

**BEFORE THE PUBLIC UTILITIES COMMISSION  
OF THE STATE OF COLORADO**

\* \* \* \* \*

**IN THE MATTER OF THE APPLICATION            )  
OF PUBLIC SERVICE COMPANY OF            ) PROCEEDING NO. 23A-0392EG  
COLORADO FOR APPROVAL OF ITS            )  
2024-2028 CLEAN HEAT PLAN.            )**

---

**DIRECT TESTIMONY AND ATTACHMENTS OF MICHAEL C. JENSEN**

**ON**

**BEHALF OF**

**PUBLIC SERVICE COMPANY OF COLORADO**

**August 1, 2023**

**BEFORE THE PUBLIC UTILITIES COMMISSION  
OF THE STATE OF COLORADO**

\* \* \* \* \*

IN THE MATTER OF THE APPLICATION )  
OF PUBLIC SERVICE COMPANY OF ) PROCEEDING NO. 23A-0392EG  
COLORADO FOR APPROVAL OF ITS )  
2024-2028 CLEAN HEAT PLAN. )

---

**TABLE OF CONTENTS**

<b><u>SECTION</u></b>	<b><u>PAGE</u></b>
I. INTRODUCTION, QUALIFICATIONS, PURPOSE OF TESTIMONY, AND RECOMMENDATIONS .....	4
II. Hydrogen Industry Background and Market Overview .....	8
A. Hydrogen Industry Background .....	8
B. Hydrogen Strategy for Xcel Energy.....	15
C. Hydrogen Use in Colorado.....	20
III. CONCLUSION .....	22

**LIST OF ATTACHMENTS**

Attachment MCJ-1	US National Clean Hydrogen Strategy and Roadmap
Attachment MCJ-2	Hydrogen Market Domestic Global
Attachment MCJ-3	Hydrogen: A Renewable Energy Perspective, International Reviewable Energy Agency
Attachment MCJ-4	HyBlend Tech Summary
Attachment MCJ-5	AGA Net Zero Emissions Opportunities for Gas Utilities
Attachment MCJ-6	Regional Clean Hydrogen Hubs Funding Opportunity Concept Paper

**BEFORE THE PUBLIC UTILITIES COMMISSION  
OF THE STATE OF COLORADO**

\* \* \* \* \*

**IN THE MATTER OF THE APPLICATION            )  
OF PUBLIC SERVICE COMPANY OF            ) PROCEEDING NO. 23A-0392EG  
COLORADO FOR APPROVAL OF ITS            )  
2024-2028 CLEAN HEAT PLAN.            )**

---

**DIRECT TESTIMONY AND ATTACHMENTS OF MICHAEL C. JENSEN**

**I. INTRODUCTION, QUALIFICATIONS, PURPOSE OF TESTIMONY, AND  
RECOMMENDATIONS**

1 **Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

2 A. My name is Mike C. Jensen. My business address is 401 Nicollet Mall,  
3 Minneapolis, Minnesota 55401.

4 **Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT POSITION?**

5 A. I am employed by Xcel Energy Services, Inc. (“XES”) as the Director of Clean  
6 Fuels PMO. XES is a wholly owned subsidiary of Xcel Energy Inc. (“Xcel Energy”)  
7 and provides an array of support services to Public Service Company of Colorado  
8 (“Public Service” or the “Company”) and the other utility operating company  
9 subsidiaries of Xcel Energy on a coordinated basis.

10 **Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THIS PROCEEDING?**

11 A. I am testifying on behalf of Public Service Company of Colorado.

12 **Q. PLEASE SUMMARIZE YOUR RESPONSIBILITIES AND QUALIFICATIONS.**

13 A. I received a Bachelor of Science in Electrical Engineering from the University of  
14 Minnesota, Institute of Technology in 2004. I am a licensed Profession Engineer

1 in the state of Minnesota, PE # 47095. I joined Xcel Energy in 2007 and have held  
2 various positions of increasing responsibilities and across multiple business areas.  
3 This includes Substation Engineering & Design, Transmission Line & Substation  
4 Standards, and Clean Fuels Project Management Office.

5 I am responsible for partnering across Company business areas and  
6 external stakeholder groups, financial compliance according to regulatory  
7 requirements and development of strategies for the people, process and  
8 technologies to be used in the execution of clean fuels-based projects.

9 **Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?**

10 A. The purpose of my Direct Testimony is to explain the current state of the market  
11 for hydrogen, describe forward-looking applications of hydrogen, and the potential  
12 use of hydrogen in the Company's effort to meet its 2050 clean energy goals. I  
13 will also discuss several initiatives in development for Public Service (and across  
14 Xcel Energy) to utilize hydrogen for reducing emissions of the gas LDC system  
15 and as part of the generation of electricity. While multiple efforts are proposed in  
16 this Clean Heat Plan to reduce the overall use of natural gas and associated  
17 emissions, demand is expected to remain in the near-term. We believe that  
18 hydrogen can play an important role in reducing the emissions from home heating  
19 without requiring customer appliance changes. At this time, through this testimony,  
20 the Company does not seek approval of investments in hydrogen projects. This  
21 testimony does not cover the technical integration aspects of hydrogen into the  
22 LDC system; that information is covered by Company witness Mr. Ray Gardner.

1 **Q. ARE YOU SPONSORING ANY ATTACHMENTS AS PART OF YOUR DIRECT**  
2 **TESTIMONY?**

3 A. Yes, I am sponsoring Attachments MCJ-1 through MCJ-6, which were prepared  
4 by me or under my direct supervision. The attachments are as follows:

- 5 • Attachment MCJ-1 – US National Hydrogen Strategy Roadmap;
- 6 • Attachment MCJ-2 – Hydrogen Market Domestic Global;
- 7 • Attachment MCJ-3 – Hydrogen: A Renewable Energy Perspective,  
8 International Reviewable Energy Agency;
- 9 • Attachment MCJ-4 – Hyblend Tech Summary;
- 10 • Attachment MCJ-5 – AGA Net Zero Emissions Opportunities for Gas  
11 Utilities; and
- 12 • Attachment MCJ-6 – Regional Clean Hydrogen Hubs Funding Opportunity  
13 Concept Paper.

14 **Q. WHAT RECOMMENDATIONS ARE YOU MAKING IN YOUR DIRECT**  
15 **TESTIMONY?**

16 A. I recommend that the Colorado Public Utilities Commission (“Commission”) approve the Company’s preferred portfolio, as presented by Company witness Mr. Jack Ihle. At present, modeling suggests that some integration into the Company’s gas LDC in the out years of this plan is cost-effective when compared to other emission reduction measures. Therefore, I recommend the Commission generally support the Company’s continuing efforts to explore the growth of the hydrogen economy in Colorado and how it could be utilized in the future, including: (1) the potential to blend hydrogen into the gas LDC system; (2) the Company’s ongoing work with the Department of Energy to secure funds for a “hydrogen hub”; (3) the

1 use of hydrogen blending at generation facilities to reduce the amount of natural  
2 gas needed in the production of electricity; and (4) the 60/90 process proposed by  
3 Mr. Ihle to add projects in the future, which could include hydrogen projects, should  
4 later modeling, program specific development and market conditions indicate that  
5 such are prudent investments. As I demonstrate below, the requested Commission  
6 support is aligned with the direction being provided by the State of Colorado and  
7 the federal government.

**II. HYDROGEN INDUSTRY BACKGROUND AND MARKET OVERVIEW**

1 **Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR TESTIMONY?**

2 A. The purpose of this section of my testimony is to discuss the role of hydrogen  
3 production and its uses today as well as its projected importance as a fuel source  
4 as part of the low-carbon economy of the future.

5 **A. Hydrogen Industry Background**

6 **Q. PLEASE EXPLAIN THE STATE OF HYDROGEN PRODUCTION AND ITS USE**  
7 **TODAY.**

8 A. Industry produces approximately 10 million metric tons (MMT) of hydrogen per  
9 year in the United States (MCJ-2); this is about 10-12% of global production.<sup>1</sup> That  
10 hydrogen is primarily used in the petroleum refining, ammonia and chemical  
11 industries.

12 **Q. HOW IS HYDROGEN MOST COMMONLY PRODUCED?**

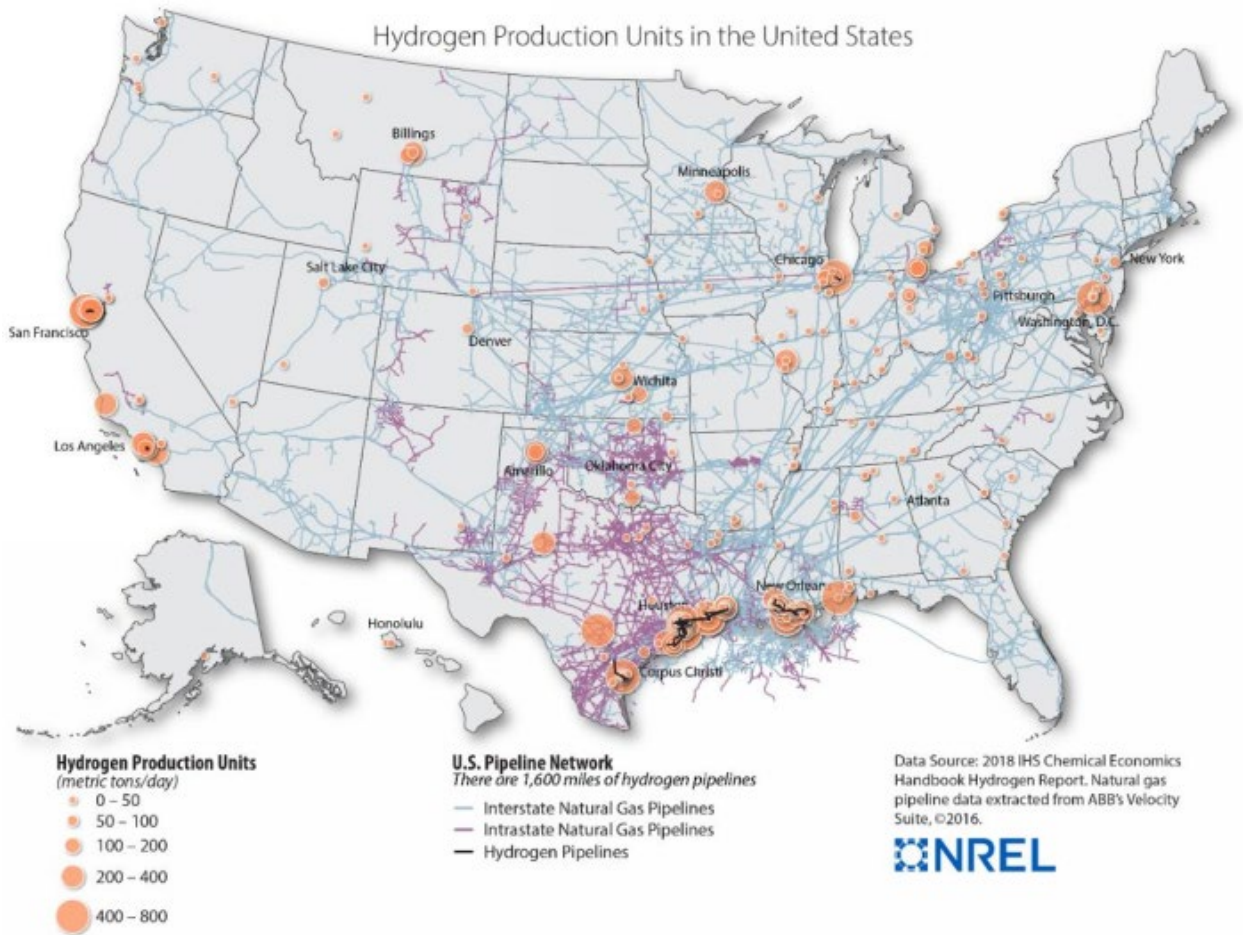
13 A. The majority of hydrogen is produced via Steam Methane Reformation, which is  
14 the process of using steam (and a catalyst) to separate Natural Gas into Hydrogen,  
15 Carbon Monoxide and additional trace components. Natural Gas is most often  
16 used as the combustion fuel to produce the steam used in the process as reflected  
17 in Attachment MCJ-2. The following graphic, excerpted from Attachment MCJ-1,  
18 shows the relative scale and locations of existing hydrogen production.

---

<sup>1</sup> I am speaking in terms of intentional production, not hydrogen produced as a bi-product of other activities.



1 **Figure MCJ-D-1: Hydrogen Production Units in the United States**



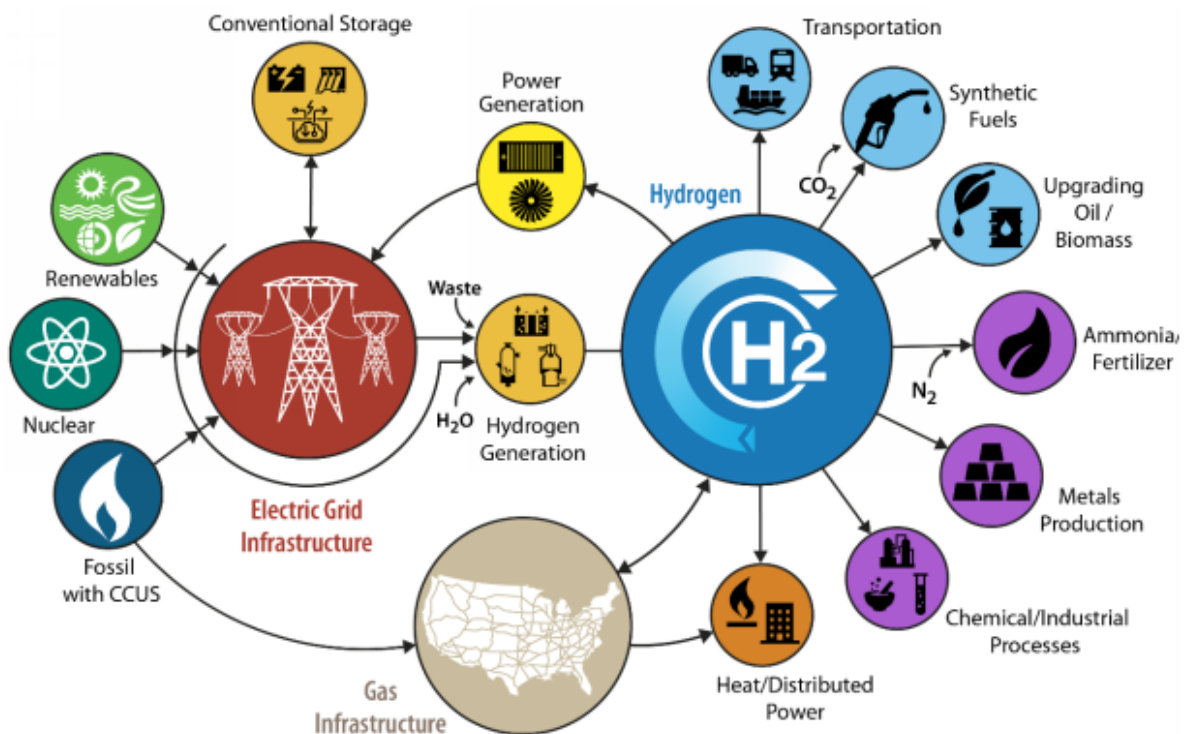
2  
3 According to the U.S. Energy Information Administration, the State of Colorado  
4 has a hydrogen production capacity (for petroleum refineries) of 22 million cubic  
5 feet per day.

6 **Q. CAN HYDROGEN BE PRODUCED BY OTHER MEANS?**

7 **A.** Yes. Hydrogen can also be produced by electrolysis, i.e., the splitting of water with  
8 electricity. If the electricity used is from zero emission power generation sources,  
9 like wind, solar and nuclear, the resulting hydrogen will have zero carbon footprint.

1 As seen in the following Department of Energy (“DOE”) graphic, hydrogen  
2 can be produced from a variety of sources and used across many sectors.

3 **Figure MCJ-D-2: Hydrogen Production Sources**



4  
5 **Q. WHAT ROLE COULD HYDROGEN PLAY WITHIN THE GAS LDC THAT**  
6 **WOULD ADVANCE EFFORTS TOWARD A LOW-CARBON ECONOMY?**

7 **A.** Hydrogen is an energy carrier that can play a critical role in reducing emissions  
8 associated with many industries. On a system-wide basis, blending hydrogen into  
9 natural gas pipelines is one potential pathway for emissions reductions with no-to-  
10 minimal modifications to Gas LDC infrastructure and customer appliances.  
11 Hydrogen blending into natural gas may contribute up to 7% emissions reductions  
12 (based on a 20% volume blend). In addition, Hydrogen is a promising natural gas

1 alternative for our customers that operate in difficult to decarbonize industrial  
2 processes.

3 **Q. IS DELIVERING NATURAL GAS BLENDED WITH HYDROGEN NOVEL?**

4 A. No. Delivering gas with high percentages of hydrogen has a long history, dating  
5 back to the origin of the natural gas system. In the 1800s and into the 1900s, gas  
6 was manufactured from coal and piped to streetlamps, commercial buildings and  
7 households. This gas, typically referred to as manufactured gas or town gas, had  
8 30%-50% hydrogen. The use of this manufactured gas continued through the  
9 1950s until it was displaced by geologic natural gas. In some areas, such as  
10 Honolulu, Hawaii, manufactured gas is still in use today, utilizing up to 15% blends  
11 of hydrogen.

12 **Q. PLEASE EXPLAIN THE DIRECTION OF HYDROGEN DEVELOPMENT AND**  
13 **FUNDING AT A FEDERAL LEVEL.**

14 A. The attached “US National Clean Hydrogen Strategy and Roadmap” sets forth the  
15 federal government’s approach to zero and low-carbon hydrogen. There are many  
16 new uses for hydrogen, across multiple sectors in development. The federal  
17 government is focused on supporting regional markets, that can match production  
18 and offtake, scale as new uses emerge and grow and optimize uses to help reduce  
19 costs and decarbonize.

20 In the last several years, Congress has passed legislation that incentivizes  
21 the use of hydrogen as a primary option for decarbonization. The Infrastructure  
22 Investment and Jobs Act, also known as the Bipartisan Infrastructure Law (“BIL”)   
23 authorized the U.S. Department of Energy (“DOE”) to appropriate \$9.5 Billion for

1 clean hydrogen. In September 2022, the DOE issued the Regional Clean  
2 Hydrogen Hubs Funding Opportunity Announcement to solicit plans in accordance  
3 with the BIL. The effort intends to catalyze investment in the development of the  
4 hydrogen economy and demonstrate the production, processing delivery, storage  
5 and end-use of zero and low-carbon hydrogen. In August 2022, President Biden  
6 signed the Inflation Reduction Act, which provides additional policies and  
7 incentives for hydrogen including a production tax credit (up to \$3/kg hydrogen).

8 Finally, under section 111(b) of the Clean Air Act, the EPA sets New Source  
9 Performance Standards (“NSPS”) for greenhouse gas (“GHG”) emissions from  
10 new, modified, and reconstructed fossil fuel-fired power plants. In May 2023, the  
11 EPA issued draft changes to these rules, proposing emission limits and guidelines  
12 for GHG from fossil fuel-fired power plants. These draft rules would require either  
13 the use of Carbon Capture & Sequestration or the blending of hydrogen with  
14 natural gas to meet emissions reduction targets.

15 **Q. EACH OF THESE LAWS AND PROPOSED RULES SHOW THAT THE**  
16 **FEDERAL GOVERNMENT VIEWS HYDROGEN AS PLAYING A CRITICAL**  
17 **ROLE FOR DECARBONIZATION. XCEL ENERGY SEES IT THE SAME**  
18 **WAY.HAS THE COLORADO GENERAL ASSEMBLY RECENTLY PASSED**  
19 **LEGISLATION RELATED TO HYDROGEN DEVELOPMENT?**

20 **A.** Yes, in 2023, the General Assembly passed House Bill 23-1281, entitled  
21 “Concerning measures to advance the production and use of clean hydrogen in  
22 the state.” This legislation, aligned with Colorado’s leadership of the Western  
23 Interstate Hydrogen Hub (“WISHH) initiative, supports utility pursuit of hydrogen

1 production. The legislation makes it clear that the leadership of the state of  
2 Colorado is seeking for Colorado to establish itself as a national leader in  
3 developing a clean hydrogen economy. The Company plans to file an application  
4 with the Commission, pursuant to this legislation, in 2024. This legislation defines  
5 the components of a Clean Hydrogen project and aligns it with the WISHH  
6 initiative, which includes hydrogen production, blending, transportation, delivery  
7 and use in both electric generation, gas distribution and potential industrial use  
8 cases. In sum, House Bill 23-1281 provides a foundation for the Commission to  
9 begin considering the development of a clean hydrogen economy, with utilities  
10 playing a role in that process. Moreover, the legislation sets forth a series of  
11 actions, including an investigatory proceeding, Company application, and  
12 rulemaking, to advance this process.

13 **Q. PLEASE DESCRIBE ANY MAJOR STUDIES AND ANALYSES THAT**  
14 **SUPPORT THE ROLE OF HYDROGEN IN A LOW CARBON ECONOMY.**

15 A. The following reports provide analysis and insight into the important role that  
16 hydrogen can have:

- 17 • US National Clean Hydrogen Strategy and Roadmap
  - 18 ○ Explores opportunities for clean hydrogen to contribute to national
  - 19 decarbonization goals across multiple sectors of the economy. It
  - 20 provides a snapshot of hydrogen production, transport, storage, and
  - 21 use in the United States today and presents a strategic framework
  - 22 for achieving large-scale production and use of clean hydrogen,
  - 23 examining scenarios for 2030, 2040, and 2050.

24 Clean hydrogen, as shown in the Biden-Harris Administration's  
25 Long-Term Strategy of the United States, is an important element of  
26 the Nation's path to decarbonization. Though much remains  
27 uncertain, the potential for hydrogen is clear. Focused investment

1 and action in the near, mid, and long-term will lay the foundation for  
2 broader clean hydrogen adoption, drive down cost, and increase  
3 scale in a sustainable and holistic manner.

- 4 • Hydrogen: A renewable Energy Perspective, International Renewable  
5 Energy Agency
  - 6 ○ This report discusses hydrogen as a complimentary solution (to  
7 efforts like electrification and DSM) with the potential for significant  
8 positive impacts in decarbonization efforts, across all sectors.
  - 9 ○ Hydrogen from renewable power is technically viable today and is  
10 quickly approaching economic competitiveness. The focus needs to  
11 be on deployment and learning-by-doing to reduce electrolyzer costs  
12 and supply chain logistics. Electrolyzer costs are project to halve by  
13 2040 to 2050, while renewable electricity costs will continue to fall as  
14 well.

15 **Q. NET-ZERO EMISSIONS OPPORTUNITIES FOR GAS UTILITIES, AMERICAN**  
16 **GAS ASSOCIATION**

17 A. This study provides a comprehensive analysis demonstrating the multiple  
18 pathways that exist to reach a net-zero future, and the role natural gas, gas utilities  
19 and delivery infrastructure will play in advancing decarbonization solutions. There  
20 is no single pathway to a net-zero economy, and planning must consider highly  
21 localized factors like geography, energy demands, resources, and weather. The  
22 study presents several pathways to underscore the range of scenarios and  
23 technology opportunities available as the nation, regions, states and communities  
24 develop and implement ambitious decarbonization plans.

25 This report calls out the common expectation for blends of up to 20%  
26 hydrogen to have minimal effect on existing Gas LDC infrastructure and customer  
27 appliances.

1           This report also talks about the use of hydrogen for synthetic methane or  
2 methanated hydrogen. Hydrogen can be converted into methane by using CO2.  
3 The result is a low-carbon, non-fossil gas.

4       **B.    Hydrogen Strategy for Xcel Energy**

5       **Q.    HOW DOES XCEL ENERGY BELIEVE IT IS APPROPRIATE TO**  
6       **STRATEGICALLY APPROACH HYDROGEN AT THIS POINT IN TIME?**

7       A.    Hydrogen has major potential to reduce emissions from multiple sectors of the  
8 economy. Consistent with the direction of the State and federal government, we  
9 want to investigate more fully its potential role in the energy transition. We do not  
10 explicitly know that role at this time, but through investigation we seek to analyze  
11 it and develop it, in partnership with the Commission, stakeholders, other relevant  
12 agencies, and customers, among others. For example, we want to understand the  
13 potential impacts of hydrogen blending for emissions reductions on the gas LDC  
14 system, whether that is direct blending at a board system level or working with  
15 individual customers that want high levels of hydrogen or using hydrogen in the  
16 production of synthetic methane.

17       **Q.    PLEASE PROVIDE AN OVERVIEW OF THE COMPANY'S LDC HYDROGEN**  
18       **BLENDING INVESTIGATORY EFFORTS TO DATE.**

19       A.    Public Service is currently in the process of designing a Hydrogen Blending  
20 Demonstration. This project will investigate blending hydrogen at levels of 2%,  
21 5%, and 10% for about eight months duration each into a small section of NE  
22 Denver and approximately 250 customers. This project is discussed in more detail

1 in the Direct Testimony of Mr. A. Ray Gardner and is included within the  
2 Company's proposed Market Transformation Portfolio.

3 **Q. PLEASE EXPLAIN THE ROLE OF HYDROGEN AND HOW IT MAY EXTEND**  
4 **BEYOND THE GAS LDC.**

5 A. While the Clean Heat Plan focuses on the gas LDC and emissions reductions  
6 associated with it, we also have multiple projects in development to showcase the  
7 potential dual use of hydrogen for Xcel Energy. These projects, to be co-located  
8 with existing electric generation power plants, would produce hydrogen to blend  
9 into the natural gas supply of the onsite power plants and injected into the LDC.  
10 This dual use model allows for optimizing hydrogen production along with the  
11 seasonal demands of each end-use. The Company anticipates these projects will  
12 be brought to the Commission as CPCN filings after the IRS provides guidance on  
13 the application of the Inflation Reduction Act and 45V hydrogen Production Tax  
14 Credit. The IRS is expected to release guidance in Q3 or Q4 of 2023. There may  
15 be other use-cases that are beneficial for our customers where the Company can  
16 sell hydrogen into other markets, e.g., as a transportation fuel.

17 **Q. IS XCEL ENERGY A PARTICIPANT IN ANY REGIONAL CLEAN HYDROGEN**  
18 **HUBS?**

19 A. Yes. Xcel Energy is a partner in the Western Interstate Hydrogen Hub (within  
20 PSCO) and Heartland Hydrogen Hub (within Northern States Power Minnesota or  
21 "NSPM") applications pending at the Department of Energy ("DOE"). The hub  
22 initiative supports emissions reduction objectives for our electric and gas utilities



1 and would reduce the cost to customers from hydrogen development by securing  
2 federal funding. The hubs include partners from multiple sectors and industries.

3 **Q. PLEASE PROVIDE MORE DETAIL REGARDING THE POTENTIAL**  
4 **COLORADO HUB.**

5 A. The first is the Western Interstate Hydrogen Hub, LLC (“WISHH”). This is an  
6 interconnected, multi-state hydrogen network to provide large-scale, commercially  
7 viable hydrogen in Colorado, New Mexico, Utah and Wyoming. Xcel Energy is  
8 one of eight key projects in the WISHH proposal. We believe that our projects  
9 have a strategic advantage based on their proximity to existing and future  
10 renewable wind and solar energy, power plant infrastructure, and geography  
11 favorable for underground hydrogen storage. Our projects could reduce Xcel  
12 Energy Gas LDC and power generation carbon emissions by 750,000 tons per  
13 year.

14 **Q. WHAT IS THE TIMELINE FOR FUNDING AWARDS AND HUB EXECUTION?**

15 A. The DOE plans to make its initial award announcements in December 2023. The  
16 DOE has broken its funding process into four phases, which spans over 10 years.  
17 Award recipients will negotiate go-no go criteria that is reviewed and approved by  
18 DOE prior to funding of each subsequent phase. Assuming Hub work begins in  
19 2024 (dependent on DOE & Hub Partner negotiations) the funding period will be  
20 approximately 2024 to 2036.

1 **Q. HOW MUCH FUNDING HAS XCEL ENERGY AND ITS PARTNERS**  
2 **REQUESTED FOR ITS COLORADO HYDROGEN HUB?**

3 A. For the WISHH project, Xcel Energy total project costs are estimated to be \$2.4  
4 billion, and the requested DOE funding award of \$600 million would reduce the  
5 Xcel Energy investment to \$1.8 billion, which represents a 75% cost share with the  
6 DOE.

7 **Q. DO XCEL ENERGY'S HYDROGEN HUB PLANS INCLUDE PLANS FOR**  
8 **BLENDING HYDROGEN INTO THE GAS LDC?**

9 A. Yes. The hydrogen production volumes could provide for up to a 5% by volume  
10 blend to the gas LDC during the hub funding period.

11 **Q. WHAT IS THE STATUS OF THE XCEL ENERGY REGIONAL CLEAN**  
12 **HYDROGEN HUB APPLICATIONS?**

13 A. We submitted three concept papers in November of 2022. Upon review of all 79  
14 concept papers the DOE received (nationwide), it gave a positive or negative  
15 assessment in the form of encouraging or discouraging submitters to complete a  
16 full application. All three of our concept papers, for Northern States Power, Public  
17 Service Company of Colorado, and the WISS paper received encouragement in  
18 December of 2022. After collaborating with the Colorado Energy Office and the  
19 WISHH group, we consolidated our paper and hydrogen concept into their four-  
20 state effort. In April 2022, we submitted our two applications to the DOE. The  
21 DOE plans to make its initial award announcements in late 2023. While the full  
22 WISHH application is not publicly available during the competitive review process,

1 the redacted WISHH concept paper is available on the Colorado Energy Office  
2 website and included as Attachment MCJ-6.

3 **Q. IS THE COMPANY PARTICIPATING IN OTHER INDUSTRY-WIDE HYDROGEN**  
4 **INITIATIVES?**

5 A. Xcel Energy is participating and funding multiple efforts related to hydrogen. We  
6 are a member of the DOE Hydrogen Blending CRADA initiative Attachment MCJ-  
7 4, that aims to address technical barriers to blending hydrogen in natural gas  
8 pipelines. Key aspects include materials compatibility R&D, technoeconomic  
9 analysis, and environmental life cycle analysis that will inform development of  
10 publicly accessible tools that characterize the opportunities, costs and risks of  
11 blending. The use of technical results of this work are explained the Direct  
12 Testimony of Mr. Gardner.

13 We are a member of the Center for Hydrogen Safety (“CHS”), through the  
14 American Institute of Chemical Engineers (“AIChE”). CHS was founded in 2019  
15 to help usher the world into the next energy transition by working to ensure safe  
16 implementation of hydrogen across the globe. They are a global non-profit  
17 dedicated to promoting hydrogen safety and best practices worldwide.

18 We are a founding member of the Low Carbon Resource Initiative (“LCRI”),  
19 by Electric Power Research Institute (“EPRI”) and GTI Energy, that seeks to  
20 accelerate development and demonstration of low- and zero-carbon energy  
21 technologies. LCRI is working towards fundamental advances in a variety of low-  
22 carbon electric generation technologies and low-carbon chemical energy carriers,  
23 such as hydrogen, bioenergy, and renewable natural gas to enable affordable

1 pathways to economy-wide decarbonization. We are also a participant in the  
2 H2EDGE Training and Educating a Workforce for the Emerging Clean Hydrogen  
3 Industry (with EPRI). This is a supplemental project that is included in our funding  
4 agreement, that is working to build a sustainable infrastructure for developing a  
5 workforce for the emerging hydrogen economy and decarbonization efforts.

6 Finally, we are a partner of the *Hydrogen Loss Quantification Technology*  
7 *Enabled by Networked Dielectric Excitation Gas Sensors* (with GE, NREL and GTI)  
8 which was recently awarded federal funding through DE-FOA-0002792 “Funding  
9 Support of the Hydrogen Shot and a University Research Consortium on Grid  
10 Resilience” to develop, model, validate, and demonstrate hydrogen sensors with  
11 parts per billion sensitivity for environmental monitoring.

12 **C. Hydrogen Use in Colorado**

13 **Q. WHAT IS THE ROLE OF HYDROGEN IN THE FIRST CHP?**

14 A. Hydrogen is a Clean Heat Resource, per the Colorado General Assembly and  
15 therefore the Company modeled the availability of hydrogen consistent with our  
16 WISHH application. As discussed by E3 witness Mr. Dan Aas, the Company’s  
17 modeling suggests that hydrogen is a cost-effective Clean Heat resource in both  
18 the ‘Emissions Target and Clean Heat Plus portfolios. As a nascent industry  
19 subject to much new legislation and pending rulemakings, the timeline and costs  
20 for large scale deployment are not yet known or advocated for in this CHP, but the  
21 Company’s initial modeling indicates support for the continued investigation of its  
22 use, particularly combined with the State and federal support detailed above. As

1 more industries look to hydrogen to play a role in decarbonization, the availability  
2 will increase, and cost will decrease.

3 **Q. GIVEN WHAT YOU DESCRIBE IN YOUR TESTIMONY ABOVE, PLEASE**  
4 **CHARACTERIZE THE STATE OF HYDROGEN MARKET IN COLORADO.**

5 A. Colorado is situated with high potential to be both a producer of zero and low-  
6 carbon hydrogen given access to significant current and future low-cost wind and  
7 solar energy, and off take opportunities with power generation, gas LDCs, and  
8 heavy industry. Hydrogen can aid the State of Colorado's efforts to diversify and  
9 decarbonize its energy economy. Colorado has businesses, national laboratories  
10 and university resources position it to be a center for innovation and model for how  
11 to take advantage of hydrogen's potential.

**III. CONCLUSION**

1 **Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS.**

2 A. Xcel Energy is excited to engage with the Commission on the development of  
3 hydrogen for the State of Colorado. We believe it has the potential to provide  
4 meaningful contributions to the State's emission reductions targets and the clean  
5 energy goals. It is our hope to have this Commission's support in investigating this  
6 potential and, should we bring a project to it at a future time, there as well. This  
7 CHP represents a key step in this process as we evaluate different emissions  
8 reduction strategies for the gas LDC.

9 **Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?**

10 A. Yes, it does.

Statement of Qualifications

Mike C. Jensen

Mr. Jensen received a Bachelor of Science in Electrical Engineering from the University of Minnesota, Institute of Technology in 2004. He is a licensed Profession Engineer in the state of Minnesota, PE # 47095. Mr. Jensen joined Xcel Energy in 2007 and has held various positions of increasing responsibilities and across multiple business areas, including Substation Engineering & Design, Transmission Line & Substation Standards, and Clean Fuels Project Management Office.

He is responsible for partnering across Company business areas and external stakeholder groups, financial compliance according to regulatory requirements and development of strategies for the people, process and technologies to be used in the execution of clean fuels-based projects.