydrogen Blending into Natural Gas Distribution System, New Networked Geothermal Systems, Commercial Hybrid Heating, and Residential Deep Energy Retrofits and Electric Air Source Heat Pumps pilots, which were prioritized for spending due to their high potential scalability and transformative potential for the gas distribution system. RNG

[6] Biogas is not necessarily represented by the proposed pilots but could be a measure implemented under the Industrial or Large Commercial GHG Audit pilot or the Decarbonizing Existing District Energy Systems pilot. Power-to-ammonia is not represented in the full pilot list but is the subject of two proposed R&D pilots.

[7] Some of the shortlisted pilots were combined in the final portfolio.

and Green Hydrogen Blending into Natural Gas Distribution System were also prioritized for additional spending to satisfy statutory requirements.

E. How the Plan Furthers the State's GHG Emissions Reduction and Renewable Energy Goals

The state of Minnesota has a goal to reduce economy-wide GHG emissions to net zero by 2050 as compared to 2005 levels.[8] The state also has a goal to derive 25 percent of all energy in state from renewable resources by 2025.[9]

As shown in the table above, CenterPoint Energy's proposed Plan will help achieve the state's GHG emissions goals by reducing or avoiding approximately 1.2 million metric tons of carbon dioxide equivalent ("CO2e") GHG emissions. This is equivalent to the energy use of approximately 150,000 homes for one year or 14 percent of total emissions from natural gas supplied to CenterPoint Energy's sales-service customers in 2020.[10]

The Company considered many potential pilots for inclusion in the NGIA Plan and completed detailed analysis on twenty-three pilot ideas. For each of the fully analyzed pilot ideas, the Company evaluated three different sizes of potential pilot with A being the smallest size and C being the largest (except for the Green Hydrogen Blending into Natural Gas System where only two sizes were considered). These pilots are ranked in the table below in order of cost per ton of reduced or avoided GHG emissions. Note that in the proposed Plan, some of these pilot concepts were grouped together into a single pilot. Specifically, the four RNG archetype pilots: RNG Archetype - Water Resource Recovery Facility ("WRRF"), RNG Archetype – Dairy Manure, RNG Archetype – Food Waste, and RNG Archetype – Landfill, which each represent different potential sources of RNG, were grouped together in the Plan into the Renewable Natural Gas RFP Purchase pilot. Also, the Green Hydrogen Archetype for Industrial or Large Commercial Facility and the Carbon Capture Archetype for Industrial or Large Commercial Facility, were grouped together into the Industrial or Large Commercial Hydrogen and Carbon Capture Incentives pilot. Only one fully analyzed pilot, Solar Thermal Heating for Commercial and Industrial, was not included in the final portfolio in some form, and this technology could be deployed through another pilot that was included. Pilots/sizes that are included in the final Plan are denoted with an asterisk.

[8] Minn. Stat. § 216H.02, subd 1. Note that this goal was increased from 80 percent to 100 percent this year with the enactment of H.F. 2310.

[9] Minn. Stat. § 216C.05, subd. 2(3).

[10] Savings that will be achieved in year 5 from measures installed during the Plan are equivalent to 1.0 percent of total emissions from natural gas supplied to CenterPoint Energy's sales-service customers in 2020.

Table 2: Ranking of Pilot Concepts Considered by Cost Per Metric Ton Reduction

Pilot Concept	Pilot Size	Size Description	Lifetime Utility Cost per GHG Reduction (Metric Tons CO2e)[11]
Decarbonizing Existing District Energy Systems	A	1 district energy system project	($29)
Decarbonizing Existing District Energy Systems*	B	2 district energy system projects	($28)
Decarbonizing Existing District Energy Systems	C	3 district energy system projects	($27)
Industrial and Large Commercial GHG Audit Pilot	C	15 projects	($21)
New District Energy System*	B	2 new district energy systems	($20)
New District Energy System	C	3 new district energy systems	($19)
New District Energy System	A	1 new district energy systems	($19)
Industrial and Large Commercial GHG Audit Pilot	B	10 projects	($18)
Green Hydrogen Archetype for Industrial or Large Commercial Facility	B	2 facilities	($14)
Green Hydrogen Archetype for Industrial or Large Commercial Facility*	A	1 facility	($14)
Green Hydrogen Archetype for Industrial or Large Commercial Facility	C	3 facilities	($13)
Industrial and Large Commercial GHG Audit Pilot*	A	5 projects	($10)
Industrial Electrification Incentive Program	C	9 facilities	($7)
Carbon Capture Rebates for Commercial Buildings	C	1,335 CarbinX systems	($5)
Carbon Capture Rebates for Commercial Buildings	B	660 CarbinX systems	($4)
Industrial Electrification Incentive Program	B	6 facilities	($3)
Carbon Capture Rebates for Commercial Buildings*	A	325 CarbinX systems	($2)
Solar Thermal Heating for C&I	C	25 projects	$1
Solar Thermal Heating for C&I	B	15 projects	$3
Industrial Electrification Incentive Program*	A	3 facilities	$5
Solar Thermal Heating for C&I	A	10 projects	$5
Industrial Methane and Refrigerant Leak Reduction Program	C	250 facilities	$20
Industrial Methane and Refrigerant Leak Reduction Program	B	125 facilities	$22
Industrial Methane and Refrigerant Leak Reduction Program*	A	50 facilities	$30
Urban Tree Carbon Offset Program	C	18,000 credits	$51
Urban Tree Carbon Offset Program	B	9,000 credits	$54
Carbon Capture Archetype for Industrial or Large Commercial Facility	C	3 facilities	$59

[11] Some portfolio-wide costs for things like plan development and regulatory support were allocated among the selected pilots in proportion to each pilot's budget. These costs are not included in the costs used to calculate figures in this table.

Pilot Concept	Pilot Size	Size Description	Lifetime Utility Cost per GHG Reduction (Metric Tons CO2e)[11]
Carbon Capture Archetype for Industrial or Large Commercial Facility	B	2 facilities	$59
Urban Tree Carbon Offset Program*	A	4,500 credits	$59
Carbon Capture Archetype for Industrial or Large Commercial Facility*	A	1 facility	$61
Residential deep energy retrofit + electric ASHP pilot (with gas backup)	C	357 buildings	$134
Residential deep energy retrofit + electric ASHP pilot (with gas backup)*	B	238 buildings	$138
RNG Archetype - Food Waste	C	500,000 Dth/year	$148
Residential deep energy retrofit + electric ASHP pilot (with gas backup)	A	119 buildings	$149
RNG Archetype - Food Waste*	B	220,000 Dth/year	$149
RNG Proposal - Anaerobic Digestion of East Metro Food Waste	C	190,767 Dth/year	$177
Commercial hybrid heating pilot	C	200 facilities	$177
RNG Proposal - Anaerobic Digestion of East Metro Food Waste*	B	152,613 Dth/year	$178
RNG Archetype - Food Waste	A	10,000 Dth/year	$183
Commercial hybrid heating pilot*	B	135 facilities	$188
RNG Archetype - Landfill Gas	C	900,000 Dth/year	$190
RNG Archetype - Landfill Gas*	A	128,750 Dth/year	$195
RNG Archetype - Landfill Gas	B	200,000 Dth/year	$195
Gas Heat Pump for Commercial Buildings	C	9 units	$200
Gas Heat Pump for Commercial Buildings	B	6 units	$209
RNG Proposal - Anaerobic Digestion of East Metro Food Waste	A	18,168 Dth/year	$209
Commercial hybrid heating pilot	A	70 facilities	$220
Small/medium business GHG audit pilot	C	1,488 GHG audits (3% implemented)	$246
Small/medium business GHG audit pilot*	B	1,240 GHG audits (3% implemented)	$253
RNG Proposal - Anaerobic Digestion of Organic Materials	C	82,880 Dth/year	$254
Gas Heat Pump for Commercial Buildings*	A	3 units	$259
RNG Proposal - Anaerobic Digestion of Organic Materials*	B	41,440 Dth/year	$262
Small/medium business GHG audit pilot	A	992 GHG audits (3% implemented)	$265
RNG Archetype - Wastewater Resource Recovery Facility	C	300,000 Dth/year	$277
RNG Archetype - Wastewater Resource Recovery Facility*	B	50,000 Dth/year	$298

Pilot Concept	Pilot Size	Size Description	Lifetime Utility Cost per GHG Reduction (Metric Tons CO2e)[11]
RNG Proposal - Anaerobic Digestion of Organic Materials	A	8,288 Dth/year	$319
RNG Archetype - Wastewater Resource Recovery Facility	A	10,000 Dth/year	$350
New Networked Geothermal Systems Pilot*	C	1,000 ton system capacity	$382
RNG Archetype - Dairy Manure	C	100,000 Dth/year	$410
New Networked Geothermal Systems Pilot	B	500 ton system capacity	$423
RNG Archetype - Dairy Manure	B	20,000 Dth/year	$436
RNG Archetype - Dairy Manure*	A	10,000 Dth/year	$442
New Networked Geothermal Systems Pilot	A	200 ton system capacity	$552
Green Hydrogen Blending into Natural Gas Distribution System*	B	1 MW electrolyzer + grid electricity purchases	$802
Residential Gas Heat Pump	C	20 units	$1,035
Residential Gas Heat Pump	B	10 units	$1,262
Residential Gas Heat Pump*	A	6 units	$1,299
Green Hydrogen Blending into Natural Gas Distribution System	A	1 MW electrolyzer (no grid electricity)	$1,355

It is important to note that CenterPoint Energy did not seek to minimize the cost per ton of GHG reduction in its selection of pilots. As discussed above, the Commission considers the cost-effectiveness of NGIA plans broadly, considering many costs and benefits beyond the monetary cost to the utility and tons of GHG reduced. CenterPoint Energy particularly emphasized innovation and opportunity for learning in its Plan design and accordingly sought to include many innovative resources and pilot designs.

Most of the pilots included in the Plan would also increase the use of renewable energy. Specifically, every pilot would increase the use of renewable energy except for Industrial Methane and Refrigerant Leak Reduction, Urban Tree Carbon Offsets, Carbon Capture Rebates for Commercial Buildings, Residential Gas Heat Pumps, and Gas Heat Pumps for Commercial Buildings.

F. Activities Required Over the Next Five Years to Implement the Plan

To implement the plan, the Company will begin to implement each of the proposed pilots over five years following plan approval. It will take CenterPoint Energy some time to begin implementation of certain pilots and other pilots are planned to be rolled out in phases. The following table summarizes the anticipated timeline for each proposed pilot.

Table 3: Estimated Pilot Timelines During Five Year Plan

Pilot	Estimated Pilot Timeline during Five Year Plan
RNG Produced from Hennepin County Organic Waste	CenterPoint Energy would begin purchasing RNG in program year ("PY") 3 and continue to purchase in PYs 4 and 5.
RNG Produced from Ramsey and Washington Counties Organic Waste	CenterPoint Energy would begin purchasing RNG in program year PY 3 and continue to purchase in PYs 4 and 5.
Renewable Natural Gas RFP Purchase	CenterPoint Energy would begin purchasing RNG in PY 1 or 2 and continue to purchase in PYs 3-5.
Green Hydrogen Blending into Natural Gas Distribution System	CenterPoint Energy would plan, design, and construct the hydrogen facility in PYs 1-2; begin blending hydrogen into its distribution system in PY 3; and continue to blend hydrogen in PYs 4 and 5.
Industrial or Large Commercial Hydrogen and Carbon Capture Incentives	CenterPoint Energy would make the program available to customers in PY 1. Subject to funding availability, it would remain open through PY 5. CenterPoint Energy plans to complete a scoping study in PY1 to help identify potential customers that may be interested in participating but would not wait until completion of the study to provide rebates if an eligible customer requested one in PY 1.
Industrial Methane and Refrigerant Leak Reduction	CenterPoint Energy would make the program available to new customers in PY 1-2 as the first stage of this pilot. If program participation goals are met in PY 1-2, PYs 3-5 are reserved for follow up sweeps of participating customer facilities to determine the effectiveness of the leak identification and repair strategies.
Urban Tree Carbon Offsets	CenterPoint Energy would purchase carbon offsets in each PYs 1-5.
Carbon Capture Rebates for Commercial Buildings	CenterPoint Energy would make the program available to customers in PY 1. Subject to funding availability, it would remain open through PY 5. As described in Exhibit D, the Company may reduce customer incentives over time.
New Networked Geothermal Systems	The first phase of this pilot is to implement a study to determine the location, design, and ownership/financial structure for the networked geothermal system, to take place in PY 1. The results of this study and next steps for pilot design will be submitted in CenterPoint Energy's annual status report. Construction would commence and the system would become operational in PY 3 and remain in operation in PYs 4 and 5.
Decarbonizing Existing District Energy Systems	CenterPoint Energy would make the program available to customers in PY 1. Subject to funding availability, it would remain open through PY 5.
New District Energy System	CenterPoint Energy would make the program available to customers in PY 1. Subject to funding availability, it would remain open through PY 5.
Industrial Electrification Incentives	Phase 1 of this pilot is to conduct a study to consider different options for heat pump technologies for various customer applications. This would take place in PY 1. In PYs 2-3, CenterPoint Energy would install heat pumps at 3 facilities (Phase 2) and conduct measurement and verification on those installations (Phase 3).
Commercial Hybrid Heating	CenterPoint Energy would make the program available to customers in PY 1. Subject to funding availability, it would remain open through PY 5.
Residential Deep Energy Retrofits and Electric Air Source Heat Pumps	In Phase 1 of this pilot, the Company will conduct a study to model different combinations of building types and energy conservation strategies and use the results to inform program design of Phase 2. Phase 1 will take place in PY 1. In Phase 2, to take place in PY 2-3, the Company will field test a smaller number of projects in customer homes. Using information from Phases 1 and 2, the Company will develop a final program design and describe next steps in an annual status report before launching Phase 3, a general incentive program, which will remain open to customers in PYs 4 and 5, subject to funding availability.

Pilot	Estimated Pilot Timeline during Five Year Plan
Small/Medium Business GHG Audit	CenterPoint Energy would make the program available to customers in PY 1. Subject to funding availability, it would remain open through PY 5.
Residential Gas Heat Pump	CenterPoint Energy would begin recruiting customers for this pilot in PY 1 and begin installations of gas heat pumps in PYs 1-5. Measurement and verification would also occur in PYs 2-5.
Gas Heat Pumps for Commercial Buildings	CenterPoint Energy would begin recruiting customers for this pilot in PY 1 and begin installations of gas heat pumps in PYs 2-5. Measurement and verification would also occur in PYs 2-5.
Industrial and Large Commercial GHG Audit Pilot	CenterPoint Energy would make the program available to customers in PY 1. Subject to funding availability, it would remain open through PY 5.

G. Likely Effect of the Proposed Plan on Natural Gas Rates and Bills

CenterPoint Energy expects the proposed Plan to increase customer bills over the five-year innovation plan period. Estimated annual bill impacts per customer by class are summarized in the following table. Note that the bill increases are partially offset by savings due to reduced purchases of geologic natural gas, although this is not quantified in the following table.

Table 4: Estimated Annual Bill Increase by Class for an Average Customer

Class	2025	2026	2027	2028	2029
Residential	$10	$12	$15	$17	$10
Comm Firm A	$13	$14	$15	$13	$7
Comm/Ind Firm B	$50	$57	$60	$51	$28
Comm/Ind Firm C - Sales Service	$293	$347	$364	$317	$162
Comm/Ind Firm C - Transport	$276	$249	$231	$177	$91
Large General Firm Sales Service	$9,494	$11,619	$12,027	$10,701	$4,118
Large Firm Transport	$10,434	$9,413	$8,728	$6,679	$3,442
Small Dual Fuel A - Sales Service	$833	$969	$9956	$866	$394
Small Dual Fuel A - Transport	$682	$615	$570	$436	$225
Small Dual Fuel B - Sales Service	$3,387	$4,044	$4,178	$3,678	$1,615
Small Dual Fuel B - Transport	$2,673	$2,412	$2,236	$1,711	$882
Large Volume - Dual Fuel Sales Service	$9,153	$11,284	$11,649	$8,346	$4,084
Large Volume - Dual Fuel Transport	$13,039	$11,763	$10,907	$8,355	$4,301
Large Volume-Transport-MR	$18,391	$16,592	$15,384	$11,772	$6,066
Large Volume-Dual Fuel Sales Service-MR	$18,120	$22,339	$23,061	$20,607	$8,085
Large Volume - Dual Fuel Transport-MR	$42,262	$38,127	$35,351	$27,052	$13,940

H. Local Economic Development and Future Innovation Associated with the Plan

With respect to local economic development, CenterPoint Energy considered a variety of costs and benefits in developing its proposed Plan.

First, CenterPoint Energy quantified the expected net job creation that would result from the Plan. Job creation is quantified in terms of full-time equivalent positions for one year, meaning a number of work hours equivalent to one full time worker for a single year. In total, the Company estimates that the Plan would create 1,174 direct jobs, 793 indirect jobs, and 980 induced jobs

in Minnesota.[12] As described above, a direct job is a job directly related to implementation of the Plan. An indirect job is related to materials and equipment that must be purchased for the Plan or construction work that must be completed. An induced job is a job that is created in the local economy due to increased consumption by direct and indirectly employed workers.

Second, CenterPoint Energy considered various quantitative costs and benefits of the Plan associated with local economic development, including the following:

Economic Development

- **Hennepin, Ramsey and Washington Counties and CenterPoint Energy Wage and Labor Commitments.** The developers for the RNG Produced from Hennepin County Organic Waste and RNG Produced from Ramsey & Washington Counties' Organic Waste pilots each have confirmed that all construction workers will be paid prevailing wages. To the extent that qualified persons are available, apprentices will be part of the construction teams to further develop the local qualified workforce and to the extent that qualified persons are available, the project developers will seek to hire members of the local community as facility operators. CenterPoint Energy also commits to these labor practices with respect to the Green Hydrogen Blending into Natural Gas Distribution System and the New Networked Geothermal Systems pilots.
- **Influence of IRA Labor Requirements.** Many of the tax credits introduced or modified in the federal Inflation Reduction Act ("IRA") reward project developers that satisfy certain labor conditions, specifically by paying prevailing wages and providing opportunities for apprentices.[13] In most cases, satisfaction of the labor requirements results in a credit that is five times higher than what would otherwise be available. Certain short-listed pilot concepts would be eligible for affected IRA tax credits. Affected pilots to be developed by CenterPoint Energy will satisfy labor requirements to take advantage of the higher tax credit amounts, to the extent labor resources are available. These pilots include Green Hydrogen Blending into the Natural Gas Distribution System and New Networked Geothermal Systems pilots. For affected pilots to be built by CenterPoint Energy customers, CenterPoint Energy does not intend to require satisfaction of the IRA labor requirements, but it is likely that many

[12] As calculated using the IMPLAN model, see Exhibit H. IMPLAN is an economic input-output model that examines the inter-industry relationships within an economy by combining a set of extensive databases related to economic factors, economic multipliers, and demographic statistics with a refined and detailed system of modeling software. Note that CenterPoint Energy will be required to report on economic impacts of the plan including job creation in annual NGIA status reports. Minn. Stat. § 216B.2427, Subd. 2(f). CenterPoint Energy will be unable to track and confirm creation of some of the jobs estimated by the IMPLAN model where jobs are created by entities not directly contracted with by CenterPoint Energy. Accordingly, the confirmed job creation total reported in annual NGIA status reports will be smaller than the IMPLAN total job creation estimate.

[13] Information on prevailing wage requirements available here: https://www.dol.gov/agencies/whd/IRA#:~:text=and%20hour%20laws%3F-,To%20qualify%20for%20enhanced%20tax%20benefits%20under%20the%20Inflation%20Reduction,Davis%2DBacon%20prevailing%20wage%20rate. Information on apprenticeship requirements available here: https://www.apprenticeship.gov/inflation-reduction-act-apprenticeship-resources.

customers will nevertheless seek to satisfy them in order to maximize their own tax credits. Affected pilots that could be constructed by customers include the Industrial or Large Commercial Hydrogen and Carbon Capture Incentives, New District Energy System, and possibly the Decarbonizing Existing District Energy Systems, Gas Heat Pumps for Commercial Buildings, and Commercial Hybrid Heating pilots.[14]

- **Jobs for Displaced Workers.** The hydrogen pilots are likely to require a highly paid workforce with a similar skill set to workers currently employed in traditional energy industries such as coal, oil, natural gas extraction and processing, and petrochemicals.[15] Thus, the hydrogen pilots represent an opportunity for workers to transition from those industries that may struggle as a result of decarbonization efforts. The U.S. Department of Energy ("DOE") recognizes the hydrogen economy as an opportunity for workers transitioning out of conventional energy jobs and cited an expected "100,000 net new direct and indirect jobs due to the build-out of new capital projects and clean hydrogen infrastructure" by 2030 in its National Clean Hydrogen Strategy Roadmap.[16] Similarly, the New Networked Geothermal Systems pilot could provide opportunities for workers in the traditional geologic natural gas industry.
- **Development of Hydrogen and Carbon Capture Industry.** With the passage of a new hydrogen production tax credit in the IRA, the hydrogen and carbon capture industries are both poised to experience a high levels of growth over the next decade.[17] The two hydrogen pilots could help Minnesota companies gain experience in this soon-to-be booming industry, which could make them more competitive regionally. CenterPoint Energy used a local engineering firm to support its first hydrogen blending pilot, completed prior to passage of the NGIA, and would anticipate continuing to rely on local support for future hydrogen blending projects. Similarly, the Carbon Capture Project for an Industrial or Large Commercial Facility pilot could help Minnesota workers gain experience in the carbon capture industry.
- **Local Opportunities for Networked Geothermal.** While CenterPoint Energy has not made final determinations about the technology that would be used for the New Networked Geothermal Systems pilot, there are local providers of geothermal technology which could be supported by the pilot.

[14] Note that IRA credits would also be available to participating customers in many cases for the residential energy efficiency and strategic electrification pilots. We have quantified those impacts on participant cost but because they are not attached to labor requirements we do not include them here in the discussion of qualitative impacts. The commercial and industrial energy efficiency and strategic electrification pilots could be part of a project qualifying for a deduction under 26 U.S.C. § 179D rather than a credit.

[15] See job categories here: https://www.energy.gov/eere/fuelcells/hydrogen-and-fuel-cells-career-map

[16] https://www.hydrogen.energy.gov/clean-hydrogen-strategy-roadmap.html

[17] An overview of the new hydrogen production tax credit is available here: https://www.energy.gov/eere/fuelcells/financial-incentives-hydrogen-and-fuel-cell-projects, discussion of the modified carbon capture credit is available here: https://www.irs.gov/pub/irs-drop/td-9944.pdf.

Public Co-Benefits

- **Local Government Waste Management.** The RNG Produced from Hennepin County Organic Waste and RNG Produced from Ramsey & Washington Counties Organic Waste pilots would both support local government waste management projects. It is also likely that any wastewater RNG purchased to complete CenterPoint Energy's portfolio would come from a public facility.
- **Benefits of Trees.** The Urban Tree Carbon Offsets pilot may reduce local government expenditures by reducing stormwater runoff and supports the Minneapolis Park and Recreation Board, Hennepin County, and other local organizations in planting and maintaining trees.

Market Development

- **Other Anaerobic Digestion Products.** Many RNG producers seek to use the leftover solid digestate in useful ways. For their RNG project, Hennepin County is evaluating the feasibility of on-site production of liquid and solid fertilizer or soil amendment products. The RNG producer for the Ramsey & Washington Counties' Organic Waste pilot is investigating the possibility of producing biochar, which can sequester additional carbon and be used to enrich nutrient impoverished soils.
- **Corporate and Business GHG Reduction Goals.** As noted above, many of the pilots could help Minnesota businesses achieve their own GHG-reduction goals, which may contribute to their competitiveness with sustainably-minded customers. Pilots that have this benefit include Industrial or Large Commercial Hydrogen and Carbon Capture Incentives, Industrial Methane and Refrigerant Leak Reduction, Carbon Capture Rebates for Commercial Buildings, Industrial Electrification Incentives, Small/Medium Business GHG Audits, Gas Heat Pumps for Commercial Buildings, and Industrial and Large Commercial GHG Audits.
- **Carbon Capture Byproducts** The units to be installed through the Carbon Capture Rebates for Commercial Buildings pilot will result in production of pearl ash, which will be sold for use in manufacturing of soap, glass, and other goods. This revenue will be shared with the participating customer. The Industrial or Large Commercial Hydrogen and Carbon Capture Incentives pilot may also produce byproducts that can be sold. It was assumed for modeling purposes that the captured carbon would be used in the production of concrete, but other uses are possible.

With respect to innovation, CenterPoint Energy made innovation a major focus in the development of the Plan. Some of the innovation benefits of the proposed Plan are as follows:

Direct Innovation Support

- **New Experiences for Gas Utility.** Each of the pilots would represent learning experiences for CenterPoint Energy, but some of the pilots represent much more significant departures from business as usual than others. CenterPoint Energy has never previously purchased RNG so all of the RNG pilots will represent learning opportunities for the Company's gas supply, legal, and peak shaving and gas control

departments in how to navigate a different kind of gas purchase. While CenterPoint Energy has constructed one green hydrogen blending project, the Company is still relatively new to the hydrogen production space. In addition, the short-listed Green Hydrogen Blending into the Natural Gas System would be the first time that CenterPoint Energy has operated hydrogen production along with the source of renewable electricity generation and equipment for hydrogen storage. Perhaps the biggest departure from business as usual would be the New Networked Geothermal System Pilot, which would require CenterPoint Energy to learn about an alternative energy delivery mechanism.

- **New Experiences for Customers.** Many of the pilots would encourage CenterPoint Energy's customers to innovate and learn about decarbonization strategies that will work for their systems. Some of the pilots that would require the most innovation on the part of customers include the Industrial Methane and Refrigerant Leak Reduction, Industrial or Large Commercial Hydrogen and Carbon Capture Incentives, New District Energy System, Industrial Electrification Incentive, Commercial Hybrid Heating, Small/Medium Business GHG Audit, and the Industrial and Large Commercial GHG Audit pilots.
- **Leak Detection Research.** In developing assumptions for the Industrial Methane and Refrigerant Leak Reduction pilot, CenterPoint Energy and ICF were confronted with substantial uncertainty about certain elements necessary to calculate GHG emissions. For example, a key research question is how often a leak survey needs to be repeated to maintain a lower level of leakage. CenterPoint Energy is confident that the pilot would result in substantial leak reduction, but its estimated GHG emissions reduction may be conservative. Accordingly, the Company designed the pilot to include significant evaluation to better determine the benefits and optimal design of the program. These learnings will not only inform a possible continuing program at CenterPoint Energy but may also help inform other utilities considering similar programs in Minnesota and beyond.
- **Commercial Carbon Capture Rebates Near-Term Innovation.** The company that builds the CarbinX units proposed to be installed through the Carbon Capture Rebates for Commercial Buildings pilot is currently developing a new version 4 which is expected to be applicable to a larger number of buildings and to capture a larger percentage of emissions. As with industrial carbon capture, discussed above, CarbinX units have potential to drive deeply negative lifecycle GHG intensity if combined with RNG.

Role in a Decarbonized Energy System

- **Role of RNG in a Decarbonized Energy System.** The American Gas Foundation's 2019 Renewable Sources of Natural Gas study, conducted by ICF, estimated national RNG potential as between 1,660 trillion Btu and 3,780 trillion Btu per year for pipeline injection by 2040. For comparison, the study states that residential consumption of

natural gas is 4,846 trillion Btu nationally.[18] Accordingly, while RNG cannot fully replace use of geologic natural gas, potential RNG volumes are sufficient to be a major part of an overall strategy to decarbonize the natural gas system. In addition, RNG is in some ways the simplest of the NGIA innovative resources to practically apply. RNG can substitute for geologic gas without changes to customer equipment or any action on the part of CenterPoint Energy customers. Accordingly, CenterPoint Energy believes that RNG will be an important strategy to decarbonize customer use of geologic gas in cases where the customer cannot, due to technological or financial limitations, or does not want to make changes to their own equipment or processes. CenterPoint Energy notes that every scenario explored in the G21 Report, including the high electrification scenario, modeled more RNG use than is included in all of the RNG pilots combined.[19]

- **Role of Hydrogen in a Decarbonized Energy System.** As noted above, in the IRA, the federal government has chosen to invest heavily in low-or-no carbon hydrogen production. With this investment, the DOE plans to drive down the cost of clean hydrogen significantly, making the task a key part of their Hydrogen Strategy; their Hydrogen Energy Earthshot targets $1/kg clean hydrogen within the next decade.[20] Consequently, hydrogen is poised to potentially become a relatively affordable way to reduce GHG emissions. While there are limits to how much hydrogen can be blended into the current gas system, including some percentage of hydrogen can be a relatively simple solution to reducing overall emissions in the same way that RNG purchases, discussed above, are a relatively simple solution requiring no action by customers. While the Industrial or Large Commercial Hydrogen Carbon Capture Incentives pilot does not share this simplicity, hydrogen may be the best solution for some large customers looking to completely decarbonize energy intensive processes after they have exhausted less expensive but incomplete solutions such as energy efficiency or partial electrification.
- **Continuing Need for Leak Detection.** Even in a fully decarbonized energy system, it is likely that many industrial customers will continue to need to use some version of methane gas whether that is RNG alone or geologic gas paired with carbon capture to reduce emissions. Accordingly, limiting methane leakage in industrial facilities may continue to be an important strategy to reduce lifecycle GHG emissions.
- **Role of Industrial Carbon Capture in a Decarbonized Energy System.** For similar reasons as noted above for industrial hydrogen, industrial carbon capture systems may be the best solution for some large customers looking to completely decarbonize energy intensive processes after they have exhausted less expensive but incomplete solutions such as energy efficiency or partial electrification. As with hydrogen, the

[18] Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment, American Gas Foundation (December 2019), available at https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf

[19] Decarbonizing Minnesota's Natural Gas End Uses, Great Plains Institute and Center for Energy and Environment (July 2021), available at https://e21initiative.org/wp-content/uploads/2021/07/Decarbonizing-NG-End-Uses-Stakeholder-Process-Summary.pdf

[20] https://www.hydrogen.energy.gov/clean-hydrogen-strategy-roadmap.html

federal government is investing in carbon capture through the IRA, which may reduce costs over time.[21] In addition, industrial carbon capture could be used in conjunction with RNG to further reduce lifecycle emissions and potentially achieve deeply negative GHG-intensity.

- **Role of Strategic Electrification in a Decarbonized Economy.** While not a complete solution, there is widespread agreement that electrification will be an important strategy for reducing emissions from industry and buildings. As discussed above, CenterPoint Energy emphasizes the importance of strategic deployment of electrification to avoid significant impacts on a possible future winter electric peak and/or substantially increased customer costs. Each of the strategic electrification pilots would explore the appropriate balance between electrification and use of geologic gas or other fuels and thus further understanding about how best to balance the use of the gas and electric systems in Minnesota to maximize reduction of carbon emissions while maintaining heat to all customer during extreme cold weather. For example, CenterPoint Energy's customers alone require a peak day demand of over 70,000 Dth/hour or 20 GW of natural gas. Under a fully electrified scenario, at negative 25° F, the current electric heating technology would require well over 16 GWs of new 100 percent capacity factor power supply, transmission, and distribution just for CenterPoint Energy's customers. Optimizing electrification options that include geological gas backup allows customers to maintain the ability to heat their homes during extreme cold weather events and greatly reduces gas consumption in the spring, fall and moderate winter days while not requiring the need for more than 16 GWs of additional generation resources.

In addition to the innovation benefits of the full pilots described above, the R&D pilots are all intended to drive innovation through the study of decarbonization strategies and low- and no-carbon technologies that can displace the use of geologic gas.

I. Conclusion

CenterPoint Energy is excited to implement its proposed Plan, the first innovation plan to be proposed in Minnesota. The Company crafted the Plan to include a broad array of innovative resources and pilot designs so as to maximize potential for learning and innovation. Innovation will be necessary for CenterPoint Energy and the state of Minnesota to achieve their ambitious GHG reduction goals. In addition, the Plan will achieve near-term GHG reductions, net job creation, and many other benefits for the state of Minnesota and our customers.

[21] Under the modified IRA credit in 26 U.S.C. § 45Q, only rather large industrial capture systems would be eligible for a credit. For purposes of modeling quantifiable costs and benefits, CenterPoint Energy assumed that participating facilities would not capture enough carbon to qualify for the credit. However, over time, even smaller facilities could benefit from overall advancement in technology that would be encouraged by the IRA credit.

In the Matter of
CenterPoint Energy Natural Gas Innovation Act (NGIA)
Innovation Plan

Petition of CenterPoint Energy

EXHIBIT C: COMPLIANCE MATRIX

Docket No. G-008/M-23-215

June 28, 2023

Statutory/Regulatory Requirement	Where Addressed
Minn. Stat. § 216B.2427, subd. 2(a)(1): The innovative resource or resources the utility plans to implement to contribute to meeting the state's GHG and renewable energy goals.	Petition, Section V, Plan Overview Exhibit D: Full Pilots Detailed Descriptions
Minn. Stat. § 216B.2427, subd. 2(a)(2): Research and development investment related to innovative resources the utility plans to undertake.	Petition, Section VII, Research and Development Exhibit J: Research and Development Pilots Detailed Descriptions
Minn. Stat. § 216B.2427, subd. 2(a)(3): Total lifecycle GHG emissions that the utility projects are reduced or avoided through implementing the plan.	Petition, Section V, Plan Overview
Minn. Stat. § 216B.2427, subd. 2(a)(4): A comparison of the total lifecycle GHG emissions expected to be reduced or avoided to total emissions from natural gas use by utility customers in 2020.	Petition, Section V, Plan Overview
Minn. Stat. § 216B.2427, subd. 2(a)(5): A description of each pilot program in the plan that is related to the development or provision of innovative resources, and an estimate of the total incremental costs to implement each pilot program.	Petition, Section V, Plan Overview Exhibit E: Pilot Cost Estimate Details
Minn. Stat. § 216B.2427, subd. 2(a)(6): The cost-effectiveness of innovative resources calculated from the perspective of the utility, society, the utility's nonparticipating customers, and the utility's participating customers.	Exhibit M: Commission Cost-Benefit Framework Chart
Minn. Stat. § 216B.2427, subd. 2(a)(7): For any pilot program not previously approved as part of the utility's most recent innovation plan, a third-party analysis of (i) the lifecycle GHG intensity of the proposed innovative resources; and (ii) the forecasted lifecycle GHG emissions reduced or avoided if the proposed pilot program is implemented.	Exhibit F: Lifecycle GHG Calculation Details Exhibit G: ICF Letter Endorsing GHG Emissions Calculation
Minn. Stat. § 216B.2427, subd. 2(a)(8): An explanation of the methodology used by the utility to calculate the lifecycle GHG emissions avoided or reduced by each pilot program included	Exhibit F: Lifecycle GHG Calculation Details

Statutory/Regulatory Requirement	Where Addressed
in the plan, including descriptions of how the utility's method deviated, if at all, from the carbon accounting frameworks established by the Commission under section 216B.2428.	
Minn. Stat. § 216B.2427, subd. 2(a)(9): A discussion of whether the plan supports the development and use of alternative agricultural products, waste reduction, reuse, or anaerobic digestion of organic waste, and the recovery of energy from wastewater, and, if it does, a description of the geographic areas of the state in which those benefits are realized.	Exhibit M: Commission Cost-Benefit Framework Chart Exhibit O: Pilot Qualitative Details
Minn. Stat. § 216B.2427, subd. 2(a)(10): a description of third-party systems and processes the utility plans to use to track the innovative resources include in the plan so that the environmental benefits produced by the plan are not claimed for any other program and verify the environmental attributes and greenhouse gas emissions intensity of innovative resources included in the plan.	Exhibit D: Full Pilots Detailed Descriptions Exhibit W: Tracking and Verification Plan
Minn. Stat. § 216B.2427, subd. 2(a)(11): Projected local job impacts resulting from the implementation of the plan and a description of steps the utility and the utility's energy suppliers are taking to maximize the availability of construction employment opportunities in the state.	Petition, Section V, Plan Overview Exhibit H: IMPLAN Modeling Details
Minn. Stat. § 216B.2427, subd. 2(a)(12): A description of how the utility proposes to recover annual total incremental costs of the plan.	Petition, Section VIII, Cost Recovery Proposal Exhibit R: Cost Recovery Proposal Details
Minn. Stat. § 216B.2427, subd. 2(a)(13): Steps the utility has taken or proposes to take to reduce the expected cost of the plan on low- and moderate-income residential customers and to ensure that low- and moderate-income residential customers benefit from innovative resources included in the plan.	Petition, Section VIII, Cost Recovery Proposal
Minn. Stat. § 216B.2427, subd. 2(a)(14): a report on the utility's progress towards implementing the utility's previously approved innovation plan, if applicable.	Not applicable, this is CenterPoint Energy's first innovation plan.

Statutory/Regulatory Requirement	Where Addressed
Minn. Stat. § 216B.2427, subd. 2(a)(15): a report of the utility's progress toward achieving the cost-effectiveness objectives established by the commission with respect the utility's previously approved innovation plan, if applicable	Not applicable, this is CenterPoint Energy's first innovation plan.
Minn. Stat. § 216B.2427, subd. 2(a)(16): collections of pilot programs that the utilities estimates would, if implemented, provide approximately 50 percent, 150 percent, and 200 percent of the GHG reduction or avoidance of the utility's proposed plan	Exhibit V: Alternative Portfolios
Minn. Stat. § 216B.2427, subd. 6: The first innovation plan filed by a utility with more than 800,000 customers must include a pilot program to provide thermal energy audits to small- and medium-sized business in order to identify opportunities to reduce or avoid GHG emissions from natural gas use	Petition, Section V, Plan Overview Exhibit D: Full Pilot Description
Minn. Stat. § 216B.2427, subd. 7: The first innovation plan filed by a utility with more than 800,000 customers must include a pilot program to provide innovative resources to industrial facilities whose manufacturing processes, for technical reasons, are not amendable to electrification.	Petition, Section V, Plan Overview Exhibit D: Full Pilot Description
Minn. Stat. § 216B.2427, subd. 8: The first innovation plan filed by a utility with more than 800,000 customers must include a pilot program that facilitates deep energy retrofits and the installation of cold climate electric air-source heat pumps in existing residential homes that have natural gas heating systems.	Petition, Section V, Plan Overview Exhibit D: Full Pilot Description
Minn. Stat. § 216B.2427, subd. 9: The first innovation plan filed by a utility with more than 800,000 customers must include a pilot program to facilitate the development, expansion, or modification of district energy systems in Minnesota.	Petition, Section V, Plan Overview Exhibit D: Full Pilot Description
Minn. Stat. § 216B.2427, subd. 11: A public utility filing an innovation plan shall concurrently submit a report to the commission with certain enumerated information.	Exhibit T: Utility System Report and Forecast

Statutory/Regulatory Requirement	Where Addressed
In the Matter of Establishing Frameworks to Compare Lifecycle Greenhouse Gas Emission Intensities of Various Resources, and to Measure Cost Effectiveness of Individual Resources and of Overall Innovation Plans, Docket No. G999/CI-21-566, ORDER ESTABLISHING FRAMEWORKS FOR IMPLEMENTING MINNESOTA'S NATURAL GAS INNOVATION ACT (June 1, 2022) ("Frameworks Order"), Order Point 1: Utilities shall file a high, low, and expected greenhouse gas intensity for innovative resources included in the proposed NGIA plan, where applicable. High and low scenarios shall incorporate at least low and high assumptions for electricity use and other fuels used in the resource's lifecycle. Expected GHG intensity values will be used in cost-benefit calculations and when determining the expected GHG reduction of pilot programs and NGIA plans.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 3: When applicable, utilities shall use the most recent version of the Argonne National Laboratory's Greenhouse Gases, Regulated Emissions and Energy Use in Technologies (GREET) model in any NGIA plan filings. Utilities may use the prior year's model if filing an NGIA plan within 30 days of the publication of a new version of the Argonne GREET model.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 4: For purposes of the NGIA, the lifecycle GHG emissions per dekatherm of geologic natural gas shall be calculated using the Argonne GREET model, using GREET's most up-to-date assumptions for fugitive methane leakage associated with geologic natural gas.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 5: The GHG intensity of RNG included in an NGIA plan will be calculated in accordance with the Argonne GREET model.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 6: Utilities shall file Argonne GREET spreadsheets with the Commission supporting their calculations of lifecycle GHG intensity for any RNG proposed as part of an innovation plan. a. Utilities shall complete the Argonne GREET model with facility-specific information for any individual RNG facilities expected to contribute five percent or more of the total	Exhibit F: Lifecycle GHG Calculation Details

Statutory/Regulatory Requirement	Where Addressed
estimated GHG emissions reduction of the utility's proposed NGIA plan. b. Utilities may use national averages and/or reasonable assumptions for any RNG facilities expected to contribute less than five percent of the total estimated GHG reduction of the utility's proposed NGIA plan, if facility-specific information is not readily available.	
Frameworks Order, Order Point 7: Utilities shall use electric-utility-specific generation mix information for the RNG facility when it is reasonably available. When electric utility-specific information is not available, the filing gas utility will use a state-specific generation mix taken from National Renewable Energy Laboratory ("NREL") Standard Scenarios. If the RNG facility is using a higher proportion of carbon free electricity than is available by default from their electric utility the filing gas utility may input facility-specific generation information into GREET as appropriate.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 8: Multi-year investments in RNG shall incorporate expected changes in the electricity system in the calculation of GHG intensity.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 9: The GHG intensity of power-to-hydrogen included in an NGIA plan will be calculated in accordance with the Argonne GREET model.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 10: Utilities may assume that hydrogen produced using carbon-free electricity has no GHG emissions associated with its production but may have GHG emissions associated with electricity used for compression, transportation, blending, injection, purification, and pumping of water, or other purposes.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 11: Utilities may use the State of Minnesota Technical Reference Manual ("TRM") for Energy Conservation Improvement Programs ("CIP") or other methods approved by the Department of Commerce, Division of Energy Resources, for the utility's CIP to calculate energy savings.	Exhibit F: Lifecycle GHG Calculation Details

Statutory/Regulatory Requirement	Where Addressed
Frameworks Order, Order Point 12: If there are no applicable methods approved by the Department for a proposed energy efficiency measure, the utility must file a proposed method for calculating energy savings with their innovation plan proposal.	Exhibit D: Full Pilot Description Exhibit W: Tracking and Verification Plan
Frameworks Order, Order Point 13: To calculate GHG reductions from an energy efficiency resource, utilities shall multiply the reduced consumption of geologic gas by the GHG intensity assigned to geologic gas.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 14: Utilities shall use estimated lifecycle GHG reductions, rather than first-year reductions, when comparing energy efficiency with other resources.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 16: This ordering point specifies a method for determining the GHG intensity of strategic electrification and requires that gas utilities seeking to implement a pilot for electrification of industrial processes include a discussion in their plan for calculating the GHG intensity of associated electricity use.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 17: Utilities may use the TRM or other methods approved by the Department for the utility's CIP to calculate the energy use of appliances installed pursuant to a strategic electrification program and the baseline appliances.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 18: If there are no applicable methods approved by the Department that the utility can use to calculate the energy use of an appliance, the utility must file a proposed method for calculating the appliance's energy use along with their innovation plan proposal.	Exhibit D: Full Pilot Description Exhibit W: Tracking and Verification Plan
Frameworks Order, Order Point 19: Utilities shall use estimated lifecycle GHG reductions, rather than first-year reductions, when comparing strategic electrification with other resources.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 21: When calculating the GHG intensity of biogas or power-to-ammonia, utilities shall use principles consistent with Argonne GREET and methods used for renewable natural gas and power-to-hydrogen, as appropriate.	Not applicable; no biogas or power-to-ammonia projects analyzed

Statutory/Regulatory Requirement	Where Addressed
Frameworks Order, Order Point 22: When calculating the GHG intensity of a district energy project, utilities shall use project-specific data as available and principles consistent with Argonne GREET and methods used for calculating the greenhouse gas intensity of electricity approved by the Commission, unless it is demonstrated that an alternative method is appropriate.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 23: When calculating the GHG intensity of a carbon capture project, utilities shall use project-specific data as available and principles consistent with Argonne GREET, unless it is demonstrated that an alternative method is appropriate.	Exhibit F: Lifecycle GHG Calculation Details
Frameworks Order, Order Point 28: Where applicable for quantifying any NGIA cost or benefit, utilities shall use structural cost-benefit values following methods described in Appendix H of the Minnesota Department of Commerce's February 11, 2020, CIP BenCost Input Decision in Docket No. G-999/CIP-18-782, with certain modifications described in the Joint Commenters' April 1, 2022 filing in Docket No. G-999/CI-21-566.	Exhibit N: Pilot Assumptions Spreadsheet Exhibit P: Pilot Quantitative Calculations
Frameworks Order, Order Point 29: Utilities shall use updated structural cost-benefit values with the filing of each innovation plan. Wherever a supporting third-party report or data is used to calculate a structural value, the utility will use the most recent version of that report or data, except that if a new report or data is published within 30 days of an innovation plan filing, the utility may use the prior version.	Exhibit N: Pilot Assumptions Spreadsheet Exhibit P: Pilot Quantitative Calculations
Frameworks Order, Order Point 30: Utilities shall include completed versions of the Exhibit B chart[1] in innovation plan filings for the plan proposed by the utility. The Exhibit B chart summarizes the costs and benefits that are expected to result from each pilot program proposed by the utility, one pilot per column.	Exhibit M: Commission Cost-Benefit Framework Chart

[1]NGIA Blank Cost-Benefit Framework Chart, CenterPoint's Proposed Cost-Benefit Framework, at Exhibit B (January 28, 2022) (Exhibit B chart).

Statutory/Regulatory Requirement	Where Addressed
Frameworks Order, Order Point 31: In completing the Exhibit B chart for their proposed plan, utilities shall quantify costs and benefits to the extent reasonably practicable, but, at a minimum, shall quantify (1) near-term expected costs and benefits to the utility system; (2) costs and benefits associated with reduction or avoidance of GHG and other emissions; and (3) any out-of-pocket costs expected to be paid by participating customers.	Exhibit M: Commission Cost-Benefit Framework Chart Exhibit N: Pilot Assumptions Spreadsheet Exhibit P: Pilot Quantitative Calculations
Frameworks Order, Order Point 32: Where it is not reasonably practicable to quantify a cost or benefit, utilities shall provide a brief qualitative description of the cost or benefit in the Exhibit B chart.	Exhibit M: Commission Cost-Benefit Framework Chart
Frameworks Order, Order Point 33: For both quantitative and qualitative costs and benefits of the utility's proposed plan summarized in an Exhibit B chart, utilities shall provide a detailed discussion in the innovation plan filing. For quantified costs and benefits, this detail shall include sufficient information for a reader to understand how the utility calculated the figure included in the chart using structural values and any other numerical inputs.	Exhibit M: Commission Cost-Benefit Framework Chart Exhibit N: Pilot Assumptions Spreadsheet Exhibit P: Pilot Quantitative Calculations
Frameworks Order, Order Point 34: Utilities shall also complete an Exhibit B chart for each collection of alternative pilot programs to be considered pursuant to Minn. Stat. § 216B.2427, subd. 2(a)(16).	Exhibit V: Alternative Portfolios
Frameworks Order, Order Point 35: For each resource proposed to be included in a utility plan, the utility shall provide a brief description of the other resources considered to reduce or avoid the same emissions targeted by the proposed resource including a discussion of how the expected costs and benefits of the alternative resource would compare to the utility's proposed resource.	Petition, Section VI: Plan Development and Engagement with Interested Parties Exhibit L: Summary of RFI responses and Other Pilots Considered Exhibit O: Pilot Quantitative Calculations Exhibit P: Pilot Qualitative Details

Statutory/Regulatory Requirement	Where Addressed
Frameworks Order, Order Point 38(a): Utility innovation plan filings shall include an assessment of impacts on local communities in and around proposed project sites and a summary of outreach/community workshops held for pilots designed to reach low- and medium-income customers.	Petition, Section VI: Plan Development and Engagement with Interested Parties Exhibit O: Pilot Qualitative Details
Frameworks Order, Order Point 38(b): Utility innovation plan filings shall include a discussion of expectations for program access and types of customers that may participate.	Exhibit D: Full Pilots Detailed Descriptions
Frameworks Order, Order Point 38(c): Utility innovation plan filings shall include a discussion of how equity and diversity was or will be considered in the program design process and any utility vendor/supplier selection process.	Petition, Section VI: Plan Development and Engagement with Interested Parties Exhibit D: Full Pilots Detailed Descriptions
Frameworks Order, Order Point 38(d): Utility innovation plan filings shall include the most recent metrics filed under the Commission's January 7, 2020, Order of Service Quality Reports in Docket No. G-008/M-19-300.	Exhibit U: Service Quality Metrics
Frameworks Order, Order Point 38(e): Utility innovation plan filings shall include a nontechnical summary describing how the innovation plan furthers the state's GHG emissions reduction and renewable energy goals, the process and analytical techniques used to create the plan, percentage GHG emissions reductions through the plan, all projects proposed and considered by the utility ranked in order of cost per ton avoided GHG emissions, and activities required over the next five years to implement the plan, the likely effect of the plan implementation on rates and bills, and local economic development and future innovation associated with the plan.	Exhibit B: Non-Technical Summary
Frameworks Order, Order Point 39: Prior to approval of any hydrogen blending pilot the utility shall (a) Clearly state the learning objectives for the proposed blending pilot and metrics it will collect to achieve those learning; (b) Document the utility's consultation with the Minnesota Office of Pipeline Safety regarding the specific pilot along with a discussion of	Exhibit D: Full Pilots Detailed Descriptions

Statutory/Regulatory Requirement	Where Addressed
why it is in compliance with the state pipeline safety standards; and (c) Provide a discussion demonstrating that the utility has determined the level of hydrogen blending will ensure the safety of its system and customers' appliances.	
In the Matter of Establishing Frameworks to Compare Lifecycle Greenhouse Gas Emission Intensities of Various Resources, and to Measure Cost Effectiveness of Individual Resources and of Overall Innovation Plans, Docket No. G999/CI-21-566, Order (Sept. 12, 2022): To be eligible for inclusion in innovation plans, utilities must: a. Demonstrate that proposed energy efficiency and strategic electrification investments are not included in the utility's current CIP Triennial Plan, and state whether the utility does or does not intend to include any of the proposed investments in future CIP Triennial Plans; b. For proposed energy efficiency and strategic electrification investments in measures that have been included in past CIP plans, provide historical measure level performance data since 2010; and c. Clearly demonstrate why the proposed energy efficiency and strategic electrification investments could not reasonably be included in the utility's conservation improvement program.	Exhibit I: CIP/NGIA Coordination Information

In the Matter of
CenterPoint Energy Natural Gas Innovation Act (NGIA)
Innovation Plan

Petition of CenterPoint Energy

EXHIBIT D: PILOT DESCRIPTIONS

Docket No. G-008/M-23-215

June 28, 2023

Table of Contents

Pilot A. RNG Produced from Hennepin County Organic Waste

Project Description

CenterPoint Energy proposes to buy renewable natural gas ("RNG"), including both the commodity and environmental attributes, from Hennepin County's anaerobic digestion ("AD") facility, which is currently under development. Hennepin County submitted this project as part of CenterPoint Energy's Request for Ideas ("RFI") issued in April 2022. Hennepin County is in the final development and planning stages for a new AD facility which will process source-separated food waste from Hennepin County's organics recycling program and a smaller quantity of yard waste. The project is expected to be operational in 2026 and CenterPoint Energy proposes to purchase 50 percent of the RNG produced by the facility from 2026 through 2036. It is anticipated that the facility will be directly interconnected to CenterPoint Energy's distribution system. As described further in Exhibit W, CenterPoint Energy proposes to record the environmental attributes in the M-RETS tracking system and retire the Renewable Thermal Certificates ("RTCs") associated with the purchased RNG on behalf of its customers. CenterPoint Energy has not yet entered into a contract with Hennepin County for the purchase of the RNG but has been in discussion with them and understands that they are amendable to the sale of 50 percent of their RNG provided pricing is reasonable. As discussed below, pricing will be determined closer to the time of purchase as a fair price will depend on both final verified GHG intensity of the constructed facility and the market conditions at the time.

Eligibility

This pilot does not require customer participation. All CenterPoint Energy sales customers will be attributed a small share of the RNG proportionate to their gas usage.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 1: Hennepin County Anaerobic Digestion of Organic Materials Participation Estimates

Unit of Participation	Dth				
Year	Year 1	Year 2	Year 3	Year 4	Year 5
Dth Purchased	0	0	41,440	41,440	41,440

Table 2: Hennepin County Anaerobic Digestion of Organic Materials Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$0	$10,094	$842,256	$851,634	$861,967
Advertising & Promotion	$0	$0	$0	$0	$0
Allocation of General Portfolio Costs	$119,490	$43,255	$42,273	$42,684	$43,107
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$0	$0	$0	$0	$0
Total	$119,490	$53,349	$884,529	$894,318	$905,074
UCT Savings[1]	$0	$0	$0	$0	$0
Total Incremental Cost[2]	**$119,490**	**$53,349**	**$884,529**	**$894,318**	**$905,074**

GHG Reduction and Geologic Gas Savings

Table 3 below summarizes the forecasted greenhouse gas ("GHG") emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions reduced by implementation of the pilot including the emissions intensity of innovative resources deployed. GHG emissions reductions from RNG have a one-year life. For modeling, CenterPoint Energy has assumed a ten-year contract term and so has projected reductions for ten years. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on ICF's application of the GREET model to the project.

Table 3: Hennepin County Anaerobic Digestion of Organic Materials GHG and Natural Gas Savings

	During Five-Year Plan	Over Contract Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	8,466	28,221
Geologic Gas Savings (Dth)	124,320	414,400

Tracking and Verification

This pilot will follow the tracking and verification approach for "Renewable Natural Gas and Biogas" described in Exhibit W.

Customer Incentive Information

No customer incentives will be paid under this pilot.

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[1] UCT stands for utility cost test.

[2] Total incremental cost is defined in the NGIA to be net of certain savings, most notably savings from reduced purchases of geologic natural gas, shown as UCT savings in the table.

IRA Incentives Considered

The renewable energy investment tax credit ("ITC"), as modified by the Inflation Reduction Act ("IRA"), contained in 26 U.S.C. § 48, may provide an incentive for Hennepin County or its project developer, depending on the date on which construction begins. To qualify for the ITC, the project would have to commence construction prior to January 1, 2025. The amount of the credit ranges between 6 percent and 50 percent of qualified costs, depending on whether the project satisfies certain labor and domestic manufacturing requirements, and whether the project is built in an energy community.[3] CenterPoint Energy has not identified any IRA incentives that it would be eligible for directly with respect to this pilot.

Equity, Diversity, and Community Engagement

Hennepin County is proposing to build the AD facility adjacent to the county's Brooklyn Park Transfer Station[4] at 9401 83rd Avenue. The proposed project is located in an Area of Concern for Environmental Justice.[5] The County has conducted several outreach activities related to this project with local community groups and the local neighborhood. This engagement with the local community has allowed the County to describe the project, introduce the concept of anaerobic digestion, and gather initial feedback. Additional engagement activities and events will be held as the project moves forward. To support local economic benefits, Hennepin County has confirmed that for their RNG project, all construction workers will be paid prevailing wages. To the extent that qualified persons are available, apprentices will be part of the construction teams to further develop the local qualified workforce and to the extent that qualified persons are available, the project developers will seek to hire members of the local community as facility operators. On CenterPoint Energy's part, as a proposed buyer of the project's RNG, the Company will support and participate in the County's community engagement efforts, as appropriate, and report on these activities in the Plan's annual reports.

Additional Project Information

Because CenterPoint Energy proposes to purchase RNG from this specific facility, we do not propose to subject the project to a request for proposal ("RFP"). CenterPoint Energy and

[3] Energy community is a term used in the IRA to designate areas of the country that have been particularly negatively economically affected by the transition away from use of fossil fuels or brownfield sites as that term is defined in the Comprehensive Environmental Response, Compensation and Liability Act, otherwise known as "CERCLA" or Superfund. 26 U.S.C. 45(b)(11)(B). The United States Department of Energy has provided an interactive map of two of the three types of energy communities; brownfield sites are not shown on this mapping tool: https://energycommunities.gov/energy-community-tax-credit-bonus/.

[4] A facility that receives trash and organics deliveries from waste-hauling companies and serves as a drop-off facility for residents for household hazardous waste and problem materials. The facility is owned and operated by Hennepin County and is located in the City of Brooklyn Park.

[5] The Minnesota Pollution Control Agency ("MPCA") considers tribal areas and census tracts with higher concentrations of low-income residents and people of color as areas of increased concern for environmental justice. Environmental justice. Minnesota Pollution Control Agency. (n.d.). Retrieved April 14, 2023, from https://www.pca.state.mn.us/about-mpca/environmental-justice.

Hennepin County plan to identify a fair market price closer to the date of contracting based on verified carbon intensity and available market benchmarks. Budget estimates above are based on ICF's current estimates of the market value of the RNG.

Pilot B. RNG Produced from Ramsey & Washington Counties' Organic Waste

Project Description

CenterPoint Energy proposes to buy RNG, including both the commodity and environmental attributes, from Ramsey and Washington Counties' anaerobic digestion facility under development. Ramsey/Washington Recycling & Energy submitted this project as part of CenterPoint Energy's RFI issued in April 2022. Ramsey and Washington Counties have entered into an agreement with Dem-Con HZI Bioenergy LLC, a joint venture between Dem-Con Companies and Hitachi Zosen Inova, LLC ("Dem-Con HZI") for the development of a new AD facility, which will process source-separated food waste from Ramsey and Washington Counties' organics recycling program and a smaller quantity of yard waste.[6] The project is expected to be operational in 2026 and CenterPoint Energy proposes to purchase 80 percent of the RNG produced by the facility from 2026 through 2036. It is anticipated that the facility will be directly interconnected to CenterPoint Energy's distribution system. As described further in Exhibit W, CenterPoint Energy proposes to record the environmental attributes in the M-RETS tracking system and retire the RTCs associated with the purchased RNG on behalf of its customers. CenterPoint Energy has not yet entered into a contract with Dem-Con HZI for the purchase of the RNG but has been in discussion with them and understands that they are amendable to the sale of 80 percent of the produced RNG provided pricing is reasonable. As discussed below, pricing will be determined closer to the time of purchase as a fair price will depend on both final verified GHG intensity of the constructed facility and the market conditions at the time.

Eligibility

This pilot does not require customer participation. All CenterPoint Energy sales customers will be attributed a small share of the RNG proportionate to their gas usage.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 4: RNG Produced from Ramsey & Washington Counties' Organic Waste Participation Estimates

Unit of Participation	Dths				
Year	Year 1	Year 2	Year 3	Year 4	Year 5
Dths Purchased	0	0	152,613	152,613	152,613

[6] A small amount of yard waste is required for structural content in the digester.

Table 5: RNG Produced from Ramsey & Washington Counties' Organic Waste Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$0	$10,094	$3,001,022	$3,038,747	$3,075,939
Advertising & Promotion	$0	$0	$0	$0	$0
Allocation of General Portfolio Costs	$424,966	$153,836	$150,342	$151,803	$153,309
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$0	$0	$0	$0	$0
Total	$424,966	$163,930	$3,151,364	$3,190,551	$3,229,248
UCT Savings	$0	$0	$0	$0	$0
Total Incremental Cost	**$424,966**	**$163,930**	**$3,151,364**	**$3,190,551**	**$3,229,248**

GHG Reduction and Geologic Gas Savings

Table 6 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions reduced by implementation of the pilot including the emissions intensity of innovative resources deployed. GHG emissions reductions from RNG have a one-year life. For modeling, CenterPoint Energy has assumed a ten-year contract term and so has projected reductions for ten years. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on ICF's application of the GREET model to the project.

Table 6: RNG Produced from Ramsey & Washington Counties' Organic Waste GHG and Geologic Gas Savings

	During Five-Year Plan	Over Contract Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	44,359	147,863
Geologic Gas Savings (Dth)	457,839	1,526,130

Tracking and Verification

This pilot will follow the tracking and verification approach for "Renewable Natural Gas and Biogas" described in Exhibit W.

Customer Incentive Information

No customer incentives will be paid under this pilot.

IRA Incentives Considered

The renewable energy ITC, as modified by the IRA, contained in 26 U.S.C. § 48, may provide an incentive for Dem-Con HZI, depending on the date on which construction begins. To qualify for the ITC, the project would have to commence construction prior to January 1, 2025. The amount of the credit ranges between 6 percent and 50 percent of qualified costs, depending on

whether the project satisfies certain labor and domestic manufacturing requirements and whether the project is built in an energy community. Dem-Con HZI expects to achieve a credit of 30-40 percent. CenterPoint Energy has not identified any IRA incentives that it would be eligible for directly with respect to this pilot.

Equity, Diversity, and Community Engagement

As part of the Minnesota Pollution Control Agency permitting process, this project will be subject to solid waste permitting, air permitting, & environmental review. This process also includes environmental justice review, State Historic Preservation Office review for any potential historic and cultural impacts, and GHG and climate change impact analysis. Additionally, both the solid waste permitting and environmental review include a 30-day public notice period where the neighbors and local community are invited to comment on the project. The Company will support and participate in the project's community engagement efforts, as appropriate, and report on these activities in the Plan's annual reports.

Additional Project Information

Because CenterPoint Energy proposes to purchase RNG from this specific facility, we do not propose to subject the project to an RFP. CenterPoint Energy and Dem-Con HZI plan to identify a fair market price closer to the date of contracting based on verified carbon intensity and available market benchmarks. Budget estimates above are based on ICF's current estimates of the market value of the RNG.

Pilot C. Renewable Natural Gas Request for Proposal ("RFP") Purchase

Project Description

CenterPoint Energy plans to issue an RFP for additional RNG to complete its portfolio. While CenterPoint Energy has heard from some developers that may be interested in responding to the RFP, CenterPoint Energy has not pre-selected any particular projects. In selecting winning proposals, CenterPoint Energy will attempt to minimize costs per ton of lifecycle CO_2e reduction while giving preference to projects in Minnesota or neighboring states. CenterPoint Energy will also prioritize projects that are eligible for the RNG additional cost cap to maximize the impact of the plan through that additional funding. CenterPoint Energy proposes to be open to investments in RNG facilities that would benefit from upfront capital provided that those investments are coupled with reduced RNG costs going forward. CenterPoint Energy also proposes to give a preference to bundled RNG (i.e. sale of both environmental attributes and commodity gas) but would consider purchasing unbundled RNG (i.e. without the commodity gas). Additional details on the RFP and CenterPoint Energy's proposed process for selecting winning projects is included in Exhibit Q. As described further in Exhibit W, CenterPoint Energy proposes to record the environmental attributes in the M-RETS tracking system and retire all of them on behalf of its customers. CenterPoint Energy proposes to be flexible as to contract length but anticipates that it will be able to secure a better price by entering into contracts of ten or more years. CenterPoint Energy plans to spend approximately $27.8M within the five-year innovation plan period on RNG selected through this RFP to satisfy the NGIA requirement that

50 percent or more of the costs in this Plan be for RNG, biogas, hydrogen produced via power-to-hydrogen, and ammonia produced via power-to-ammonia.[7]

Eligibility

This pilot does not require customer participation. All CenterPoint Energy sales customers will be attributed a small share of the RNG proportionate to their gas usage.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 7: Renewable Natural Gas Request for Proposal Purchase Participation Estimates

Unit of Participation	Dths				
Year	Year 1	Year 2	Year 3	Year 4	Year 5
Dths Purchased	0	408,750	408,750	408,750	408,750

Table 8: Renewable Natural Gas Request for Proposal Purchase Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$49,000	$7,144,213	$7,187,175	$7,292,958	$7,393,317
Advertising & Promotion	$0	$7,125	$0	$0	$0
Allocation of General Portfolio Costs	$1,353,893	$490,103	$478,972	$483,629	$488,425
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$0	$0	$0	$0	$0
Total	$1,402,893	$7,641,441	$7,666,148	$7,776,587	$7,881,742
UCT Savings	$0	$0	$0	$0	$0
Total Incremental Cost	**$1,402,893**	**$7,641,441**	**$7,666,148**	**$7,776,587**	**$7,881,742**

GHG Reduction and Geologic Gas Savings

Table 9 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions reduced by implementation of the pilot including the emissions intensity of innovative resources deployed. GHG emissions reductions from RNG have a one-year life. For modeling, CenterPoint Energy

[7] Minn. Stat. § 216B.2427, subd. 2(d)(1).

has assumed a ten-year contract term and so has projected reductions for ten years. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on ICF's application of the GREET model to the project.

Table 9: Renewable Natural Gas Request for Proposal Purchase GHG and Geologic Gas Savings

	During Five-Year Plan	Over Contract Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	143,954	359,884
Geologic Gas Savings (Dth)	1,635,000	4,087,500

Tracking and Verification

This pilot will follow the tracking and verification approach for "Renewable Natural Gas and Biogas" described in Exhibit W.

Customer Incentive Information

No customer incentives will be paid under this pilot.

IRA Incentives Considered

The renewable energy ITC, as modified by the IRA, contained in 26 U.S.C. § 48, may provide an incentive for RNG project developers depending on the date on which construction begins. To qualify for the ITC, the project would have to commence construction prior to January 1, 2025. The amount of the credit ranges between 6 and 50 percent of qualified costs depending on whether or not the project satisfies certain labor and domestic manufacturing requirements and whether the project is built in an energy community. CenterPoint Energy has not identified any IRA incentives that it would be eligible for directly with respect to this pilot.

Equity, Diversity, and Community Engagement

CenterPoint Energy proposes a process for evaluating and selecting RNG purchases that includes several criteria prioritizing local environmental and economic co-benefits as described in the draft RFP in Exhibit Q. In its RFP, CenterPoint Energy will take into consideration whether the project is in an energy community, as defined by the Inflation Reduction Act, or a Disadvantaged Community as defined by the US Department of Energy's Justice40 initiative.[8] Additionally, the RFP requests information from the bidder on how the project has or will engage the surrounding community. The Company will support and participate in selected projects' community engagement efforts, as appropriate. CenterPoint Energy will track and report local co-benefits of RNG projects and any community engagement activities in its annual reports.

[8] https://energyjustice.egs.anl.gov/

This pilot will include contracted vendor services. The Company commits to tracking and reporting on an annual basis the total and percent of Plan spending on vendor services for diverse vendors or suppliers.[9]

Additional Project Information

ICF modeled and evaluated lifecycle GHG emissions reductions for four different kinds of RNG archetype projects: food waste, dairy, wastewater treatment, and landfill. ICF also evaluated likely RNG prices that could be obtained for each archetype in the competitive RNG market assuming a ten-year contract term. Based on this analysis, ICF and CenterPoint Energy developed assumptions about what kinds of RNG would likely be selected in an RFP and in what quantities they would select. This, in turn, allowed CenterPoint Energy and ICF to create overall estimates for costs, quantities, and GHG emissions reductions for this pilot. However, CenterPoint Energy does not anticipate that the RNG projects actually selected will exactly mirror those modeled. CenterPoint Energy's purchasing choices will be guided by the RFP responses actually submitted and the Company may buy more or less RNG from a given source depending on actual project-specific pricing, GHG intensity, and other project features as described in Exhibit Q.

Pilot D. Green Hydrogen Blending into Natural Gas Distribution System

Project Description

CenterPoint Energy proposes to own and operate a 1 megawatt ("MW") green hydrogen plant at an existing Company facility in Mankato, Minnesota. CenterPoint Energy would install dedicated solar panels, an electrolyzer, a hydrogen storage system, and other necessary systems and equipment to generate and store hydrogen and blend it into the gas distribution system. The solar panels would be used to supply power to the electrolyzer. Grid electricity would also be used to increase the utilization of the electrolyzer, allowing hydrogen production at times when the solar panels are not producing sufficient (or any) electricity. Given typical solar generation capacity factors for Minnesota, it is expected that the pilot will leverage more grid electricity than on-site solar production. CenterPoint Energy plans to purchase any grid electricity under an Xcel Energy green tariff program or other independent power purchase agreement.

Eligibility

This pilot does not require customer participation. All CenterPoint Energy sales customers will be attributed a small share of the blended hydrogen proportionate to their gas usage.

[9] CenterPoint Energy defines diverse suppliers per the guidelines of the National Minority Supplier Development Council, the Women's Business Enterprise National Council and the U.S. Small Business Administration.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 10: Green Hydrogen Blending into Natural Gas Distribution System Participation Estimates

Unit of Participation	Hydrogen Facilities Starting Operation				
Year	Year 1	Year 2	Year 3	Year 4	Year 5
Facilities	0	0	1	0	0

Table 11: Green Hydrogen Blending into Natural Gas Distribution System Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$49,800	$150,094	$152,955	$121,767	$172,088
Advertising & Promotion	$0	$0	$0	$0	$0
Allocation of General Portfolio Costs	$212,192	$76,812	$75,068	$75,798	$76,549
Electricity Purchase Costs	$0	$0	$925,710	$925,710	$925,710
Revenue Requirement for Capital Investment	$0	$0	$370,356	$589,632	$552,129
Customer Incentives	$0	$0	$0	$0	$0
Total	$261,992	$226,906	$1,524,089	$1,712,906	$1,726,476
UCT Savings	$0	$0	$133,310	$126,312	$119,680
Total Incremental Cost	**$261,992**	**$226,906**	**$1,390,778**	**$1,586,595**	**$1,606,796**

GHG Reduction and Geologic Gas Savings

Table 12 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions reduced by implementation of the pilot. GHG emissions reductions from power-to-hydrogen production have a one-year life and are counted in the year in which the hydrogen is produced. CenterPoint Energy estimates a 20-year facility life for the pilot and thus 20 years of emissions reductions. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on ICF's application of the GREET model to the proposed facility.

Table 12: Green Hydrogen Blending into Natural Gas Distribution System GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	4,199	27,993
Geologic Gas Savings (Dth)	63,481	423,204

Tracking and Verification

This pilot will follow the tracking and verification approach for "Power-to-Hydrogen" described in Exhibit W. Additional pilot-specific details include:

Verification: CenterPoint Energy will engage a third party to conduct measurement and verification ("M&V") for the initial two years of operation of the hydrogen blending to monitor renewable energy generation and hydrogen production. The verifier will establish an ongoing monitoring and reporting plan to validate and report system performance.

Tracking: CenterPoint Energy will use M-RETS to issue RTCs for environmental attributes of each Dth of hydrogen that is generated through this pilot (the heat content per kilogram of hydrogen (higher heating value or "HHV") is 0.1368 Dth/kilogram). All such RTCs will be retired on behalf of all CenterPoint Energy customers.

Customer Incentive Information

No customer incentives will be paid under this pilot.

IRA Incentives Considered

CenterPoint Energy believes that it would be eligible for an ITC for the facility under 26 U.S.C. § 48.[10] The project could be eligible for a credit of between 6 and 40 percent of costs, depending on whether the project satisfies certain labor requirements and domestic manufacturing requirements. CenterPoint Energy is committed to satisfying the IRA labor requirements, provided that appropriate workers are available, so assumes that it would achieve at least a 30 percent tax credit. CenterPoint Energy will evaluate whether it is feasible to satisfy domestic content requirements as part of the project design.

It is possible that it would be more favorable for CenterPoint Energy to claim the clean hydrogen production tax credit ("PTC") under 26 U.S.C. § 45V rather than the ITC. The proposed facility may be eligible for up to $3/kg of hydrogen production and could also likely separately claim an ITC for the solar system.[11] The Treasury Department has not yet published final rules describing eligibility for the PTC and it is unclear whether CenterPoint Energy would satisfy credit

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[10] Both the electrolyzer and the solar system are likely eligible for ITCs. For purposes of this analysis, CenterPoint Energy assumed a 30 percent ITC on both systems.

[11] The solar system ITC by itself would similarly vary between 6 and 40 percent of costs, with CenterPoint Energy likely to achieve between 30 and 40 percent. The solar system may also qualify for a PTC under 26 U.S.C. § 45, but preliminary analysis indicates that the ITC is likely more favorable.

requirements by purchasing green tariff electricity or through a power purchase agreement that the Company could reasonably obtain. In particular, it is not yet clear whether Treasury will require a demonstration that carbon-free generation is matched with hydrogen generation on an annual basis, monthly basis, hourly basis or some other time scale. While the Company plans to partially supply the electrolyzer with dedicated solar production from its own solar panels, and hydrogen generated with this electricity will likely be eligible for the hydrogen PTC, the Company plans to purchase the majority of the electricity for the electrolyzer from the grid. When final guidance is issued, CenterPoint Energy will evaluate its options for maximizing the tax benefit to its customers.

Equity, Diversity, and Community Engagement

CenterPoint Energy will engage with the City of Mankato to identify and address community questions with the proposed hydrogen blending project. CenterPoint Energy plans to contract services for the design and construction of the electrolyzer and solar panels from Minnesota-based businesses, pay prevailing wages, and satisfy IRA apprenticeship requirements. CenterPoint Energy will track and report on these efforts in its annual report. The Company commits to tracking and reporting on an annual basis the total and percent of Plan spending on vendor services for diverse vendors or suppliers.[12]

Additional Project Information

In its June 1, 2022 Order Establishing Frameworks for Implementing Minnesota's Natural Gas Innovation Act in Docket No. G-999/CI-21-566, the Minnesota Public Utilities Commission ("Commission") ordered that prior to approval of a hydrogen blending pilot, the utility shall: (a) Clearly state the learning objectives for the proposed blending pilot and metrics it will collect to achieve those learning objectives; (b) Document the utility's consultation with the Minnesota Office of Pipeline Safety regarding the specific pilot along with a discussion of why it is in compliance with state pipeline safety standards; and (c) Provide a discussion demonstrating that the utility has determined the level of hydrogen blending will ensure the safety of its system and customers' appliances. The Company provides the required information on this hydrogen blending pilot below.

The learning objectives of this pilot include:

1. Gain experience generating hydrogen with dedicated renewable energy and operation of a hydrogen system with variable power input.
2. Gain experience building and operating a hydrogen storage system.
3. Understand operational and economic considerations of storing hydrogen during periods of high renewable electricity availability for use during periods of low renewable generation availability.

[12] CenterPoint Energy defines diverse suppliers per the guidelines of the National Minority Supplier Development Council, the Women's Business Enterprise National Council and the U.S. Small Business Administration.

Metrics to be collected include:

- Hourly electricity generation profile of dedicated solar array
- Hourly electricity consumption data for the electrolyzer
- Monthly capacity utilization factor, split by solar power input vs. grid electricity
- Expected levelized cost of energy (assuming future performance is consistent with past performance), excluding cost of storage
- Operational cost of hydrogen storage system
- Operational performance of the combined electrolyzer and solar facilities

CenterPoint Energy met with the Minnesota Office of Pipeline Safety ("MNOPS") on May 9, 2023 to discuss the proposed hydrogen project in Mankato, where the Company plans to utilize an electrolyzer to produce hydrogen and blend up to 5 percent of it in the natural gas distribution system. As discussed during that meeting, the plant piping containing pure hydrogen will be governed under National Fire Protection Association ("NFPA") Code 2, Hydrogen Technologies Code, and ASME B31.12, Hydrogen Piping and Pipelines. The point at which the blending occurs on the distribution system will follow 49 CFR Part 192 and will be subject to oversight by MNOPS. MNOPS plans to visit the hydrogen installation and review jurisdictional components of the project.

Hydrogen blending into CenterPoint Energy's gas system in the proposed Mankato project will blend hydrogen between 0.5 percent up to a maximum of 5 percent. The Company has decades of experience in blending supplemental gases into its distribution system and uses industry standards to assess interchangeability of gases and their impacts on customer appliances. The most cited recent industry document on interchangeability of gases is the "White Paper on Natural Gas Interchangeability and Non-Combustion End Use" by the NGC+ Interchangeability Work Group published February 28, 2005.[13] The most important factor in determining end use appliance compatibility is the Wobbe Index of the supplied fuel mixture. The NGC+ paper provides acceptable Wobbe Index ranges of plus or minus 4 percent. The addition of 5 percent hydrogen to the current pipeline gas composition will reduce the Wobbe Index by approximately 1 percent. This small change is less than CenterPoint Energy experiences within a year across certain areas of our system in geologic gas supplies and well within the appliance compatibility range described in the NGC+ paper.

The low levels of hydrogen blending proposed in our Mankato project are not expected to cause safety issues within our gas distribution system. CenterPoint Energy has received interstate pipeline natural gas with low levels of hydrogen, (up to 0.35 percent) across its system for many years. The Company routinely sends pipe samples removed from our system to its materials laboratory in Golden Valley, Minnesota for material examination and the Company's laboratory has never seen evidence of material problems related to hydrogen exposure. The potential effects of hydrogen exposure have been correlated with the partial pressure or percentage contribution

[13] See https://www.beg.utexas.edu/files/energyecon/global-gas-and-lng/NGC_Interchangeability_Paper.pdf

of the hydrogen in the natural gas stream relative to the total pressure in the pipeline. At 5 percent hydrogen in the Mankato system, the partial pressure will be lower than the hydrogen partial pressure many of our higher-pressure systems have experienced for years. There can also be material concerns with hydrogen in high stress steels, however the Mankato project will be supplying a relatively low-pressure distribution system with correspondingly low stress levels in the pipelines. Accordingly, CenterPoint Energy is confident in the safe operation of the proposed hydrogen project at our Mankato location.

Pilot E. Industrial or Large Commercial Hydrogen and Carbon Capture Incentives

Project Description

CenterPoint Energy will identify a small number of large commercial or industrial customers interested in installing either power-to-hydrogen or carbon capture demonstration projects. CenterPoint Energy would support the projects by paying 20 percent of the costs for a feasibility study, up to $30,000, and providing a rebate for customers who move forward. Additionally, the pilot contains budget for an initial scoping study to aid with customer identification. CenterPoint Energy will not own the hydrogen or carbon capture equipment and will not take ownership of any associated environmental attributes. However, as discussed further in Exhibit W, CenterPoint Energy will require customers to agree not to resell any environmental attributes generated.[14]

This pilot satisfies Minn. Stat. § 216B.2427, subd. 7, which requires the Company to include a pilot in its first NGIA Plan which provides innovative resources to industrial facilities whose manufacturing processes, for technical reasons, are not amenable to electrification.

This pilot is the combination of two similar short-listed pilot concepts: the Green Hydrogen Archetype for Industrial or Large Commercial Facility and the Carbon Capture Archetype for Industrial or Large Commercial Facility pilot. Because CenterPoint Energy wishes to pursue both pilots, they are structured similarly, and they target similar customers, the Company is proposing them as a single combined offering to streamline its portfolio.

Eligibility

This pilot is open to the following rate classes: Small Volume Dual Fuel B, Large Volume Dual Fuel, Commercial/Industrial Firm C, and Large Volume Firm.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

[14] As described in Exhibit W, CenterPoint Energy may grant an exception to allow sale or transfer of environmental attributes if there are sufficient controls and tracking to ensure that the environmental attributes and their benefits are retired on behalf of an entity within the state of Minnesota.

Table 13: Industrial or Large Commercial Hydrogen and Carbon Capture Incentives Participation Estimates

Unit of Participation	Customers				
Year	Year 1	Year 2	Year 3	Year 4	Year 5
Customers	0	0	2	0	0

Table 14: Industrial or Large Commercial Hydrogen and Carbon Capture Incentives Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$280,800	$43,260	$178,187	$135,785	$74,189
Advertising & Promotion	$2,500	$0	$2,500	$0	$0
Allocation of General Portfolio Costs	$158,682	$57,442	$56,138	$56,683	$57,246
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$0	$0	$3,030,000	$0	$0
Total	$441,982	$100,702	$3,266,825	$192,469	$131,435
UCT Savings	$0	$0	$119,371	$113,104	$107,167
Total Incremental Cost	**$441,982**	**$100,702**	**$3,147,453**	**$79,364**	**$24,268**

GHG Reduction and Geologic Gas Savings

Table 15 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions reduced by implementation of the pilot. GHG emissions reductions from power-to-hydrogen production and carbon capture have a one-year life. CenterPoint Energy estimates a 20-year life for both kinds of facilities and thus twenty-years of emissions reductions following installation. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions for hydrogen projects are based on ICF's application of the GREET model to the proposed facility. For carbon capture projects, CenterPoint Energy plans to require a lifecycle analysis specific to each facility, as emissions can vary based on facility characteristics and end-uses for the captured carbon. This is further discussed in Exhibits F and W.

Table 15: Industrial or Large Commercial Hydrogen and Carbon Capture Incentives GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	15,706	107,196
Geologic Gas Savings (Dth)	56,843	378,953

Tracking and Verification

This pilot will follow the tracking and verification approach for "Carbon Capture" and "Power-to-Hydrogen," as applicable, as described in Exhibit W. Additional pilot-specific details include:

Verification: All projects completed under this pilot will undergo dedicated M&V to monitor system performance. CenterPoint Energy will engage a third party to develop and implement an M&V plan for each pilot. For power-to-hydrogen, CenterPoint Energy will obtain documentation of carbon-free electricity as described in Exhibit W. For carbon capture, CenterPoint Energy will engage a third party to conduct a lifecycle assessment of avoided emissions. Results of these studies will be used to establish annual avoided emissions to be multiplied by the project life to calculate lifetime emissions reductions.

Customer Incentive Information

CenterPoint Energy plans to pay 20 percent of upfront feasibility study costs, up to a maximum of $30,000, and 100 percent of capital costs for project installation, up to a maximum of $1.5 million for a single project.

IRA Incentives Considered

For hydrogen, the customer may be eligible for either an ITC or a PTC under 26 U.S.C. § 48 or 26 U.S.C. § 45V respectively. For the ITC, amounts range between 6 percent and 50 percent of costs depending on whether the project satisfies labor requirements, whether the project meets domestic content requirements, and whether the project is located in an energy community. The clean hydrogen PTC would range between $0.60/kg produced and $3.00/kg produced for ten years, depending on whether the project satisfies certain labor requirements. For modeling, we have assumed that participants would qualify for the $3.00/kg PTC.

For carbon capture, participating customers may be eligible for a tax credit under 26 U.S.C. § 45Q. However, to qualify for a credit, customers would have to capture at least 12,500 metric tons annually. We have assumed that participating customers would not capture sufficient amounts of carbon to clear that threshold and so have assumed no tax credit.

CenterPoint Energy has not identified any IRA incentives that it would be directly eligible for under this pilot.

Equity, Diversity, and Community Engagement

No specific project locations have been identified as of the filing of this Plan. CenterPoint Energy will require pre-approval for incentives paid through this program, and as part of the pre-approval process, customers must provide a description of the land uses and demographics of the community and area surrounding the participant site - including whether the project is in an energy community, as defined by the Inflation Reduction Act, or a Disadvantaged Community as defined by the US Department of Energy's Justice40 initiative - and describe any planned community engagement activities. CenterPoint Energy will encourage and support pilot participants' community engagement efforts and will report on these efforts in annual reports.

Additional Project Information

CenterPoint Energy anticipates considerable effort to identify viable projects for this pilot. To aid in project identification and selection, CenterPoint Energy will conduct a scoping study in the first year of the Plan.

CenterPoint Energy would target sites where customers are open to hosting walk-throughs, so that contractors, design firms, and other industry participants can gain exposure to the technology.

Pilot F. Industrial Methane and Refrigerant Leak Reduction Program

Project Description

CenterPoint Energy will hire a third-party vendor to conduct surveys of participating industrial and large commercial facilities for methane and refrigerant leaks behind the customer gas meter. After leaks are identified, the third-party vendor will provide planning support to help establish a systematic leak repair program and CenterPoint Energy will offer incentives to partially offset the cost of leak repair. Participating customers will also receive follow up surveys every two years during the term of the Plan to test how well the impacts of the leak survey on reducing methane and refrigerant leakage and subsequent repairs are sustained. While CenterPoint Energy has high confidence that this pilot will result in a substantial reduction of GHG emissions, there are several open questions that would allow for a more precise estimates of GHG savings potential in different facilities and the optimal program design. Accordingly, CenterPoint Energy aims to answer two main research questions in the course of implementing this pilot:

1) What size and quantity of leaks are most likely to be identified on a first leak survey in different kinds of customer facilities (e.g. how much methane is leaking from customer sites, are the leaks distributed between customers or concentrated in just a few sites, etc.)?
2) What are the quantity and size of leaks most likely to be identified on a follow-up survey two years later and four years later (e.g. have the original leaks been repaired, were any repairs sustained, how many new leaks have occurred in a two year window)?

Answering these two questions will allow CenterPoint Energy to more accurately estimate GHG emissions reductions resulting from leak identification and repair, the best facilities to target with a program like this, and how often surveys should be repeated.

Eligibility

This pilot is open to the following rate classes: Small Volume Dual Fuel B, Large Volume Dual Fuel, Commercial/Industrial Firm C, and Large Volume Firm.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 16: Industrial Methane and Refrigerant Leak Reduction Program Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Customers Receiving Initial Survey	25	25	0	0	0

Table 17: Industrial Methane and Refrigerant Leak Reduction Program Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$374,000	$387,885	$210,904	$218,778	$226,947
Advertising & Promotion	$25,000	$25,000	$0	$0	$0
Allocation of General Portfolio Costs	$52,186	$18,891	$18,462	$18,641	$18,826
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$37,676	$37,676	$0	$0	$0
Total	$488,861	$469,452	$229,366	$237,420	$245,774
UCT Savings	$52,878	$100,204	$94,943	$89,959	$85,236
Total Incremental Cost	**$435,983**	**$369,248**	**$134,423**	**$147,461**	**$160,537**

GHG Reduction and Geologic Gas Savings

Table 18 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. CenterPoint Energy has estimated a five-year life for leak repairs, which we believe is conservative.[15] Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on estimated average Dth savings per participant multiplied by the lifecycle GHG-intensity of geologic gas. CenterPoint Energy has not attempted to quantify GHG reductions as a result of refrigerant leak repair.[16]

Table 18: Industrial Methane and Refrigerant Leak Reduction Program GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	30,387	33,763
Geologic Gas Savings (Dth)	67,816	75,351

Tracking and Verification

This pilot will follow the tracking and verification approach for "Carbon Capture" described in Exhibit W. Additional pilot-specific details include:

[15] We were not able to identify much publicly available information on likely duration of leak repairs. An RFI respondent suggesting a pilot along these lines recommended five to eight years, which ICF found to be reasonable. One of the research goals of the pilot is to determine average life of leak repairs with more accuracy.

[16] Limited information is available to estimate likely refrigerant leak quantities or sizes. One of the research goals of the pilot is to determine GHG emissions resulting from refrigerant leaks with more accuracy.

Verification: As described above, CenterPoint Energy's vendor for this pilot will revisit project sites to quantify the actual GHG emissions reduced as a result of leak identification and repair.

Customer Incentive Information

CenterPoint Energy plans to pay for the initial facility survey, the third-party vendor's planning support to help establish a systematic leak repair program, and for follow up facility surveys. CenterPoint Energy also plans to provide customer incentives of $5.00/Dth of expected annual savings for leak repairs up to the incremental cost of the repair. We estimate an average customer leak repair cost of $5,000 and an average incentive of approximately $1,500. No incentives (or GHG savings) have been included at this time for refrigerant leak repairs. CenterPoint Energy will evaluate with its selected third-party vendor whether modest incentives would be valuable and may include them in the existing budget if it is determined that modest incentives would be valuable in driving GHG reductions.

IRA Incentives Considered

CenterPoint Energy has not identified any applicable IRA incentives for this program.

Equity, Diversity, and Community Engagement

As noted above, CenterPoint Energy anticipates that this pilot will include contracted vendor services and will seek diverse and qualified vendors to participate in an RFP process to select an implementation provider. The Company commits to tracking and reporting on an annual basis the total and percent of Plan spending on vendor services for diverse vendors or suppliers.[17]

No specific project locations have been identified as of the filing of this Plan. CenterPoint Energy does not anticipate major impacts to local communities surrounding project sites for this type of project, but would support participating customers in community engagement efforts, where applicable.

Additional Project Information

None.

Pilot G. Urban Tree Carbon Offsets

Project Description

Local non-profit Green Minneapolis, which is working in partnership with local tree planting partners across the 7-county Twin Cities Metro area, is selling carbon offsets registered as City Forest Carbon+ Credits for trees planted in the community. Under this pilot, CenterPoint Energy

[17] CenterPoint Energy defines diverse suppliers per the guidelines of the National Minority Supplier Development Council, the Women's Business Enterprise National Council and the U.S. Small Business Administration.

will purchase these Carbon+ Credits and retire them on behalf of CenterPoint Energy customers. The proceeds will be used for additional tree planting and maintenance by partners, including the Minneapolis Parks and Recreation Board, Hennepin County, and other local organizations.

Eligibility

This pilot does not require customer participation.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 19: Urban Tree Carbon Offsets Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Credits Purchased	800	850	900	950	1000

Table 20: Urban Tree Offset Program Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$45,000	$50,894	$58,097	$66,759	$75,030
Advertising & Promotion	$0	$0	$0	$0	$0
Allocation of General Portfolio Costs	$13,774	$4,986	$4,873	$4,920	$4,969
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$0	$0	$0	$0	$0
Total	$58,774	$55,880	$62,970	$71,679	$79,999
UCT Savings	$0	$0	$0	$0	$0
Total Incremental Cost	**$58,774**	**$55,880**	**$62,970**	**$71,679**	**$79,999**

GHG Reduction and Geologic Gas Savings

Table 21 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. Purchased offsets have a life of one year. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, CenterPoint Energy based its GHG reduction estimates on published guidance from the City Forest Credit program.

Table 21: Urban Tree Carbon Offsets GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	4,500	4,500
Geologic Gas Savings (Dth)	-	-

Tracking and Verification

This pilot will follow the tracking and verification approach for "Carbon Capture" described in Exhibit W. Additional pilot-specific details include:

Carbon offsets retired under this pilot will be generated following the carbon protocols established by City Forest Credits, which contains specific provisions for verification and tracking.[18] Tracking and verification requirements of this protocol are summarized below.

> *Verification:* City Forest Credits' carbon protocols requires third-party verification by a Validation and Verification Body approved by the organization.
>
> *Tracking:* City Forest Credits' carbon protocols include a requirement to track carbon offset credits through a Registry Database.

Customer Incentive Information

No customer incentives will be paid under this pilot.

IRA Incentives Considered

CenterPoint Energy has not identified any applicable IRA incentives for this program.

Equity, Diversity, and Community Engagement

Green Minneapolis targets tree planting particularly in areas of limited tree coverage which have a high correlation with areas of concentrated poverty.[19] Tree planting has multiple benefits for nearby residents as further described in Exhibit O. As a proposed buyer of the carbon offsets, the Company will support and participate in any Green Minneapolis' and/or its partner organizations' community engagement efforts, as appropriate, and report on these activities in the Plan's annual reports.

Additional Project Information

None.

Pilot H. Carbon Capture Rebates for Commercial Buildings

Project Description

CenterPoint Energy proposes to provide rebates to commercial customers that install CarbinX carbon capture systems manufactured by the Canadian company CleanO2. These units connect to existing natural gas heating equipment, capture CO_2 and convert it to a solid

[18] City Forest Credits Standard February 22, 2023 | Version 3.0, accessed May 25, 2023, https://www.cityforestcredits.org/wp-content/uploads/2023/02/City-Forest-Credits-Standard-V3.pdf. More information on City Forest Credits is available at https://www.cityforestcredits.org/carbon-credits/carbon-protocols/.

[19] See growing shade resource and map: https://metrocouncil.org/Communities/Planning/Local-Planning-Assistance/Tree-Canopy.aspx

potassium carbonate ("K_2CO_3"). The units also work as an economizer, recapturing waste heat for use in the building (i.e., reducing natural gas consumption). The potassium carbonate byproduct of the carbon capture, also known as pearl ash, is harvested by CleanO2 periodically and sold for use in various manufacturing processes. For example, the pearl ash can be used in the manufacture of soap, detergents, fertilizer. Revenue from the resale is shared between CleanO2 and the participating customer.

Eligibility

This pilot is open to all non-residential CenterPoint Energy customers.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 22: Carbon Capture Rebates for Commercial Buildings Participation Estimates

	Units Installed				
	Year 1	Year 2	Year 3	Year 4	Year 5
Units of Participation	37	72	72	72	72

Table 23: Carbon Capture Rebates for Commercial Buildings Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$49,000	$50,470	$51,984	$53,544	$55,150
Advertising & Promotion	$5,000	$5,000	$5,000	$5,000	$5,000
Allocation of General Portfolio Costs	$54,502	$19,729	$19,281	$19,469	$19,662
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$222,000	$432,000	$432,000	$144,000	$144,000
Total	$330,502	$507,199	$508,265	$222,012	$223,812
UCT Savings	$23,188	$64,723	$101,834	$134,869	$164,155
Total Incremental Cost	**$307,314**	**$442,476**	**$406,432**	**$87,143**	**$59,656**

GHG Reduction and Geologic Gas Savings

Table 24 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. CarbinX units have an estimated 20-year life. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on GHG lifecycle assessments of the CarbinX units conducted by the University of British Columbia.

Table 24: Carbon Capture Rebates for Commercial Buildings GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	7,531	55,150
Geologic Gas Savings (Dth)	80,820	580,472

Tracking and Verification

This pilot will follow the tracking and verification approach for "Carbon Capture" described in Exhibit W. Additional pilot-specific details include:

> *Verification:* CenterPoint Energy will use the GHG savings algorithm described below to quantify annual GHG savings from CarbinX units installed. Natural gas appliance efficiency, annual firing hours of gas appliances, and expected annual potassium carbonate generated will be determined using site-specific data provided upon customer application for a rebate. Deemed inputs are shown below. The values provided are based on expected performance information provided by the manufacturer and may be updated based on M&V results from the Conservation Improvement Program ("CIP") CleanO2 pilot.

Annual GHG emissions savings will be calculated using the following algorithm:

Emissions reduced from direct capture of CO_2 molecules

+ Net upstream emissions avoided from manufacture of potassium carbonate

+ Emissions reduced from heat recovery (due to decreased natural gas use)

– Emissions increased by electricity consumption (due to increased electricity use)

Total emissions reductions (kg carbon dioxide equivalent ("kgCO2e"))

Where:

Emissions reduced from direct capture of CO_2 molecules=

[K_2CO_3 generated] * 0.319

Net upstream emissions avoided from manufacture of potassium carbonate=

[K_2CO_3 generated] * 0.319 * 2.757

Emissions reduced from heat recovery =

[annual firing hours] * [rate of heat recovery] / [appliance efficiency] * 66.14

Emissions increased by electricity consumption =

[annual firing hours] / 8760 * [electricity consumption factor] * 0.06312

And

[K_2CO_3 generated] = mass of expected annual K_2CO_3 generated (kg)

[annual firing hours]	=	annual firing hours of gas appliance (hrs)
[rate of heat recovery]	=	rate of heat recovery (MMBTU/hr)
		Deemed value: 0.010245 MMBTU/hr
[appliance efficiency]	=	natural gas appliance efficiency (%)
[elec. consumption factor]	=	annual electricity usage for units operating continuously (kWh/yr)
		Deemed value: 1489 kWh/yr
0.319	=	conversion factor ($kgCO2/kgK_2CO_3$)
		parameter is based on the following stoichiometric chemical equation and molar masses: [20]

$$1\ CO_2 + 2\ KOH \rightarrow 1\ K_2CO_3 + 1\ H_2O$$

Chemical	Molar Mass [g/mol]
KOH	56
CO_2	44
K_2CO_3	138
H_2O	18

2.757	=	GHG savings ratio, additional upstream emissions avoided per kg CO2 directly captured [21]
66.14	=	NGIA natural gas emissions factor ($kgCO_2e/MMBTU$)[22]
0.06312	=	NGIA electricity GHG emissions factor[23] ($kgCO_2e/kWh$)

[20] The balanced chemical equation says that 2*56=112 kg of KOH will react with 44 kg of CO2 to form 138 kg of K2CO3 plus 18 kg of H2O. 44 kg CO2 / 138 kg K2CO3 = 0.319 kg CO2 / kg K2CO3.

[21] These are net emission reductions based on a Life Cycle Emissions Analysis ("LCA") of CarbinX units, consistent with the verification approach for "Carbon Capture" described in Exhibit W. Ignoring the LCA components related to direct capture and reduced natural gas consumption (which are captured elsewhere in this formula), the LCA shows a net decrease in lifecycle emissions of 2,495 $kgCO_2$/year for a CarbinX unit that is capturing 905 kgCO2/year. The main components in that net lifecycle emission reductions are a reduction in emissions from the production of potassium carbonate (K_2CO_3) that would have otherwise needed to have been manufactured, which are partially offset by the amount of emissions required to produce the input chemicals (potassium hydroxide or KOH) which are fed into the CarbinX units. To summarize, CarbinX units capturing 905 kgCO2/year will displace net GHG emissions otherwise needed to manufacture the CarbinX byproduct by 2,495 kgCO2/year. To scale these savings up or down based on the actual level of by-product creation (and hence displaced upstream emissions) this is converted into a savings ratio = 2495/905 = 2.757.

[22] Emissions factor for natural gas. See Exhibit F. This will be updated annually.

[23] Represents the weighted-average calculated lifecycle GHG intensity for Minnesota's grid for 2024-2043, 63.12 gCO_2e/kWh. *See* Exhibit F. This will be updated annually to reflect updates in the GHG intensity of electricity.

8760	=	conversion factor, number of hours in 1 year (hr/year)

Customer Incentive Information

CenterPoint Energy proposes to pay an $8,000 incentive per unit for a customer's first installation, which is designed to cover a portion of installation costs. A higher incentive is offered for first installations to provide additional encouragement to customers who may be hesitant about the process of trying out a unit. If a customer chooses to install additional units at other business locations, CenterPoint Energy will pay an incentive of $3,000 per unit for subsequent installations. Additionally, CenterPoint Energy anticipates reducing this rebate in later years of the program as adoption increases and/or if an incentive for the energy efficiency component of savings is established in CIP/Energy Conservation and Optimization ("ECO"). CenterPoint Energy will include any future reduction in an annual status report filing prior to implementation. Total upfront costs are estimated to be $39,000, including the CarbinX unit and installation costs.

IRA Incentives Considered

CenterPoint Energy has not identified any applicable IRA incentives for this program.

Equity, Diversity, and Community Engagement

No specific project locations have been identified as of the filing of this Plan. CenterPoint Energy does not anticipate major impacts to local communities surrounding project sites for this type of project, but would support participating customers in community engagement efforts, where applicable.

Additional Project Information

CenterPoint Energy has been piloting CarbinX units through its CIP Analysis, Evaluation, & Project Development project. However, as discussed further in Exhibit I, the Company believes that continued investment in this technology is better done through NGIA at this time.

CleanO2 is developing a next generation of its product (version 4.0) that captures a higher proportion of carbon emissions. This product will be field tested in the "Assessing Next-Generation Micro-Carbon Capture for Commercial Buildings" research and development ("R&D") project described in Exhibit J. If results of that R&D project are favorable, CarbinX version 4.0 would be eligible for rebates through this pilot. Updated energy savings algorithms would be provided in an annual status report.

Targeted Outreach

Where available, the pilot would leverage public commercial energy benchmarking data for customer recruitment.

Pilot I. New Networked Geothermal Systems

Project Description

CenterPoint Energy proposes to develop a new networked geothermal system to provide building heat and cooling for a neighborhood currently served by the Company. This involves installation of a new 'distributed' geothermal system where individual customers would have a heat pump accessing a common water loop (instead of their own geothermal wells or air source heat pumps). The pilot begins with a feasibility study, planning and modeling, and site selection, prior to design and construction.

Eligibility

CenterPoint Energy will select one neighborhood currently served by CenterPoint Energy's geologic gas distribution system. Ideally, this neighborhood would include a combination of residential and commercial customers.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 25: New Networked Geothermal Systems Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Tons of Heating/Cooling Capacity Becoming Operational	0	0	200	400	400

Table 26: New Networked Geothermal Systems Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$613,378	$2,157,511	$2,157,511	$2,228,100	$2,419,276
Advertising & Promotion	$25,000	$25,000	$0	$0	$0
Allocation of General Portfolio Costs	$486,272	$176,028	$172,030	$173,703	$175,426
Revenue Requirement for Capital Investment	$0	$0	$112,447	$400,062	$743,796
Customer Incentives	$0	$0	$0	$0	$0
Total	$1,124,650	$2,358,540	$2,441,989	$2,801,864	$3,338,498
UCT Savings	$0	$0	$52,786	$150,045	$236,946
Total Incremental Cost	**$1,124,650**	**$2,358,540**	**$2,389,203**	**$2,651,820**	**$3,101,552**

GHG Reduction and Geologic Gas Savings

Table 27 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. CenterPoint Energy estimates a forty-year life for the new networked geothermal system. Exhibit G provides a third-party analysis of the lifecycle GHG emissions

calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on estimated reduction in natural gas emissions and estimated emissions from electricity consumption. Our estimates for this pilot were strongly informed by analysis completed for a similar project being undertaken by National Grid in Massachusetts, which assumes constructing a system serving 185 customers.

Table 27: New Networked Geothermal Systems Five Year Spending Estimate GHG Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	4,358	107,355
Geologic Gas Savings (Dth)	75,408	1,675,733

Tracking and Verification

This pilot will follow the tracking and verification approach for "Energy Efficiency, Strategic Electrification, and District Energy" described in Exhibit W. Additional pilot-specific details include:

Verification: CenterPoint Energy will develop a verification plan during the planning and modeling phase for this pilot.

Tracking: CenterPoint Energy will develop a tracking plan during the planning and modeling phase for this pilot.

Customer Incentive Information

Customer incentives will be determined during the planning and modeling phase of the pilot.

IRA Incentives Considered

CenterPoint Energy believes that it would be eligible for an ITC for the facility under 26 U.S.C. § 48E. The project could be eligible for a credit of between 6 and 50 percent of costs depending on whether the project satisfies labor and domestic content requirements and whether the project is located in an energy community. For purposes of its analysis, CenterPoint Energy assumed it would achieve a 30 percent credit by satisfying applicable labor requirements and has reduced estimated project costs accordingly. CenterPoint Energy will investigate the feasibility of locating the project in an energy community and/or satisfying applicable domestic content requirements as part of the initial feasibility study.

It is also possible that participants could be eligible for IRA tax incentives or rebates, However, CenterPoint Energy did not include these in its calculation of participant cost due to uncertainty about the quantity of credit or rebates available to participants.

Participants may be able to claim a credit under 26 U.S.C. § 25D up to the lesser of 30 percent of their costs (not including costs paid by CenterPoint Energy) or $3,200[24] for efficient equipment installed in conjunction with the district energy system. However, because this tax credit is non-refundable, participants may only claim it to the extent they have tax liability and a majority of U.S. households paid no income tax in 2021.[25]

In addition, participants may be eligible for rebates under IRA §§ 50121 (Home Energy Performance-Based, Whole House Rebates) and/or 50122 (High-Efficiency Electric Home Rebate Program). However, major questions about the operation of these programs are outstanding. Department of Energy guidance is expected to be issued this summer and following publication of guidance, the Minnesota Department of Commerce will develop an application including an implementation plan for the programs.

CenterPoint Energy will evaluate the likelihood of participant tax credits and/or rebates as part of the planning and modeling phase of this pilot.

Equity, Diversity, and Community Engagement

A project site has not been selected as of the filing of this Plan. However, the Company anticipates significant impacts to the community in which the project would take place. Accordingly, community engagement and outreach will be integrated into this project during all stages. The feasibility study and site selection process will include consideration of the land uses and demographics of the community and area surrounding the potential sites, an assessment of potential impacts to local communities, and will provide recommendations for community engagement. CenterPoint Energy will develop a community engagement and outreach plan as part of its planning process for this pilot, taking into consideration any recommendations received. CenterPoint Energy will track and report on community engagement efforts in annual reports. Additionally, the Company commits to tracking and reporting on an annual basis the total and percent spend of Plan vendor services on diverse vendors or suppliers used for this project.

Additional Project Information

As noted above, CenterPoint Energy plans to proceed with site identification and a feasibility study prior to beginning design or construction. CenterPoint Energy will file this study with the Commission and provide updated cost and estimated lifecycle GHG reduction information in an annual status report before proceeding to project construction.

[24] The credit has separate limitations for heat pumps than for most efficiency measures including insulation. Participants may be able to claim up to $2,000 for the heat pump and $1,200 for efficiency measures provided that each figure exceeds 30 percent of their costs for the designated measures, adding up to a total limitation of $3,200.

[25] https://www.cnbc.com/2022/03/25/57percent-of-us-households-paid-no-federal-income-tax-in-2021-study.html

Pilot J. Decarbonizing Existing District Energy Systems

Project Description

CenterPoint Energy proposes a two-part pilot to help existing district energy systems that currently use geologic gas, to identify opportunities to reduce the lifecycle GHG impact of their systems. First, CenterPoint Energy proposes to support customers who hire expert engineering firms, or similar, to complete feasibility studies to identify decarbonization opportunities. Second, CenterPoint Energy would support customers in implementing GHG reduction projects that deploy NGIA innovative resources.

Eligibility

This pilot is open to CenterPoint Energy customers operating district energy systems.[26]

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 28: Table 28: Decarbonizing Existing District Energy Systems Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Systems Implementing Projects	0	1	1	0	0

Table 29: Decarbonizing Existing District Energy Systems Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$9,800	$10,094	$10,397	$10,709	$61,030
Advertising & Promotion	$0	$0	$0	$0	$0
Allocation of General Portfolio Costs	$25,009	$9,053	$8,847	$8,933	$9,022
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$30,000	$1,280,000	$1,250,000	$0	$0
Total	$64,809	$1,299,147	$1,269,244	$19,642	$70,052
UCT Savings	$0	$332,456	$630,006	$596,931	$565,593
Total Incremental Cost	**$64,809**	**$966,691**	**$639,239**	**-$577,289**	**-$495,541**

[26] See discussion of the definition of district energy in the additional information section below.

Tracking and Verification

This pilot may support the deployment of multiple innovative resources, and will follow the tracking and verification approach for a project's relevant innovative resources as described in Exhibit W.

GHG Reduction and Geologic Gas Savings

Table 30 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. CenterPoint Energy estimates a thirty-year life for existing district energy decarbonization projects. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on estimated reduction in natural gas emissions and estimated emissions from electricity consumption.

Table 30: Decarbonizing Existing District Energy Systems GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	18,902	124,030
Geologic Gas Savings (Dth)	350,000	2,000,000

Customer Incentive Information

CenterPoint Energy proposes to pay 20 percent of feasibility study costs up to $30,000. For customers implementing GHG reduction projects, CenterPoint Energy proposes to pay a rebate equal to between $10/Dth and $25/Dth of annual geologic natural gas savings for measures installed through this pilot up to $1.5 million per project. CenterPoint Energy requests some flexibility in the rebate amount as it has through its CIP Commercial & Industrial Custom Rebates project. Through that CIP project, CenterPoint Energy caps on project cost coverage generally lead to incentives that do not exceed $10/Dth with many projects receiving lower amounts if determined to be sufficient to spur action by the customer. For this pilot, the Company believes that higher rebate amounts are likely necessary to drive customer action as measures will be less cost-effective in terms of natural gas bill savings. Since this project may involve energy efficiency and strategic electrification projects, CenterPoint Energy also wants to ensure that projects that are borderline for CIP/ECO eligibility are not paid incentives that are significantly more than they would receive through CIP/ECO. For example, energy efficiency projects that are almost cost effective under the CIP/ECO societal test should not receive a windfall if they are barely in scope for NGIA. Accordingly, the Company requests a range between the upper limit for CIP/ECO custom projects and $25/Dth.

In order to coordinate incentives through this pilot with CIP/ECO incentives, the Company proposes to take the following steps for energy efficiency and strategic electrification projects:

1. CenterPoint Energy will determine whether the measure could qualify for CIP/ECO as a custom measure or otherwise. If it can, the measure will be processed through CIP/ECO and no NGIA rebate will be paid for that measure.
2. If the measure is not eligible for CIP/ECO, CenterPoint Energy will determine if the measure will cost less than $150/ton CO_2e from the NGIA utility perspective, considering only quantitative costs and benefits. Only measures that pass this screen will be eligible for an NGIA incentive.
3. Measures rebated through this pilot will be subjected to measurement and verification as further described in Exhibit W.

IRA Incentives Considered

For purposes of modeling, CenterPoint Energy did not assume that projects would be eligible for IRA incentives, however, depending on the exact measures undertaken, projects may be eligible for an ITC as an energy storage property under 26 U.S.C. § 48E, the commercial buildings energy-efficiency tax deduction under 26 U.S.C. § 179D, or other tax benefits or funded federal grant or loan programs. CenterPoint Energy has not identified any IRA benefits which it, as opposed to the facility owner, would be directly eligible for.

Equity, Diversity, and Community Engagement

No specific project locations have been identified as of the filing of this Plan. CenterPoint Energy will require pre-approval for incentives paid through this program, and as part of the pre-approval process, customers must provide a description of the land uses and demographics of the community and area surrounding the participant site - including whether the project is in an energy community, as defined by the Inflation Reduction Act, or a Disadvantaged Community as defined by the US Department of Energy's Justice40 initiative - and describe any planned community engagement activities. CenterPoint Energy will encourage and support pilot participants' community engagement efforts and will report on these efforts in annual reports.

Additional Project Information

CenterPoint Energy notes that the statutory definition of "district energy" is "a heating or cooling system that is solar thermal powered or that uses the constant temperature of the earth or underground aquifers as a thermal exchange or medium to heat or cool multiple buildings connected through a piping network."[27] The statutory definition, which specifies what kind of district energy qualifies as an innovative resource, is somewhat more limited than the common definition, which does not assume a low or no carbon energy source.[28] CenterPoint Energy intends to aim this pilot at district energy systems as that term is commonly understood. Participating systems will not satisfy the statutory definition prior to implementation of

[27] Minn. Stat. 216B.2427, subd. 1(e).

[28] See https://www.energy.gov/eere/amo/articles/combined-heat-and-power-technology-fact-sheet-series-district-energy#:~:text=2012%20data).3-,District%20Energy%20Systems,condi%2D%20tioning%20for%20nearby%20buildings (stating that over 90 percent of district energy systems were powered by fossil fuel in 2012).

decarbonization measures and may not satisfy it after completing projects, depending on what measures they undertake.

Accordingly, depending on the specific measures implemented, this proposed pilot may not support "district energy" in the statutory sense but rather support the use of strategic electrification, energy efficiency, or other innovative resources to reduce the lifecycle GHG intensity of district energy systems, as the term is more commonly used.

As noted above, this pilot proposes to pay 20 percent of feasibility study costs up to $30,000. During the NGIA portfolio development process, CenterPoint Energy engaged with Hennepin County who was seeking funding to support a decarbonization study for their Hennepin County Energy Center. As Hennepin County Energy Center is one of the largest users on our system, this decarbonization study is aligned with the goals of NGIA and has potential to lead to projects that significantly reduce GHG emissions for this customer that would be eligible for incentives under this pilot. Accordingly, CenterPoint Energy plans to provide $30,000 in funding for this study prior to Plan approval and is requesting recovery as part of its NGIA Plan as a cost "to develop and administer programs"[29] and has counted this cost towards our estimates for this proposed pilot.

Additional detail on CIP/ECO/NGIA coordination for this pilot is included in Exhibit I.

Pilot K. New District Energy System

Project Description

CenterPoint Energy proposes a two-part pilot to help current natural gas customers considering developing district energy systems. First, CenterPoint Energy proposes to support customers who hire expert engineering firms, or similar, to complete feasibility studies for new district energy systems. Second, CenterPoint Energy would support customers in developing new district energy systems.

Eligibility

This pilot is open to CenterPoint Energy commercial and industrial customers.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 31: New District Energy System Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Systems Implementing Projects	0	1	1	0	0

29 Minn. Stat. § 216B.2427, subd. 1(r)(iv).

Table 32: New District Energy System Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$9,800	$10,094	$10,397	$10,709	$61,030
Advertising & Promotion	$0	$0	$0	$0	$0
Allocation of General Portfolio Costs	$9,020	$3,265	$3,191	$3,222	$3,254
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$0	$261,635	$271,635	$0	$0
Total	$18,820	$274,994	$285,223	$13,931	$64,284
UCT Savings	$0	$69,090	$130,926	$124,052	$117,540
Total Incremental Cost	**$18,820**	**$205,904**	**$154,297**	**-$110,122**	**-$53,256**

GHG Reduction and Geologic Gas Savings

Table 33 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. CenterPoint Energy estimates a thirty-year life for new district energy systems. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on estimated reduction in natural gas emissions and estimated emissions from electricity consumption.

Table 33: New District Energy System GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	4,685	40,882
Geologic Gas Savings (Dth)	73,258	627,924

Tracking and Verification

This pilot will follow the tracking and verification approach for "Energy Efficiency, Strategic Electrification, and District Energy" described in Exhibit W.

Customer Incentive Information

CenterPoint Energy proposes to pay 50 percent of the cost of an engineering study, up to $10,000. CenterPoint Energy proposes to pay a rebate equal to between $10/Dth and $25/Dth of annual geologic natural gas savings for measures installed through this pilot, up to $1.5 million per project. CenterPoint Energy requests some flexibility in the rebate amount as it has through its CIP Commercial & Industrial Custom Rebates project. Through that CIP project, CenterPoint Energy caps on project cost coverage generally lead to incentives that do not exceed $10/Dth with many projects receiving lower amounts if determined to be sufficient to spur action by the customer. For this pilot, the Company believes that higher rebate amounts are likely necessary to drive customer action as measures will be less cost-effective in terms of natural gas bill savings. Since this project may involve energy efficiency and strategic

electrification projects, CenterPoint Energy also wants to ensure that projects that are borderline for CIP/ECO eligibility are not paid incentives that are significantly more than they would receive through CIP/ECO. For example, energy efficiency projects that are almost cost effective under the CIP/ECO societal test should not receive a windfall if they are barely in scope for NGIA. Accordingly, the Company requests a range between the upper limit for CIP/ECO custom projects and $25/Dth.

In order to coordinate incentives through this pilot with CIP/ECO incentives, the Company proposes to take the following steps for energy efficiency and strategic electrification projects:

1. CenterPoint Energy will determine whether the measure could qualify for CIP/ECO as a custom measure or otherwise. If it can, the measure will be processed through CIP/ECO and no NGIA rebate will be paid for that measure.
2. If the measure is not eligible for CIP/ECO, CenterPoint Energy will determine if the measure will cost less than $150/ton CO_2e from the NGIA utility perspective, considering only quantitative costs and benefits. Only measures that pass this screen will be eligible for an NGIA incentive.
3. Measures rebated through this pilot will be subjected to measurement and verification as further described in Exhibit W.

IRA Incentives Considered

CenterPoint Energy believes that customers developing new district energy systems could be eligible for an ITC for the facility under 26 U.S.C. § 48E. The project could be eligible for a credit of between 6 percent and 50 percent of costs depending on whether the project satisfies labor and domestic content requirements and whether the project is located in an energy community. For purposes of its analysis, CenterPoint Energy assumed customers would achieve a 30 percent credit by satisfying applicable labor requirements and has reduced estimated participant costs accordingly. CenterPoint Energy has not identified any IRA incentives it would be directly eligible for as a result of this pilot.

Equity, Diversity, and Community Engagement

No specific project locations have been identified as of the filing of this Plan. CenterPoint Energy will require pre-approval for incentives paid through this program, and as part of the pre-approval process, customers must provide a description of the land uses and demographics of the community and area surrounding the participant site - including whether the project is in an energy community, as defined by the Inflation Reduction Act, or a Disadvantaged Community as defined by the US Department of Energy's Justice40 initiative - and describe any planned community engagement activities. CenterPoint Energy will encourage and support pilot participants' community engagement efforts and will report on these efforts in annual reports.

Additional Project Information

CenterPoint Energy notes that the statutory definition of "district energy" is "a heating or cooling system that is solar thermal powered or that uses the constant temperature of the earth or underground aquifers as a thermal exchange or medium to heat or cool multiple buildings

connected through a piping network."[30] While the statutory definition requires the system to include multiple buildings, CenterPoint Energy would allow participation by customers that intend to use systems in a single building that would otherwise qualify as district energy systems. In these cases, the project could qualify for inclusion in the NGIA plan as a strategic electrification measure. CenterPoint Energy would work with customers to ensure the project would satisfy the statutory requirements of strategic electrification by maintaining some gas use and by improving the electric utility load factor.

CenterPoint Energy would target sites where customers are open to hosting walk-throughs, so that contractors, design firms, and other industry participants can gain exposure to the technology.

Additional detail on CIP/ECO/NGIA coordination for this pilot is included in Exhibit I.

Pilot L. Industrial Electrification Incentives

Project Description

CenterPoint Energy proposes to provide support for industrial customers to electrify low-to-medium heat processes using electric heat pump technologies. CenterPoint Energy expects to hire a third-party vendor via RFP to implement this program. This pilot would be implemented in three phases:

1) A study to look at the technical potential of various heat pump technologies and identify potential customers who could pilot heat pump technologies;
2) Installation of heat pumps at 3 facilities;
3) Measurement and verification of heat pump performance.

CenterPoint Energy will pay the full cost for the heat pumps and their installation, up to $1.5 million per facility.

Eligibility

This pilot is open to the following rate classes: Small Volume Dual Fuel B, Large Volume Dual Fuel, Commercial/Industrial Firm C, and Large Volume Firm.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 34: Industrial Electrification Incentives Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Facilities	0	3	0	0	0

[30] Minn. Stat. 216B.2427, subd. 1(e).

Table 35: Industrial Electrification Incentives Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$149,000	$500,470	$10,397	$10,709	$11,030
Advertising & Promotion	$0	$2,500	$0	$0	$0
Allocation of General Portfolio Costs	$21,073	$7,628	$7,455	$7,528	$7,602
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$0	$0	$0	$0	$0
Total	$170,073	$510,598	$17,852	$18,236	$18,632
UCT Savings	$0	$62,577	$59,341	$56,277	$53,376
Total Incremental Cost	**$170,073**	**$448,021**	**-$41,489**	**-$38,040**	**-$34,744**

GHG Reduction and Geologic Gas Savings

Table 36 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. CenterPoint Energy estimates that the new hybrid heating systems will have a fifteen-year life. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on the estimated decrease in geologic gas usage multiplied by the lifecycle GHG-intensity of geologic gas minus estimated increase in electricity usage multiplied by the estimated lifecycle GHG-intensity of that electricity.

Table 36: Industrial Electrification Incentives GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	2,173	11,896
Geologic Gas Savings (Dth)	37,617	188,087

Tracking and Verification

This pilot will follow the tracking and verification approach for "Energy Efficiency, Strategic Electrification, and District Energy" described in Exhibit W. Additional pilot-specific details include:

> *Verification:* CenterPoint Energy will conduct M&V for each participating project, regardless of estimated natural gas use reduction. This M&V may be conducted by the selected program vendor rather than a third-party verifier.

Customer Incentive Information

CenterPoint Energy proposes 100 percent of capital costs for project installation, up to $1.5 million per facility.

IRA Incentives Considered

Some participants may be eligible for Advanced Energy Production Credits under the IRA, 26 U.S.C. 48C. This credit allows owners of manufacturing facilities to claim a credit for re-equipping their facilities with equipment designed to reduce GHG emissions by at least 20 percent through the installation of low- or zero-carbon process heat systems, carbon capture, energy efficiency, and other industrial technologies. Because the credit is a percentage of the taxpayer's investment in the property, and CenterPoint plans to pay the full cost of the heat pumps and installation, participating customers would not be able to claim a credit if their project consists only of the new heat pump. However, it may be possible for customers to count the heat pump towards overall emissions reductions of a larger project allowing them to qualify for the credit with respect to other investments.

In addition, there are several competitive grant programs in the IRA and the 2021 Infrastructure Investment and Jobs Act ("IIJA")[31] that encourage reductions in emissions at industrial facilities such as the Advanced Industrial Facilities Deployment Program, IRA § 50161, the Future of Industry Program and Industrial Research and Assessment Centers, IIJA § 40521, and the Industrial Emissions Demonstration Projects, IIJA § 41008. CenterPoint Energy will monitor these grant program opportunities to determine if CenterPoint Energy or participating customers may be eligible.

Equity, Diversity, and Community Engagement

No specific project locations have been identified as of the filing of this Plan. CenterPoint Energy does not anticipate major impacts to local communities surrounding project sites for this type of project, but would support participating customers in community engagement efforts, where applicable.

CenterPoint Energy anticipates that this pilot will include contracted vendor services and will seek diverse and qualified vendors to participate in an RFP process to select an implementation provider. The Company commits to tracking and reporting on an annual basis the total and percent of Plan spending on vendor services for diverse vendors or suppliers.[32]

Additional Project Information

CenterPoint Energy would target sites where customers are open to hosting walk-throughs, so that contractors, design firms, and other industry participants can gain exposure to the technology.

CIP/ECO/NGIA coordination for this pilot is discussed in Exhibit I.

[31] Pub. L. 117-58 (2021).

[32] CenterPoint Energy defines diverse suppliers per the guidelines of the National Minority Supplier Development Council, the Women's Business Enterprise National Council and the U.S. Small Business Administration.

Pilot M. Commercial Hybrid Heating

Project Description

CenterPoint Energy proposes to provide support for commercial buildings interested in replacing existing Heating, Ventilation, and Air Conditioning ("HVAC") systems with hybrid system using electric heat pumps and gas backup. The pilot would focus on dual-fuel rooftop units, but may support installation of other hybrid heating systems (e.g., split system hybrid heat pumps). CenterPoint Energy will hire a third-party vendor via RFP to implement this program. Vendor services include targeted customer outreach, technical support for project sizing and design, custom savings calculations, and direct installation of hybrid heating systems using a network of participating trade allies.

Eligibility

This pilot is open to all non-residential CenterPoint Energy customers.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 37: Commercial Hybrid Heating Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Customers	15	30	30	30	30

Table 38: Commercial Hybrid Heating Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$422,000	$569,310	$576,689	$414,140	$416,664
Advertising & Promotion	$5,000	$5,000	$5,000	$5,000	$5,000
Allocation of General Portfolio Costs	$295,603	$107,007	$104,577	$105,594	$106,641
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$486,000	$972,000	$972,000	$972,000	$972,000
Total	$1,208,603	$1,653,317	$1,658,266	$1,496,733	$1,500,305
UCT Savings	$20,842	$59,288	$93,703	$124,410	$151,711
Total Incremental Cost	**$1,187,761**	**$1,594,029**	**$1,564,563**	**$1,372,323**	**$1,348,594**

GHG Reduction and Geologic Gas Savings

Table 36 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. CenterPoint Energy estimates that the new hybrid heating systems will have a fifteen-year life. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions

are based on the estimated decrease in geologic gas usage multiplied by the lifecycle GHG-intensity of geologic gas minus estimated increase in electricity usage multiplied by the estimated lifecycle GHG-intensity of that electricity.

Table 39: Commercial Hybrid Heating GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	4,536	25,609
Geologic Gas Savings (Dth)	74,250	400,950

Tracking and Verification

This pilot will follow the tracking and verification approach for "Energy Efficiency, Strategic Electrification, and District Energy" described in Exhibit W. Additional pilot-specific details include:

> *Verification:* Project-level verification processes described in Exhibit W will be used for the initial years of the pilot. Additionally, CenterPoint Energy plans to engage a third party to develop and implement an M&V plan to analyze system performance in a variety of buildings. CenterPoint Energy may use the results of the M&V to establish a deemed-calculated savings algorithm to calculate annual energy savings and carbon reductions in subsequent years of the program. Customers or the program vendor will provide required inputs when applying for an incentive. CenterPoint Energy will propose this methodology in an annual status report prior to implementation.

Customer Incentive Information

CenterPoint Energy proposes to pay customer incentives equal to 40 percent of hybrid heating system costs, up to $100,000. CenterPoint Energy may consider higher incentives for large systems on a case-by-case basis. CenterPoint Energy estimates the total cost of the heating system conversion will be approximately $81,000 for an average participant and so the average rebate amount will be approximately $32,400.

IRA Incentives Considered

Participants may be eligible for the commercial retrofit deduction under 26 U.S.C. § 179D. To qualify for the deduction, retrofits must result in savings of 25 percent or more as compared to the pre-retrofit building energy usage. CenterPoint Energy and ICF expect the average participant to clear this threshold, but some participants may not.[33] In addition, whether or not a

[33] The modeled archetype project used to develop estimates for the pilot would achieve a 72 percent reduction in total energy usage for heating, combining gas savings with increased electricity usage. With a 72 percent reduction in space heating energy, a facility that uses 35 percent or more of its energy for space heating should clear the 25 percent reduction required for the deduction. According to the Energy

particular participant can claim the deduction and the value of the deduction to a participant depends on their tax situation. CenterPoint Energy used conservative estimates that 50 percent of participants would clear the 25 percent threshold for eligibility for the deduction and the average actual reduction in taxes for those qualifying participants would be $500.[34]

To obtain the deduction, the retrofit must be completed according to a plan prepared by a "qualified professional" and a qualified person must also verify that the plan was carried out. Final Treasury guidance for the commercial retrofit deduction is not yet available, but when it is published, CenterPoint Energy will evaluate whether it is feasible for the vendor delivering this project to serve as a qualified professional for participating customers.

CenterPoint Energy did not identify any IRA incentives that it would be eligible for directly.

Equity, Diversity, and Community Engagement

No specific project locations have been identified as of the filing of this Plan. CenterPoint Energy does not anticipate major impacts to local communities surrounding project sites for this type of project, but would support participating customers in community engagement efforts, where applicable.

CenterPoint Energy anticipates that this pilot will include contracted vendor services and will seek diverse and qualified vendors to participate in an RFP process to select an implementation provider. The Company commits to tracking and reporting on an annual basis the total and percent of Plan spending on vendor services for diverse vendors or suppliers.[35]

Additional Project Information

Targeted Outreach

Where available, the pilot would leverage public commercial energy benchmarking data for customer recruitment.

CIP/NGIACIP/ECO/NGIA Coordination

CIP/ECO/NGIA coordination for this pilot is discussed in Exhibit I.

Information Administration's Commercial Buildings Energy Consumption Survey, https://www.eia.gov/consumption/commercial/, in the West North Central region, which includes Minnesota, 40 percent of total commercial energy consumption was for space heating. It is important to note however that this figure includes both smaller buildings, which are the target of this pilot, and larger facilities. Altogether, it seems likely that many but not all participants will clear the 25 percent threshold as a result of participation in the pilot.

[34] This assumes that participants achieve only 25 percent savings, while higher savings levels would qualify for a higher deduction. It also assumes a 10 percent top marginal tax bracket, a 10,000 square foot building, and that participants would not satisfy labor requirements to achieve a bonus deduction amount.

[35] CenterPoint Energy defines diverse suppliers per the guidelines of the National Minority Supplier Development Council, the Women's Business Enterprise National Council and the U.S. Small Business Administration.

High-performance rooftop units, including dual fuel rooftop units, are included in the Minnesota Efficient Technology Accelerator's ("ETA") starter portfolio, a market transformation initiative that will work to accelerate adoption of emerging technologies. CenterPoint Energy would coordinate with ETA where appropriate.

Pilot N. Residential Deep Energy Retrofits and Electric Air Source Heat Pumps

Project Description

CenterPoint Energy proposes a three-phase pilot program to test a combination of deep energy retrofits and air-source electric heat pumps with gas back-up in a variety of residential building types. This pilot proposal satisfies the requirement in Minn. Stat. § 216B.2427, subd. 8.[36] Note that to ensure projects qualify as strategic electrification under NGIA, homes enrolling in the pilot will maintain gas back-up heat.[37]

In brief, the three pilot phases consist of:

1) Study Scoping & Program Design: Modeling of different combinations of residential building types and energy conservation strategies, including innovative and emerging weatherization measures. CenterPoint Energy anticipates completing Phase 1 in year 1 of Plan implementation.

2) Demonstration Projects: Based on the results of Phase 1 modeling, CenterPoint Energy will select single and multifamily building host sites to field test selected technologies and measure home performance. CenterPoint Energy anticipates beginning Phase 2 in year 2 of Plan implementation and completing it in Year 4.

3) Broader Deployment: Following field testing, CenterPoint Energy will shift to an ongoing incentive program considering equitable deployment to a larger number of buildings. CenterPoint Energy anticipates beginning Phase 3 in year 4 of Plan implementation and continuing it in year 5.

Eligibility

This pilot will be targeted at CenterPoint Energy residential customers and multi-family building customers.

[36] The statute reads in part: "The first innovation plan filed under this section by a utility with more than 800,000 customers must include a pilot program that facilitates deep energy retrofits and the installation of cold climate air-source heat pumps in existing residential homes that have natural gas heating systems… ."

[37] NGIA defines "strategic electrification" in part as "installation of electric end-use equipment in an existing building in which natural gas is a primary or back-up fuel source, or in a newly constructed building in which a customer receives natural gas service for one or more end-uses… ." Minn. Stat. §216B.2427, subd. 1(q).

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 40: Residential Deep Energy Retrofits and Electric Air Source Heat Pumps Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Buildings	-	14	14	70	140

Table 41: Residential Deep Energy Retrofits and Electric Air Source Heat Pumps Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$197,000	$2,035,070	$2,037,449	$574,140	$1,066,664
Advertising & Promotion	$0	$10,000	$10,000	$50,000	$50,000
Allocation of General Portfolio Costs	$569,540	$206,171	$201,488	$203,447	$205,465
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$0	$0	$0	$2,165,950	$4,331,900
Total	$766,540	$2,251,241	$2,248,938	$2,993,537	$5,654,029
UCT Savings	$0	$12,568	$23,835	$79,116	$182,234
Total Incremental Cost	**$766,540**	**$2,238,673**	**$2,225,103**	**$2,914,422**	**$5,471,795**

GHG Reduction and Natural Gas Savings

Table 42 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. CenterPoint Energy estimates that projects completed through this pilot will have an approximately 32-year life.[38] The table below provides estimates for lifecycle GHG emissions and natural gas savings both during the five-year Plan period and over the life of measures expected to be installed during implementation of the five-year Plan. Additional details on these figures can be found in Exhibits F. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated lifecycle GHG emissions reduction for this pilot are based on a combination of energy efficiency and strategic electrification measures. For energy efficiency measures, lifecycle GHG emissions reduction estimates are calculated by multiplying natural gas savings by the estimated lifecycle GHG emissions intensity of geologic gas. For strategic electrification measures, GHG emissions

[38] Weatherization measures are estimated to have a 40 year life and air source heat pumps are estimated to have a 12-year life. The estimated 32-year life for pilot projects reflects the weighted average based on expected savings for each type of measure for each project.

reductions represent the difference between the estimated GHG emissions of added electricity load and reduced emissions from geologic natural gas use.

Table 42: Residential Deep Energy Retrofits and Electric Air Source Heat Pumps GHG and Natural Gas Savings

	During Five-Year Plan	Over Measure Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	3,153	66,760
Natural Gas Savings (Dth)	50,995	1,027,453
Estimated GHG Emissions Reduction per Single Family Home (metric tons CO_2e)	8[39]	135
Estimated GHG Emissions Reduction per Multi-Family Building (metric tons CO_2e)	72[40]	1,153
Estimated Gas Savings Per Single Family Home (Dth)	130[41]	2,076
Estimated Gas Savings Per Multi-Family Building (Dth)	1,110[42]	17,763

Tracking and Verification

This pilot will follow the tracking and verification approach for "Energy Efficiency, Strategic Electrification, and District Energy" described in Exhibit W. Additional pilot-specific details include:

Verification: CenterPoint Energy will develop a verification plan as part of the design of Phases 2 and 3 of this pilot.

Tracking: CenterPoint Energy will develop a tracking plan as part of the design of Phases 2 and 3 of this pilot.

Customer Incentive Information

CenterPoint Energy does not expect to incur rebate costs in Phase 1 or 2 of the pilot. In Phase 2, CenterPoint Energy expects to pay the full cost of installed measures and so classifies measure costs as a project delivery expense rather than a customer rebate expense. In Phase 3, CenterPoint Energy assumed rebates of $16,933 per single family home participant and $115,000 per multi-family building participant, which is equal to 25 percent of estimated

[39] Assumes measure installation in year 4.

[40] Assumes measure installation in year 4.

[41] Assumes measure installation in year 4.

[42] Assumes measure installation in year 4.

project cost. CenterPoint Energy plans to revisit the appropriate level of rebate per participant before launching Phase 3.

IRA Incentives Considered

While it is likely that at least some participants in Phase 3 would be eligible for IRA tax incentives or rebates, CenterPoint Energy did not include these in its calculation of participant cost due to uncertainty about the quantity of credit or rebates available to participants. CenterPoint Energy has not identified any avenue for the Company to receive IRA support for the program directly.

Phase 3 participants may be able to claim a credit under 26 U.S.C. § 25D up to the lesser of 30 percent of their costs (not including costs paid by CenterPoint Energy) or $3,200[43] for energy efficiency and strategic electrification measures. However, because this tax credit is non-refundable, participants may only claim it to the extent they have tax liability and a majority of U.S. households paid no income tax in 2021.[44] Particularly if CenterPoint Energy targets Phase 3 at low- or moderate-income households, there is a substantial possibility that many of them will not have sufficient tax liability to benefit from the credit.

In addition, Phase 3 participants may be eligible for rebates under IRA §§ 50121 (Home Energy Performance-Based, Whole House Rebates) and/or 50122 (High-Efficiency Electric Home Rebate Program). However, major questions about the operation of these programs are outstanding. Department of Energy guidance is expected to be issued this summer and following publication of guidance, the Minnesota Department of Commerce will develop an application including an implementation plan for the programs.

CenterPoint Energy will reevaluate the likelihood of participant tax credits and/or rebates prior to launch of Phase 3 and include updated information in its first annual NGIA status report.

Equity, Diversity, and Community Engagement

In addition to the opportunity to engage through public meetings during the plan development process, CenterPoint Energy intends to host one or more public meetings during the implementation planning process to gather additional feedback from members of impacted communities, targeted customers, and other interested parties, including feedback on equity and diversity considerations for program implementation. Specifically, CenterPoint Energy will include an assessment and discussion of approaches to address equity and inclusion during the design of Phases 2 and 3, including community outreach and workshops.

[43] The credit has separate limitations for heat pumps than for most efficiency measures including insulation. Participants may be able to claim up to $2,000 for the heat pump and $1,200 for efficiency measures provided that each figure exceeds 30 percent of their costs for the designated measures, adding up to a total limitation of $3,200.

[44] https://www.cnbc.com/2022/03/25/57percent-of-us-households-paid-no-federal-income-tax-in-2021-study.html

CenterPoint Energy will target 40 percent[45] of residential units served by the pilot qualify as low-income, as that term is defined in CIP/ECO, or are located in a disadvantaged community, as that term is defined by the federal government for the Inflation Reduction Act programs. CenterPoint Energy will track and report on these efforts in annual reports.

Additional Project Information

Phase 1 Details

CenterPoint Energy proposes to start this pilot with a study to model different combinations of building types and energy conservation strategies. The NGIA requires that this pilot facilitate deep energy retrofits which are defined as follows:

> [T]he installation of any measure or combination of measures, including air sealing and addressing thermal bridges, that under normal weather and operating conditions can reasonably be expected to reduce a building's calculated design load to ten or fewer British Thermal Units per hour per square foot of conditioned floor area. Deep energy retrofit does not include the installation of photovoltaic electric generation equipment, but may include the installation of a solar energy project.[46]

CenterPoint Energy believes that this level of retrofit may be infeasible or cost-prohibitive in many homes. Accordingly, CenterPoint Energy intends to evaluate, through Phase 1, what levels of retrofit can be accomplished in various types of housing and at what cost. Through this study, CenterPoint Energy hopes to determine:

1) What homes may be able to achieve the statutory definition of "deep energy retrofit" at a reasonable cost level?
2) What level of retrofit is reasonable for homes that cannot feasibly reach the statutory defined level of retrofit?
3) What measures are required to reach various levels of design load in different kinds of homes?

CenterPoint Energy plans to hire a qualified vendor to complete this study under its direction and plans to make the final report available to the Commission and interested parties.

Phase 2 Details

CenterPoint Energy will use the information gathered in Phase 1 to develop "Tiers" of retrofit to be field tested in Phase 2. For example, CenterPoint Energy may determine that it is reasonable to field test measures that would achieve a design load to 44 British Thermal Units (BTU)/sq ft in some homes, 22 BTU/sq ft in some homes, and the statutorily required 10 BTU/sq ft in other homes. CenterPoint Energy would then field test these various levels of retrofit along with air

[45] Selected to align with the federal Justice40 initiative which aims to direct at least 40 percent of the benefits of certain federal investments towards disadvantaged communities.
[46] Minn. Stat. §216B.2427, subd. 8(b).

source heat pumps and gas backup in a small number of homes and collect significant data on home heating performance. CenterPoint Energy proposes to fully fund projects in field tested homes with no required participant contribution. Participants would be required to cooperate with CenterPoint Energy's field testing including by allowing CenterPoint Energy personnel into their homes periodically, with advanced notice, to access heating equipment and other areas of the home where field testing measures were installed.

Some of the key objectives of Phase 2 include:

1) Confirming or refining the results of the Phase 1 study regarding measure combinations and cost of achieving various levels of retrofit in different kinds of homes.
2) Evaluating air source heat pump performance in various kinds of homes and at various levels of retrofit. This will include evaluating how often gas backup is used in the field testing homes.
3) Understanding any real-world difficulties around coordinating air-source heat pumps and gas backup to maximize GHG reductions while ensuring the comfort of residents.

Phase 3 Details

Using the results of Phases 1 and 2, CenterPoint Energy proposes to launch a larger incentive program that will support retrofits and installation of air-source heat pumps in a larger number of single-family and multi-family homes. CenterPoint Energy may propose tiers of incentive to encourage some homes to achieve the statutory definition of deep energy retrofit but allow other homes to receive a smaller incentive for lesser levels of retrofit. As part of its incentive design, CenterPoint Energy will also consider testing rate design options that may better serve hybrid heating customers and/or an energy system with a high number of hybrid heating customers.

CenterPoint Energy proposes to finalize details of the incentive program after Phase 1 is completed and Phase 2 is underway. CenterPoint Energy proposes to provide more details on Phase 3 program design in its first annual NGIA status report anticipated to be filed during year 2 of Plan implementation.

NGIA/CIP Coordination

Please see Exhibit I for information about CIP/ECO/NGIA coordination for this project.

Pilot O. Small/Medium Business GHG Audit

Project Description

CenterPoint Energy proposes to expand its existing Natural Gas Energy Analysis ("NGEA") CIP offering, which it will propose to continue in its 2024-2026 Triennial Plan, to include identification of non-CIP/ECO GHG reducing opportunities for small and medium businesses. NGEA requires a customer copay; new services proposed under this pilot will be offered at no additional charge to customers. Measures that may be recommended include measures available under the Carbon Capture Rebates for Commercial Buildings and Commercial Hybrid Heating pilots. The Company proposes to include the incremental costs associated with this expansion in its NGIA Plan for cost recovery as well as the costs of rebates for NGIA measures customers install as a

result of GHG audits. This program will also be credited with GHG savings from NGIA measures installed (and those savings will not count towards other NGIA projects that include those measures). CenterPoint Energy proposes to continue to attribute savings and costs for CIP/ECO measures to the appropriate CIP/ECO projects.

Thermal energy leaders will be defined as businesses that either:

- Implement the top three recommendations (i.e., the three recommendations with the highest GHG/energy savings) or
- Implement one or more recommendations that reduce site GHG emissions from current natural gas end uses by at least 50 percent

Upon notification from customer that eligible projects have been completed, CenterPoint Energy proposes to recognize thermal energy leaders as follows:

- Businesses will be provided a certificate and/or window decal identifying them as a thermal energy leader which they can display.
- Businesses will be eligible to receive a bonus rebate of up to $5,000, not to exceed the amount of the rebates initially paid for the qualifying projects.
- Each year, CenterPoint Energy will select one thermal energy leader with a notable project and honor them at CenterPoint Energy's annual Energy Efficiency and Technology Conference, through social media, or through other company communications.

This pilot satisfies the NGIA requirement in Minn. Stat. § 216B.2427, subd. 6, which requires the Company to propose a pilot to provide thermal energy audits to small- and medium- sized businesses in order to identify opportunities to reduce or avoid GHG emissions from natural gas use. The pilot program is required to provide incentives for businesses to implement recommendations made by the audit. In addition, CenterPoint Energy is required to develop criteria to identify business that achieve significant emissions reduction by implementing audit recommendations and must recognize those businesses as thermal energy leaders.

Eligibility

All commercial and industrial customers are eligible for participation in the pilot. However, the Company plans to target this offering towards small and medium business customers.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 43: Small/Medium Business GHG Audit Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Audits	220	240	260	260	260

Table 44: Small/Medium Business GHG Audit Five Year Spending Estimate

Year	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$250,300	$270,070	$289,884	$291,444	$343,050
Advertising & Promotion	$5,000	$5,000	$5,000	$5,000	$5,000
Allocation of General Portfolio Costs	$95,834	$34,692	$33,904	$34,233	$34,573
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$126,720	$138,240	$149,760	$134,160	$134,160
Total	$477,854	$448,002	$478,548	$464,837	$516,783
UCT Savings	$6,653	$13,181	$19,548	$25,211	$30,224
Total Incremental Cost	**$471,201**	**$434,820**	**$459,000**	**$439,626**	**$486,558**

GHG Reduction and Natural Gas Savings

Table 45 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. Various potential measures that may be installed through this pilot have different lifetimes. For purposes of estimating lifecycle GHG reductions, CenterPoint Energy assumed a 17-year life which is the average of the life of CarbinX unit which could be installed through the Carbon Capture Rebates for Commercial Buildings pilot and a hybrid heating system which could be installed through the Commercial Hybrid Heating pilot, rounded down. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions use the same methodology as used in the other NGIA pilots through which these measures may be installed.

Table 45: Small/Medium Business GHG Audit GHG Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (tons CO_2e)	1,055	6,570
Geologic Gas Savings (Dth)	15,601	90,845

Tracking and Verification

This pilot will follow the tracking and verification approach for "Energy Efficiency, Strategic Electrification, and District Energy" described in Exhibit W. Additional pilot-specific details include:

Verification: Measures rebated through this pilot will be subject to the same M&V procedures established for those measures in other NGIA pilots.

Tracking: Measures rebated through this pilot will be subject to the same tracking procedures established for those measures in other NGIA pilots but will be counted towards this pilot's participation and GHG reductions. Additionally, CenterPoint Energy will establish a process for tracking thermal energy leaders in our NGIA tracking system.

Customer Incentive Information

CenterPoint Energy proposes to pay the same rebates through this pilot as are available through other NGIA pilots for the same measures. Specifically, for hybrid heating measures, customer incentives equal to 40 percent of hybrid heating system costs. For the CarbinX unit, CenterPoint Energy proposes an $8,000 incentive per unit for a customer's first installation, and if a customer chooses to install additional units at other business locations, CenterPoint Energy will pay an incentive of $3,000 per unit for subsequent installations.

IRA Incentives Considered

See discussion of IRA rebates in the above sections describing the Carbon Capture Rebates for Commercial Buildings and Commercial Hybrid Heating pilots.

Equity, Diversity, and Community Engagement

CenterPoint Energy will seek diverse and qualified vendors to participate in any RFP process to select an implementation provider. The Company commits to tracking and reporting on an annual basis the total and percent spend of Plan vendor services on diverse vendors or suppliers.

Additional Project Information

Targeted Outreach

Where available, the pilot would leverage public commercial energy benchmarking data for customer recruitment.

Alternative CIP Program Coordination

Small and medium business CenterPoint Energy customers participating alternative CIP programs funded by CenterPoint Energy will be eligible for Thermal Energy Leader recognition if they complete three recommended projects that receive CenterPoint Energy rebates. Customers must supply CenterPoint Energy with a copy of their alternative CIP program report for validation to be eligible to receive the bonus rebate.

CIP/ECO/NGIA Coordination

CIP/ECO/NGIA coordination for this pilot is discussed in Exhibit I.

Pilot P. Residential Gas Heat Pumps

Project Description

CenterPoint Energy proposes to fund the deployment and testing of 'combi' space and water heating gas heat pump systems in Minnesota homes to evaluate the technology's performance. An initial phase would review available market research and analysis to prioritize which gas heat pump units should be included in the field testing. Outreach would be conducted to recruit CenterPoint Energy customers to participate in the pilot, and contractors would be engaged and trained to install and maintain the heat pumps with support from equipment manufacturers. The

installations would be metered and trial data analyzed to develop reporting metrics that would better inform opportunities for gas heat pumps to be part of future CIP/ECO or NGIA programs.

Eligibility

This pilot will be open to CenterPoint Energy residential customers.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P

Table 46: Residential Gas Heat Pumps Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Units Installed	0	3	3	0	0

Table 47: Residential Gas Heat Pumps Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$19,800	$125,094	$125,397	$60,709	$11,030
Advertising & Promotion	$0	$2,500	$2,500	$0	$0
Allocation of General Portfolio Costs	$15,926	$5,765	$5,634	$5,689	$5,745
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$0	$0	$0	$0	$0
Total	$35,726	$133,359	$133,531	$66,398	$16,775
UCT Savings	$0	$787	$1,491	$1,413	$1,339
Total Incremental Cost	**$35,726**	**$132,572**	**$132,040**	**$64,985**	**$15,436**

GHG Reduction and Natural Gas Savings

Table X below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. CenterPoint Energy estimates a 15-year life for residential gas heat pumps. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on unit efficiency levels provided by an RFI respondent in combination with CenterPoint Energy data on residential usage. Actual savings will vary depending on the specific units installed and home characteristics.

Table 48: Residential Gas Heat Pumps GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	55	235
Geologic Gas Savings (Dth)	829	3,551

Tracking and Verification

This pilot will follow the tracking and verification approach for "Energy Efficiency, Strategic Electrification, and District Energy" described in Exhibit W. Additional pilot-specific details include:

> *Verification:* Despite expected energy savings being below the 20,000 Dth threshold for custom project M&V as noted in Exhibit W, the program vendor will conduct detailed on-site M&V to validate system performance for each installation.

Customer Incentive Information

CenterPoint Energy proposes to pay the full cost of the units for participants so does not anticipate paying customer incentives.

IRA Incentives Considered

While gas heat pumps generally are eligible for the energy efficient home improvement credit in 26 U.S.C. § 25C, because CenterPoint Energy proposes to pay the full unit cost, we do not expect participants to be eligible for the tax credit. CenterPoint Energy has not identified any IRA incentives for which it would be directly eligible for in relation to this pilot.

Equity, Diversity, and Community Engagement

CenterPoint Energy will seek diverse and qualified vendors to participate in any RFP process to select an implementation provider. The Company commits to tracking and reporting on an annual basis the total and percent spend of Plan vendor services on diverse vendors or suppliers.

Additional Project Information

CIP/ECO/NGIA coordination for this pilot is discussed in Exhibit I.

Pilot Q. Gas Heat Pumps for Commercial Buildings

Project Description

CenterPoint Energy proposes to fund the deployment and testing of engine-driven and/or absorption gas heat pump systems in Minnesota commercial buildings, to evaluate the technologies' performance. An initial phase will include site identification, including outreach to find CenterPoint Energy customers willing to participate in the pilot and with a site appropriate for gas heat pump application. After site identification, the demonstration equipment will be installed. The installations would be metered and trial data analyzed to develop reporting metrics that would better inform the opportunity for gas heat pumps to be part of future CIP/ECO or NGIA programs.

Eligibility

This pilot will be open to CenterPoint Energy commercial and industrial customers.

Budget and Participation

Below CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 49: Gas Heat Pumps for Commercial Buildings Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
Units Installed	0	3	0	0	0

Table 50: Gas Heat Pumps for Commercial Buildings Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$108,500	$459,130	$109,779	$22,947	$23,636
Advertising & Promotion	$0	$2,500	$0	$0	$0
Allocation of General Portfolio Costs	$31,347	$11,347	$11,090	$11,198	$11,309
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$0	$0	$0	$0	$0
Total	$139,847	$472,977	$120,869	$34,145	$34,944
UCT Savings	$0	$14,432	$13,675	$12,957	$12,277
Total Incremental Cost	**$139,847**	**$458,545**	**$107,194**	**$21,188**	**$22,668**

GHG Reduction and Natural Gas Savings

Table 51 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. CenterPoint Energy estimates a 15-year life for commercial gas heat pumps. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations. As described in more detail in Exhibit F, estimated emissions reductions are based on expected unit efficiency levels and estimated heating load for a typical commercial participant.

Table 51: Gas Heat Pumps for Commercial Buildings GHG and Geologic Gas Savings

	During Five-Year Plan	Over Lifetime
Lifecycle GHG Emissions Reduction (metric tons CO_2e)	574	2,154
Geologic Gas Savings (Dth)	8,682	32,558

Tracking and Verification

This pilot will follow the tracking and verification approach for "Energy Efficiency, Strategic Electrification, and District Energy" described in Exhibit W. Additional pilot-specific details include:

> *Verification:* Despite expected energy savings being below the 20,000 Dth threshold for custom project M&V as noted in Exhibit W, the program vendor(s) will conduct detailed on-site M&V to validate system performance for each installation.

Customer Incentive Information

CenterPoint Energy proposes to pay the full cost of the units for participants so does not anticipate paying customer incentives.

IRA Incentives Considered

Commercial gas heat pumps can contribute to eligibility for the Commercial Buildings Energy Efficiency Tax Deduction under 26 U.S.C. § 179D. However, because participants are not paying for the units installed, they would not be able to claim expenses associated with the heat pump as part of a deduction. CenterPoint Energy did not identify any IRA incentives that it would be directly eligible for as a result of this pilot.

Equity, Diversity, and Community Engagement

CenterPoint Energy will seek diverse and qualified vendors to participate in any RFP process to select an implementation provider. The Company commits to tracking and reporting on an annual basis the total and percent spend of Plan vendor services on diverse vendors or suppliers.

Additional Project Information

CenterPoint Energy would target sites where customers are open to hosting walk-throughs, so that contractors, design firms, and other industry participants can gain exposure to the technology.

CIP/ECO/NGIA coordination for this pilot is discussed in Exhibit I.

Gas absorption heat pumps are included in the Minnesota ETA starter portfolio, a market transformation initiative that will work to accelerate adoption of emerging technologies. This field demonstration will complement the strategy and planning work that will be completed within the ETA program, and CenterPoint Energy would coordinate with ETA where appropriate.

Pilot R. Industrial and Large Commercial GHG Audit

Project Description

CenterPoint Energy proposes to expand its existing Process Efficiency and Commercial Efficiency CIP offerings, which it will propose to continue in its 2024-2026 Triennial Plan, to include identification of non-CIP/ECO GHG reducing opportunities for industrial and large commercial customers. Measures that may be recommended include electric heat pumps or hybrid heating systems, CarbinX carbon capture units, industrial heat pumps, solar thermal walls, onsite biogas production/use, and energy efficiency and strategic electrification measures that are not cost-effective under the CIP/ECO societal test. The Company proposes to include the incremental costs associated with this expansion in its NGIA Plan for cost recovery as well as the costs of rebates for NGIA measures customers install as a result of GHG audits. This program will also be credited with GHG savings from NGIA measures installed (and those savings will not count towards other NGIA projects that include those measures). CenterPoint Energy proposes to continue to attribute savings and costs for CIP/ECO measures to the

appropriate CIP/ECO projects. As described further in Exhibit W, CenterPoint Energy will complete custom analysis to determine the energy savings of energy efficiency and strategic electrification measures installed through NGIA where those measures are not included in the Minnesota Technical Reference Manual.

Eligibility

This pilot is open to the following rate classes: Small Volume Dual Fuel B, Large Volume Dual Fuel, Commercial/Industrial Firm C, and Large Volume Firm.

Budget and Participation

Below, CenterPoint Energy provides estimated participation and spending. Additional details on the tables below can be found in Exhibits E and N. Overall cost-effectiveness is addressed in Exhibits M, O, and P.

Table 52: Industrial and Large Commercial GHG Audit Participation Estimates

	Year 1	Year 2	Year 3	Year 4	Year 5
GHG Reduction Project Implemented	1	1	1	1	1
Audits Completed	10	10	10	10	10

Table 53: Industrial and Large Commercial GHG Audit Five Year Spending Estimate

	Year 1	Year 2	Year 3	Year 4	Year 5
Project Delivery	$121,000	$121,630	$122,279	$122,947	$173,636
Advertising & Promotion	$1,600	$1,600	$1,600	$1,600	$1,600
Allocation of General Portfolio Costs	$39,748	$14,388	$14,062	$14,198	$14,339
Revenue Requirement for Capital Investment	$0	$0	$0	$0	$0
Customer Incentives	$136,838	$136,838	$136,838	$136,838	$136,838
Total	$299,185	$274,456	$274,778	$275,583	$326,412
UCT Savings	$38,411	$72,788	$103,450	$130,692	$154,789
Total Incremental Cost	**$260,775**	**$201,668**	**$171,328**	**$144,891**	**$171,624**

GHG Reduction and Natural Gas Savings

Table 54 below summarizes the forecasted GHG emissions reductions from implementation of this pilot. Exhibit F provides additional details on the forecasted GHG emissions avoided by implementation of the pilot. For purposes of estimating lifecycle GHG reductions, CenterPoint Energy assumed a 20-year life for process equipment. Exhibit G provides a third-party analysis of the lifecycle GHG emissions calculations.

Table 54: Industrial and Large Commercial GHG Audit GHG Savings

	During Five-Year Plan	Over Lifetime

Lifecycle GHG Emissions Reduction (metric tons CO_2e)	5,147	35,560
Geologic Gas Savings (Dth)	82,103	547,350

Tracking and Verification

This pilot will follow the tracking and verification approach for "Energy Efficiency, Strategic Electrification, and District Energy" described in Exhibit W. Additional pilot-specific details include:

> *Tracking*: Some of the measures identified through audits completed through this pilot are likely to be eligible for incentives through other NGIA pilots (e.g., Commercial Hybrid Heating, CarbinX). CenterPoint Energy proposes to pay incentives and count savings towards those other pilots where applicable. Where measures are identified that are not eligible for incentives through other pilots, CenterPoint Energy will pay incentives and claim savings in this pilot, as described below.

Customer Incentive Information

CenterPoint Energy proposes to pay a rebate equal to between $10/Dth and $25/Dth of annual geologic natural gas savings for measures installed through this pilot, up to $1.5 million per project. CenterPoint Energy requests some flexibility in the rebate amount as it has through its CIP Commercial & Industrial Custom Rebates project. Through that CIP project, CenterPoint Energy caps on project cost coverage generally lead to incentives that do not exceed $10/Dth with many projects receiving lower amounts if a lower amount is sufficient to spur action by the customer. For this pilot, the Company believes that higher rebate amounts are likely necessary to drive customer action as measures will be less cost-effective in terms of natural gas bill savings. Since this project may involve energy efficiency and strategic electrification projects, CenterPoint Energy also wants to ensure that projects that are borderline for CIP/ECO eligibility are not paid incentives that are significantly more than they would receive through CIP/ECO. For example, energy efficiency projects that are almost cost effective under the CIP/ECO societal test should not receive a windfall if they are barely in scope for NGIA. Accordingly, the Company requests a range between the upper limit for CIP/ECO custom projects and $25/Dth.

In order to coordinate incentives through this pilot with CIP/ECO incentives, the Company proposes to take the following steps for energy efficiency and strategic electrification projects:

1. CenterPoint Energy will determine whether the measure could qualify for CIP/ECO as a custom measure or otherwise. If it can, the measure will be processed through CIP/ECO and no NGIA rebate will be paid for that measure.
2. If the measure is not eligible for CIP/ECO, CenterPoint Energy will determine if the measure will cost less than $150/metric ton from the NGIA utility perspective, considering only quantitative costs and benefits. Only measures that pass this screen will be eligible for an NGIA incentive.
3. Measures rebated through this pilot will be subjected to measurement and verification as further described in Exhibit W.

IRA Incentives Considered

Some participants may be eligible for Advanced Energy Production Credits under the IRA, 26 U.S.C. § 48C. This credit allows owners of manufacturing facilities to claim a credit for re-equipping their facilities with equipment designed to reduce GHG emissions by at least 20 percent through the installation of low- or zero-carbon process heat systems, among other things. Due to uncertainty about whether the measures likely to be implemented could clear this threshold in the case of particular facilities, the Company did not include this credit in its modeling of participant costs.

In addition, there are several competitive grant programs in IRA and IIJA that encourage reductions in emissions at industrial facilities such as the Advanced Industrial Facilities Deployment Program, IRA § 50161, the Future of Industry Program and Industrial Research and Assessment Centers, IIJA § 40521, Industrial Emissions Demonstration Projects, IIJA § 41008, which customers could potentially be eligible for.

CenterPoint Energy is not aware of any IRA or IIJA incentives that it could be directly eligible for with respect to this pilot.

Equity, Diversity, and Community Engagement

CenterPoint Energy will seek diverse and qualified vendors to participate in any RFP process to select an implementation provider. The Company commits to tracking and reporting on an annual basis the total and percent spend of Plan vendor services on diverse vendors or suppliers.

Additional Project Information

CIP/ECO/NGIA coordination for this pilot is discussed in Exhibit I.

While this pilot is focused on customers participating in CenterPoint Energy's Commercial Efficiency and Process Efficiency programs, CenterPoint Energy will allow energy efficiency or strategic electrification projects that are evaluated for custom rebates through CIP/ECO, but do not qualify, to be referred to this pilot for evaluation for NGIA incentive eligibility, following the incentive guidelines described above.

List of Final Pilot Names with Reference to Shortlisted Concepts

The full pilot descriptions are based on shortlisted concepts from the RFI and public engagement sessions. The table below shows earlier names that appear in process documentation, along with the corresponding final pilot name used in the innovation plan.

Shortlist #	Shortlist Pilot Concept Name	Final Pilot Letter	Name of Full Pilot
1	RNG Proposal - Anaerobic Digestion of Organic Materials	A	RNG Produced from Hennepin County Organic Waste
2	RNG Proposal - Anaerobic Digestion of East Metro Food Waste	B	RNG Produced from Ramsey & Washington Counties Organic Waste

Shortlist #	Shortlist Pilot Concept Name	Final Pilot Letter	Name of Full Pilot
3	RNG Archetype - Wastewater Resource Recovery Facility	C	Renewable Natural Gas Request for Proposal ("RFP") Purchase
4	RNG Archetype - Dairy Manure		
5	RNG Archetype - Food Waste		
6	RNG Archetype - Landfill Gas		
7	Green Hydrogen Blending into Natural Gas Distribution System	D	Green Hydrogen Blending into Natural Gas Distribution System
8	Green Hydrogen Archetype for Industrial or Large Commercial Facility	E	Industrial or Large Commercial Hydrogen and Carbon Capture Incentives
11	Carbon Capture Archetype for Industrial or Large Commercial Facility		
9	Industrial Methane and Refrigerant Leak Reduction Program	F	Industrial Methane and Refrigerant Leak Reduction
10	Urban Tree Carbon Offset Program	G	Urban Tree Carbon Offsets
13	Carbon Capture Rebates for Commercial Buildings	H	Carbon Capture Rebates for Commercial Buildings
14	New Networked Geothermal Systems Pilot	I	New Networked Geothermal Systems
15	Decarbonizing Existing District Energy Systems	J	Decarbonizing Existing District Energy Systems
16	New District Energy System	K	New District Energy System
17	Industrial Electrification Incentive Program	L	Industrial Electrification Incentives
18	Commercial hybrid heating pilot	M	Commercial Hybrid Heating
19	Residential deep energy retrofit + electric ASHP pilot (with gas backup)	N	Residential Deep Energy Retrofits and Electric Air Source Heat Pumps
20	Small/medium business GHG audit pilot	O	Small/Medium Business GHG Audit
21	Residential Gas Heat Pump	P	Residential Gas Heat Pumps
22	Gas Heat Pump for Commercial Buildings	Q	Gas Heat Pumps for Commercial Buildings
25	Industrial and Large Commercial GHG Audit Pilot	R	Industrial and Large Commercial GHG Audit

In the Matter of
CenterPoint Energy Natural Gas Innovation Act (NGIA)
Innovation Plan

Petition of CenterPoint Energy

EXHIBIT E: PILOT COST ESTIMATE DETAILS

Docket No. G-008/M-23-215

June 28, 2023

Pilot	Project Delivery	Advertising and Promotion	Allocation of General Portfolio Costs	Trade Ally Incentives	Workforce Development	Increased Electricity/ Water Costs	Revenue Requirement for Capital Investment	Customer Incentives	Total Costs (Not Net of Savings)	UCT Savings	Total Incremental Costs
RNG Produced from Hennepin County Organic Waste	$2,565,952	$0	$290,807	$0	$0	$0	$0	$0	$2,856,759	$0	$2,856,759
RNG Produced from Ramsey & Washington Counties' Organic Waste	$9,125,802	$0	$1,034,255	$0	$0	$0	$0	$0	$10,160,058	$0	$10,160,058
Renewable Natural Gas RFP Purchase	$29,066,663	$7,125	$3,295,023	$0	$0	$0	$0	$0	$32,368,811	$0	$32,368,811
Green Hydrogen Blending into Natural Gas Distribution System	$646,704	$0	$516,419	$0	$0	$2,777,130	$1,512,117	$0	$5,452,369	$379,302	$5,073,067
Industrial or Large Commercial Hydrogen and Carbon Capture Incentives	$712,221	$5,000	$386,191	$0	$0	$0	$0	$3,030,000	$4,133,412	$339,642	$3,793,770
Industrial Methane and Refrigerant Leak Reduction	$1,418,515	$50,000	$127,006	$0	$0	$0	$0	$75,351	$1,670,872	$423,221	$1,247,651
Urban Tree Carbon Offsets	$295,780	$0	$33,522	$0	$0	$0	$0	$0	$329,301	$0	$329,301
Carbon Capture Rebates for Commercial Buildings	$260,148	$25,000	$132,643	$0	$0	$0	$0	$1,374,000	$1,791,790	$488,768	$1,303,022
New Networked Geothermal Systems	$9,575,777	$50,000	$1,183,459	$0	$0	$0	$1,256,305	$0	$12,065,540	$439,776	$11,625,764
Decarbonizing Existing District Energy Systems	$102,030	$0	$60,865	$0	$0	$0	$0	$2,560,000	$2,722,894	$2,124,986	$597,909
New District Energy System	$102,030	$0	$21,952	$0	$0	$0	$0	$533,270	$657,251	$441,607	$215,644
Industrial Electrification Incentives	$681,606	$2,500	$51,287	$0	$0	$0	$0	$0	$735,393	$231,571	$503,821
Commercial Hybrid Heating	$2,398,803	$25,000	$719,421	$0	$0	$0	$0	$4,374,000	$7,517,225	$449,955	$7,067,270
Residential Deep Energy Retrofits and Electric Air Source Heat Pumps	$5,910,323	$120,000	$1,386,111	$0	$0	$0	$0	$6,497,850	$13,914,285	$297,753	$13,616,532
Small/Medium Business GHG Audit	$1,444,748	$25,000	$233,236	$0	$0	$0	$0	$683,040	$2,386,024	$94,818	$2,291,206
Residential Gas Heat Pumps	$342,030	$5,000	$38,760	$0	$0	$0	$0	$0	$385,789	$5,031	$380,759
Gas Heat Pumps for Commercial Buildings	$723,992	$2,500	$76,290	$0	$0	$0	$0	$0	$802,782	$53,340	$749,442
Industrial and Large Commercial GHG Audit	$661,492	$8,000	$96,735	$0	$0	$0	$0	$684,188	$1,450,415	$500,129	$950,286
Research and Development	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$10,570,462
Total Portfolio	**$66,034,613**	**$325,125**	**$9,683,983**	**$0**	**$0**	**$2,777,130**	**$2,768,421**	**$19,811,699**	**$101,400,972**	**$6,269,900**	**$105,701,533**

Pilot	Estimated Lifecycle GHG Reductions (Tons CO2e)	Estimated GHG Reductions During Plan (Tons CO2e)	Quantitative UCT Costs Only (Not Net of Savings) Lifetime	Quantitative UCT Costs Only (Not Net of Savings) 5-Year Plan	Quantitative UCT Savings Lifetime	Quantitative UCT Savings 5-Year Plan	Net UCT Costs Lifetime	Net UCT Costs 5-Year Budget*
RNG Produced from Hennepin County Organic Waste	$ 28,221	$ 8,466	$ 7,384,330	$ 2,856,759	$ -	$ -	$ 7,384,330	$ 2,856,759
RNG Produced from Ramsey & Washington Counties' Organic Waste	$ 147,863	$ 44,359	$ 26,322,323	$ 10,160,058	$ -	$ -	$ 26,322,323	$ 10,160,058
Renewable Natural Gas RFP Purchase	$ 359,884	$ 143,954	$ 63,675,702	$ 32,368,811	$ -	$ -	$ 63,675,702	$ 32,368,811
Green Hydrogen Blending into Natural Gas Distribution System	$ 27,993	$ 4,199	$ 23,646,492	$ 5,452,369	$ 1,201,725	$ 379,302	$ 22,444,767	$ 5,073,067
Industrial or Large Commercial Hydrogen and Carbon Capture Incentives	$ 107,196	$ 15,706	$ 4,752,126	$ 4,133,412	$ 2,418,261	$ 339,642	$ 2,333,865	$ 3,793,770
Industrial Methane and Refrigerant Leak Reduction	$ 33,763	$ 30,387	$ 1,421,407	$ 1,670,872	$ 415,942	$ 423,221	$ 1,005,465	$ 1,247,651
Urban Tree Carbon Offsets	$ 4,500	$ 4,500	$ 266,387	$ 329,301	$ -	$ -	$ 266,387	$ 329,301
Carbon Capture Rebates for Commercial Buildings	$ 55,150	$ 7,531	$ 1,519,092	$ 1,791,790	$ 1,628,479	$ 488,768	$ (109,387)	$ 1,303,022
New Networked Geothermal Systems	$ 107,355	$ 4,358	$ 43,571,155	$ 12,065,540	$ 2,531,402	$ 439,776	$ 41,039,753	$ 11,625,764
Decarbonizing Existing District Energy Systems	$ 124,030	$ 18,902	$ 2,452,298	$ 2,722,894	$ 5,935,378	$ 2,124,986	$ (3,483,080)	$ 597,909
New District Energy System	$ 40,882	$ 4,685	$ 581,298	$ 657,251	$ 1,387,662	$ 441,607	$ (806,364)	$ 215,644
Industrial Electrification Incentives	$ 11,896	$ 2,173	$ 643,816	$ 735,393	$ 582,711	$ 231,571	$ 61,105	$ 503,821
Commercial Hybrid Heating	$ 25,609	$ 4,536	$ 6,149,191	$ 7,517,225	$ 1,326,141	$ 449,955	$ 4,823,050	$ 7,067,270
Residential Deep Energy Retrofits and Electric Air Source Heat Pumps	$ 66,760	$ 3,153	$ 11,047,557	$ 13,914,285	$ 1,849,576	$ 297,753	$ 9,197,981	$ 13,616,532
Small/Medium Business GHG Audit	$ 6,570	$ 1,055	$ 1,948,704	$ 2,386,024	$ 284,170	$ 94,818	$ 1,664,533	$ 2,291,206
Residential Gas Heat Pumps	$ 235	$ 55	$ 317,469	$ 385,789	$ 12,411	$ 5,031	$ 305,058	$ 380,759
Gas Heat Pumps for Commercial Buildings	$ 2,154	$ 574	$ 677,495	$ 802,782	$ 118,703	$ 53,340	$ 558,792	$ 749,442
Industrial and Large Commercial GHG Audit	$ 35,560	$ 5,147	$ 1,226,292	$ 1,450,415	$ 1,565,872	$ 500,129	$ (339,580)	$ 950,286
Research and Development	$ -	$ -	$ 10,570,462	$ 10,570,462	$ -	$ -	$ 10,570,462	$ 10,570,462
Total Portfolio	**$ 1,185,620**	**$ 303,739**	**$ 208,173,596**	**$ 111,971,433**	**$ 21,258,433**	**$ 6,269,900**	**$ 186,915,163**	**$ 105,701,533**

* For this plan, this is the same as costs counting towards the NGIA budget.

Pilot	Estimated Lifecycle GHG Reductions (Tons CO2e)	Estimated GHG Reductions During Plan (Tons CO2e)	Net Quantified Costs Lifetime*
RNG Produced from Hennepin County Organic Waste	28,221	8,466	$6,233,262
RNG Produced from Ramsey & Washington Counties' Organic Waste	147,863	44,359	$19,801,962
Renewable Natural Gas RFP Purchase	359,884	143,954	$48,308,149
Green Hydrogen Blending into Natural Gas Distribution System	27,993	4,199	$22,019,473
Industrial or Large Commercial Hydrogen and Carbon Capture Incentives	107,196	15,706	$64,458,919
Industrial Methane and Refrigerant Leak Reduction	33,763	30,387	($822,905)
Urban Tree Carbon Offsets	4,500	4,500	$54,958
Carbon Capture Rebates for Commercial Buildings	55,150	7,531	($1,671,919)
New Networked Geothermal Systems	107,355	4,358	$43,129,796
Decarbonizing Existing District Energy Systems	124,030	18,902	($4,165,816)
New District Energy System	40,882	4,685	$15,170,736
Industrial Electrification Incentives	11,896	2,173	$23,502
Commercial Hybrid Heating	25,609	4,536	$5,213,143
Residential Deep Energy Retrofits and Electric Air Source Heat Pumps	66,760	3,153	$26,052,423
Small/Medium Business GHG Audit	6,570	1,055	$1,825,299
Residential Gas Heat Pumps	235	55	$319,060
Gas Heat Pumps for Commercial Buildings	2,154	574	$446,748
Industrial and Large Commercial GHG Audit	35,560	5,147	($1,803,711)
Research and Development	-	-	$10,570,462
Total Portfolio	**1,185,620**	**303,739**	**$255,163,542**

*The Net Quantified Costs seeks to capture 'all the value and cost streams' that have been quantified in this analysis. It includes costs to the utility, to the participant, and the value of GHG and other pollutant savings. Net Quantified Costs ($2023) = UCT test costs + PCT test costs – UCT test benefits - PCT test benefits + social cost of GHG emission reductions + social cost of non-GHG emission reductions + third party funding

Pilot	Estimated Lifecycle GHG Reductions (Tons CO2e)	Estimated GHG Reductions During Plan (Tons CO2e)	Lifetime Net Participant Costs	Lifetime Net Non-Participating Customer Costs	Upfront Equipment and Installation Costs*
RNG Produced from Hennepin County Organic Waste	28,221	8,466	-	2,545,183	7,355,834
RNG Produced from Ramsey & Washington Counties' Organic Waste	147,863	44,359	-	9,050,289	27,089,839
Renewable Natural Gas RFP Purchase	359,884	143,954	-	29,255,637	66,034,126
Green Hydrogen Blending into Natural Gas Distribution System	27,993	4,199	-	4,640,604	5,979,326
Industrial or Large Commercial Hydrogen and Carbon Capture Incentives	107,196	15,706	58,744,599	3,477,556	12,872,056
Industrial Methane and Refrigerant Leak Reduction	33,763	30,387	(100,759)	1,411,201	582,305
Urban Tree Carbon Offsets	4,500	4,500	-	299,909	219,226
Carbon Capture Rebates for Commercial Buildings	55,150	7,531	1,103,836	1,173,086	12,408,096
New Networked Geothermal Systems	107,355	4,358	3,721,380	10,519,887	24,879,156
Decarbonizing Existing District Energy Systems	124,030	18,902	5,862,748	686,393	4,933,706
New District Energy System	40,882	4,685	14,918,235	338,502	18,932,519
Industrial Electrification Incentives	11,896	2,173	547,391	509,195	374,861
Commercial Hybrid Heating	25,609	4,536	1,037,147	6,477,456	2,555,827
Residential Deep Energy Retrofits and Electric Air Source Heat Pumps	66,760	3,153	18,687,352	12,158,964	25,536,912
Small/Medium Business GHG Audit	6,570	1,055	273,343	2,097,447	1,853,228
Residential Gas Heat Pumps	235	55	(11,879)	355,697	165,994
Gas Heat Pump for Commercial Buildings	2,154	574	(69,236)	715,975	328,003
Industrial and Large Commercial GHG Audit	35,560	5,147	311,245	854,452	1,362,270
Research and Development	-	-	-	10,570,462	10,570,462
Total Portfolio	**1,185,620**	**303,739**	**105,025,401**	**97,137,894**	**224,033,746**

*The upfront equipment and installation costs simply looks at the total upfront cost to purchase and install the relevant technology, stripping out the impacts of different incentive levels and/or supplemental pilot budgets for programmatic support (like program administration, marketing and customer recruitment, etc). This perspective may help better understand the ongoing cost of a technology at scale separately from start-up administrative costs (but does not capture the full lifecycle / operating costs).

Sensitivity scenario 1: Assuming a commodity cost annual escalation rate of 1.03%

Pilot	Net UCT Costs 5-Year Plan	Net UCT Costs Lifetime	Net Quantified Costs Lifetime
RNG Produced from Hennepin County Organic Waste	$2,734,388	$6,964,196	$5,811,659
RNG Produced from Ramsey & Washington Counties' Organic Waste	$9,707,771	$24,775,067	$18,247,673
Renewable Natural Gas RFP Purchase	$31,025,336	$59,844,864	$44,465,218
Green Hydrogen Blending into Natural Gas Distribution System	$4,972,508	$21,253,790	$19,864,279
Industrial or Large Commercial Hydrogen and Carbon Capture Incentives	$3,700,360	$1,267,417	$62,847,161
Industrial Methane and Refrigerant Leak Reduction	$1,146,226	$905,029	($991,885)
Urban Tree Carbon Offsets	$330,781	$266,387	$56,438
Carbon Capture Rebates for Commercial Buildings	$1,159,817	($1,748,504)	($4,177,267)
New Networked Geothermal Systems	$11,516,444	$36,000,169	$33,839,294
Decarbonizing Existing District Energy Systems	($33,088)	($8,982,313)	($12,512,532)
New District Energy System	$84,646	($2,642,563)	$11,834,308
Industrial Electrification Incentives	$442,039	($443,743)	($736,011)
Commercial Hybrid Heating	$6,962,627	$3,770,843	$3,584,007
Residential Deep Energy Retrofits and Electric Air Source Heat Pumps	$13,568,295	$6,052,186	$20,260,640
Small/Medium Business GHG Audit	$2,273,376	$1,419,578	$1,454,399
Residential Gas Heat Pumps	$380,970	$296,084	$303,028
Gas Heat Pumps for Commercial Buildings	$737,954	$479,242	$326,409
Industrial and Large Commercial GHG Audit	$808,082	($1,869,835)	($4,138,114)
Research and Development	$10,570,462	$10,570,462	$10,570,462
Total Portfolio	**$102,088,993**	**$158,178,356**	**$210,909,167**

Sensitivity scenario 2: Assuming a flat commodity cost of $2.8/Dth

Pilot	Net UCT Costs 5-Year Plan	Net UCT Costs Lifetime	Net Quantified Costs Lifetime
Hennepin County Anaerobic Digestion of Organic Materials	$3,087,599	$7,967,021	$6,822,228
Ramsey and Washington Counties Anaerobic Digestion of Organic Materials	$11,012,412	$28,468,241	$21,973,214
Renewable Natural Gas RFP Purchase	$35,671,838	$69,771,952	$54,541,642
Green Hydrogen Blending into Natural Gas Distribution System	$5,124,741	$22,270,547	$21,066,814
Industrial or Large Commercial Hydrogen and Carbon Capture Incentives	$3,844,663	$2,177,862	$63,857,300
Industrial Methane and Refrigerant Leak Reduction	$1,348,536	$1,098,606	($778,707)
Urban Tree Offset	$327,269	$266,387	$52,926
Carbon Capture Rebates for Commercial Buildings	$1,407,121	($356,745)	($2,582,866)
New Networked Geothermal Systems	$11,640,643	$39,580,884	$38,519,372
Decarbonizing Existing District Energy Systems	$1,089,056	($4,157,475)	($6,970,724)
New District Energy System	$318,433	($1,202,962)	$13,666,489
Industrial Electrification Incentive	$557,161	$11,816	($219,348)
Commercial Hybrid Heating	$7,127,120	$4,753,441	$4,640,566
Residential Deep Energy Retrofit and Electric Air Source Heat Pump	$13,590,975	$8,343,462	$23,128,312
Small/Medium Business GHG Audit	$2,299,232	$1,640,596	$1,684,687
Residential Gas Heat Pump	$379,580	$304,838	$309,794
Gas Heat Pump for Commercial Buildings	$757,785	$559,808	$410,530
Industrial and Large Commercial GHG Audit	$1,062,328	($555,161)	($2,631,320)
Research and Development	$10,570,462	$10,570,462	$10,570,462
Total Portfolio	**$111,216,953**	**$191,513,580**	**$248,061,371**

Sensitivity scenario 3: Assuming a flat commodity cost of $8.8/Dth

Pilot	Net UCT Costs 5-Year Plan	Net UCT Costs Lifetime	Net Quantified Costs Lifetime
Hennepin County Anaerobic Digestion of Organic Materials	$2,321,780	$5,831,927	$4,667,232
Ramsey and Washington Counties Anaerobic Digestion of Organic Materials	$8,182,649	$20,605,182	$14,027,430
Renewable Natural Gas RFP Purchase	$25,470,276	$48,498,779	$32,876,907
Green Hydrogen Blending into Natural Gas Distribution System	$4,827,029	$20,548,319	$19,427,757
Industrial or Large Commercial Hydrogen and Carbon Capture Incentives	$3,558,503	$635,711	$62,370,047
Industrial Methane and Refrigerant Leak Reduction	$921,950	$694,567	($1,202,434)
Urban Tree Offset	$335,877	$266,387	$61,534
Carbon Capture Rebates for Commercial Buildings	$893,480	($2,704,673)	($4,959,517)
New Networked Geothermal Systems	$11,433,065	$34,586,386	$33,769,743
Decarbonizing Existing District Energy Systems	($1,266,986)	($12,430,723)	($15,500,014)
New District Energy System	($172,326)	($3,459,803)	$11,358,435
Industrial Electrification Incentive	$315,515	($778,852)	($1,025,958)
Commercial Hybrid Heating	$6,808,704	$3,008,361	$3,022,569
Residential Deep Energy Retrofit and Electric Air Source Heat Pump	$13,601,037	$4,964,782	$20,065,664
Small/Medium Business GHG Audit	$2,253,420	$1,254,947	$1,346,830
Residential Gas Heat Pump	$383,919	$289,028	$303,295
Gas Heat Pump for Commercial Buildings	$718,563	$412,502	$276,096
Industrial and Large Commercial GHG Audit	$530,875	($2,784,950)	($4,899,947)
Research and Development	$10,570,462	$10,570,462	$10,570,462
Total Portfolio	**$91,687,792**	**$130,008,340**	**$186,556,132**

In the Matter of
CenterPoint Energy Natural Gas Innovation Act (NGIA)
Innovation Plan

Petition of CenterPoint Energy

EXHIBIT F: LIFECYCLE GHG CALCULATION DETAILS

Docket No. G-008/M-23-215

June 28, 2023

PUBLIC VERSION

Attachments 1-10 are provided separately as excel files. These files are too large to upload into the Commission's EDockets system. To view the Attachments please visit: https://www.centerpointenergy.com/en-us/InYourCommunity/Pages/NGIA-Filing.aspx?sa=mn&au=res

I. Introduction

This Exhibit describes how CenterPoint Energy and ICF evaluated the lifecycle[1] greenhouse gas ("GHG") intensity, defined as kilograms of carbon dioxide equivalent ("kgCO_2e") per unit (e.g., per dekatherm ("Dth") of fuel or per pilot participant) of each innovative resource included in the shortlisted pilots as well as the lifecycle GHG intensity of geologic natural gas for comparison. The Minnesota Public Utilities Commission's ("Commission's") June 1, 2022 Order Establishing Frameworks for Implementing Minnesota's Natural Gas Innovation Act in Docket No. G-999/CI-21-566 ("Frameworks Order") provides significant guidance on how lifecycle GHG intensity should be calculated for each innovative resource.

Lifecycle GHG intensity of certain innovative resources and associated pilot GHG impact forecasts were calculated using the Greenhouse gases, Regulated Emissions, and Energy use in Technologies ("GREET") model, developed by the Argonne National Laboratory ("ANL"). As required by the Frameworks Order, GREET was used to calculate the lifecycle carbon intensity of geologic natural gas, renewable natural gas ("RNG"), and power-to-hydrogen. The latest version of GREET Fuel Cycle model at the time of filing, GREET1_2022, was released in October 2022 and last revised on March 28, 2023, is the foundation of the Plan's modeling.[2] For district energy and carbon capture, which are not directly represented in the GREET model, academic research and information provided by technology manufacturers, CenterPoint Energy customers, and respondents to CenterPoint Energy's request for information ("RFI") were referenced to build lifecycle GHG emissions profiles.[3] CenterPoint Energy and ICF followed the guidance of the Frameworks Order in calculating the GHG intensity of strategic electrification.

CenterPoint Energy provides the following Attachments in support of this Exhibit[4]:

- Attachment 1: GREET model spreadsheet calculating the lifecycle GHG intensity of geologic natural gas
- Attachment 2: GREET model spreadsheet calculating the lifecycle GHG intensity of electricity
- Attachment 3: GREET model spreadsheet calculating the lifecycle GHG intensity for the RNG Produced from Hennepin County Organic Waste pilot
- Attachment 4: GREET model spreadsheet calculating the lifecycle GHG intensity for the RNG Produced from Ramsey & Washington Counties Organic Waste pilot
- Attachment 5: GREET model spreadsheet calculating the lifecycle GHG intensity for RNG Archetype – Wastewater Resource Recovery Facility

[1] As defined in the Minn. Stat. § 216B.2427, subd. 1(j), "lifecycle greenhouse gas emissions" reflects the aggregate GHG emissions resulting from the production, processing, transmission, and consumption of an energy resource.

[2] Excel Model (anl.gov)

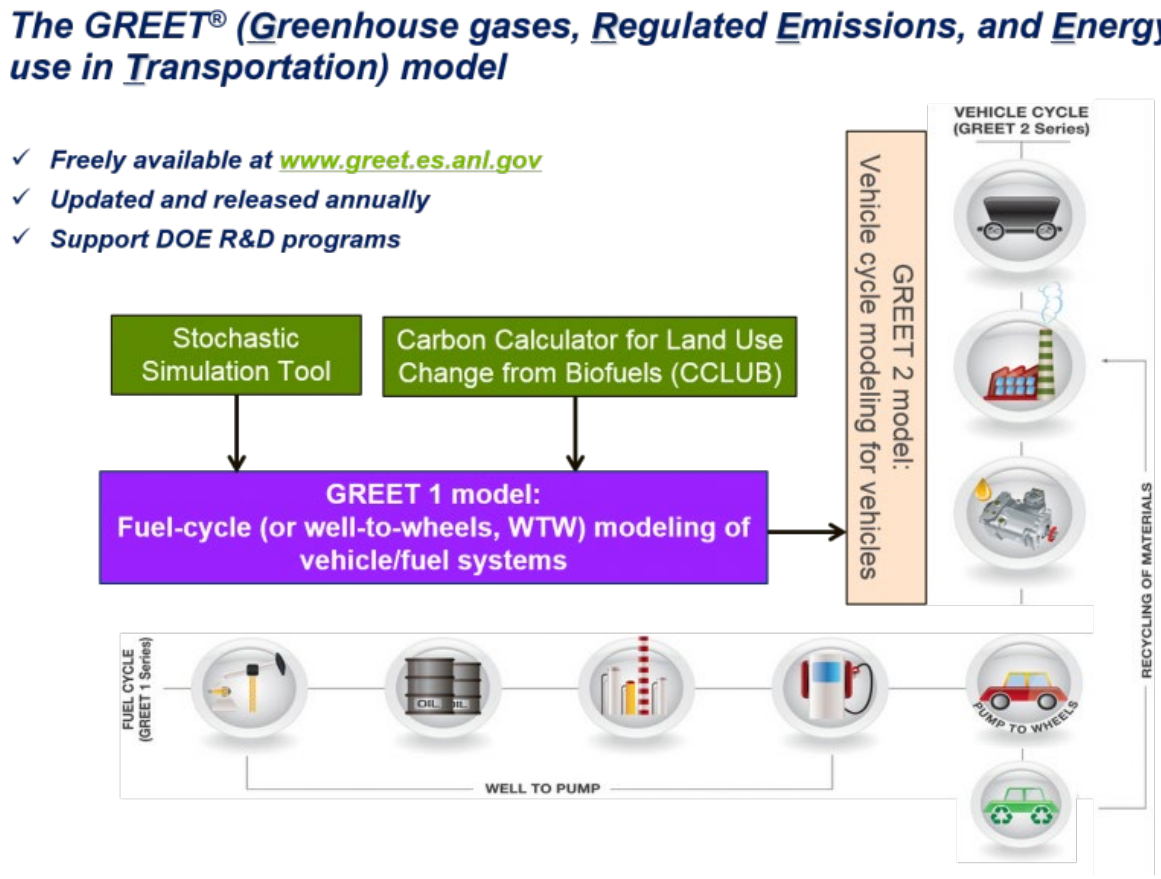
[3] As required by the Frameworks Order, CenterPoint Energy and ICF used lifecycle accounting principles consistent with ANL GREET for these resources.

[4] Attachments 1-10 are provided separately as excel files in both .xlsm and .xls file formats. These files are too large to upload into the Commission's EDockets system. To view the Attachments please visit: https://www.centerpointenergy.com/en-us/InYourCommunity/Pages/NGIA-Filing.aspx?sa=mn&au=res

- Attachment 6: GREET model spreadsheet calculating the lifecycle GHG intensity for RNG Archetype – Dairy Manure
- Attachment 7: GREET model spreadsheet calculating the lifecycle GHG intensity for RNG Archetype – Food Waste
- Attachment 8: GREET model spreadsheet calculating the lifecycle GHG intensity for RNG Archetype – Landfill Gas
- Attachment 9: GREET model spreadsheet calculating the lifecycle GHG intensity for the Green Hydrogen Blending into Natural Gas Distribution System pilot
- Attachment 10: GREET model spreadsheet calculating the lifecycle GHG intensity for Green Hydrogen Archetype for Industrial or Large Commercial Facility

II. GREET Overview

Figure 1: The ANL GREET Model (via US DOE Bioenergy Technologies Office)[5]



Fundamentally, GREET is a transportation emissions model. It can model fuel lifecycle from well-to-wheels. Consequently, the model does not automatically generate NGIA-appropriate GHG intensity metrics, as GREET is designed to output results in terms of fuel lifecycle

[5] https://www.energy.gov/eere/bioenergy/articles/greet-greenhouse-gases-regulated-emissions-and-energy-use-transportation

emissions for vehicle end uses rather than end uses in buildings and industry. For NGIA stationary fuel applications, the well-to-gate and fuel transmission sections of GREET 1 Fuel Cycle lifecycle model (as shown in Figure 1 above) is used. ICF's GHG analysts used the GREET model with customized parameters specific to CenterPoint Energy's pilots' innovative resources for relevant lifecycle stages, assuming the innovative resource will be used in a boiler,[6] (upstream emissions are generally aligned with GREET 1's well-to-pump framework, with stationary end use instead of "wheel" end use). ICF then aggregated the lifecycle GHG emissions into carbon intensity metrics in terms of $kgCO_2e$/Dth. ICF leveraged its knowledge of the model to build representations of the uses of innovative resources for the pilots profiled in the Plan.

In many respects, the GREET model serves the NGIA as a library/lifecycle inventory, providing one of the best available repositories of conventional and alternative fuel emissions data. GREET's default values were leveraged unless pilot-specific data was available (as was the case for the Hennepin County Anaerobic Digestion of Organic Materials and Ramsey and Washington Counties Anaerobic Digestion of Organic Materials pilots, for example) or subject matter expertise indicated that a different approach would be more appropriate. ICF RNG experts suggested that RNG developers today use practices not aligned with GREET's assumed default practices for energy use during RNG production, namely, most RNG producers do not use biogas for heat or electricity onsite, opting instead for utility-sourced energy supplies, which implies a tradeoff between GHG intensity and RNG production quantity.[7]

III. Geologic Natural Gas GHG Emissions Intensity

The Frameworks Order dictates that innovative resources should be evaluated against the emissions that would be released from geologic natural gas use if not for the pilot. GREET was used to calculate conventional geologic natural gas's lifecycle GHG emissions in terms of $kgCO_2e$/Dth. In GREET, fuel used as a "feedstock" is ANL's way of aggregating the fuel extraction, processing, and distribution emissions – essentially all relevant lifecycle emissions for a fuel up to the point of consumption/combustion – and this value (12.4 $kgCO_2e$/Dth)[8] was pulled from the GREET model for natural gas, and then added to GREET's combustion emissions metric for natural gas burned in a small industrial boiler (10-100 MMBtu/hour input), 53.74 $kgCO_2e$/Dth. The total carbon intensity metric used to evaluate the Plan, based on GREET, was 66.14 $kgCO_2e$/Dth for geologic natural gas. The GREET spreadsheet showing the calculation of this value is included in this Exhibit.

The small industrial boiler was deemed to be most representative of the various stationary end uses profiled in the Plan while remaining consistent with the Frameworks Order. Namely, the Frameworks Order cited the GHG "intensity of geologic natural gas delivered to end use

[6] Higher heating value (HHV) was referenced in emissions modeling for the Plan given its stationary combustion focus.

[7] See RNG section of this Exhibit for more details.

[8] The GREET value (NG tab, Cell B103) is presented as 13,740 gCO2e/MMBtu, lower heating value (LHV) basis, based on a transmission distance of 680 miles. Converting to higher heating value (HHV) basis (convention for stationary fuel use) and kgCO2e/Dth yields 12.4 $kgCO_2e$/Dth.

customers via the natural gas distribution system [as] 66.16 kilograms per dekatherm using the [2021] Argonne GREET model." The Frameworks Order does not specify which stationary end use in GREET should be assumed to be consistent with the Framework's modeling assumptions, and at the same time, it indicates that one metric can be assumed to be representative of all stationary geologic natural gas end uses. Our GHG analysts concluded that the marginal variance in combustion profiles across different boilers was inconsequential to profiling the impact of pilots, given the other areas of uncertainty in GHG modeling at this level. Further, to attempt to use different lifecycle GHG metrics for each combustion use of natural gas is a level of detail that would overcomplicate modeling for utility-wide pilots of innovative resources with diverse customer appliances. Finally, because ANL built GREET to profile the fuel-to-vehicle supply chain, GREET's ingrained metrics for stationary fuel combustion are for commercial and industrial scale uses, and residential options are not available.

RNG and hydrogen were profiled using GREET as well. When alternative fuels are proposed as replacements for geologic natural gas, modeling assumed that they would be burned in the same equipment, i.e., a small industrial boiler.

IV. Electricity GHG Emissions Modeling

The electricity GHG emissions modeling followed the Frameworks Order guidance to leverage electric-utility-specific generation mix information for each pilot when possible. Of the RNG pilots, the Hennepin County Anaerobic Digestion of Organic Materials and Ramsey and Washington Counties Anaerobic Digestion of Organic Materials pilots are the only two that, at this stage, CenterPoint had confirmation of the specific RNG facility's location and associated grid electricity provider. These two projects are planned to be in Xcel Energy's electric service territory. Xcel Energy's service territory was also assumed for the "New District Energy Pilot" as that pilot was largely modeled after a specific interested CenterPoint Energy customer. Modeling of Xcel's electric generation and associated fuel mix cited Xcel's "Alternate Plan" from their Upper Midwest Energy Plan for a grid mix forecast.[9]

When electric utility-specific information was not available, including when the locations of participants (and hence the electric utility serving them) was not yet known, a state-specific generation mix from National Renewable Energy Laboratory ("NREL") Standard Scenarios was used. As presented for comment in CenterPoint Energy's February 2023 regulatory stakeholder meeting, CenterPoint Energy chose to use the Minnesota data in the Mid-Case, Nascent Techs, Current Policies 2022 NREL Standard Scenario.[10] This scenario reflects the grid impacts of existing policies,[11] including the Inflation Reduction Act, and otherwise makes reasonable

[9] Midwest Energy Plan | Xcel Energy; Alternate Plan in Upper Midwest Energy Plan - Reply Comments.pdf (xcelenergy.com). Note that Xcel Energy has not yet filed a newer Integrated Resource Plan accounting for impacts of the Inflation Reduction Act.

[10] 2022 NREL Standard Scenarios Technical Report; NREL Standard Scenario Viewer

[11] Both the Xcel Alternate Plan and NREL grid scenarios referenced in the Plan predate the enactment of the Minnesota Clean Electricity Bill, S.F. 4 (2023). They align with the Clean Electricity Bill's 2030 clean electricity targets but fall short of the bill's interim targets between 2030 and 2050. When new grid data is published from both sources, they are expected to align with all active policies and CenterPoint Energy's NGIA GHG accounting will be updated accordingly in annual NGIA status report filings.

assumptions about the future of the grid, aligned with previous grid modeling guidance from the Commission and earlier filings.

As required by the Frameworks Order, strategic electrification was modeled using a 50 percent blend of the appropriate grid mix (NREL or Xcel) and 50 percent wind.[12] For the power-to-hydrogen pilots, carbon-free electricity was assumed.[13]

Table 1: Grid Mix Used for GHG Lifecycle Modeling for Each Shortlisted Pilot

Short-Listed Pilot		Grid Mix Modeled
1	RNG Produced from Hennepin County Organic Waste	Xcel
2	RNG Produced from Ramsey & Washington Counties Organic Waste	Xcel
3	RNG Request for Proposal (RFP) Purchase – Wastewater	NREL
4	RNG RFP Purchase – Dairy Manure	NREL
5	RNG RFP Purchase – Food Waste	NREL
6	RNG RFP Purchase – Landfill Gas (LFG)	NREL
7	Green Hydrogen Blending into Natural Gas Distribution System	Carbon-free Electricity
8	Industrial or Large Commercial Hydrogen and Carbon Capture Incentives – Hydrogen Measures	Carbon-free Electricity
9	Industrial Methane and Refrigerant Leak Reduction	No Electricity Impact
10	Urban Tree Carbon Offsets	No Electricity Impact
11	Industrial or Large Commercial Hydrogen and Carbon Capture Incentives – Carbon Capture Measures	NREL
13	Carbon Capture Rebates for Commercial Buildings	NREL
14	New Networked Geothermal Systems	NREL
15	Decarbonizing Existing District Energy Systems	NREL
16	New District Energy System	Xcel
17	Industrial Electrification Incentives	NREL/wind 50/50

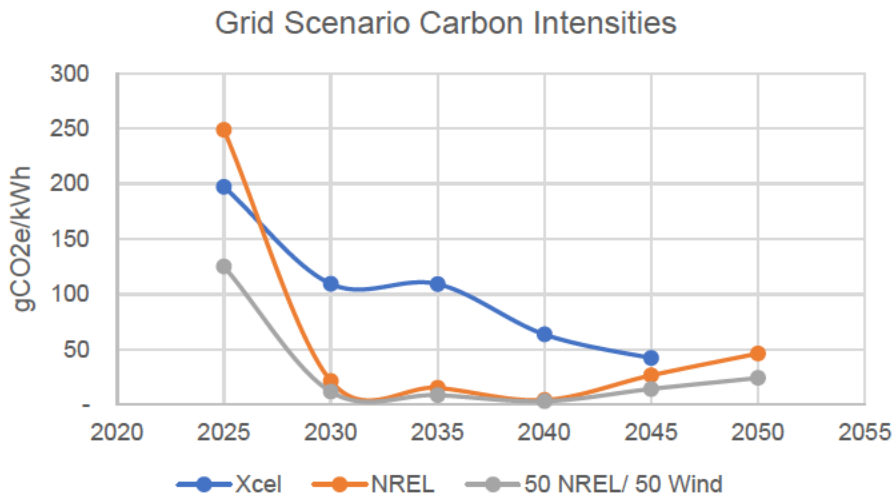
[12] The 50/50 modeling methodology used for strategic electrification grid factors was outlined by Xcel Energy in Exhibit B to CenterPoint Energy's January 13, 2022 Lifecycle GHG Accounting Framework Proposal in Docket No. G-999/M-21-566.

[13] The NGIA requires that carbon-free electricity be used to produce hydrogen. It is possible that non-carbon-free electricity could be used for other parts of power-to-hydrogen projects such as pumping water or hydrogen compression. CenterPoint Energy plans to use carbon-free electricity for all parts of Pilot 7. For Pilot 8, it is possible that participating customers could select to use non-carbon-free electricity for parts of the power-to-hydrogen production, however using multiple sources of electricity may complicate their projects and increase their upfront costs, so for the purposes of modeling ICF assumed that one carbon-free electricity source would be used for all aspects of the project. If participating customers select to use non-carbon-free electricity for portions of participating power-to-hydrogen projects, CenterPoint Energy will factor that into its evaluation of the lifecycle GHG intensity of actual projects completed and reported in annual NGIA Status Reports.

Short-Listed Pilot		Grid Mix Modeled
18	Commercial Hybrid Heating	NREL/wind 50/50
19	Residential Deep Energy Retrofits and Electric Air Source Heat Pumps	NREL/wind 50/50
20	Small/Medium Business GHG Audit	NREL
21	Residential Gas Heat Pumps	No Electricity Impact
22	Gas Heat Pumps for Commercial Buildings	No Electricity Impact
25	Industrial and Large Commercial GHG Audit	NREL

Xcel and NREL grid mix information was matched with GREET grid mix categories for GHG modeling. GREET provides the GHG intensity for each of the types of electricity generation included in Xcel and NREL forecasts. The electric GHG intensities (in terms of grams of CO_2e per kilowatt-hour of electricity, gCO_2e/kWh) that resulted were leveraged for pilots that expect to increase electric demand explicitly, such as strategic electrification pilots, and in the GHG modeling for other pilots like RNG, where electricity use influences the overall $kgCO_2e/Dth$ of RNG produced for each pilot. Working from published generation data on five- and two-year intervals for Xcel and NREL respectively, the grid carbon intensities were generated on five-year intervals for modeling consistency across pilots. Pilot emissions forecasting for multi-year investments in RNG consequently incorporated expected changes in the electricity system into updated RNG GHG intensity factors on five-year intervals.[14]

Figure 2: Grid GHG Intensities Used for Pilot Modeling



[14] NREL modeling provides bi-annual forecasts whereas Xcel's IRP only provides five-year increments. For consistency and simplicity and to reduce the number of modeling runs required, CenterPoint Energy and ICF modeled each five-year window using single values from either NREL or Xcel rather than revaluing impacts every two years for pilots using NREL values. NREL values selected align with the five-year marks set by Xcel data. Xcel Energy proposed a five-year update process in its Exhibit B attachment to CenterPoint Energy's January 13, 2022 Lifecycle GHG Accounting Framework Proposal in Docket No. G-999/M-21-566 and no party objected to the simplification.

In its Midwest Energy plan, Xcel had not published data for its Alternate Plan past 2045, but it has expressed intent for its electricity reach net zero by 2050.[15]

V. Renewable Natural Gas GHG Emissions Intensity

As noted above, CenterPoint Energy and ICF used GREET to model the lifecycle GHG intensity of all RNG pilots. Excel files of GREET models showing the calculations for each shortlisted RNG pilot are included as Attachments to this Exhibit. In this section, CenterPoint Energy describes various choices ICF and CenterPoint Energy made in applying the GREET model to RNG pilots.

Assumed No Biogas CHP

In its default settings, GREET assumes some of the produced biogas from digesters is used in an onsite combined heat and power ("CHP") setup, wherein heat from the boiler can meet the digester thermal demand while the electricity generated can be used to meet the onsite electricity demand for biogas processing, or exported if excess exists. ICF experts suggested that, given the high financial value of RNG as a low-carbon fuel, it is more common for RNG producers to use grid electricity and/or utility natural gas supplies for their energy demands, maximizing production volumes of RNG rather than leverage parasitic use of biogas to produce a smaller volume of RNG with a slightly lower GHG impact. Accordingly, ICF and CenterPoint Energy evaluated scenarios where biogas is not sent to a CHP system. In the "No CHP" scenario, grid electricity replaces electricity via CHP fed by biogas, and biogas is sent to a boiler for heat demands in the RNG setup. In the "No CHP/Boiler" scenario, utility-sourced geologic natural gas and grid electricity replace biogas consumption. For archetype RNG pilots, these scenario modifications were the key structural diversions from ANL GREET defaults, the other change being electric grid mix profiles that align with Frameworks Order requirements discussed above. For all other modeling inputs to the RNG archetypes' GHG intensity calculations, ANL defaults were used. The following table demonstrates which scenario was used to characterize the "expected" GHG impact of a given pilot, based on GREET limitations and ICF insight on standard practices for RNG projects of the various feedstocks considered. Thus, the table's headers denote which, if any, inputs diverged from ANL GREET standard defaults. Note that the Custom Inputs category is limited to the pilots where CenterPoint was provided sufficient data from the potential pilot partners to overwrite ANL GREET defaults, namely the pilots with Hennepin County and Ramsey and Washington Counties, where they do not anticipate using biogas in a CHP system.

[15] Carbon Reduction Plan | Our Commitment Xcel Energy

Table 2: Scenarios Used to Characterize Lifecyle GHG Emissions of RNG

RNG Pilot	ANL Default	ANL Default, No Biogas to CHP; Grid Electricity	ANL Default, No Biogas to CHP or Boiler; Grid Electricity & Utility NG	Custom Inputs, No Biogas to CHP or Boiler; Grid Electricity & Utility NG
Hennepin County Organic Waste				✓
Ramsey Washington Counties' Organic Waste				✓
Wastewater RFP Archetype		✓		N/A
Dairy RFP Archetype			✓	N/A
Food Waste RFP Archetype			✓	N/A
Landfill Gas RFP Archetype		✓	N/A – ANL default for landfill gas RNG already assumes no heat needs	N/A

GHG intensity modeling assumptions and modifications to GREET defaults for each RNG pilot are outlined in detail in the "Data Inputs", "GREET 2022 Modifications", and "ICF_Inputs_Calcs" tabs added to the GREET model spreadsheets filed as Attachments to this Exhibit for each RNG pilot.

RNG Produced from Hennepin County Organic Waste

RNG production in this Hennepin County pilot was modeled as an anaerobic digestion facility fed by over 30,000 metric tons per year ("tpy") of organics, approximately 75 percent of which would be landfill-avoided food waste (source-separated organics ("SSO")), supplemented by approximately 25 percent of other green organics to facilitate digestion. The County shared feedstock characteristics, feedstock handling insight, expected energy consumption and flaring rates, as well as anticipated RNG production quantities. These insights and Xcel's grid mix emissions metrics over an anticipated 10-year pilot agreement informed a calculation of -1.96 $kgCO_2e$/Dth RNG pilot lifetime weighted average GHG intensity.[16]

The lifecycle GHG emissions reductions are a function of the difference between the lifecycle GHG intensity of geologic gas (66.14 $kgCO_2e$/Dth) and the pilot's -1.96 $kgCO_2e$/Dth RNG, multiplied by the modeled pilot size of 41,440 Dth/year of RNG over the estimated 10-year pilot life, calculated to be 28,221 metric tons CO_2e.

RNG Produced from Ramsey & Washington Counties' Organic Waste

RNG production in this pilot was modeled as an anaerobic digestion facility fed by over 60,000 tpy of waste. Approximately 50,000 tpy of this waste will be sourced from Ramsey/Washington Recycling & Energy ("R&E"), in two different streams. R&E will leverage a novel food scrap

[16] "Pilot lifetime weighted" refers to the effect of the changing grid mix on the GHG intensity of RNG produced within the anticipated pilot lifetime. As previously discussed, the Frameworks Order informed a modeling decision to generate 5-year interval updates to grid GHG factors and, subsequently, RNG GHG factors. These RNG GHG intensities were then condensed to a lifetime metric based on anticipated pilot initiation year and duration.

collection program for residents of Ramsey and Washington Counties, anticipated to yield 30,000 tpy of landfill-avoided SSO once the collection program reaches maturity. The Counties also plan to provide an additional approximately 20,000 tpy of organics recovered from the R&E processing facility, considered in GREET modeling to be food waste, captured at the R&E facility using new sortation equipment (landfill-avoided). The Counties will be supplying these organics to a digester facility operator, who will then source the remaining approximately 20 percent of the digester tonnage with green waste to facilitate digestion and other assumed-landfill-avoided food waste (not from the Counties).

The Counties and the planned facility operator shared feedstock characteristics, feedstock handling insight, expected energy consumption and flaring rates, as well as anticipated RNG production quantities. These insights and Xcel's grid mix emissions metrics over an anticipated 10-year pilot agreement informed a calculation of -30.74 $kgCO_2e$/Dth RNG pilot lifetime weighted average GHG intensity. The lifecycle GHG emissions reductions are a function of the difference between the lifecycle GHG intensity of geologic gas (66.14 $kgCO_2e$/Dth), discussed above, and the pilot GHG intensity of -30.74 $kgCO_2e$/Dth RNG, multiplied by the intended purchase of 152,613 Dth/year of RNG over the estimated 10-year pilot life, calculated to be 147,863 metric tons CO_2e.

Renewable Natural Gas Request for Proposal ("RFP") Purchase Archetype Pilots

GREET default inputs for the feedstocks modeled in the archetype pilots were leveraged except where previously outlined in this Exhibit. Further details for these pilots' GHG intensity calculations are denoted in the accompanying spreadsheets.

Like the RNG pilots discussed above, the estimated lifecycle GHG emissions reductions of the potential RFP RNG pilots are a function of the difference between the lifecycle GHG intensity of geologic gas (66.14 $kgCO_2e$/Dth) and the pilot's GHG intensity in terms of $kgCO_2e$/Dth RNG, multiplied by the assumed Dths of RNG over the estimated 10-year pilot life. Both GHG intensity and aggregate lifetime GHG impact are summarized for the four archetype RNG pilots. RNG GHG intensity is project-specific; these estimates are meant to be representative of archetypical operations.

Table 3: Estimated GHG Impact of RNG RFP Pilots

Archetype Pilot	**Pilot Lifetime Weighted Average GHG Intensity** *(kg CO_2e/Dth RNG)*	**Estimated Pilot Size** *(Dth/year)*	**Pilot Lifetime Total GHG Impact** *(metric tCO_2e/ 10 years)*
Wastewater	13.03	50,000	26,556
Dairy Manure	-32.81	10,000	9,895
Food Waste	-49.65	220,000	254,739
Landfill Gas	12.79	128,750	68,694

VI. Hydrogen GHG Emissions Intensity

The Frameworks Order provides that:

> *"Utilities may assume that hydrogen produced using carbon-free electricity has no greenhouse gas emissions associated with its production but may have greenhouse gas emissions associated with electricity used for compression, transportation, blending, injection, purification and pumping of water, or other purposes."*

Modeling for hydrogen pilots assumed that carbon-free electricity would be generated or purchased to cover all electricity used in power-to-hydrogen production processes, consistent with CenterPoint Energy's current hydrogen efforts. The GHG emissions from electrolytic hydrogen production are driven by the emissions intensity of the electricity source, and thus, production and handling yield zero $kgCO_2e$/Dth hydrogen for both pilots. Also, hydrogen combustion[17] does not release CO_2, and when a blend of hydrogen and natural gas is combusted, the reduced carbon in the fuel mix yields a reduction in CO_2 emissions. Thus, the lifecycle GHG intensities of the Plan's hydrogen pilots are zero, yielding a full reduction of natural gas emissions for every Dth of natural gas displaced.

Green Hydrogen Blending into Natural Gas Distribution System

CenterPoint Energy plans to use carbon-free electricity for all aspects of the proposed hydrogen facility, including the compression, transportation, blending, injection, and purification and pumping of water. Accordingly, the lifecycle GHG intensity of this pilot is zero $kgCO_2e$/Dth and the lifecycle emissions reductions are equal to the full emissions from displaced geologic natural gas, estimated to be 21,160 Dth per year. As a result, the lifecycle GHG emissions reductions are the lifecycle GHG intensity of geologic gas (66.14 $kgCO_2e$/Dth), discussed above, multiplied by the displaced Dths over the estimated 20-year pilot life, calculated to be 27,993 metric tons CO_2e.

Industrial or Large Commercial Hydrogen and Carbon Capture Incentives – Hydrogen Measures

ICF assumed that most large commercial or industrial customers seeking to install a green hydrogen pilot will use the same carbon-free electricity source for hydrogen production as they use for any compression, transportation, and purification and pumping of water due to added complexity of using different electricity sources for different components of the same system. Accordingly, ICF estimated the lifecycle intensity of this pilot to be zero $kgCO_2e$/Dth and the lifecycle emissions reductions are equal to the full emissions from displaced geologic natural gas for the hydrogen measures in this pilot. As noted in Exhibit W, CenterPoint Energy will evaluate the sources of electricity used for each actual hydrogen project and adjust reported GHG emissions for the projects accordingly. Altogether, the lifecycle GHG emissions reductions are the lifecycle GHG intensity of geologic gas (66.14 $kgCO_2e$/Dth), discussed above, multiplied by the displaced dekatherms (estimated to be 42,851 Dth per participant per year) multiplied by one participant over the estimated 20-year measure life, calculated to be 56,330 metric tons CO_2e in total.

[17] In a perfect combustion reaction, hydrogen reacts with oxygen and creates H_2O, water vapor. In practice, H_2 is not burned in pure O_2, but in air, which is ~78 percent nitrogen, so NO_x is also emitted. Though this does not impact hydrogen pilots' GHG emissions, it is an air quality consideration for power-to-hydrogen pilots in the Plan.

VII. Carbon Capture Pilots GHG Emissions Modeling

The Frameworks Order dictates that utilities must "use project-specific data as available and principles consistent with Argonne GREET" for carbon capture pilots. Where possible, CenterPoint Energy, with support from potential future partners and analysts at ICF, used available research to guide the carbon capture pilot lifecycle GHG assessments.

Industrial Methane and Refrigerant Leak Reduction

The Industrial Methane and Refrigerant Leak Reduction pilot's GHG benefit was modeled based on GREET's methane 100-year global warming potential of 29.8,[18] via the Intergovernmental Panel on Climate Change Sixth Assessment Report. The pilot assumes that on average, each participating facility will reduce annual methane leaks by 301 Dth/year and that these leaks would have otherwise continued for a period of 5 years. This assumption represents 0.25 percent of the annual gas consumption for CenterPoint's largest industrial and commercial customers.[19] Using the pilot's assumed reduction in methane leaks, the density of methane, and a delivered natural gas methane composition of 84.5 percent, the mass of fugitive methane reductions was translated into carbon dioxide equivalents. Accordingly, the lifecycle GHG emissions reductions are equal to the carbon intensity of the leaked gas, estimated to be 115,116 $kgCO_2e$/year/participant, multiplied by the number of participants (50 customers) over the course of the estimated measure life (5 years), calculated as 33,763 metric tons CO_2e.

Urban Tree Carbon Offsets

Each City Forest Credit ("CFC") in the Urban Tree Carbon Offsets Program pilot represents an offset of one tCO_2e (equivalent to 1,000 $kgCO_2$) based on published guidance from the program.[20] Accordingly, total lifecycle GHG reductions are estimated to be the proposed number of carbon credits to be purchased (4,500) multiplied by the equivalent carbon offset per credit, calculated to be 4,500 metric tons CO_2e in total.

[18] Global Warming Potential (GWP) is a measure of the warming capacity of the emissions of one ton of a greenhouse gas relative to one ton of CO_2 emissions over a given period; it contextualizes GHG emissions. So, 1 ton of methane has the global warming potential over 100 yrs of 29.8 tons of CO_2.

[19] This is an assumption being made in an area where there is a lot of uncertainty. The testing in this pilot would quantify the leaks that are identified so that actual reductions can be reported for NGIA savings. The respondent to the RFI that proposed this pilot initially proposed that a higher level of leak reduction might be possible, so this could be viewed as conservative (i.e., GHG reduction impacts may be higher than what is calculated here, if leak reduction rates are higher). One EPA estimate of methane leaks from industrial facilities calculated the rate at up to 5 percent, however this work was concentrated on refineries, and we do not expect this level to be common at most industrial facilities. Other work in California, in the commercial sector, has found leak rates ranging between 0.14% - 0.28% of total customer consumption (https://www.energy.ca.gov/sites/default/files/2021-05/CEC-500-2020-048.pdf). Estimates are further complicated by the fact that in some studies, many facilities have no/minimal leaks while a few facilities make up the majority of total leaks.

[20] MPRB 2021 Project Design Document and Attachments (cityforestcredits.org)

Industrial or Large Commercial Hydrogen and Carbon Capture Incentives – Carbon Capture Measures

The Archetype Carbon Capture Pilot for Industrial or Large Commercial Facilities anticipates completing a full lifecycle GHG assessment for each completed project, because the actual GHG impact of the pilot will be subject to customers engaged and CO_2 utilization approaches that suit the project partner(s). Prospective GHG analysis for this pilot needed to reflect a high-level estimate of potential impact based on best-available insight, knowing that actual impacts will vary. Based on Minnesota's geology, which lacks the geologic formations that would typically be used to permanently sequester carbon, it is unlikely that captured CO_2 will be sequestered underground locally. Thus, the high-level GHG estimate for the pilot is framed around CO_2 utilization. ICF has studied available utilization techniques and found that utilization in concrete production is one of the most established methods of utilizing captured CO_2 with substantive market growth potential.[21] As a result, the GHG estimate for this pilot is based on available research on carbon capture and utilization in concrete, though in practice CenterPoint Energy is open to other approaches that can demonstrate meaningful GHG reductions, and acknowledges that there may be better CO_2 utilization options available than what is assumed here.

An initial literature review found that CarbonCure's research[22] into its commercial process was commonly cited as indicative of the GHG impact of CO_2 utilization in concrete. The CarbonCure report determined that approximately 60 percent of a carbon dioxide stream that is injected into concrete production is retained, solidified as carbonate, and stabilized.[23] CarbonCure's research goes on to explore potential added GHG savings from displacing emissions from conventional concrete production, but ICF experts suggested taking a more conservative approach and limiting the scope of GHG modeling for CenterPoint Energy's pilot to the capture process at a commercial/industrial site.[24] The carbon capture unit is estimated to be 90 percent effective at

[21] C2ES. (2019). "Carbon Utilization—A Vital and Effective Pathway for Decarbonization, Summary Report." Retrieved from https://www.c2es.org/site/assets/uploads/2019/09/carbon-utilization-a-vital-and-effective-pathway-for-decarbonization.pdf/.

[22] CarbonCure-Case-Studies.pdf (conewagomfg.com)

[23] Converted to a chemically stable form. Chemically-stabilized CO_2 may be released if the end use form degrades or undergoes a chemical reaction, thereby releasing the CO_2.

[24] CO_2 injection with cement can reduce the emissions released from the typical concrete production process. In the CarbonCure study, this reduction in lifecycle GHG emissions is much larger than the emission reductions generated from storing captured carbon within the concrete. This NGIA pilot is not claiming pilot lifecycle GHG reduction credit for improving the concrete production process because this pilot does not envision funding the associated equipment upgrades at a concrete facility. Instead, the pilot envisions that a concrete facility pursuing such upgrades could leverage the CO_2 stream from the industrial carbon capture unit supported through NGIA, and that this would displace other industrial sources of CO_2 production that the concrete facility would otherwise have relied upon. From this perspective, the NGIA assumption to only credit this pilot with the 60 percent of CO_2 that is absorbed in concrete is conservative, since it is possible that the pilot could qualify for a 100 percent displacement credit if (absent the NGIA pilot being used as the CO_2 source) the concrete facility was going to source CO_2 from elsewhere and still lose 40 percent of that alternative CO_2 source (portion that is not absorbed).

capturing CO_2 from the commercial/industrial partner's combustion emissions based on available technology. Consequently, accounting for the 90 percent carbon capture efficiency and 60 percent utilization efficacy of captured carbon, GHG modeling for CenterPoint Energy's archetype CO_2 capture and utilization pilot assumed that the carbon capture and utilization process might result in a 54 percent combustion GHG emissions reduction from a baseline facility without the pilot. CO_2 capture potential was based on CenterPoint Energy data on its large commercial and industrial customers' natural gas consumption, to ensure that a number of the utility's customers would be large enough gas consumers to host such a system. ICF carbon capture experts guided modeling of CO_2 capture efficacy from these combustion streams based on their market insight into available capture technologies. GHG modeling of the pilot also accounted for the additional GHG emissions via energy consumption from running the capture unit.

As outlined above, CenterPoint Energy modeled a representative pilot where an industrial customer burning geologic gas with a carbon capture and utilization system in place is 54 percent less combustion emissions-intense than it would have been without the pilot. Based on a pilot-representative industrial customer facility natural gas firing rate of 22 MMBtu/hour, operating at average annual capacity factor of 75 percent, a 53.74 kg CO_2e/Dth combustion factor for geologic natural gas in a small industrial boiler via GREET (the combustion piece of the 66.14 kgCO_2e/Dth lifecycle factor), and 90 percent capture efficiency, the industrial facility is estimated to capture 6,951 tCO_2e/year, where 60 percent of that could be utilized in concrete (reduced from baseline). After accounting for the limits of the CO_2 utilization process and the associated GHG emissions added from the 757,662 kWh/year electricity use at the facility for compression, as well as for the added 23,633 Dth/year of geologic natural gas used at the facility to power the carbon capture unit (3.4 Dth of gas needed per metric ton of CO_2 captured), the overall lifecycle GHG reduction for the pilot over its 20-year life was quantified at 50,865 tCO_2e.

Carbon Capture Rebates for Commercial Buildings

The Carbon Capture Rebates for Commercial Buildings pilot's GHG impacts are based on CleanO2's lifecycle assessment research into its commercial process with CarbinX units.[25] CleanO2's lifecycle GHG analysis factors in annual consumption of natural gas, production of potassium carbonate ("K_2CO_3") that is displaced by the unit's by-product, increase in production of potassium hydroxide ("KOH") required for the units, electricity consumed by the device, production of the feed chemicals required by the capture unit, transportation of chemicals, and manufacture of the machines. Their lifecycle assessment approach is consistent with the principles of GHG accounting in the Frameworks Order. GHG emissions results vary based on installation and depend on a variety of factors including boiler efficiency and runtime. CleanO2's lifecycle assessment is largely based on work done by University of British Columbia ("UBC") researchers, studying a system connected to a 250,000 Btu domestic hot water boiler in a

A conservative estimation approach is aligned with the fact that concrete utilization is being modeled as a representation of one of various approaches CenterPoint Energy is willing to explore for its carbon capture pilot.

[25] Microsoft Word - LCA (Edited) Thomas and Mo Joint April 7.docx (squarespace.com)

30,000 square foot office located in Calgary, Alberta, Canada, which is smaller than the expected average boiler application.

The UBC lifecycle assessment was used primarily to develop an emissions factor that could be used to represent the lifecycle emissions reductions associated with direct carbon capture and net avoided carbon emissions from displacing production of potassium carbonate. The UBC analysis estimated 5,400 $kgCO_2$/year in GHG reductions including: 2,000 $kgCO_2e$/year in reductions from reduced natural gas consumption (efficiency improvements from heat recovery) 905 $kgCO_2$/year from direct capture of CO_2 from the flue gas, and most of the remaining lifecycle savings come from how the potassium carbonate byproduct from the CarbinX units can offset the emissions from the traditional methods of manufacturing potassium carbonate. It follows that, in addition to the 2,000 $kgCO_2$/year in reductions from reduced natural gas consumption, the CarbinX units capturing 905 $kgCO_2$/year actually has the impact of reducing lifecycle emissions by roughly 3,400 $kgCO_2$/year (including additional displacement of emissions otherwise needed to manufacture the CarbinX byproduct). In other words, the total lifecycle emission reductions are 3.76 times higher than the amount of carbon physically captured by the CarbinX units, before accounting for emissions from reduced geologic gas consumption.

CleanO2 has indicated that for an expected average application, the building size and operation is expected to differ from the application studied by UBC. Based on the RFI respondent's expectations for typical systems, instead of reductions in emissions of 905 $kgCO_2$/year from captured carbon, the average units are expected to achieve reductions of roughly 708 $kgCO_2$/year from captured carbon. Additional net lifecycle emissions reductions from avoided manufacture of potassium carbonate were calculated by applying the same 3.76 factor to these 708 $kgCO_2$/year of captured carbon. This would imply 2,662 $kgCO_2$/year of lifecycle savings from the captured carbon, in addition to the GHG savings from reduced gas consumption.[26]

While the UBC lifecycle assessment included an analysis of estimated emissions reductions from decreased natural gas consumption as well as increased emissions from increased electricity consumption, they were not used for the purposes of this pilot's emissions calculations. Instead, emissions reductions from natural gas consumption and electricity use were estimated by using an average quantity of natural gas reduced (Dth) and average quantity of electricity increase (kWh) and applying the geologic gas GHG emissions intensity and electricity GHG emissions intensity factors, respectively, described above.

In summary, lifecycle GHG emissions for this pilot are based on 2,662 $kgCO_2$/year/participant[27] lifecycle savings from the captured carbon, 89.3 Dth/year/participant in natural gas savings, and increased electricity consumption of 993 kWh/year/participant. Each of these components (and associated emission factors) are multiplied by 325 participants and 20 years of pilot life. In total, ICF calculates lifetime emissions reductions to be 55,150 metric tons CO_2e.

[26] The same ratio from the UBC work is considered to be appropriate here under the different operating conditions as it is primarily a reflection of the amount of GHG emission reductions that can be achieved by displacing the traditional methods of manufacturing potassium carbonate, based on a certain volume of byproduct (e.g., amount of captured carbon).

[27] This value excludes savings from reduced natural gas consumption, which is calculated separately.

VIII. Strategic Electrification and District Energy Pilot GHG Emissions Modeling

Strategic electrification pilots and district energy pilots were not modeled in GREET. Instead, the GREET-derived geologic natural gas emission factor, scaled by Dth saved of geologic natural gas, was leveraged in combination with the appropriate GREET-derived grid mix factor scaled by the pilot's increase in electricity use to calculate net pilot impact.

New Networked Geothermal Systems

The units of participation for this pilot were tons of heating/cooling capacity for the networked geothermal system. Natural gas savings and increased electricity use were also estimated on a 'per ton' basis, based on information from planned pilots for this technology in other regions. The 1,407 kWh/year/ton increase in electricity use is based on expectations in a pilot geothermal project design for Rochester, New York. To estimate the decrease in natural gas consumption, first the equivalent natural gas equipment capacity was calculated by converting tons of heating capacity to Btu/hour (by multiplying by 12,000 Btu/hr/ton) and dividing by an assumed average baseline efficiency for the replaced gas equipment of 85 percent. Annual gas savings were then calculated from the equivalent gas equipment capacity by multiplying by 8,760 hours/year and by an assumed geothermal heating capacity factor[28] of 33 percent. The result of this was gas savings of 40.8 Dth/ton for space and water heating, and an additional 1.1 Dth/ton of gas savings was added to approximate savings in other gas end uses at targeted buildings, for a total of 41.9 Dth/year/ton of natural gas savings from this pilot. This pilot would start with an engineering study to identify potential locations and refine the cost and savings estimates.

Lifecycle GHG emissions for this pilot are based on the calculated lifecycle GHG intensity of electricity using NREL and GREET, as described above, and the calculated lifecycle GHG intensity of geologic natural gas, described above. The lifecycle GHG intensity of electricity was multiplied by an estimated increase in electricity consumption of 1,407 kWh/year/ton of heating or cooling capacity at five-year intervals during the 40-year pilot life to determine increased lifecycle GHG emissions resulting from increased electricity consumption. The lifecycle GHG intensity of geologic gas was multiplied by estimated gas savings of 41.9 Dth/year/ton of heating or cooling capacity over the 40-year pilot life to determine reduction in emissions from use of geologic natural gas. In total, ICF calculates total lifetime emissions reductions to be 107,355 metric tons CO_2e.

Decarbonizing Existing District Energy Systems

The 50,000 Dth/year of natural gas savings assumed for each participant in this pilot are based roughly on hypothetical project sizes for two customers that CenterPoint Energy has had

[28] This factor indicates, compared to capacity, how much heating energy is used throughout the year. Three geothermal analyses in New York (for NYSEG/RG&E) with heating-dominant systems, as expected in Minnesota, were considered. Heating capacity factors for these sites were approximately 33 percent (Rochester), 50 percent (Ithaca), and 66 percent (Norwich). This quantification is conservatively based on the lowest geothermal capacity factor observed in New York analyses above. The factors will depend on the customer mix and coincidence of demand on the system, with a higher capacity factor resulting in larger gas savings from the pilot.

preliminary discussions with related to this potential pilot. The increase in electricity use for this pilot is based on data provided by one of the RFI respondents for a potential project that would replace the steam chillers from an existing district energy system with new electric chillers. The 2,440,000 kWh/year is estimated from an expectation for chiller requirements of 0.61 kWh/ton-hr of cooling and an estimated cooling load of 4,000,000 ton-hours per year.

Lifecycle GHG emissions for this pilot are based on the calculated lifecycle GHG intensity of electricity using NREL and GREET, as described above, and the calculated lifecycle GHG intensity of geologic natural gas, described above. The lifecycle GHG intensity of electricity was multiplied by an estimated increase in electricity consumption of 2,440,000 kWh/year/participant at five-year intervals during the 20-year pilot life to determine increased lifecycle GHG emissions resulting from increased electricity consumption. The lifecycle GHG intensity of geologic gas was multiplied by estimated gas savings of 50,000 Dth/year/participant over the 20-year pilot life to determine reduction in emissions from use of geologic natural gas. In total, for two participants, ICF calculates total lifetime emissions reductions to be 124,030 metric tons CO_2e.

New District Energy System

The 10,465 Dth/year of natural gas savings assumed for each participant in this pilot, was provided by an RFI respondent. These are the expected savings for a specific project that would replace an existing steam district energy system with a hot water system, allowing for electric heating of the water, but also maintaining some gas boiler capacity to support higher heating loads. The RFI respondent also provided the estimate of a net increase in electricity use of 116,117 kWh/year for the project. While a second specific site has not been identified at this point in time, the same project parameters were assumed for additional participants.

Lifecycle GHG emissions for this pilot are based on the calculated lifecycle GHG intensity of electricity using NREL and GREET, as described above, and the calculated lifecycle GHG intensity of geologic natural gas, described above. The lifecycle GHG intensity of electricity was multiplied by an estimated increase in electricity consumption of 116,117 kWh/year/participant at five-year intervals during the 30-year pilot life to determine increased lifecycle GHG emissions resulting from increased electricity consumption. The lifecycle GHG intensity of geologic gas was multiplied by estimated gas savings of 10,465 Dth/year/participant over the 30-year pilot life to determine reduction in emissions from use of geologic natural gas. In total, for two participants, ICF calculates total lifetime emissions reductions to be 40,882 metric tons CO_2e.

Industrial Electrification Incentives

For this pilot, an RFI respondent had recommended the approximate size and number of industrial heat pumps they intended to install. ICF made some high-level estimates to approximate the potential increase in electricity use for these units, and then the corresponding reduction in natural gas consumption. Increased electricity use of 210,000 kWh/year/participant was estimated based on a 70-kW heat pump (RFI respondent suggested 40-100 kW range might be targeted), operating 4,000 hours per year (e.g., 16 hours/day * 5 days/week* 50 weeks/year), and assuming the heat pump operates at an average load factor of 75 percent of

total capacity across that time period. Reduced natural gas consumption of 3,135 Dth/year/participant was calculated from the increased electricity consumption, assuming that the heat pump would operate with an average coefficient of performance ("COP") of 3.5, that the efficiency of equipment for displaced natural gas heating load was 80 percent, and converting units of energy from kWh to Dth. There is significant uncertainty in the electricity consumption that will be added, and natural gas consumption reduced, given how site and application specific these results will be (and specific sites have not yet been identified).

Lifecycle GHG emissions for this pilot are based on the calculated lifecycle GHG intensity of electricity using NREL and GREET, as described above, and the calculated lifecycle GHG intensity of geologic natural gas, described above. The lifecycle GHG intensity of electricity was multiplied by an estimated increase in electricity consumption of 210,000 kWh/year/customer at five-year intervals during the 20-year pilot life to determine increased lifecycle GHG emissions resulting from increased electricity consumption. The lifecycle GHG intensity of geologic gas was multiplied by estimated gas savings of 3,135 Dth/year/customer over the 20-year pilot life to determine reduction in emissions from use of geologic natural gas. In total, for 3 participants, ICF calculates total lifetime emissions reductions to be 11,896 metric tons CO_2e.

Commercial Hybrid Heating

The 198 Dth/year of natural gas savings assumed for each participant in this pilot, was provided by an RFI respondent, based on experience with a similar offering in the New York Clean Heat program. The RFI respondent also provided the estimate of a net increase in electricity use of 8,000 kWh/year/participant.

Lifecycle GHG emissions for this pilot are based on the calculated lifecycle GHG intensity of electricity using NREL and GREET, as described above, and the calculated lifecycle GHG intensity of geologic natural gas, described above. The lifecycle GHG intensity of electricity was multiplied by an estimated increase in electricity consumption of 8,000 kWh/year/facility at five-year intervals during the 15-year pilot life to determine increased lifecycle GHG emissions resulting from increased electricity consumption. The lifecycle GHG intensity of geologic gas was multiplied by estimated gas savings of 198 Dth/year/facility over the 15-year pilot life to determine reduction in emissions from use of geologic natural gas. In total, for 135 participants, ICF calculates total lifetime emissions reductions to be 25,609 metric tons CO_2e.

Residential Deep Energy Retrofits and Electric Air Source Heat Pumps

This pilot includes a blend of single-family homes and multi-family buildings. For the single-family homes, the pilot also includes four different tiers of customer retrofits. Phase one of the pilot involves a more detailed analysis of potential projects and program design, which could change the current assumptions used to quantify this pilot that are included here. The average per participant natural gas savings across the pilot is 135 Dth/year, which is based on a 6 to 1 ratio of single-family homes (which average 65 Dth/year savings, based on the weighted average of calculations shown in Table 4 below) and multi-family buildings (which average 555 Dth/year savings, based on information provided by an RFI respondent). The average per participant increase in electricity consumption across the pilot is 4,657 kWh/year, which is based on a 6 to 1 ratio of single-family homes (which average a 2,025 kWh/year increase, based on

the weighted average of net electric load estimated by CenterPoint Energy that is shown in Table 4 below) and multi-family buildings (which average a 20,447 kWh/year increase, based on information provided by an RFI respondent).

Table 4: Estimated Single Family Home Gas Savings and Electricity Use by Retrofit Tier

	Retrofit Tier				
Parameters	Tier 1	Tier 2	Tier 3 - Conventional Tech	Tier 4 - R&D Tech	**Weighted Average**
Portion of Total Retrofits in this Tier	25%	25%	25%	25%	
Approx % Load Reduction	20%	60%	80%	80%	**60%**
Space Heating load shifted to electric after retrofit	50%	75%	90%	90%	**76%**
Gas savings due to retrofit (Dth/yr)	15	45	60	60	**45**
Remaining gas load if no ASHP (Dth/yr)	60	30	15	15	**30**
Gas savings from ASHP installation (with Gas back-up) (Dth/yr)	30	22.5	13.5	13.5	**20**
Total Estimated Gas Savings (Dth/yr)	45	67.5	73.5	73.5	**65**
Remaining Gas Space Heating Load (Dth/yr)	30	7.5	1.5	1.5	**10**
Net electric load added (kWh/year)	2,879	2,460	1,381	1,381	**2,025**

Lifecycle GHG emissions for this pilot are based on the calculated lifecycle GHG intensity of electricity using NREL and GREET, as described above, and the calculated lifecycle GHG intensity of geologic natural gas, described above. The lifecycle GHG intensity of electricity was multiplied by an estimated increase in electricity consumption of 4,657 kWh/year/facility[29] at

[29] Weighted average based on modeled participation of single-family and multi-family properties.

five-year intervals during the 32-year pilot life to determine increased lifecycle GHG emissions resulting from increased electricity consumption. The lifecycle GHG intensity of geologic gas was multiplied by estimated gas savings of 135 Dth/year/facility over the 32-year pilot life to determine reduction in emissions from use of geologic natural gas. In total, for 238 participants across all phases of the pilot, ICF calculates total lifetime emissions reductions to be 66,760 metric tons CO_2e.

IX. Energy Efficiency Pilots GHG Emissions Modeling

When pilots' GHG benefits are tied to reduced use of geologic natural gas, their GHG emissions forecasting is straightforward; for every Dth of natural gas reduced across the pilot life, 66.14 $kgCO_2e$ of emissions are not emitted (modeling scaled gas savings by the geologic natural gas carbon intensity to demonstrate GHG emissions reduction). The other pilots in the plan consider instead the net impact of natural gas emissions exchanged for electricity generation GHG emissions or the lifecycle GHG emissions from other innovative resources like RNG. However, any increase in electricity consumption associated with pilots would be accounted for in modeling; the net impact (lifecycle GHG reductions) are outlined below.

Small/Medium Business GHG Audit

This pilot is designed to supplement CenterPoint Energy's existing Natural Gas Energy Analysis ("NGEA") audit program with additional GHG context. No emission reductions are claimed directly from this new GHG context, but the pilot also plans to include funding for GHG reduction efforts by audit recipients. More specifically, this pilot would have funding for commercial hybrid heating systems (as per the Commercial Hybrid Heating Pilot) and CarbinX systems (as per the Carbon Capture Rebates for Commercial Buildings pilot). Overall, it is assumed that 3 percent of the 1,240 audit recipients would implement one of these two emission reduction opportunities. This pilot assumes half of the participation is for hybrid heating, and half is for CarbinX units, or roughly 17 units of each technology are installed in this pilot (in addition to the units installed through the respective pilots for each technology).

The lifecycle emission reductions for this pilot are based on the lifecycle emission reductions from the other two pilots noted above but scaled for the respective levels of participation expected through this pilot. ICF calculated the lifetime GHG emissions reductions of this pilot to be 6,570 metric tons CO_2e.

Residential Gas Heat Pumps

The natural gas savings used in this pilot (39.5 Dth/year/participant) are based on an assumed shift to a 138 percent efficient gas heat pump providing both space and water heating. The weighted average baseline efficiency for space and water heating is 78 percent. This results in a 43.8 percent improvement from the 90 Dth/year baseline gas consumption, or 39.5 Dth/year/participant in gas savings.

Lifecycle GHG emission reductions for this pilot were calculated by multiplying the 6 participants by the estimated natural gas savings per participant, 39.5 Dth/year, by the calculated GHG intensity of geologic natural gas, described above, over the pilot life of 15 years. ICF calculated the lifetime GHG emissions reductions of this pilot to be 235 metric tons CO_2e.

Gas Heat Pumps for Commercial Buildings

The natural gas savings used in this pilot (724 Dth/year/participant) are based on a mix of information from different RFI respondents and the Minnesota Technical Reference Manual ("TRM"). Gas savings are assumed to be 48 percent, based on a mid-point value between expectations from two separate RFI respondents (70 percent savings and 25 percent savings) for different heat pump systems, with the potential to test multiple system types in this pilot. It was assumed that each participating facility might require three 140,000 Btu/hour gas heat pumps, and that these units run for 1,904 Equivalent Full Load Hours of Heating.[30]

Lifecycle GHG emission reductions for this pilot were calculated by multiplying the 3 participants by the estimated natural gas savings per participant, 724 Dth/year, by the calculated GHG intensity of geologic natural gas, described above, over the pilot life of 15 years. ICF calculated the lifetime GHG emissions reductions of this pilot to be 2,154 metric tons CO_2e.

Industrial and Large Commercial GHG Audit Pilot

The natural gas savings used in this pilot (5,474 Dth/year/participant) are based on a heat recovery project that was quantified in a past CIP energy audit, used as a project that could be representative of projects complete through this pilot. This project was not eligible for an incentive through CIP. The increase in electricity consumption (76,107 kWh/year/participant) is a high-level estimate based on the same heat recovery project, reflecting the need for additional circulating pump for heat exchangers and extra static loading for an exhaust fan. Lifecycle GHG emission reductions for this pilot were calculated by multiplying the 5 participants by the estimated natural gas savings per participant, 5,474 Dth/year, by the calculated GHG intensity of geologic natural gas, described above, over the pilot life of 20 years. The lifecycle GHG intensity of electricity was multiplied by an estimated increase in electricity consumption of 76,107 kWh/year/participant at five -year intervals during the 20-year pilot life to determine increased lifecycle GHG emissions resulting from increased electricity consumption. ICF calculated the lifetime GHG emissions reductions of this pilot to be 35,560 metric tons CO_2e.

X. High and Low GHG Sensitivities

The Frameworks Order, Order Point 1, requires utilities to file high, low, and expected GHG intensity for innovative resources where applicable. High and low scenarios must incorporate at least low and high assumptions for electricity use and other fuels used in the resource's lifecycle.

For RNG pilots, ICF referenced the California Air Resources Board's Low Carbon Fuel Standard ("LCFS") certified pathways[31] to derive the mean and standard deviation on registered carbon intensities from relevant RNG feedstock categories. The relative changes (percent) within one standard deviation for RNG projects certified in the LCFS under the same feedstock category (e.g., landfill gas) were determined to be indicative of the uncertainty range of RNG projects

[30] Equivalent Full Load Hours of Heating from MN TRM 3.0 (page 283), assuming 'office - low rise' building in Zone 3.

[31] https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities

broadly. Variation in these intensities could be attributed to feedstock composition and handling, project geographic variability, different energy efficiency or different grid mixes, and other operational choices. Among other things, GREET modeling incorporates differences in electricity and fuel use at different facilities.

In addition to the RNG pilots, ICF developed low and high GHG intensities for the Green Hydrogen Archetype for Industrial or Large Commercial Facility pilot, Industrial Methane Refrigerant Leak Reduction, and the Carbon Capture Archetype for Industrial or Large Commercial Facility. The Green Hydrogen Archetype for Industrial or Large Commercial Facility pilot does not explore a lower bound on GHG intensity, as it already expects to achieve zero $kgCO_2e/Dth\ H_2$ with no plans to explore carbon-negative energy resources or offsets for the pilot, and energy efficiency improvements when the electricity supply is already carbon-free will not translate to GHG savings. For its upper GHG bound, ICF and CenterPoint Energy explored how the lifecycle GHG would worsen if grid electricity, instead of renewable electricity, supplied the pilot's balance-of-plant ("BOP") facility electricity needs (while the hydrogen electrolyzer would still be powered by carbon-free electricity). Using the NREL grid data outlined above across the pilot's 20-year life, knowing the pilot is anticipated to need eight kWh for BOP for every kg of hydrogen produced, this BOP energy consumption of non-renewable electricity would increase the pilot's GHG intensity by approximately 3 $kgCO_2e/Dth\ H_2$.

There is significant uncertainty as to the level of methane leaks behind the meter at CenterPoint Energy's large customers, and an important part of the Industrial Methane Refrigerant Leak Reduction pilot will be quantifying leak levels at participating facilities. The expected savings are based on an assumption that the program will repair leaks representing 0.25 percent of the annual gas consumption for CenterPoint Energy's largest 200 industrial and commercial customers, and those leaks would otherwise have continued emitting methane for five years. The sensitivities show how the results would change if the average level of repaired leaks was equivalent to 0.05 percent (low) or 1.25 percent (high) of annual throughput, for those same large customers. For the Archetype Carbon Capture Project for Industrial or Large Commercial Facility pilot sensitivity, the focus was on the various potential utilization/storage outcomes for the captured carbon. The low and high bounds for this pilot reflect the lifecycle GHG impact of storing all of the facility's combustion CO_2 that is captured at 90 percent efficiency (low GHG intensity) or storing none of the captured carbon if no offtaker can be found (high).[32] The GHG intensity bounds shown for the pilot focus on carbon utilization and are independent of the added GHG impacts of the carbon capture process's energy consumption. There was limited available literature to inform the development of upper and lower bounds on the GHG intensity of the capture process itself relative to its energy consumption.

ICF did not develop a high and low estimate for the Green Hydrogen Blending into Natural Gas Distribution System because of CenterPoint Energy's commitment to use carbon-free electricity

[32] Because CenterPoint Energy is open to other end uses besides concrete production for the captured carbon in this pilot, the range in potential lifecycle GHG impacts of the pilot is inherently wide and challenging to quantify, as some carbon storage/utilization processes are not well-studied. The wide bounds in GHG sensitivity identified here aim to encompass the ultimate impact of many end uses. The lifecycle GHG assessment planned for this pilot would be the best way to get pilot-specific GHG insight.

for all aspects of that pilot, resulting in an emissions intensity of zero $kgCO_2e$/Dth regardless of project scale. ICF also did not develop high and low emissions intensity estimates for Urban Tree Carbon Credits pilot due to the lack of any electricity or fuel use for those pilots and no reasonable basis for creating upper and lower bounds based on available literature. No low and high intensities were developed for strategic electrification pilots because the Frameworks Order provides a system for calculating the GHG intensity of electricity and does not provide a method for calculating upper and lower bounds. No low and high intensities were developed for energy efficiency because energy efficiency has no GHG intensity. No low and high intensities were developed for the Carbon Capture Rebates for Commercial Buildings pilot, for the same reasons as the strategic electrification and energy efficiency pilots, as well as because any assumed changes to the existing lifecycle carbon assessment would be speculative. No low and high intensities were developed for the district energy pilots because district energy, as defined in NGIA, has a GHG intensity of zero $kgCO_2e$/Dth, and other measures expected to be installed through those pilots are generally energy efficiency and strategic electrification measures.

Table 5: Estimated GHG Sensitivity for Relevant Pilots

Pilot	GHG Intensity			Unit
	Expected	Low	High	
RNG Produced from Hennepin County Organic Waste	-1.96	-38.50=	34.58	$kgCO_2e$/Dth RNG
RNG Produced from Ramsey & Washington Counties' Organic Waste	-30.74	-67.29	5.80	$kgCO_2e$/Dth RNG
RNG Archetype – Wastewater	13.03	1.92	24.14	$kgCO_2e$/Dth RNG
RNG Archetype - Dairy Manure	-32.81	-110.76	45.14	$kgCO_2e$/Dth RNG
RNG Archetype – Food Waste	-49.65	-86.19	-13.11	$kgCO_2e$/Dth RNG
RNG Archetype - Landfill Gas (LFG)	12.79	2.57	23.01	$kgCO_2e$/Dth RNG
Green Hydrogen Archetype for Industrial or Large Commercial Facility	0	0	2.98	$kgCO_2e$/Dth H_2
Industrial Methane and Refrigerant Leak Reduction	776.6	155.3	3,883.1	$kgCO_2e$/ Participant
Carbon Capture Archetype for Industrial or Large Commercial Facility	54%	90%	0%	% GHG reduction from baseline without pilot (independent of energy consumption impacts)

In the Matter of
CenterPoint Energy Natural Gas Innovation Act (NGIA)
Innovation Plan

Petition of CenterPoint Energy

EXHIBIT G: ICF LETTER ENDORSING GHG EMISSIONS CALCULATION

Docket No. G-008/M-23-215

June 28, 2023

Exhibit G: Letter Endorsing GHG Emissions Calculations
Petition of CenterPoint Energy
Docket No. G-008/M-23-215

June 28, 2023

Mr. Will Seuffert
Executive Secretary
Minnesota Public Utilities Commission
121 East Seventh Place, Suite 350
St. Paul, MN 55101-2147

Subject: Greenhouse Gas Accounting Methodologies Used in CenterPoint Energy's Natural Gas Innovation Plan

Dear Mr. Seuffert:

I, Andrew Pettit, have reviewed the methodology and assumptions used in the calculations of lifecycle greenhouse gas emissions intensity for the proposed innovative resources and the forecasted lifecycle greenhouse gas emissions reduced or avoided for evaluated pilot programs. The methodology and assumptions used are reasonable based on available information and the methodologies prescribed by the Natural Gas Innovation Act ("NGIA") legislation[1] and NGIA Frameworks Order.[2]

The analysis and my conclusion are based on various information received from CenterPoint Energy and potential project developers and gathered by ICF from various other sources. While ICF has reviewed this third-party information for apparent errors, I can make no ultimate guarantee as to its accuracy. I note that the actual lifecycle greenhouse gas intensity of all pilots in implementation will vary from estimated values based on differences between the models and actual pilot operation including, but not limited to, operational variables, project locations, and the number and type of participants who enroll in NGIA pilots. No warranty, whether express or implied, including the warranties of merchantability or fitness for a particular purpose, is given or made by ICF in connection to any products (e.g., renewable natural gas, hydrogen) evaluated in the analysis.

Sincerely,

Andrew Pettit
Senior Managing Consultant, Climate Change and Sustainability
ICF

[1] Minnesota Laws 2021, 1st Special Session, Chapter 4, Article 8, §§ 20, 21 and 27, partially codified at Minn. Stat. §§ 216B.2427-2428.

[2] *In the Matter of Establishing Frameworks to Compare Lifecycle Greenhouse Gas Emission Intensities of Various Resources, and to Measure Cost Effectiveness of Individual Resources and of Overall Innovation Plans,* Docket No. G-999/CI-21-566, Order Establishing Frameworks for Implementing Minnesota's Natural Gas Innovation Act (June 1, 2022).

In the Matter of
CenterPoint Energy Natural Gas Innovation Act (NGIA)
Innovation Plan

Petition of CenterPoint Energy

EXHIBIT H: IMPLAN MODELING DETAILS

Docket No. G-008/M-23-215

June 28, 2023

IMPLAN Model Background

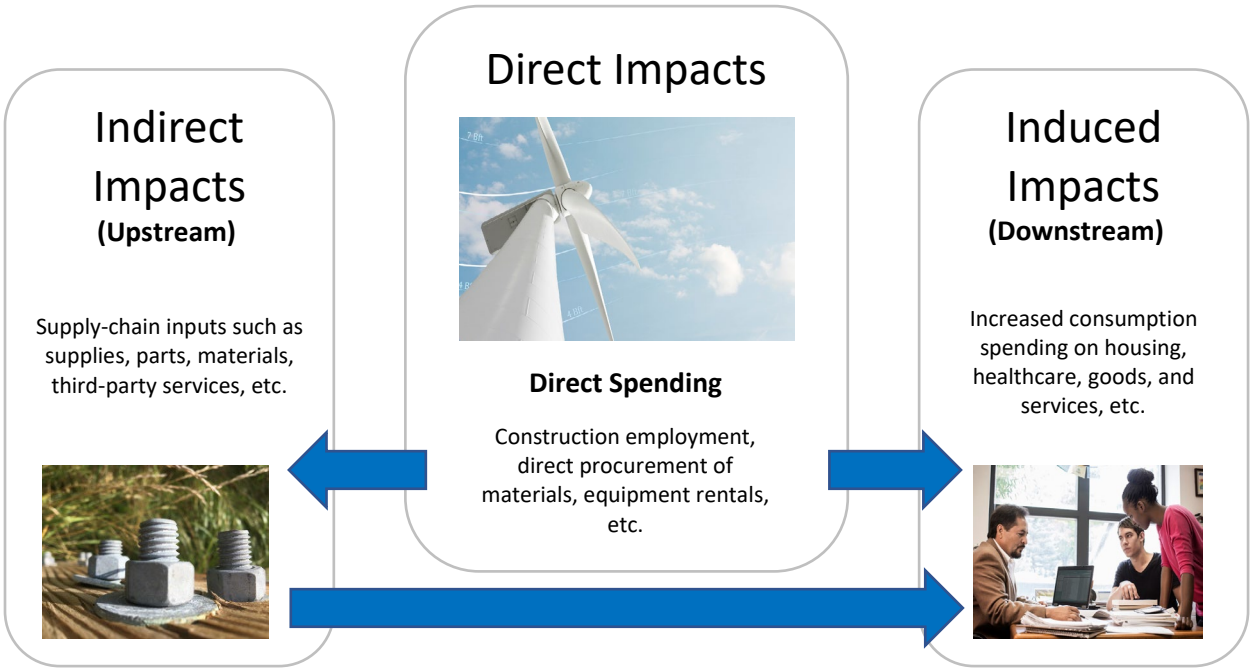
Under Minnesota's Natural Gas Innovation Act ("NGIA"), CenterPoint Energy will pilot the use of innovative resources to reduce greenhouse gas ("GHG") emissions. CenterPoint Energy's investments in the different pilot projects and local communities will result in positive economic impacts for the state of Minnesota. These investments, including investment by contractors and their supply chains, will have impacts on employment, regional output, personal income, and state and local taxes.

ICF used the IMPLAN model to estimate the regional economic impacts of the pilot projects, including their net job creation potential. IMPLAN is an economic input-output model that examines the inter-industry relationships within an economy by combining a set of extensive databases related to economic factors, economic multipliers, and demographic statistics with a refined and detailed system of modeling software. There are three primary types of impacts in IMPLAN, which are described below and summarized in Figure 1:

- **Direct** – refers to the impacts on the industries that are directly related to the technology implemented by the pilot projects. Direct impacts include purchases of equipment and machinery that are installed in the various pilot projects.
- **Indirect** – refers to the impacts in inter-industry purchases resulting from direct spending on materials, equipment, and construction. Indirect impacts represent the upstream supply chain impacts that are created due to the industry linkages caused by project-related industries purchasing from other industries such as raw materials sectors supplying the manufacturers of equipment and machinery installed in the pilot projects.
- **Induced** – refers to the downstream impacts created in all local industries due to an increase in consumers' consumption expenditures caused by the direct and indirect effects.

The total impact is the sum of the multiple rounds of secondary indirect and induced impacts that remain in the region (as opposed to impacts that "leak out" to other regions or states). IMPLAN then uses this total impact to calculate subsequent impacts such as total jobs created and tax impacts. The results of the IMPLAN analysis for each short-listed pilot are included as Attachment 1 to this Exhibit.

Figure 1: Direct, Indirect and Induced Impacts



IMPLAN allows for the development of local-level input-output models that can estimate the economic impact of investments on local communities. The model identifies direct impacts by sector and then develops a set of indirect and induced impacts by sector using industry-specific multipliers, local purchase coefficients, income-to-output ratios, and other factors and relationships. The model is comprehensive in its level of detail, with a breakdown of the economy into roughly 500 sectors. For this analysis, ICF utilized the Minnesota-specific IMPLAN model, although the model can be customized to any area being studied, and can be applied at various scales, such as at the national or county level. The use of the IMPLAN model allows for the estimation of the total impacts of construction activity on the regional economy in terms of the following types of impacts:

- **Employment** – employment supported by CenterPoint Energy's NGIA Plan investments. IMPLAN estimates employment by aggregated sector.
- **Output** – the contribution of the investments to total local and state economic activity.
- **Value added** – the difference between industry output and the cost of intermediate inputs. This value represents the pilot projects' contribution to the state Gross Domestic Product ("GDP").
- **Personal income** – wages and salaries (including benefits) paid to workers, plus proprietor income, supported by Innovation Plan investments.
- **Tax revenues** – tax revenues from businesses, sales, excise, and property from all project-related activity.

Modeling Approach

The ICF IMPLAN team utilized the assumptions for each of the CenterPoint Energy pilot projects shown in Exhibit F. The inputs used in the model included internal and external project delivery costs, advertising and promotions, incentives, third-party funding, variable operation and maintenance savings, participant pilot costs, energy savings, and others. ICF mapped the inputs for the different pilot projects to IMPLAN sectors and results are presented in the form of direct, indirect, and induced jobs.

CenterPoint Energy's innovation plan has a five-year term, with investments beginning in 2024 and ending in 2028. Many of the pilot projects will continue to operate up to 40 years, resulting in continued impacts, costs, and savings. The results are broken down by annual jobs numbers for the first five years of the project, with a total jobs number provided for the remainder of the project's life. Additionally, for projects with low investment, IMPLAN job numbers may be presented in fractions. It is significant to note that the annual jobs are estimated as Full-Time Equivalents ("FTE") and have been rounded.

RNG Proposal - Anaerobic Digestion of Organic Materials

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	0	1	1	1	3	8
	Indirect	0	0	0	0	0	1	3
	Induced	0	0	1	1	1	2	4

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	0	4	4	4	12	33
	Indirect	0	0	2	2	1	5	12
	Induced	0	0	2	2	2	7	18

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	0	8	8	8	25	65
	Indirect	0	0	3	3	3	9	23
	Induced	0	0	5	4	4	13	35

RNG Proposal -Anaerobic Digestion of East Metro Food Waste

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	0	1	1	1	4	10
	Indirect	0	0	1	1	1	2	6
	Induced	0	0	1	1	1	2	6

Size B	CNP 2	2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	0	11	9	9	29	81
	Indirect	0	0	6	6	5	17	44
	Induced	0	0	6	6	6	18	50

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	0	13	13	12	38	101
	Indirect	0	0	7	7	7	21	54
	Induced	0	0	8	8	8	24	62

RNG Archetype – WRRF

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	1	1	1	1	3	5
	Indirect	0	0	0	0	0	2	2
	Induced	0	0	0	0	0	2	3

Size B	CNP 3	2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	3	3	3	3	12	21
	Indirect	0	2	2	2	2	6	11
	Induced	0	2	2	2	2	7	13

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	17	17	16	16	66	115
	Indirect	0	9	9	9	9	36	62
	Induced	0	11	10	10	10	41	71

RNG Archetype - Dairy Manure

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	1	1	1	1	2	4
	Indirect	0	1	1	1	1	6	9
	Induced	0	1	1	1	1	3	5

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	1	1	1	1	5	8
	Indirect	0	3	3	3	3	11	18
	Induced	0	1	1	1	1	5	9

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	6	6	5	5	22	38
	Indirect	0	13	13	12	12	51	87
	Induced	7	6	6	6	6	31	42

RNG Archetype – Food Waste

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	1	1	1	1	3	5
	Indirect	0	0	0	0	0	2	3
	Induced	0	1	0	0	0	2	3

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	15	14	14	14	57	100
	Indirect	0	8	8	8	8	31	54
	Induced	0	9	9	8	8	35	62

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	34	32	31	31	129	225
	Indirect	0	18	18	17	17	70	121
	Induced	0	21	20	20	19	80	139

RNG Archetype - Landfill Gas

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	4	4	4	4	16	27
	Indirect	0	2	2	2	2	8	15
	Induced	0	3	2	2	2	9	18

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	17	17	17	17	69	120
	Indirect	0	9	9	9	9	37	65
	Induced	0	11	11	10	10	42	75

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	35	34	34	33	136	240
	Indirect	0	19	18	18	18	73	130
	Induced	0	21	21	20	21	84	148

Green Hydrogen Blending into Natural Gas Distribution System

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	1	4	1	1	7	10
	Indirect	0	0	3	0	0	3	5
	Induced	0	0	4	0	0	4	5

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	1	6	2	2	11	31
	Indirect	0	0	6	3	3	12	47
	Induced	0	0	5	2	2	9	36

Green Hydrogen Archetype - Industrial or Large Commercial Facility Electrolyzer Pilot

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	20	6	6	6	39	125
	Indirect	0	12	4	4	4	24	75
	Induced	0	16	5	4	4	28	91

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	0	45	32	11	89	241
	Indirect	0	0	27	19	6	52	145
	Induced	0	0	34	24	8	66	176

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	0	24	27	35	87	281
	Indirect	0	0	14	17	20	51	169
	Induced	0	0	18	21	25	64	213

Industrial Methane and Refrigerant Leak Reduction Program

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	3	3	1	1	1	9	0
	Indirect	1	1	1	1	1	5	0
	Induced	2	2	1	1	1	7	0

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	5	5	8	8	11	37	4
	Indirect	1	1	2	2	2	8	1
	Induced	2	2	3	3	3	13	1

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	3	3	4	4	5	18	1
	Indirect	2	3	4	4	5	17	1
	Induced	3	3	5	5	7	22	1

Urban Tree Carbon Offset Program

Size A		2024	2025	2026	2027	2028	Total
	Direct	0	0	0	0	1	1
	Indirect	0	0	0	0	0	0
	Induced	0	0	0	0	0	0

Size B		2024	2025	2026	2027	2028	Total
	Direct	1	1	1	1	1	5
	Indirect	0	0	0	0	0	0
	Induced	0	0	0	0	0	0

Size C		2024	2025	2026	2027	2028	Total
	Direct	1	1	1	2	2	7
	Indirect	0	0	0	0	0	0
	Induced	0	0	0	1	1	2

Archetype Carbon Capture Project for Industrial or Large Commercial Facility

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	0	5	1	1	7	16
	Indirect	0	0	5	1	1	7	19
	Induced	0	0	6	1	1	8	20

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	0	9	2	2	14	30
	Indirect	0	0	9	2	2	14	35
	Induced	0	0	12	3	2	17	28

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	0	14	4	1	19	45
	Indirect	0	0	14	4	2	20	53
	Induced	0	0	18	4	1	23	56

Carbon Capture Rebates for Commercial Buildings

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	4	8	8	9	10	38	50
	Indirect	2	4	5	5	6	22	30
	Induced	3	4	5	5	7	24	31

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	7	15	16	18	22	78	95
	Indirect	4	9	10	10	13	47	57
	Induced	4	9	10	11	13	48	60

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	14	30	33	35	43	155	193
	Indirect	9	19	20	21	26	94	116
	Induced	9	19	21	22	27	97	121

New Networked Geothermal Systems Pilot

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	1	2	2	2	8	16
	Indirect	1	1	2	2	1	7	27
	Induced	1	1	2	2	1	7	34

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	3	5	7	3	19	34
	Indirect	1	2	4	5	3	16	50
	Induced	1	2	4	6	3	16	74

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	7	6	10	25	49	64
	Indirect	1	5	5	8	20	39	88
	Induced	1	4	5	9	22	42	142

Decarbonizing Existing District Energy Systems

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	11	2	2	2	16	28
	Indirect	0	5	1	1	1	8	17
	Induced	0	7	1	1	1	10	17

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	6	7	3	4	84	58
	Indirect	0	3	4	1	2	49	34
	Induced	0	4	4	1	2	53	36

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	11	10	11	5	37	89
	Indirect	0	5	6	7	3	21	53
	Induced	0	7	6	7	3	23	55

New District Energy System

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	22	0	0	0	22	3
	Indirect	0	14	0	0	0	14	2
	Induced	0	13	0	0	0	13	9

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	22	20	0	0	42	6
	Indirect	0	14	13	0	0	27	4
	Induced	0	13	13	1	1	27	18

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	22	20	20	0	62	11
	Indirect	0	14	13	13	0	39	6
	Induced	0	13	13	13	1	40	27

Industrial Electrification Incentive Program

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	3	0	0	0	5	6
	Indirect	0	1	0	0	0	2	3
	Induced	0	2	0	0	0	3	3

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	3	3	1	1	8	13
	Indirect	0	1	1	0	0	3	8
	Induced	0	2	2	0	0	5	8

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	3	5	1	1	11	19
	Indirect	0	1	2	1	1	5	11
	Induced	0	2	3	1	1	7	12

Commercial hybrid heating pilot

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	2	3	3	3	3	14	5
	Indirect	1	2	2	2	2	9	3
	Induced	2	2	2	2	2	10	3

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	3	6	6	6	6	26	12
	Indirect	2	4	4	3	3	16	7
	Induced	2	4	4	3	4	17	8

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	4	9	9	8	9	38	17
	Indirect	3	5	5	5	5	22	11
	Induced	3	5	6	5	5	23	11

Residential deep energy retrofit + electric ASHP pilot

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	4	4	5	9	21	0
	Indirect	0	3	3	3	6	15	0
	Induced	0	2	2	3	7	15	32

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	7	7	9	18	41	0
	Indirect	0	5	5	6	12	29	0
	Induced	0	4	5	7	13	29	65
	Total	1	16	17	22	43	99	65

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	10	10	14	26	61	0
	Indirect	0	7	7	9	18	42	0
	Induced	0	7	7	10	20	43	98

Small/medium business GHG audit pilot

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	2	2	2	2	9	4
	Indirect	1	1	1	1	1	6	2
	Induced	1	1	1	1	1	6	2

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	2	2	2	2	2	11	5
	Indirect	1	1	1	1	2	7	3
	Induced	1	1	1	1	2	7	3

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	2	3	2	3	3	13	6
	Indirect	1	2	2	2	2	9	3
	Induced	1	2	2	2	2	9	4

Residential Gas Heat Pump

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	1	1	0	0	2	0
	Indirect	0	0	0	0	0	1	0
	Induced	0	0	0	0	0	1	0

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	1	1	0	0	2	0
	Indirect	0	0	0	0	0	1	0
	Induced	0	1	1	0	0	2	0

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	2	2	0	0	4	0
	Indirect	0	1	1	0	0	2	0
	Induced	0	1	1	0	0	2	1

Gas Heat Pump for Commercial Buildings

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	0	2	0	0	0	2	1
	Indirect	0	1	0	0	0	2	0
	Induced	0	1	0	0	0	2	0

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	2	2	0	0	4	1
	Indirect	0	1	1	0	0	3	1
	Induced	0	1	1	0	0	3	1

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	2	3	0	0	6	1
	Indirect	0	1	2	0	0	4	1
	Induced	0	1	2	0	0	4	1

Solar Thermal Heating for C&I

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	1	1	1	1	4	0
	Indirect	1	1	1	1	1	3	0
	Induced	1	1	1	1	1	3	28

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	1	1	1	2	2	7	0
	Indirect	1	1	1	1	1	4	0
	Induced	1	1	1	1	1	4	56

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	2	2	2	2	2	11	0
	Indirect	1	1	1	1	1	7	0
	Induced	1	1	1	1	2	7	85

Industrial and Large Commercial GHG Audit Pilot

Size A		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	2	2	2	2	2	10	10
	Indirect	1	1	1	1	1	6	6
	Induced	1	1	1	1	1	6	6

Size B		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	3	3	3	4	3	16	20
	Indirect	2	2	2	2	2	10	13
	Induced	2	2	2	2	2	10	13

Size C		2024	2025	2026	2027	2028	Total	Rest of Project Life
	Direct	4	5	5	5	6	25	31
	Indirect	3	3	3	3	4	15	19
	Induced	3	3	3	3	4	16	20

In the Matter of
CenterPoint Energy Natural Gas Innovation Act (NGIA)
Innovation Plan

Petition of CenterPoint Energy

EXHIBIT I: CIP NGIA COORDINATION INFORMATION

Docket No. G-008/M-23-215

June 28, 2023

In its September 12, 2022, Order in Docket No. G-999/CI-21-566, the Commission adopted the recommendations of the Department of Commerce with respect to coordination of energy efficiency and strategic electrification between utility Conservation Improvement Program ("CIP") and Natural Gas Innovation Act ("NGIA") plans. To include energy efficiency or strategic electrification investments in innovation plans, utilities must:

1. Demonstrate that proposed energy efficiency and strategic electrification investments are not included in the utility's current CIP Triennial Plan, and state whether the utility does or does not intend to include any of the proposed investments in future CIP/Energy Conservation and Optimization ("ECO") Triennial Plans;
2. For the proposed energy efficiency and strategic electrification investments in measures that have been included in past CIP plans, provide historical measure level performance data since 2010; and
3. Clearly demonstrate why the proposed energy efficiency and strategic electrification investments could not reasonably be included in the utility's conservation improvement program.

In this Exhibit, CenterPoint Energy discusses these requirements for each proposed pilot that includes energy efficiency or strategic electrification.

Carbon Capture Rebates for Commercial Buildings

This pilot includes energy efficiency. Specifically, the CarbinX units result in greenhouse gas ("GHG") emission savings from energy efficiency in addition to carbon capture.

1. CenterPoint Energy piloted CarbinX units in its current CIP Triennial Plan[1] as a research and development ("R&D") effort but plans to claim savings in CIP only based on the energy efficiency and not the carbon capture savings. CenterPoint Energy only included a handful of CarbinX units in its CIP/ECO R&D pilot. CenterPoint Energy is not including CarbinX in its proposed Triennial Plan to be filed on June 30, 2023,[2] but continues to evaluate what investments may be appropriate in CarbinX through CIP/ECO.
2. CenterPoint Energy has installed four CarbinX units through CIP but savings information is not yet available to report.
3. CarbinX units are appropriately included in NGIA because a substantial portion of the GHG savings from the units is associated with carbon capture rather than energy efficiency.

Decarbonizing Existing District Energy Systems

This pilot may include strategic electrification and energy efficiency. Specifically, owners of existing district energy systems may seek to reduce the GHG emissions from those systems

[1] *In the Matter of CenterPoint Energy's 2021-2023 Natural Gas Conservation Improvement Program Triennial Plan*, Docket No. G008/CIP-20-478, 2021-2023 Triennial Plan Compliance Filing (Jan. 20, 2021).

[2] To be filed in Docket No. G008/CIP-23-95.

through energy efficiency or strategic electrification measures. However, specific measures that may be installed through this pilot are unclear.

1. Because it is not clear what measures district energy systems may seek to install, CenterPoint Energy cannot state whether the proposed measures are included in its current or its proposed CIP plan. However, under this pilot, CenterPoint Energy would not allow customers to receive NGIA rebates for energy efficiency or strategic electrification measures that would be eligible for CIP/ECO custom or prescriptive rebates; all proposed energy efficiency or strategic electrification projects would be screened for eligibility in CIP/ECO before pursuing incentives through NGIA.
2. Because it is not clear what measures district energy systems may seek to install, CenterPoint Energy is not able to provide this information.
3. While the Decarbonizing Existing District Energy Systems pilot may have some overlap with CIP/ECO in terms of measures that could be installed, the pilot, as a whole, goes significantly beyond what is possible through CIP/ECO. In addition to energy efficiency and strategic electrification measures, customers may seek to use other resources such as biogas, power-to-hydrogen, or district energy as defined in the NGIA.[3] Moreover, the energy efficiency and strategic electrification measures that customers may wish to implement may or may not be possible through CIP/ECO.

New District Energy System

To the extent that customers seek to install systems through this pilot that would qualify as district energy, as that term is defined in NGIA, but for the fact that they are in a single building, CenterPoint Energy expects that those projects would qualify as strategic electrification and has proposed to provide incentives for those investments through this pilot.

1. CenterPoint Energy's current CIP Triennial Plan does not include any strategic electrification. CenterPoint Energy's proposed Triennial Plan to be filed on June 30, 2023 does not include any commercial strategic electrification measures.[4] For its next Triennial Plan, to be filed on June 1, 2026, CenterPoint Energy will reevaluate the inclusion of commercial strategic electrification measures and make adjustments to this pilot as appropriate to account for changes in its CIP/ECO plan.
2. Not applicable. Strategic electrification has not been included in any past CIP plans.
3. This pilot is primarily a district energy, rather than a strategic electrification, pilot. Accordingly, it is reasonable to include it in NGIA as opposed to CIP/ECO. It would lead to customer confusion and inequitable treatment of similar projects to allow multi-building participants to participate in this NGIA pilot but require single-building

[3] See discussion in Exhibit D regarding the statutory definition of district energy versus the common use of the term.

[4] The Company is proposing to consider strategic electrification measures through the Energy Design Assistance project, but initial testing from the Company's project vendor indicates that strategic electrification measures are unlikely to qualify in practice. CenterPoint Energy is also proposing to evaluate certain strategic electrification measures through its Commercial & Industrial Custom Rebates project, but it remains to be seen whether any of these measures will ultimately qualify for rebates through the project.

participants to participate in CIP/ECO and be required to pass CIP/ECO cost-effectiveness testing.

Industrial Electrification Incentive

This pilot includes support for industrial strategic electrification.

1. CenterPoint Energy's current CIP Triennial Plan does not include any strategic electrification. CenterPoint Energy's proposed Triennial Plan to be filed on June 30, 2023 does not include any industrial strategic electrification measures.[5] The primary barrier to including industrial electrification in CIP is the nascence of electric industrial heating technologies. While heat pumps may be cost effective for some low-heat industrial processes, they have not been widely deployed or tested, there are limited examples of successful application, and customers are hesitant to apply them to their processes. CenterPoint Energy's proposed NGIA pilot is very focused on finding the right technological fit for a few industrial applications and field testing those applications to identify barriers and confirm cost-effectiveness. This may pave the way for future inclusion of industrial heat pump technologies in CIP/ECO.
2. Not applicable. Strategic electrification has not been included in any past CIP plans.
3. As noted above, the primary barrier to including this pilot in CIP is the nascence of the technologies. As described in Exhibits D and W, this pilot includes a study to evaluate potential technology options, customers that may be well situated to pilot them, and measurement and verification of installed units. This additional data will help CenterPoint Energy evaluate the place, if any, for industrial heat pump technology in CIP/ECO or NGIA going forward.

Commercial Hybrid Heating Pilot

This pilot includes strategic electrification; specifically, the installation of dual fuel electric/gas heating systems in commercial buildings.

1. CenterPoint Energy's current CIP Triennial Plan does not include any strategic electrification. CenterPoint Energy's proposed Triennial Plan to be filed on June 30, 2023 does not include any commercial strategic electrification measures.[6] The primary barrier to including commercial hybrid heating systems in CIP is the CIP cost-effectiveness test, which is more stringent than the NGIA cost-effectiveness

[5] The Company is proposing to consider strategic electrification measures through the Energy Design Assistance project, but initial testing from the Company's project vendor indicates that strategic electrification measures are unlikely to qualify in practice. CenterPoint Energy is also proposing to evaluate certain strategic electrification measures through its Commercial & Industrial Custom Rebates project, but it remains to be seen whether any of these measures will ultimately qualify for rebates through the project.

[6] The Company is proposing to consider strategic electrification measures through the Energy Design Assistance project, but initial testing from the Company's project vendor indicates that strategic electrification measures are unlikely to qualify in practice. CenterPoint Energy is also evaluating certain strategic electrification measures through its Commercial & Industrial Custom Rebates project, but it remains to be seen whether any of these measures will ultimately qualify for rebates through the project.

framework. Using the same assumptions that were used in NGIA plan development, the proposed pilot would not pass the CIP societal cost test. For its next Triennial Plan, to be filed on June 1, 2026, CenterPoint Energy will reevaluate the cost-effectiveness of commercial hybrid heating systems under the CIP/ECO tests and if the measure appears more promising under the CIP/ECO framework will consider whether to transition this offering from NGIA to CIP/ECO.

2. Not applicable. Strategic electrification has not been included in any past CIP plans.
3. As noted above, the primary barrier to including this pilot in CIP is cost-effectiveness. While individual CIP projects and measures are not required to be cost-effective, CenterPoint Energy believes it is appropriate to include non-cost-effective emerging measures, such as commercial hybrid heating, in its NGIA plan. As described in Exhibit W, CenterPoint Energy plans to conduct monitoring and analysis to learn more about the performance and cost-effectiveness of commercial hybrid heating for different kinds of commercial buildings. This may assist CenterPoint Energy in developing a more cost-effective future offering.

Residential Deep Energy Retrofits and Electric Air Source Heat Pumps

This pilot includes both strategic electrification and energy efficiency measures. Specifically, this pilot involves the installation of insulation and other envelope measures and dual fuel heating systems including electric air source heat pumps in residential buildings.

1. CenterPoint Energy's current 2021-2023 CIP Triennial Plan does not include any strategic electrification. CenterPoint Energy's proposed 2024-2026 Triennial Plan to be filed on June 30, 2023 does include electric air source heat pumps with gas back up as a stand-alone measure without requiring insulation or other envelope measures.[7] CenterPoint Energy's current Triennial Plan and proposed Triennial Plan also include insulation and other envelope measures as stand-alone rebate offerings, but the minimum level of insulation/air sealing required to achieve a CIP rebate, and the rebate available, are both substantially lower than are contemplated for this NGIA pilot.
2. Strategic electrification has not been included in any past CIP plans. As noted above, CenterPoint Energy's current Triennial Plan and proposed Triennial Plan do include insulation and other envelope measures as stand-alone rebate offerings, but the minimum level of insulation/air sealing required to achieve a CIP/ECO rebate, and the rebate available, are both substantially lower than are contemplated for this NGIA pilot.[8] Historic measure-level performance data for envelope measures is as follows:

[7] CenterPoint Energy plans to encourage customers receiving CIP heat pump rebates to also pursue weatherization measures but is not requiring it.

[8] For the NGIA pilot, CenterPoint Energy proposes to pay the full measure cost for the heat pump and weatherization in the second phase of the pilot, where a small number of installations will be field tested. Final rebate amounts in the third phase of the pilot, which is a more general incentive program, will be finalized after field testing has begun but for modeling, CenterPoint Energy assumed incentives of approximately one-quarter of the total project costs or approximately $17,000 per participating single-family home. Savings amounts for phase 3 will similarly depend on final pilot design to be proposed after field testing is underway, but for modeling, CenterPoint Energy assumed savings of 65 Dth/year for a single-family home.

Table 1. Historic Performance – Insulation and Other Envelope Measure Rebates

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Rebates	960	3,272	4,995	2,192	935	1,298	1,329	1,135	1,705	2,059	2,416	2,034	1,817
Average Savings (Dth/per measure)	5.3	5.4	5.4	14.1	15.0	16.3	17.0	18.6	16.9	16.4	15	17.6	17.7
Average Rebate ($/per measure)	$192	$168	$171	$449	$450	$466	$458	$472	$441	$478	$467	$464	$466

3. CenterPoint Energy is required to propose a pilot that facilitates deep energy retrofits and the installation of cold climate electric air-source heat pumps in existing residential homes that have natural gas heating systems in its first NGIA Plan.[9] In addition, CenterPoint Energy does not believe that the proposed pilot would be suitable for CIP/ECO given the highly research-oriented nature of the pilot and low cost effectiveness if evaluated under the CIP/ECO cost-effectiveness tests. As described in Exhibit D, CenterPoint Energy proposes to roll out this pilot in three phases, of which the first two are modeling and field testing. Only the final phase is similar to a typical CIP/ECO rebate program. However, even the final phase is unlikely to be cost-effective under the CIP/ECO cost-effectiveness structure given the emphasis of the pilot on deep energy retrofits. All levels of retrofit being considered for field testing exceed the requirements of CenterPoint Energy's CIP/ECO rebate.

Small/Medium Business GHG Audit

The Small/Medium Business GHG Audit will expand on CenterPoint Energy's Natural Gas Energy Analysis ("NGEA") CIP/ECO offering to identify opportunities for GHG-reducing measures that are not offered in CIP. Initially, CenterPoint Energy plans to focus this pilot on offering CarbinX carbon capture units and commercial hybrid heating systems.

1. CenterPoint Energy's current CIP Triennial Plan and proposed Triennial Plan to be filed on June 30, 2023 include the NGEA project, but neither include any of the measures to be included in this NGIA expansion pilot. Please see the discussion above about the Commercial Hybrid Heating pilot for discussion of the commercial hybrid heating measure.
2. Strategic electrification has not been included in any past CIP plans. Data on performance of the NGEA project is provided below.

[9] Minn. Stat. § 216B.2427, subd. 8.

Table 2. Historic Performance – NGEA Audits

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Audits	138	124	63	50	63	91	60	92	141	164	143	194	182
Direct Install Savings per Audit (Dth)	0	0	0	0	0	0	0	21.7	29.8	47.3	35.3	48.5	125

3. CenterPoint Energy is required to propose a pilot to provide thermal energy audits to small- and medium-sized businesses in order to identify opportunities to reduce or avoid GHG emissions from natural gas use in its first NGIA plan.[10] However, CenterPoint Energy also believes that this pilot is appropriately included in NGIA as it is intended to encourage uptake of other NGIA measures that are not included in CIP/ECO.

Residential Gas Heat Pumps

The Residential Gas Heat Pumps pilot will provide a gas energy efficiency measure, specifically gas heat pumps, to CenterPoint Energy residential customers.

1. CenterPoint Energy's current CIP Triennial Plan and proposed Triennial Plan to be filed on June 30, 2023 do not include residential gas heat pumps.
2. Residential gas heat pumps have not been included in any past CIP plans.
3. Residential gas heat pumps are not currently cost effective under the CIP cost-effectiveness structure. If the cost-effectiveness of residential gas heat pumps increased, CenterPoint Energy would consider them for inclusion in CIP/ECO.

Gas Heat Pumps for Commercial Buildings

The Gas Heat Pumps for Commercial Buildings pilot will provide a gas energy efficiency measure, specifically gas heat pumps, to CenterPoint Energy commercial and industrial customers.

1. CenterPoint Energy's current CIP Triennial Plan and proposed Triennial Plan to be filed on June 30, 2023 do not include commercial or industrial gas heat pumps.
2. CenterPoint Energy has supported the installation of commercial gas heat pumps through CIP research and development funding in prior CIP plans. Specifically, CenterPoint Energy contributed funding for lab and field testing of pre-commercialized absorption heat pump technology in 2018-2019. Field testing was not conducted in Minnesota.
3. Commercial gas heat pumps are not currently cost effective under the CIP/ECO cost-effectiveness structure. If the cost-effectiveness of commercial gas heat pumps increased, CenterPoint Energy would consider them for inclusion in CIP/ECO.

[10] Minn. Stat. § 216B.2427,subd. 6.

Industrial and Large Commercial GHG Audit

The Industrial and Large Commercial GHG Audit will expand on CenterPoint Energy's Process Efficiency and Commercial Efficiency CIP/ECO offering to identify opportunities for GHG-reducing measures that are not offered in CIP/ECO. Initially, CenterPoint Energy plans to focus this pilot on offering CarbinX carbon capture units, industrial heat pumps, solar thermal walls, onsite biogas production/use, and energy efficiency measures that are not cost-effective under the CIP societal cost test.

1. CenterPoint Energy's current CIP Triennial Plan and proposed Triennial Plan to be filed on June 30, 2023 include the Process Efficiency and Commercial Efficiency project, but CenterPoint Energy will only support measures through this pilot which are not eligible for CIP. See discussion in Exhibit D regarding customer incentives.
2. Strategic electrification has not been included in any past CIP plans. Data on performance of the Process Efficiency and Commercial Efficiency projects is provided below.

Table 3. Historic Performance – Process Efficiency and Commercial Efficiency

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number Customers	0	0	0	3	1	6	10	17	8	11	11	11	7
Savings per Customer (Dth)	0	0	0	7,330	10,566	1,786	3,663	1,424	735	1,026	1,180	901	5,831

3. It is reasonable to include this pilot in NGIA as it is intended to encourage measures that are not included in CIP/ECO.

In the Matter of
CenterPoint Energy Natural Gas Innovation Act (NGIA)
Innovation Plan

Petition of CenterPoint Energy

EXHIBIT J: RESEARCH & DEVELOPMENT

Docket No. G-008/M-23-215

June 28, 2023

PUBLIC VERSION

CenterPoint Energy has designated information in Attachment 2 as trade secret. The information meets the definition of trade secret in Minn. Stat. § 13.37, subd. 1(b), as follows: (1) the information was supplied by CenterPoint Energy, the affected organization; (2) we have taken all reasonable efforts to maintain the secrecy of the information, including protecting it from disclosure in this proceeding; and (3) the protected information contains budgetary information and technological specifications provided to CenterPoint Energy by potential project partners, which derives independent economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means, by other persons who could obtain economic value from its disclosure or use.

In this Exhibit, CenterPoint Energy provides additional detail on each of the research and development ("R&D") pilots it proposes for the first two years of its initial Natural Gas Innovation Act ("NGIA") plan ("Plan"). As described in the body of the filing, CenterPoint Energy proposes to utilize the full available budget for R&D over the five-year Plan term but is only proposing specific projects for the first two years of the Plan at this time. CenterPoint Energy will propose additional R&D pilots in annual NGIA status reports.

The proposed R&D projects include:

- CenterPoint Energy Minnesota Net Zero Study
- Weatherization Blitzes
- High Performance Commercial New Construction Building Envelope Initiative
- Assessing Next-Generation Micro-Carbon Capture for Commercial Buildings
- Green Ammonia Novel Technology
- Renewable Natural Gas ("RNG") Potential Study
- Utilization of Green Ammonia for Thermal Applications

In addition to the short descriptions below, the following attachments include additional details on the R&D pilots that were proposed to CenterPoint Energy by external parties:

- Attachment 1: High Performance Building Envelope Detail
- Attachment 2: Assessing Next-Generation Micro-Carbon Capture for Commercial Buildings Detail
- Attachment 3: Green Ammonia Novel Technology Detail
- Attachment 4: RNG Potential Study Detail
- Attachment 5: Utilization of Green Ammonia for Thermal Applications Detail

CenterPoint Energy Minnesota Net Zero Study

CenterPoint Energy proposes hire a consulting firm ("Contractor") selected based on responses to a request for proposal ("RFP") to investigate pathways for achieving net-zero emissions from natural gas use in its Minnesota service territory by 2050, with a focus on both scope 1 and 3 emissions. This analysis, specific to CenterPoint Energy's service territory, will build off of the statewide G21 Report.[1] CenterPoint Energy's primary goal for this R&D pilot is to gain additional knowledge about potential pathways to net zero emissions for its system that can guide future NGIA activities and plan filings.

CenterPoint Energy anticipates that the work will have five steps as follows:

Step 1: Base Year & 2050 Reference Case Growth. Contractor will review CenterPoint Energy's existing accounting of emissions in Minnesota across three main categories: customers, local distribution company (methane), and suppliers (upstream), including supporting materials or analysis CenterPoint Energy has already completed in support of its

[1] Decarbonizing Minnesota's Natural Gas End Uses: Stakeholder Process Summary and Consensus Recommendations (July 2021), https://e21initiative.org/wp-content/uploads/2021/07/Decarbonizing-NG-End-Uses-Stakeholder-Process-Summary.pdf.

corporate Net Zero emissions target. Contractor will also gather and request more granular information on CenterPoint Energy customer consumption and emissions. Contractor will discuss with CenterPoint Energy existing customer growth expectations and other plans expected to contribute to emission reductions or increases (for example, energy efficiency programs, adoption of low-carbon gas supplies, etc.). Given this information, Contractor would then establish a reference case for future CenterPoint Energy emissions, from which it can assess additional emission reduction opportunities.

Step 2: Review and Discussion of 2050 Options. Contractor will consider a range of additional emissions reductions strategies that should be considered to achieve net zero emissions by 2050. CenterPoint Energy will then host a discussion engaging interested parties to build an understanding of the challenges and opportunities for different scope 1 and 3 emission reduction opportunities.

Step 3: Pathway Development. CenterPoint Energy will identify pathways to be modeled in the study. Pathways should be aligned with core tenets of scenarios in the G21 report but may also incorporate different elements from the American Gas Association's Net-Zero Emissions Opportunities for Gas Utilities Report[2] and other research.

Step 4: Modeling of Pathways. Contractor will model the impacts of the selected pathways. Modelling results would include impacts on gas and electricity consumption, customer energy and equipment costs, GHG emissions reductions, and other areas identified as important in steps 1-3.

Step 5: Final Report. Contractor and CenterPoint Energy will prepare a final report on the pathways selected and modeling results. This report will be filed with the Commission.

CenterPoint Energy estimates that this study will take approximately one year to complete and will cost approximately $220,000.

Weatherization Blitzes

CenterPoint Energy proposes to test intensive, novel, and community-based marketing and outreach to increase participation in CenterPoint Energy's existing Conservation Improvement Program ("CIP") weatherization offerings. CenterPoint Energy would also seek to promote Inflation Reduction Act tax credits and rebates that complement CIP offerings in order to 'braid' federal and utility funding for maximum effect. CenterPoint Energy expects to implement this pilot in one or more low-income neighborhoods and one or more neighborhoods that are not low-income.

CenterPoint Energy's research questions for this pilot are as follows:

1) Which community-based, local outreach tactics are most effective at increasing participation in weatherization programs?
2) What is the cost-effectiveness of various tactics?

[2] https://www.aga.org/research-policy/pathways-to-net-zero/.

3) Does the success of various tactics depend on particular neighborhood characteristics?

CenterPoint Energy anticipates hiring a contractor ("Contractor") to deliver this project following an RFP process. The contractor would be responsible for research design and project management. CenterPoint Energy anticipates that additional partners would be engaged as part of the implementation of the project.

CenterPoint Energy expects this pilot to have the following steps:

Step 1: Customer Survey and Data Collection. Contractor will gather data from CenterPoint Energy, administration of customer survey, and other sources to inform research design and selection of outreach tactics and identify neighborhoods for potential inclusion. This data would include demographic data, data on the age of homes, past CIP participation, and data on enrollment in public benefit programs such as the Supplemental Nutrition Assistance Program, the Low Income Home Energy Assistance Program, Medicaid, etc., if available.

Step 2: Neighborhood Selection. Contractor will identify possible neighborhoods to target with the pilot. CenterPoint Energy will hold a meeting with interested parties to discuss neighborhood selection. Note that more neighborhoods will be "selected" at this stage than may ultimately be included in the pilot.

Step 3: Community Engagement. CenterPoint Energy will reach out to community/government leaders, community organizations, and other potential partners within selected neighborhoods to discuss potential inclusion of neighborhoods in the pilot, tactics to be used, and how CenterPoint Energy and the Contractor could work with partner organizations to give the pilot the best chance of success.

Step 4: Research Design and Implementation. Using information and feedback collected in Steps 1-3, Contractor will design the research plan (i.e., finalize research questions, analysis to be conducted, and data collection requirements) and develop a plan for implementation. Additional implementation partners appropriate for outreach activities will be identified and engaged. Contractor and other implementation partners will conduct community outreach using a variety of tactics including potentially:

- Attendance/presentations at community events;
- Door-to-door canvassing;
- Radio and newspaper ads/interviews;
- Workshops to educate residents on energy efficiency and available incentives;
- Promotions through local government outreach channels;
- Community challenges; and
- Geotargeted social media or web advertisements.

Using demographic information for the neighborhoods included in the pilot, CenterPoint Energy may conduct outreach and promotions in multiple languages.

Step 5: Data Collection and Analysis. Contractor and CenterPoint Energy will take appropriate steps in the implementation phase to track each neighborhood's participation in CIP.

During and after the implementation phase, Contractor will examine data collected to provide answers to the research questions identified above and draw conclusions, where appropriate, regarding the tactics that resulted in the greatest increase in CIP utilization.

CenterPoint Energy plans to deliver this pilot over the first two years of the Plan and estimates that it will cost approximately $800,000. At the conclusion of this pilot, CenterPoint Energy will evaluate what pilot strategies were effective and could be included in CIP or future NGIA efforts. CenterPoint Energy will provide updates on this pilot, including its conclusions after project completion, in annual NGIA status report filings.

High Performance Commercial New Construction Building Envelope Initiative

CenterPoint Energy proposes to provide funding to one of the respondents to CenterPoint Energy's request for ideas ("RFI") to test a multi-strategy to address barriers to integrating high-performance commercial building envelopes in new commercial construction. The estimated cost of this proposal is $400,000 and it is expected to take approximately two-years to complete. Details for this pilot were provided by the RFI respondent and are included as Attachment 1 to this Exhibit.

Assessing Next-Generation Micro-Carbon Capture for Commercial Buildings

CenterPoint Energy proposes to provide funding to one of the respondents to CenterPoint Energy's RFI to investigate the carbon capture effectiveness and heat recovery efficiency of CleanO2's next generation CarbinX units (version 4.0). This pilot complements the full pilot Carbon Capture Rebates for Commercial Buildings, which will incent installation of version 3.0 units. The estimated cost of this research is $275,000 and it is expected to take 20 months to complete. Details for this pilot were provided by the RFI respondent and are included as Attachment 2 to this Exhibit.

Green Ammonia Novel Technology

CenterPoint Energy proposes to support testing of a Modular One Vessel Ammonia Production System for green ammonia, which has the potential to improve production efficiency and reduce costs for green ammonia production. CenterPoint Energy proposes to provide $100,000 in funding for this pilot,[3] and the pilot is expected to take 24 months to complete. Details for this pilot were provided by an RFI respondent and are included as Attachment 3 to this Exhibit.

Pursuant to Minn. Stat. §216B.2427, Subd. 5, in determining whether to approve a power-to-ammonia pilot program as part of an innovation plan, the Commission must consider: (1) the risk of exposing any person to unhealthy concentrations of ammonia; (2) the risk that any home or business might be affected by ammonia odors; (3) whether the GHG emissions addressed by the proposed power-to-ammonia project could be more effectively addressed using power-to-hydrogen; and (4) whether the power-to-ammonia project achieves lifecycle GHG emissions reductions in the agricultural sector more effectively than power-to-hydrogen. CenterPoint Energy addresses these points below.

[3] As shown in Attachment 3, the project proponent requested $250,000 but CenterPoint Energy is proposing to provide $100,000 in funding.

The risk of exposing any person to unhealthy concentrations of ammonia and the risk that any home or business might be affected by ammonia odors.

As a small-scale demonstration pilot to take place at a research facility, the likelihood of exposing any person to unhealthy concentrations of ammonia or exposing a home or business to ammonia odors is minimal. The research facility where this demonstration will take place has previously worked with novel ammonia technologies and has processes in place to ensure the safety of its personnel and comfort of nearby homes and businesses.

Whether the GHG emissions addressed by the proposed power-to-ammonia project could be more effectively addressed using power-to-hydrogen.

Because this pilot is specifically intended to improve power-to-ammonia production processes, its goals could not be better addressed by a power-to-hydrogen pilot.

Whether the power-to-ammonia project achieves lifecycle GHG emissions reduction in the agricultural sector more effectively than power-to-hydrogen.

This demonstration pilot will not target emissions reductions in any particular sector but will instead seek to demonstrate the viability of a novel approach to power-to-ammonia production.

RNG Potential Study

CenterPoint Energy proposes to study three regions of the CenterPoint Energy service territory for potential development of an RNG production facility. Regions will be selected based on potential for production of RNG feedstock and feasibility of accepting substantial quantities of RNG into CenterPoint Energy's system. Estimated cost for this study is $60,000 and the study is expected to be completed by the end of 2023. CenterPoint Energy plans to fund this study prior to Plan approval based on expected benefits for the proposed RNG RFP Purchase Pilot and is requesting recovery as part of its NGIA Plan both as a cost "to develop and administer programs"[4] and a cost "for research and development related to innovative resources." These are counted towards plan costs once as part of the R&D budget.[5] Details for this pilot were provided by an RFI respondent and are included as Attachment 4 to this Exhibit.

Utilization of Green Ammonia for Thermal Applications

CenterPoint Energy proposes to support research into how green ammonia may be used in industrial-scale burner applications. The primary goal of this pilot is to determine operating ranges and burner concepts that can be applied to industrial burners used in grain drying and boilers used for district heating. Estimated cost for this research is $205,000 and the research is expected to take approximately two years. Details for this pilot were provided by an RFI respondent and are included as Attachment 5 to this Exhibit.

Pursuant to Minn. Stat. §216B.2427, Subd. 5, in determining whether to approve a power-to-ammonia pilot program as part of an innovation plan, the Commission must consider: (1) the

[4]Minn. Stat. § 216B.2427, subd. 1(r)(iv).

[5]Minn. Stat. § 216B.2427, subd. 1(r)(v).

risk of exposing any person to unhealthy concentrations of ammonia; (2) the risk that any home or business might be affected by ammonia odors; (3) whether the GHG emissions addressed by the proposed power-to-ammonia project could be more effectively addressed using power-to-hydrogen; and (4) whether the power-to-ammonia project achieves lifecycle GHG emissions reductions in the agricultural sector more effectively than power-to-hydrogen. CenterPoint Energy addresses these points below.

The risk of exposing any person to unhealthy concentrations of ammonia and the risk that any home or business might be affected by ammonia odors.

As a small-scale demonstration pilot to take place at a research facility, the likelihood of exposing any person to unhealthy concentrations of ammonia or exposing a home or business to ammonia odors is minimal. The research facility where this demonstration will take place has previously worked with novel ammonia technologies and has processes in place to ensure the safety of its personnel and comfort of nearby homes and businesses.

Whether the GHG emissions addressed by the proposed power-to-ammonia project could be more effectively addressed using power-to-hydrogen.

Because this pilot is specifically intended to determine operating ranges and burner concepts that could be compatible with green ammonia, the goals of the pilot could not be better addressed by a power-to-hydrogen pilot.

Whether the power-to-ammonia project achieves lifecycle GHG emissions reduction in the agricultural sector more effectively than power-to-hydrogen.

One of the goals of this pilot is to investigate operating ranges and burner concepts that can be applied to industrial burners used in grain drying. Ammonia may be a particularly promising fuel for grain dryer applications because grain dryers could potentially use the same source of ammonia for fuel as is used in nearby farming operations for fertilizer. If the ammonia source for fertilizer operations was decarbonized via power-to-ammonia, grain dryer fuel use could be decarbonized via the same supply chain. Because hydrogen is not used as a fertilizer, power-to-hydrogen does not have the same potential as power-to-ammonia to decarbonize both grain dryer fuel and fertilizer simultaneously.

1. Basic Information

R&D Project Title: High-Performance Building Envelope Initiative

Lead Organization: Center for Energy and Environment

Name of Primary Contact: Russ Landry, PE

Email: rlandry@mncee.org

Phone Number: 612-335-5863

Other Project Partners: LHB Corporation, Willdan, and Precipitate Architecture

2. Project Overview

Provide a high-level overview of your project.

Minnesota is not currently on track to meet its greenhouse gas (GHG) reduction targets. High-performing commercial building envelopes are critical in reducing GHG emissions, but are rarely incorporated into new commercial construction, especially in small and medium-sized buildings. There are many market barriers that limit the demand and implementation of high-performance envelopes. This project will undertake a multifaceted strategy to address these barriers and start creating a more focused and streamlined approach to high-performance building envelope design and integration into new commercial construction in Minnesota. This is needed to improve the envelope thermal and air tightness characteristics.

The project's efforts will include:

1. Survey designers to gather insight regarding decision making behind high-performance envelope options and gaps between their current processes and the potential for early design phase building energy simulation and cost modeling to better inform decision making.
2. Gather and analyze data for 5–10 existing buildings with high-performance envelopes, including detailed interviews with designer and others about decision making, costs, and the impact on HVAC systems.
3. Review previous prototype modeling and conduct new modeling to provide insights about optimal design and cost interactions for a range of building types and sizes.
4. Compile information about various definitions of high-performance building envelopes into a single resource and develop best practices recommendations.
5. Develop and deliver training for key industry decision makers.

Together, these efforts will both provide better information for utility program planning and increase the use of building envelope design best practices in Minnesota.

3. Learning Goals

What new information will we learn from this project? How will this project advance the development of NGIA Innovative Resources?

The new information and resources that will be compiled by this project include the following.

1. We will compile information about current design decision making and modeling practices, and how those compare to available tools and potential best practices.
2. We will compile information about the impact of high-performance building envelopes directly on building envelope costs and HVAC system cost savings associated with lower capacity requirements and/or enabling a change in HVAC system type. Similarly, information about the amplified energy impact from HVAC system changes will be evaluated. The data will come from a combination of real-world buildings and modeling exercises that extend those findings to a wider variety of building types and sizes. This information will be compiled in a resource that can be made available to designers and developers.

The above information will advance the development of NGIA Innovative Resources by:

1. Identifying the best opportunities for CenterPoint Energy to intervene in building envelope design decision making and developing resources that can be used for that intervention.
2. With the expected trends toward fully electrified and hybrid heating systems, the project's new information about the relationships between high-performance building envelopes and HVAC system size, type, and cost will be valuable for planning. This information can be used to help identify opportunities where the reduced loads associated with higher performance building envelopes expands the potential for innovative HVAC system solutions.
3. The resources and training provided will help to increase the uptake of high-performance building envelopes that provide much more reliable long-term load reduction than many other measures that have far shorter expected measure lifetimes.

4. Data Collection and Analysis

Describe the data that will be collected through this project. How will this data be analyzed?

The project's data collection and analysis will include two different but related activities that will collect and analyze new data, as well as a subsequent analysis stage guided by the findings of the first two activities. As outlined below, the team will survey designers and analyze data from 5 to 10 existing buildings. In addition to analyzing the data from each of the raw data collection activities, the team will perform prototype modeling that will help inform decision making for a wider variety of building types.

Designer Surveys. The team will primarily collect information through interviews conducted by professional staff with knowledge of the building design process. As needed, the interview approach

may be supplemented with an online survey form that addresses the same questions. The designer survey is expected to include the following items.

- The number of Minnesota buildings designed per year
- Typical building envelope design practices for key building types
- Awareness of different thermal and air barrier high-performance building envelope options
- How often different high-performance building envelope options are included in designs
- Decision-making process when considering high-performance building envelope options
- Whether an air barrier consultant is used for design and/or commissioning
- Use of modeling tools and approaches for evaluating high-performance building envelopes
- Use of utility design assistance programs
- Current and expected trends in HVAC system type for different building types and sizes
- Use of modeling tools and approaches for HVAC system sizing
- Level of integration of envelope and HVAC design considerations (e.g., are HVAC cost savings considered for cost/benefit evaluation of higher performance envelope options)
- Barriers to high-performance building envelope designs
- Training, information, and services that would allow them to design high-performance envelopes
- Impressions of building types and sizes where high performance building envelopes are the most cost-effective and the most likely to significantly impact HVAC system cost

The survey results will be reviewed with objective statistical analysis of trends and correlations, as well as subjective analysis of open-ended responses. This will include an analysis of gaps between current energy performance and HVAC system sizing modeling tools and approaches, and available modeling tools and approaches that could better inform the design process regarding the energy savings and HVAC cost reduction benefits of high-performance building envelopes. The results will also help guide targeting of specific high-performance building envelope options, HVAC system types, and building types in the subsequent project activities.

Analysis of Existing Buildings. The team will collect detailed design and decision-making information through designer interviews, contractor interviews, building owner interviews, email correspondence, review of plan excerpts, building owner interviews. The team expects the types of raw data that will be gathered to include the following information.

- Details of the high-performance building envelope options included in the building
- Information about the HVAC system type and size
- How were high-performance building envelope options evaluated against standard designs
- What key factors led to the selection of a high performance building envelope
- How was the HVAC system type evaluated and selected
- Construction process impacts
- Owner satisfaction and perceived value items
- First costs of the as-built envelope and HVAC systems
- Projected energy performance of the building
- What the costs would have been with a standard envelope design

It is expected that, in many cases, the last two items noted above will not be available as raw data points but will be determined by a combination of further analysis performed by the design teams and analysis performed by the research project team. Where appropriate and as design teams are willing, we will compensate design team members for their time performing this additional analysis. In other cases, the research project team will perform this analysis based on the information provided by the design teams.

The existing building data will be reviewed with objective statistical analysis of trends and correlations, as well as subjective analysis. The results will help guide targeting specific high-performance building envelope options, HVAC system types, and building types in all subsequent project activities, in addition to providing the basis for case studies that will be used in training, and other possible future promotion activities.

Prototype Modeling. The project will review past prototype modeling efforts and conduct new modeling as necessary to fill in key gaps to guide well-informed decision making for buildings in CenterPoint Energy's Minnesota service territory. This analysis is expected to include whole-building energy simulation analysis of energy performance and HVAC system sizing for a limited number of prototype buildings. Each prototype building model will provide information for a key representative building type and size. Then, the impact of various options for building envelope performance—including envelope air leakage rates--on energy performance and HVAC sizing will be evaluated with permutations of the prototype building model. The results will be combined with information from a cost-estimator to compile information on how the direct envelope construction costs and indirect HVAC system costs change for different high-performance building envelope design options. Graphical, statistical, and trend analysis of the results from the large number of individual simulation runs will be carried out to:

1. Provide inside into what building types and sizes provide the best opportunities for high-performance building envelopes in CenterPoint Energy's Minnesota service territory.
2. Provide information on trends that will serve as a resource for designers.
3. Guide this project's training activities and provide critical material to include in the training.
4. Help guide recommendations for future CenterPoint Energy activities related to high-performance building envelopes.

5. Project Team

List the project team members, their role in the project. Please note any other organizations that project partners

The project team member roles are outlined in the table below, and summary information about each organization on the team is provided in the paragraphs following the table. The team's history of working closely together includes:

- CEE, LHB, and Willdan collaborating on the Sustainable Buildings 2030 program for 14 years
- CEE and LHB collaborating on several CARD-funded research projects
- LHB and Precipitate working together on a Phius certified passive building project

#	Task	Roles			
		CEE	LHB	Willdan	Precipitate
1	Design Firm Surveys	Lead survey development, deployment and analysis of results	Provide input into design, participate, and provide feedback on analysis	Provide modeling tool information for EDA and assist with recruitment	Assist with design, provide modeling tool information for WUFI, and provide feedback on analysis
2	Analysis of Existing Buildings	Assist with survey design, recrtuitment, data gathering from non-partner firms, and analysis	Lead survey design, provide responses for ~3 projects, and assist with analysis	Assist with recruitment and provide data from modeling for ~4 projects	Assist with survey design, provide responses for ~4 projects, and provide feedback on analysis
3	Prototype Modeling	Lead	Provide input into prototype modeling	Provide input into prototype modeling	Provide extensive guidance on prototype modeling
4	Guidance on High Performance Envelope Definitions	Lead	Assist with research and provide guidance on resource development	Provide input	Provide input
5	Training	Lead overall, colead mechanical engineer/modeling training	Colead architect training	Colead mechanical engineer/modeling training	Colead architect training and mechanical engineer/modeling training
6	Project Management & Report	Lead	Take part in team meetings, assist with recommendations development and contribute to report	Assist with recommendations for EDA	Take part in team meetings, assist with recommendations development and contribute to report

Center for Energy and Environment (CEE) – CEE is a community-based clean energy nonprofit. Our mission is to discover and deploy the most effective energy solutions that strengthen the economy and improve the environment. We have extensive experience in energy modeling, air sealing/leakage testing and stakeholder engagement.

LHB – Originally founded as a structural engineering firm, LHB includes architects, interior designers, and surveyors. LHB is a full-service firm that can complete all facets of a project using dedicated, in-house teams. LHB has extensive connections in the commercial building industry as well as extensive energy modeling expertise.

Willdan – Willdan is a leading energy efficiency implementor in the United States, currently serving 24 of the 25 largest utilities. With tailored energy analysis models, Willdan collaborates with design teams and building owners to improve energy performance of new construction and major renovation projects. Willdan has extensive experience developing tools and processes to support energy design assistance and energy modeling.

Precipitate – Precipitate was founded in June 2017 to accelerate the adoption of carbon-neutral building practices. We believe that in order to design healthy buildings and communities, we must prioritize the health and well-being of people and planet. We work toward climate justice for all through carbon neutral architecture, advocacy, teaching, planning, and research. We are changemakers forging a path for climate action in the AEC industry and our communities. Precipitate has supported two project teams to achieve passive house certification through Phius, with eight designs certified and entering construction and more on the drawing boards. We're passionate about helping project teams increase energy efficiency and occupant well-being.

Others Expected to Receive Project Funds – We anticipate subcontracting with a yet to be determined cost estimator. We also expect to be paying currently undetermined design and/or modeling firms to provide information on and perform additional analysis for the individual high-performance building projects that will be selected. Lastly, we plan to provide a nominal incentive to design professionals that participate in the survey (e.g., $100 gift cards).

6. Workplan

Provide a workplan listing major tasks, their timelines, and key deliverables.

The table below summarizes the work plan tasks and timelines. The work plan tasks and their associated deliverables are detailed in the paragraphs following the table.

#	Task	Timeline
1	Design Firm Surveys	Q1 & Q2
2	Analysis of Existing Buildings	Q1 - Q6
3	Prototype Modeling	Q2 - Q8
4	Guidance on High Performance Envelope Definitions	Q1 - Q4
5	Training	Q5 - Q8
6	Project Management & Report	Q1 - Q8

Task 1. Design Firm Surveys. Interview design firms to better understand how they incorporate modeling into their designs. This will be compared against information the team will compile information on existing energy modeling tools and the degree to which various tools adequately and most easily incorporate building envelope adjustments into their calculations. If they are not conducting their own modeling, why have they made that decision and what would have to change for them to bring that activity in-house? What are the barriers they believe make it difficult to propose high-performance envelopes as part of their projects? The deliverables for this task will include:

- Survey questionnaire – at 1.5 months
- Summary report of survey results — end of Q2

Task 2. Analysis of Existing Buildings. Because commercial buildings vary significantly by type and size, gauging the impact of high-performance envelopes on the efficiency of other systems, like HVAC, can be difficult. As building size increases, there is not a linear impact on energy savings that can be obtained from downsizing other systems. There is also a lack of accurate information on incremental costs and other associated benefits related to high-performance envelopes. These complicating factors and the lack of a comprehensive resource to consult makes it more difficult for designers and building developers to pursue better performing projects.

We propose to gather data through analyses of 5 to 10 existing buildings with high-performance envelopes to better understand incremental costs and the envelope's impact on other aspects of the building. Data gathering would also include interviews with designers, building owners, contractors and

real estate experts to gather information not only on specific system impacts, but other value-added impacts like occupant comfort and green building designation. The deliverables for this task will include:

- List of information to be gathered for each site – end of month 2
- Preliminary site targeting criteria and preliminary candidates – end of Q1
- Final list of sites selected – end of Q5
- Summary report of survey results – end of Q2

Task 3. Prototype Modeling. Because few projects are designed with high-performing envelopes, we also plan to collect information on past prototype modeling efforts and complete our own prototype modeling as necessary to more accurately determine associated incremental costs and how envelope best practices change as building types change. The goal is to create a comprehensive resource that designers and building developers can access to inform their projects and decision making. The deliverables for this task with include:

- Summary of previous prototyping – end of Q2
- Preliminary prototyping analysis plan – at 7.5 months
- Interim prototyping status report – end of Q4
- Summary report of prototyping results – middle of Q8

Task 4. Guidance on High-Performance Building Envelope Definitions. We will survey existing Minnesota codes and national efforts to provide guidance on the definition of a high-performance commercial building. There are many approaches, but currently no agreed upon target for designers and developers to pursue. A few examples include:

- US Army Corps of Engineers – 0.25 cfm/ft^2 air leakage target (compared to 0.40 cfm/ft^2 that is expected to be incorporated into a 2023 Minnesota Energy Code update).
- DOE's Building Envelope Campaign – targets for new commercial buildings.
- Novel 20 – Recognition available to new buildings that demonstrate a building envelope heat loss/gain reduction of 20% over code, due to incorporation of emerging high-performance envelope technologies.
- Novel 40 – Recognition available to new buildings that demonstrate a building envelope heat loss/gain reduction of 40% over code, due to incorporation of emerging high-performance envelope technologies.
- Passive House guidelines for commercial buildings – These guidelines provide a limit on the peak heating and cooling design loads. According to Passive House Institute U.S., developers pursuing certification under the PHIUS+ Standard report a cost premium for passive building methods at approximately 0–3% over a standard Energy Star construction baseline.
- ASHRAE's Advanced Energy Design Guide series provides clear roadmaps for achieving a high level of whole-building energy savings for a number of specific, small to medium-sized building types.

Minimally, this part of the effort would be incorporated into a comprehensive resource and provide easy access to existing guidance. This could also be a first step in choosing a single path for Minnesota to

follow, which would make it easier for designers and building developers to establish high-performance targets for building design. The deliverable for this task will consist of:

- Summary report of guidance – end of Q4

Task 5. Training. Education will be a significant part of the process. We would create an initiative and training to engage the utility, designers, building developers, contractors, cities, and manufacturers to encourage uptake of best practices in energy efficient building envelope design. This initiative will be modeled after the successful air source heat pump collaborative. As part of this engagement, we would encourage policy decisions at the city and state level that would support higher performance standards. The deliverables for this task will consist of:

- Outline plan of training activities and key themes – end of month 13
- Electronic versions of case study document(s)
- Electronic versions of training materials, including any available recordings of training activities

Task 6. Project Management and Report. In addition to the communication, management, and invoicing details required by CenterPoint Energy, CEE will augment the project management approach to ensure that high-quality results are achieved in a timely manner. This is expected to include a kickoff meeting with CenterPoint Energy's project manager to review a detailed breakdown of the work structure. This ensures a shared understanding of the project and allows for any foreseeable issues to be addressed early, avoiding future rework and delays. Additionally, the CEE and LHB project leads will conduct phone conferences with CenterPoint Energy's project manager at least bimonthly to share accomplishments and discuss issues encountered; they will also meet as needed to discuss key decision points, and in the event of any significant deviations from the project schedule, budget, or scope.

Internally, the project team will meet biweekly. The PI will update CEE's research director bimonthly throughout the project to review progress on all tasks. Periodic risk assessments and quality audits will be conducted. Three-month projections of staff allocations by project will be used to identify over-allocations and staff assignments will be shifted to assure tasks can be completed on schedule.

The deliverables for this task will consist of:

- Final report incorporating findings from all tasks and recommendations for future activities – end of Q8

7. Budget

Provide a budget for the CenterPoint Energy component of your project.

Please note any other funding you will be leveraging (e.g. federal grants, other utility funding, etc.)

The tables below summarize the estimated budget breakdown by task, organization and year.

Estimated Budget Breakdown by Task

#	Task	Budget
1	Design Firm Surveys	$44,060
2	Analysis of Existing Buildings	$116,728
3	Prototype Modeling	$109,620
4	Guidance on High Performance Envelope Definitions	$15,756
5	Training	$50,360
6	Project Management & Report	$62,424
	TOTAL	$398,948

Estimated Budget Breakdown by Organization

Organization	Budget
CEE	$191,700
LHB	$54,748
Willdan	$51,500
Precipitate	$67,000
Others	$34,000
TOTAL	$398,948

Estimated Budget Breakdown by Project Year

Period	Budget
Project Year 1	$207,412
Project Year 2	$191,536
TOTAL	$398,948

If funded, a CEE-led project application for DOE funding (under FOA Number DE-FOA-0002813 Resilient and Efficient Codes Implementation) is expected to include activities that would complement some of this NGIA project's activities. If that proposal to DOE is funded, the funding level and a more detailed outline of activities will be known by the time that contracting for this NGIA project takes place.

8. Other resources required from CNP

Beyond direct funding, list other resources or support needed from CenterPoint Energy that would help the success of this project.

No other need for CenterPoint Energy resources or support is anticipated at this time.

CenterPoint Energy NGIA Innovation Plan
Research & Development Project – Project Plan Template

1. Basic Information

R&D Project Title: Carbon Capture for Residential and Commercial Water Heating

Lead Organization: GTI Energy

Name of Primary Contact: Abbas Ahsan

Email: aahsan@gti.energy

Phone Number: 847-768-0515

Other Project Partners: CleanO2

2. Project Overview

For residential and commercial buildings, distributed carbon capture is an emerging technology for decarbonization. These technologies can be integrated with boilers or water heaters to reduce carbon emissions from gas combustion. For this proposed project, GTI Energy (GTI) will demonstrate CleanO2's latest carbon capture technology with existing gas-fired space or water heating equipment in coordination with CenterPoint Energy (CNP). GTI will document its installed performance, carbon capture effectiveness, energy savings, economics, and best practices for installation, operation, and maintenance. This assessment will also identify areas of improvement with respect to product design and operation to support continued technology development. GTI will also collect feedback from facility staff and identify codes, standards, regulations, and policies which may be potential barriers to broader deployment of promising distributed carbon capture technologies.

3. Learning Goals

The demonstration of CleanO2's latest carbon capture technology will provide valuable insight into the potential of using novel distributed carbon capture technology to mitigate the carbon emissions from gas-fired appliances. Previous demonstrations of CleanO2's technology featured an older generation of their CarbinX unit which is limited in terms of compatibility with modern, higher-efficiency water heating appliances. [redacted] The learning objectives of this project are as follows:

- Demonstrate best practices for installing carbon capture technology with condensing efficiency appliances, particularly in regards to venting and condensate management.
- Provide data-driven carbon capture metrics to validate CleanO2's target of a [redacted]
- Determine the payback period for a field installation of the CarbinX and extrapolate the results of the case study to provide insight into the economic feasibility of small-scale post-combustion carbon capture technology.

The outcomes from this demonstration of CleanO2's latest CarbinX technology would directly advance NGIA's focus on carbon capture as an innovative resource to help meet Minnesota's greenhouse gas

reduction goal. The results from the technology demonstration will provide CNP with the insight needed to better engage with the Minnesota Public Utilities Commission on regulatory and policy changes needed to decarbonize natural gas services.

4. Data Collection and Analysis

The proposed project will include a full M&V campaign with a comprehensive set of instrumentation, sensors, and data acquisition hardware that will be installed to collect data for both the baseline scenario and the demonstration of CleanO2's CarbinX technology. The data for the baseline scenario will include the gas consumption, electricity usage, water draw volume profile, and flue emissions of the boiler to establish baseline carbon emissions from standard usage of the boiler over a predetermined period of time. Once sufficient baseline data has been collected to accurately characterize the boiler performance, the boiler will be retrofitted with CleanO2's CarbinX unit. Additional M&V equipment will be installed to collect data on electricity usage, CO2 emissions, and water flow rate and temperature from the CarbinX unit. Similar to the baseline test, the demonstration of the CarbinX will take place over a fixed period of time that will ideally cover both winter and summer months to characterize the seasonal performance of the unit. This will allow a determination to be made of total carbon emissions avoided from both the carbon capture and waste heat recovery aspects of the technology. Data will also be collected on the mass of pearl ash that is generated relative to the usage of the boiler. This data will be used to complete the payback calculation for the retrofit installation and will help inform the economic feasibility study for a wider deployment of carbon capture technology.

The data will be collected using Campbell Scientific data acquisition hardware and will be relayed to a server using a cellular modem. The data will be analyzed in real-time using Microsoft Power BI, to provide continuous performance metrics on the carbon capture efficiency and waste heat recovery of the CarbinX unit. The chemical reaction rate of the CarbinX will also be collected to track the production of pearl ash and analyze how it changes based on boiler operating conditions.

5. Project Team

The project team will be as follows:

1) Abbas Ahsan (Principal Engineer)
   Role: Project Manager / Principal Investigator: Manage test plan, project milestones, budget and report writing. Assist with M&V installation, data collection, and analysis.
   Organization: GTI Energy
2) Navin Kumar (Principal Engineer)
   Role: Principal Investigator: Lead M&V installation, data acquisition. Assist with data analysis.
   Organization: GTI Energy
3) Aaron Hernandez (Associate Engineer)
   Role: Field Engineer: Lead M&V installation and data collection.
   Organization: GTI Energy
4) Contractor (TBD)
   Role: Installation and servicing of CarbinX unit
5) Jaeson Cardiff (CEO)
   Role: Project consulting

Organization: CleanO2

6) Calvin Jones (Director of Technical Operations)
Role: Commissioning of CarbinX unit and chemical logistics.
Organization: CleanO2

6. Workplan

The workplan for the proposed carbon capture demonstration consists of six tasks conducted over an 18–24-month period. All tasks will involve close coordination with CNP and CleanO2.

Task 1 includes selection of an appropriate site to demonstrate CleanO2's carbon capture technology. GTI will select the latest available CarbinX prototype (e.g., version 4.0) and will work with CNP to find a suitable water heating appliance to retrofit with the CarbinX. The ideal appliance will be a condensing efficiency boiler with ≥1.5MMBTU/hr firing rate. A safety plan, as well as drawings and submittals, will be developed and submitted to CNP for review and approval before any remaining tasks can be initiated.

For Task 2, GTI will develop a baseline demonstration test plan outlining the M&V and data acquisition system required to complete 3 months of data collection to establish baseline performance metrics of the chosen water heating appliance. GTI will work with facility staff and local subcontractor to install the necessary equipment and instrumentation to collect the baseline data, including gas consumption, electricity usage, carbon emissions, and water draw profile.

For Task 3, GTI will work with CleanO2 and local subcontractor to procure, install, and commission the CarbinX unit. The subcontractor will also install required water piping, electric service, and flue venting for the unit. Installation of this technology at the demonstration site will be completed in compliance with all applicable codes and standards. For the duration of the carbon capture demonstration, a local subcontractor will deliver potassium hydroxide on an approximately biweekly schedule, and remove the potassium carbonate (pearl ash) from the unit and ship it back to CleanO2.

In Task 4, GTI will develop a detailed test plan to measure the carbon capture efficiency, energy savings, and economic benefits of the CarbinX unit compared to baseline. This task will include specification, installation, and commissioning of sensors and instrumentation. A data acquisition system will be installed onsite to collect and transmit data via a secure cell modem for real-time monitoring.

Task 5 will include data collection and analysis for approximately 6 months. Carbon capture efficiency and waste heat recovery effectiveness will be determined across the range of operating conditions.

Task 6 will cover project management and reporting throughout the project including: Monthly Updates, Draft Final Report, Final Report, and potentially public dissemination through a conference paper and presentation. The final report will summarize the technical approach, results, key findings, lessons learned, and best practices. This task will include technology transfer of the demonstration results to share lessons learned with CNP through industry publications or presentations.

A summary of each milestone and associated timeline and deliverable is shown in the table below.

Task #	Task Description	Timeline	Deliverable
1	Site selection, design submittal and safety plan submitted for CNP approval	Months 1-3	Design submittal and safety plan
2	Water heating appliance baseline demonstration test plan and execution	Months 3-7	Baseline demonstration plan and baseline performance metrics
3	CarbinX unit: procure, install, and commission	Months 7-10	Successful commission and shakedown of CarbinX
4	Demonstration test plan: specify, install, commission sensors and data acquisition system	Months 7-12	Demonstration test plan
5	Data collection and analysis: minimum 6-months performance monitoring	Months 13-19	Monthly/quarterly update on CarbinX performance metrics
6	Project Management and Reporting	Months 1-20	Final report

7. Budget

The total budget request for the proposed project is $275k. [redacted]

Task #	Task Description	Labor + Travel	Material + Supply	Subcontract	Total
[redacted]					
	Total				**$275,000**

8. Other resources required from CNP

Due to CNP's current collaboration with CleanO2 and ongoing pilot demonstration of the CarbinX technology, details from CNP's pilot installation and M&V would be highly valuable, including site selection criteria, design drawings, and data collection. Also, recommendations for contractors to perform the installation, commissioning, and servicing of CleanO2's technology would be useful, in order to better streamline the logistics of multiple CarbinX demonstrations under CNP's purview.

1. Basic Information

R&D Project Title: Development of system to produce ammonia via a novel catalytic reaction in one reactor vessel that has inputs of water, nitrogen and electricity, preferably green electricity, currently termed the Modular One Vessel Ammonia Production System ("MOVAPS")

Lead Organization: Green Nitrogen Company LLC (to be formed)

Name of Primary Contact: Douglas A. Fisher

Email: dfisher@douglasafisher.com

Phone Number: (312) 914 7464

Other Project Partners: Dr. Reza Nazemi, Colorado State University, reza.nazemi@colostate.edu ; (906) 281-8770

2. Project Overview

Provide a high-level overview of your project. The project in Phase I is to develop a reactor vessel that can produce Green Ammonia from use of novel catalysts and chemical reactions using Green Electricity at a variable input rate and functioning at low temperature and low pressure, whose design, construction and operation significantly reduces CAPEX and OPEX via needing neither a separate electrolyzer nor a Haber-Bosch system. The MOVAPS vessel will be small (estimated to be 1 meter square and a foot deep), cheap to produce and therefore be capable of (i) modularity (production volume at a plant can be increased or decreased by adding or subtracting the MOVAPS reactors) and (ii) distributive placement – it can be placed where needed, and, importantly, close to existing or planned green electricity production

The project further includes additional tasks, grouped together in a Phase II, which is a "soup to nuts" approach to develop the MOVAPS for commercial application, including engineering and design of the entire system: from electricity supply to ammonia storage; production of hydrogen from the ammonia; design and planning for mass production of the MOVAPS reactor vessel; advantages of locational placement close to existing or new green electricity production; techno -economic analysis and comparison to existing Green Ammonia systems – those requiring separate electrolyzers, hydrogen storage and Haber-Bosch systems - (including potentially a side by side comparison, of MOVAPS with the U of Minn Morris green ammonia system).

Phase II will also include discussions and potential collaborations with companies looking to use ammonia for green energy storage and those producing systems for conversion of ammonia to hydrogen, looking for synergistic collaborations and commercial relationships.

Identification and protection of intellectual property developed during the project will be pursued in both Phase I and II.

Phase I and Phase II are intended to result in commercial ready systems.

3. Learning Goals

What new information will we learn from this project? How will this project advance the development of NGIA Innovative Resources?

Key information will be:

(i) identification and usage of novel catalysts, including usage in a multi-function reactor vessel.

(ii) Ability to conduct electrolysis and ammonia production in one vessel simultaneously.

(iii) Design, construction and costs of production of MOVAPS reactors

(iv) Design, construction, CAPEX and OPEX of a standalone ammonia and ammonia to hydrogen plant using MOVAPS.

(v) Analysis of economics of distributive production of MOVAPS plants, including proximity to green electricity production and customer delivery.

4. Data Collection and Analysis

Describe the data that will be collected through this project. How will this data be analyzed?

All of the information set out above will be continuously collected and analyzed for viability of and planning for commercial production of MOVAPS system in commercial production.

5. Project Team

List the project team members, their role in the project. Please note any other organizations that project partners

Douglas A Fisher – Co -Founder and CEO of Green Nitrogen Company LLC will oversee the overall project development, strategy for commercialization and lead discussions with third party collaborators.

Scott Hoerr – Co Founder of Green Nitrogen Company LLC will assist Fisher in the above, with emphasis on the development of commercial plants.

Reza Nazemi, Ph.D. and Colorado State University team will undertake the development of the MOVAPS pursuant to a Research Agreement and License with Green Nitrogen Company.

Rod Larkins will be an advisor to the project, assisting in coordinating efforts with U of Minnesota and AURI.

It is contemplated that the University of Minnesota and AURI will assist in areas of their existing experience and expertise in production of green ammonia; techno-economic analysis of complete production plants and distributive locations.

6. Workplan

Provide a workplan listing major tasks, their timelines, and key deliverables.

Phase I workplan and deliverable is the development of the MOVAPS, which will be primarily carried out by Colorado State University with Dr. Nazemi as Principal Investigator. During Phase I highly preliminary estimates of CAPEX and OPEX of a commercial plant may be undertaken. Patent applications may be filed. It is contemplated that Phase I Proof of Concept may take up to a year and further refinement of the MOVAPS to be commercial ready up to a year thereafter.

Phase II will begin in earnest upon POC showing in more detail the operational and CAPEX parameters of the MOVAPS. Deliverables will be the design and resulting construction costs estimates of various sizes of plants utilizing MOVAPS. Commercial POC, refinement and techno-economic analysis should be assisted by side-by-side comparison with a state of the art system, such as the one at U of Minnesota, Morris campus with Dr. Reese, who has agreed to assist. It is contemplated that Phase II, which results in technical commercial readiness and customer acceptance, would take 2+ years from start of Phase I.

7. Budget

Provide a budget for the CenterPoint Energy component of your project.

We are suggesting that CenterPoint Energy funds $250,000, which, estimating the potential development at the time of receipt of funds, would be used for the end of the Phase I tasks, which would be: final POC for lab bench trials; planning for scale up; techno-economic analysis.

Hopefully, we could continue funding in the next funding cycle with CenterPoint, which funds would be used for the work with U of Minn and AURI in finalizing development of commercial scale MOVAPS and demonstrations.

Please note any other funding you will be leveraging (e.g. federal grants, other utility funding, etc.)

Green Nitrogen Energy LLC will also fund significant portions of the Phase I and Phase II costs, planned to be $1.5 to $2 million dollars. It has developed significant interest from individual investors. Federal DOE and USDA grants and assistance will be pursued.

8. Other resources required from CNP

Beyond direct funding, list other resources or support needed from CenterPoint Energy that would help the success of this project.

It is hoped that CenterPoint will advise and work with the Project team regarding their commercial needs for hydrogen and ammonia, and how a MOVAPS plant producing and storing green ammonia and conversion back to hydrogen best integrates with their desire to utilize hydrogen in energy production.

1) **Preliminary techno-economic analysis of an RNG projects at three Center Point Energy, locations.** Center Point Energy intends to investigate the potential of developing RNG production facilities at three Minnesota location. This analysis aims to support CenterPoint Energy in the possible issuance of an RFP and subsequent benchmarking of the RFP's answers. In addition, the research is intended to provide Center Point Energy with a techno-economic baseline to define a business model and evaluate various scenarios for Center Point Energy's participation in the project. This analysis will include:

    i) Feedstock availability analysis centered around the proposed location's 50-75 miles radius. This analysis will provide an inventory of existing and potential feedstock available in that area. The potential feedstock is current organic waste from farming operations (manures) or ag commodity processing (high-strength wastewater, DAF floats, and other residues from ag commodity and food processors. In addition, given the vicinity of the urban area, food waste from food distribution, institutional catering, and commercial kitchens may be included. AURI will identify quantity, seasonal availability, and essential characteristics such as biomethane potential, nutrient (NPK) content, moisture content, and total solids for each feedstock type. AURI will identify quantity, seasonal availability, and essential characteristics such as biomethane potential, nutrient (NPK) content, moisture content, and total solids for each feedstock type. When needed, these data will be obtained from literature and, if required, appropriate analytical characterization of field-collected samples. Given the stage of this scope, analytical characterization will be limited to high-value feedstock, which may represent a considerable fraction of the facility throughput.
    ii) Preliminary techno-economic analysis of RNG production at the site if feedstock analysis identifies suitable feedstock availability and prices. This techno-economic analysis will include a vendor-neutral class 5 capital[1] and operating cost analysis of a digester facility.
    iii) Estimating digestate quality and quantity based on the expected feedstock mix. Identification of possible disposal and valorization opportunities based on the predicted nutrient content. Note that this analysis is based on calculations based on feedstock composition and expected volatilization of the substrate. Currently, the analysis does not entail digestion experiments and characterization of actual digestate.
    iv) Assessment of RNG production cost consistent with the scope of the capital and operating cost estimate.
    v) Gap analysis (space requirements, permitting, possible environmental risks, expected development costs, technology risks, etc.)

[1] For definition of capital cost estimate class, see for example, The Cost Estimating Series: Capital Cost Estimate Classes (processengineer.com).

COST: The budget for this work is not to exceed 600hr. @ $75/hr. and $4,000 for travel or $49000 plus direct consumables costs for lab work, whose needs will be determined during the project.

1. Basic Information

R&D Project Title: **Fuel Blending in Ammonia Burners for Industrial Applications: Flame Stability and Emissions**

Lead Organization: University of Minnesota – Twin Cities

Name of Primary Contact: Will Northrop

Email: wnorthro@umn.edu

Phone Number: (612) 625 6854

Other Project Partners: Mike Reese, WCROC and Bryan Hermann, University of Minnesota Morris

2. Project Overview

With more widespread availability of green ammonia, using it for energy applications has become increasingly attractive. However, ammonia alone is not a suitable direct replacement for natural gas or propane due to is lower reactivity and slower burning velocity. Research and development are needed to determine how anhydrous ammonia can be used in industrial burner applications like boilers, duct burners, and grain dryers. This research project will investigate turbulent burners for ammonia combustion blended with reactive fuels like hydrogen, syngas from biomass gasification, and natural gas. Experiments will be conducted in an application-relevant laboratory test burner apparatus with the capability to measure flame stability and emissions metrics. The project will focus on operational ranges possible with already developed swirl burner technology and develop new burner designs that can eventually be incorporated into existing industrial heating equipment.

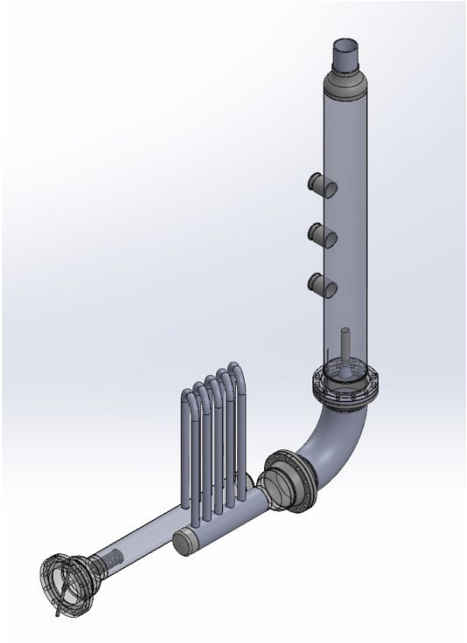
3. Learning Goals

Green ammonia is an innovative resource that has potential to significantly reduce greenhouse gas emissions in the industrial, agriculture, and commercial sectors. There are few, if any, published datasets on ammonia combustion in turbulent burners that are relevant to devices used in commercial practice. Combining green ammonia with other innovative resources like green hydrogen, biomass, and renewable natural gas can overcome ammonia's poor combustion performance in turbulent burners like those used in applications like grain drying and boilers. This project will provide critical information about whether renewable fuels can use used together with ammonia in burner applications. The primary outcome of the two-year research project will be a set of operating ranges and burner concepts that can be applied to industrial burners used in grain drying for agriculture applications and in boilers for district heating.

4. Data Collection and Analysis

The data collected in this project will include experimental flame stability and emissions information from a laboratory burner setup. A cutaway of the burner is shown in Figure 1. The burner to be used in the experiments is currently under construction at the UMN laboratory for developing ammonia-hydrogen systems. It includes an air handling system with the ability to preheat and dilute the oxidizing gas prior to the burner test section. The burner test section has a maximum heat rate capability of 30

kWth (102,360 Btu/hr). The burner itself is removable and reconfigurable to experiment with different swirl and air mixing. Ammonia burners require more turbulence than hydrocarbon flames. The UMN ammonia burner concept uses a two-stage air mixing process combined with swirl to increase turbulence.



The test plan for the experimental work to be conducted will include operating the test burner on mixtures of ammonia and other fuels including natural gas, and syngas from biomass gasification. The composition of these fuels will be guided by data from external partners. The fuel mixture will be blended from compressed cylinders using mass flow controllers and sent either as a separate stream to the burner or premixed with ammonia at different ratios. As time permits, propane will also be added to the experimental test matrix as a blending fuel because it is pertinent to grain drying systems used in the agricultural sector.

Data to be collected from the experiments will include temperatures, visual flame stability information, and emissions. Temperatures will be measured from the flame directly and in the downstream exhaust. Visual flame information will include images in the visual light spectrum as well as chemiluminescence images to qualitatively determine flame structure and chemistry. Another example of stability data is pressure fluctuations in the reactants to detect flame oscillations due to resonant frequencies. In preliminary data on hydrogen-ammonia flames, thermo-acoustic instabilities have been observed at normal operating conditions. Emissions data will be collected from a downstream location using a Fourier Transform Infrared (FTIR) analyzer. Exhaust species to be recorded will include unburied ammonia, hydrogen, carbon oxides (CO, CO_2), and nitrogen oxides (NO, NO_2, N_2O).

The collected data will be analyzed and stored using processing software codes developed at UMN. Calculated variables will include normalized emissions factors on a per mass of fuel basis and on a per kWth basis. Regime diagrams will be used to identify where stable and low emissions operation can be achieved as a function of fuel composition, flow rate and inlet temperature. The collected data and analyses will be included in project reports and in published peer-reviewed papers.

Data from the project will be used to determine the applicability of the developed burner technology in industrial burners. Specifically, the experiments will guide a follow-on demonstration project to retrofit a biomass gasifier district heating and power system at the University of Minnesota Morris. The biomass boiler system currently uses natural gas as a supplementary fuel. A future effort will seek to replace the natural gas burner with an ammonia/hydrogen burner system to decrease its overall carbon emissions.

5. Project Team

Principal Investigator, Will Northrop, Ph.D. Professor of mechanical engineering, University of Minnesota – Prof. Northrop is the Director of the Thomas E. Murphy Engine Research Laboratory, a facility dedicated to experimental research in engines, combustion, and alternative fuels. The MERL has been at

the forefront of ammonia combustion and utilization research and received international attention for the innovative work Prof. Northrop will manage the technical and administrative portions of the proposed project. Prof. Northrop will hire one graduate research assistant (RA) to perform the experimental combustion research in this project. The RA will be assisted by an undergraduate research assistant part time in the academic year and full time during the summer.

Collaborator, Michael Reese: West Central Outreach and Research Canter, Morris, MN – Mr. Reese is the Director of operations at the WCROC. Prior to his current role, he served as Renewable Energy Director since 2001. Mr. Reese has overseen the development of the renewable-energy program and has participated as Principal Investigator or Project Manager on more than $18 million of research and demonstration projects including wind energy, biomass gasification, renewable hydrogen and ammonia, and solar-energy systems. Mr. Reese will be responsible for assisting the collaboration between the Prof. Northrop and the UMN Morris campus facilities. His work will not be funded by the grant. He will also provide technical guidance on ammonia supply and planning for eventual demonstration of the ammonia burner at the UMN Morris facility.

Collaborator, Bryan Herrmann: University of Minnesota Morris – Bryan Herrmann has been vice chancellor for finance and facilities at UMN Morris since July of 2015. Under his leadership the campus has pursued a diverse renewable energy platform to achieve carbon neutrality. Mr. Herrmann will be responsible for collaborations to understand the needs of the biomass CHP system, the eventual target application for the burner system developed in this research project. His work will not be funded by the grant.

6. Workplan

The following work plan will be followed in the execution of the project:

Task 1 – Setup Laboratory Burner

Task 1 Duration: January 1, 2024 – May 31, 2024

Task Description: In this task, the laboratory burner shown in Figure 1 will be configured for operation with different blending fuels. Some preliminary experiments will be necessary to determine preliminary sizing of swirl geometry and overall burner flowrates. Preliminary experiments will be done using a smaller bench-scale turbulent swirl burner at the MERL. Once the desired gas flows are determined for both natural gas and syngas blending, the lab burner system will be upgraded with new flow control devices and instrumentation to accomplish the experimental objectives. Also, within this task, emissions instrumentation including the FTIR and any optical instruments will be installed, serviced and calibrated.

Deliverables

1. PowerPoint presentation of final burner design including system and instrumentation sent to Centerpoint Energy program manager.
2. Initial results from small-scale burner on syngas and natural gas blended ammonia presented to Centerpoint to prove design decisions for larger lab burner.

Task 2 – Perform Experiments for Natural Gas and Ammonia Fuel Blends

Task 2 Duration: June 1, 2024 – December 31, 2024

Task Description: In this task, the developed lab burner will be operated at least 10 kWth input using natural gas and ammonia blends as fuel. Natural gas composition will be determined through conversations with Centerpoint staff. Propane will also be considered as a blending fuel within this task as time allows. A full range of experiments with emissions and optical diagnostics will be conducted as part of the study to understand the operability range under conditions relevant to industrial burners. The results of the study will be stability and emissions ranges for given burner geometries studies. It is expected that new burner designs will be experimented with and developed as part of the research process in this task. Material budget is requested throughout to aid the iterative development process.

Deliverables

1. Periodic presentations to Centerpoint staff at frequency to be determined during the project, regarding results of the natural gas and ammonia blending study.
2. Final presentation at the end of 2024 to Centerpoint with results of natural gas/ammonia blending experiments with the lab burner.

Task 3 – Perform Experiments for Syngas and Ammonia Fuel Blends

Task 3 Duration: January 1, 2025 – May 31, 2025

Task Description: Here, the same main tasks from Task 2 will be performed, but with syngas as the blending fuel. Syngas can be derived from several sources including biomass and coal. In this case, the composition will be determined through communication with UMN Morris to match their biomass gasifier output composition. A full range of experiments will be conducted with surrogate syngas and ammonia generated using mixing. It is possible that yet a different burner design from the natural gas design will result from this task given syngas' different reactivity and flame speed.

Deliverables

1. Periodic presentations to Centerpoint staff at frequency to be determined during the project, regarding results of the syngas and ammonia blending study.
2. Final presentation at the end of 2024 to Centerpoint with results of natural gas/ammonia blending experiments with the lab burner.

Task 4 – Design Burner for Integration with Biomass Gasifier Heating System

Task 4 Duration: June 1, 2025 – August 31, 2025

Task Description: In this task, data from Tasks 2 and 3 will be used to design a prototype burner for use in the biomass boiler system at UMN Morris. The design will be completed with guidance from collaborators at UMN Morris and the WCROC. Measurements from drawings of the boiler will be converted to a three-dimensional CAD model, and the burner model will be mounted inside. The output of this task will be use to propose a second phase of this project where the burner is implemented for use by UMN Morris in 2026.

Deliverables

1. A final PowerPoint presentation of the integrated burner design will be sent to Centerpoint Energy staff for their review and comments.

Task 5 – Data Analysis and Dissemination of Research Findings

Task 5 Duration: September 1, 2025 – December 31, 2025

Task Description: In this final task, the UMN team will analyze the data from the project and summarize findings into a final report or other format required by Centerpoint staff. Research will also be disseminated at conferences like the Combustion Institute National Meeting in the fall of 2025, and in peer-reviewed journal papers like Combustion and Flame or Journal of Applied Energy and Combustion.

Deliverables:

1. Final report or presentation in the format required by Centerpoint program manager.
2. Copies of conference and journal papers produced from the research project analysis sent to Centerpoint Energy.

7. Budget

The project budget is shown in the following table. It represents the Centerpoint Energy portion of the project. The burner setup and other equipment used in the research was paid for through other State of Minnesota funding from the LCCMR and RDA fund.

Category	Year 1	Year 2	Total
Personnel - Prof Northrop 1 week/year + graduate researcher	59,781	61,574	121,355
Supplies and Non-Cap Equipment - Burner parts, flow control, analyzer parts, consumables (fuel), plumbing, wiring, safety	8,500	8,500	17,000
Services - Analyzer calibration, machining services for burners	1,000	1,000	2,000
Travel - MN travel to Morris for site visits	500	500	1,000
Indirect Costs - 55% established overhead rate	29,074	29,782	58,856
Total	98,855	101,356	200,212

8. Other resources required from CNP

Information that would be helpful to this project from CNP include detailed information on gas composition for understanding proper blending fuels. Technical guidance from CNP staff would also be helpful throughout the project duration.