Direct Testimony and Schedules
Dr. Ren Orans

Before the Minnesota Public Utilities Commission
State of Minnesota

In the Matter of the Application of Northern States Power Company
for Authority to Increase Rates for Electric Service in Minnesota

Docket No. E002/GR-20-723
Exhibit___(RO-1)

Performance Based Ratemaking

November 2, 2020

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Schedules

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME, OCCUPATION AND JOB RESPONSIBILITIES.

A. My name is Ren Orans. I am the founder and Managing Partner of Energy and Environmental Economics, Inc. (E3), located at 44 Montgomery Street, Suite 1500, San Francisco, California 94104, USA.

Q. PLEASE SUMMARIZE YOUR QUALIFICATIONS AND EXPERIENCE.

A. With over 30 years of experience in the electric utility business, I have worked extensively in transmission planning and pricing, integrated resource planning, and wholesale and retail ratemaking. Prior to forming E3 in 1989, I worked at Pacific Gas and Electric Company (PGandE), which was at the time the largest electric utility in North America, where I was responsible for electric rate design. While at PGandE I designed their first Time-of-Use Tariff for residential customers and designed and implemented their first shared savings incentive mechanism for energy efficiency.

Over my career, I have been an expert witness in many cases where commissions were considering performance incentive mechanisms (PIMs) as alternatives or supplements to cost of service regulation. I designed an incentive mechanism used by regulators in Texas to track and collect stranded costs for the utilities prior to allowing customers to directly choose their retail service providers. I designed a similar tracking and market-based pricing mechanism for Trans Canada's Mainline network of gas pipelines that extends from the Western Canadian Basin through to both midwestern and eastern markets in the United States and Canada. This is the first pipeline owner in North America that has been allowed to charge market-based rates for short-term service. Most recently, I developed a bidding process and evaluation mechanism for the state of South Carolina in their deliberations over the future of Santee Cooper.

The company I founded more than 30 years ago is dedicated to helping utilities, stakeholders and regulators transition to a decarbonized clean energy future. Our firm developed the models and scenarios used by the U.S. team at the Paris Climate Accord as well as the reported metrics used by all of the country participants. We continue to expand our work beyond California, Hawaii and New York to include recently completed decarbonized plans for Xcel Energy in the Midwest and for other jurisdictions in the Northeastern U.S.

I received my Ph.D. in Civil Engineering from Stanford University and my B.A. in Economics from the University of California, Berkeley. I have more than 25 publications in refereed journals detailed in my curriculum vitae included as Exhibit___(RO-1), Schedule 1.

Q. BRIEFLY DESCRIBE THE CARBON REDUCTION PIMS FRAMEWORK AND PIMS YOU PROPOSE IN YOUR TESTIMONY.

A. I am proposing that the Commission consider the following three simple Clean Energy and Policy driven performance incentive mechanisms (PIMs):

a. A clean electricity portfolio PIM that incents Xcel Energy to reduce carbon emissions. The utility is already actively engaged in this sector, and the proposed PIM aligns the regulatory incentives with both company and state policy carbon metrics.
b. Two "managed charging" program-specific PIMs to incent Xcel Energy to actively encourage EV owners to both participate in Xcel Energy's

managed charging program and increase their use of lower-cost off-peak charging.

My testimony will also describe a framework for consideration of future PIMs. This framework acknowledges the longer-term need for more broadly-defined PIMs focused on decarbonizing Transportation and Buildings. These beneficial electrification PIMs would be implemented, if supported by the Commission, in Xcel Energy's subsequent rate case or in its ongoing performance based ratemaking (PBR) proceeding in Docket No. E002/CI-17-401. Xcel Energy continues to work with key stakeholders to develop reasonable goals, metrics, and programs in both sectors.

Q. PLEASE PROVIDE AN OVERVIEW OF THE PROPOSED CLEAN ELECTRICITY PORTFOLIO PIM.

A. The clean electricity portfolio PIM would be based on the carbon emissions associated with serving Xcel Energy's load. Achieved reductions, compared to 2005 emissions, would be compared to a straight-line projection from 2019 actual emissions to Xcel Energy's 2030 carbon goal of 80 percent below 2005 levels. This projection is illustrated by the "Xcel Target" line in Figure 1 below.

In the mechanism I propose, no incentive would be earned for emissions reductions that fall more than 8 percent short of the "Xcel Target" projection. A maximum incentive of $10.5 million would be received for emissions reductions that exceed the projection by more than 8 percent. Within the incentive *working zone* region bounded by this 16 percent band, the incentive would reward $656,250 for each percentage point of reductions achieved.

Figure 1 below displays the evolution of the no-incentive region, working zone, and max-incentive regions over time. Figure 2 below provides an illustration of the incentive structure for 2021, as an example year.

Figure 1

Incentive Regions for the Electricity Portfolio PIM

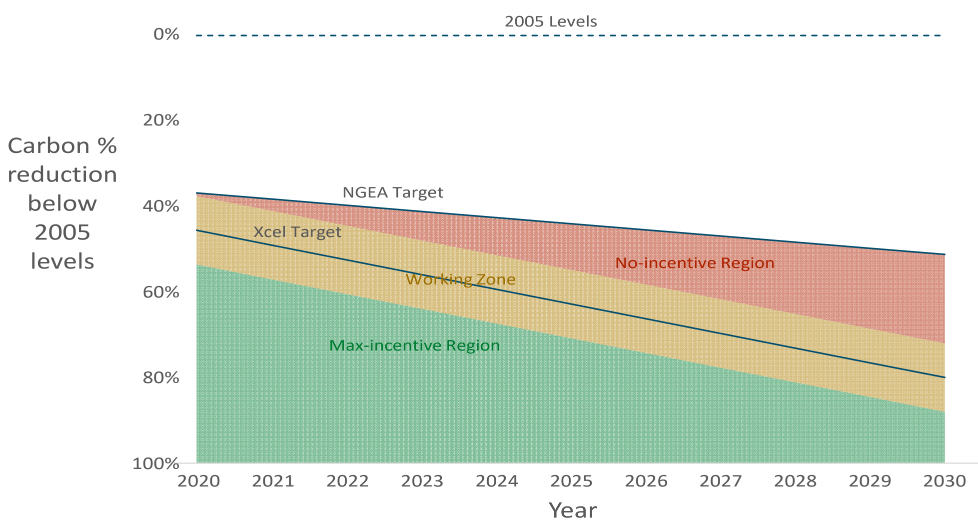
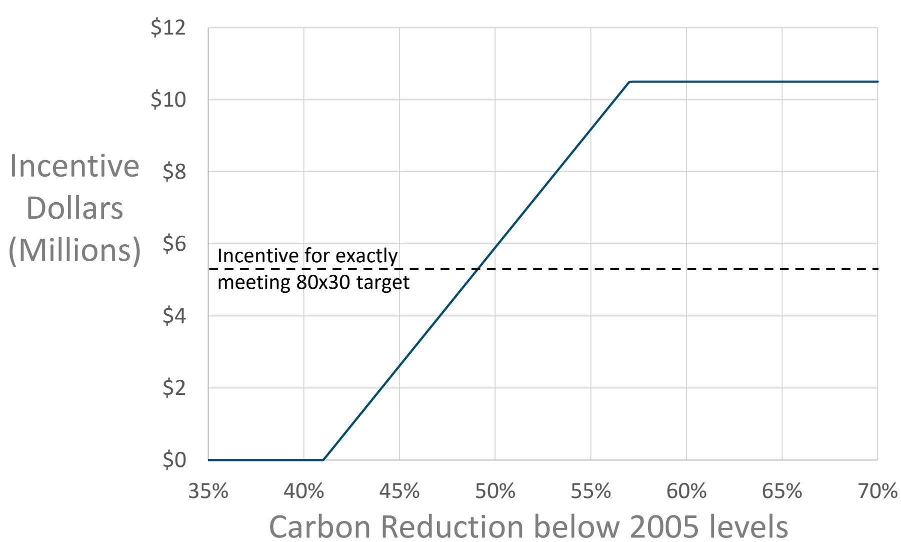


Figure 2

Relationship Between Incentive Dollars and Electricity Portfolio Carbon Reductions in 2021



Q. CAN YOU EXPLAIN THE EXAMPLE DEPICTED IN FIGURE 2?

A. Yes. This figure envisions that, sometime in 2022, Xcel Energy would calculate the total amount of carbon emitted to produce and deliver electricity to its customers in 2021. If the reported carbon reduction number were less than 41 percent below 2005 levels (see Figure 2) it would receive no PIM incentive. On the high-performance end, the PIM could reward Xcel Energy a maximum incentive of $10.5 million for reducing its carbon emissions by 57 percent or more below 2005 levels. Within this incentive working zone, the Company would receive $656,250 for each percentage increase in carbon reduction between the minimum and maximum thresholds in each year as shown in Figure 1.

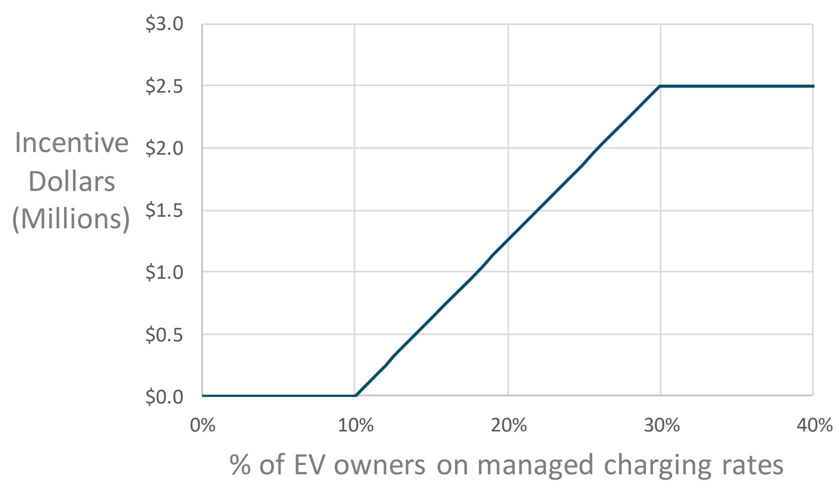
Q. PLEASE PROVIDE AN OVERVIEW OF THE PROPOSED MANAGED CHARGING PROGRAMMATIC PIMS.

A. The proposed PIMs decrease carbon and increase flexible load by promoting managed charging of electric vehicles (EV). The first managed charging PIM would be based on the percentage of EVs in Xcel Energy territory that are served on managed charging rates. The second managed charging PIM would be based on the percentage of managed charging customers' EV charging occurring during off-peak hours. Achievement of these metrics would be compared to targets based on historical performance in the more mature California EV market. Over time, as the program matures, the baseline numbers would be based on Minnesota's EV market data.

The managed charging enrollment PIM structure appears in Figure 3 below. No incentive is earned if the percentage of EV owners enrolled in managed-charging rates is less than 10 percent. A maximum incentive of $2.5 million would be received if the percentage is more than 30 percent. Within the region bounded by the no-incentive and max-incentive regions, the incentive would reward $125,000 for each percentage point of improvement beyond the no-incentive region.

Figure 3

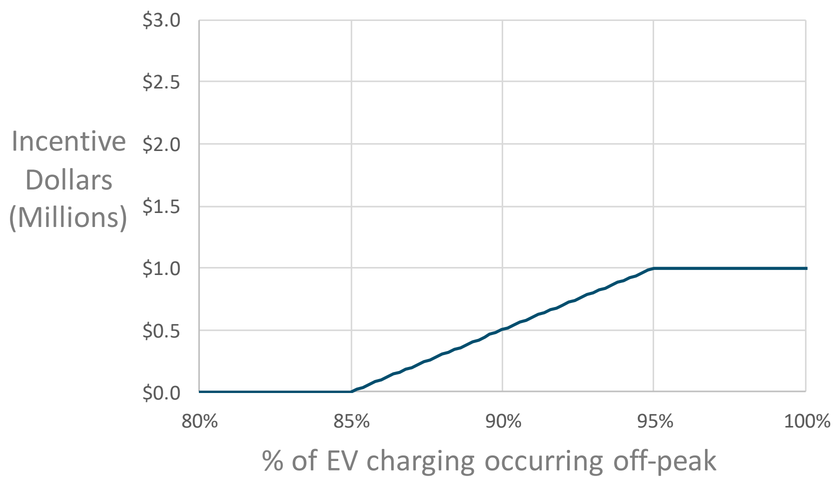
EV Rate Participation PIM Structure



The off-peak charging PIM structure appears in Figure 4 below. No incentive is earned if less than 85 percent of EV charging occurs during off-peak hours. A maximum incentive of $1.0 million would be received if more than 95 percent of EV charging occurs off-peak. Within the region bounded by the no-incentive and max-incentive regions, the incentive would reward $100,000 for each percentage point of charging load occurring off-peak beyond the no-incentive region.

Figure 4

EV Charging Shift PIM Structure



Q. WHAT WOULD THE MAXIMUM COST TO ELECTRICITY CONSUMERS IN A SINGLE YEAR BE IF XCEL ENERGY WERE TO MEET OR EXCEED ALL OF THE TARGETS CAPS YOU PROPOSE?

A. The total possible value of my proposed PIMs is modest in comparison to the Company's overall cost of service. Achieving the maximum possible incentive across the three proposed PIMs would give Xcel Energy a maximum award of $14 million in any year.

Q. IN ADDITION TO THE SPECIFIC PIMS DESCRIBED ABOVE, WHY ARE YOU INTRODUCING THE LONG-TERM PIMS FRAMEWORK FOR XCEL ENERGY AT THIS TIME?

A. Based on my experience in other jurisdictions, I believe that a more flexible, broadly-defined set of metrics that measure and incent reductions in direct emissions will lead to lower-cost compliance with the state's carbon reduction goals.

While Xcel Energy has already made a substantial commitment to lead the clean energy transition, the fact remains that Minnesota as a whole is behind in meeting its statutory greenhouse gas (GHG) mitigation targets. It missed its 15 percent reduction target for 2015 and is at risk of not meeting its 30 percent reduction target for 2025. In its 2019 report to the Legislature, the Minnesota Pollution Control Agency stated, "Minnesota has been and will remain a leader in GHG emission trends, but without continued support and additional effort, we are not likely to achieve the goals of the Next Generation Energy Act."[1]

Xcel Energy announced in December of 2018 that it is committed to reducing its electricity carbon emissions by 80 percent from 2005 levels by 2030 and 100 percent by 2050. These goals are laudable, but also substantially more aggressive than the Company's proportional share of the economy-wide reductions required by state law. The electricity portfolio PIM appropriately rewards Xcel Energy to exceed its commitment to reductions, which contribute more than its proportional share of state reductions.

Achieving Minnesota's GHG reduction targets of 30 percent by 2025 and 80 percent by 2050 requires continued accelerated progress in the electricity generation sector and substantial efforts to jump-start progress in the transportation and building sectors over the next five to 10-year transitional period. **Error! Reference source not found.** below shows how emissions from these sectors have not declined similarly to Electricity Generation. Especially in Minnesota, where the cold winter climate is a driving factor of the state's heating supply, economy-wide decarbonization of end-uses will need to

[1] Minnesota Pollution Control Agency (2019). Greenhouse gas emissions in Minnesota. 1990-2016.

be led by a strong and coordinated policy-driven approach. Although the exact energy mix of the future in all sectors is yet to be determined, policies that incentivize carbon reductions and focus on cost-effective early applications are essential to help guide the direction of the clean energy transition codified in Minnesota's GHG reduction targets.

Figure 5

Trend in Minnesota Emissions by Sector, 2005-2016[2]

Xcel Energy is well-positioned to contribute to GHG reductions not only in the electricity sector, but also the transportation and building sectors. PIMs would

[2] Minnesota Pollution Control Agency (2019). Greenhouse gas emissions in Minnesota. 1990-2016.

align utility performance with the achievement of the state's policy objectives. Specifically, decarbonization PIMs would complement Minnesota's current regulatory framework by rewarding specific actions by Xcel Energy that will further GHG reductions in sectors of the economy beyond the production of electricity, as the utility continues to provide safe, reliable and affordable service. The longer-term vision and phased approach to decarbonization PIMs that I describe in my testimony will incentivize steady progress and attention to the most impactful initiatives.

Q. HOW IS THE REMAINDER OF YOUR TESTIMONY ORGANIZED?

A. The remainder of my testimony is organized as follows.

- *Section II:* Need for New Carbon Reduction PIMs
- *Section III:* PIMs Proposal in the Electric Generation Sector
- *Section IV:* PIMs Proposal in the Transportation Sector
- *Section V:* Recommended Long-Term Framework for Carbon Reduction PIMs for Xcel Energy
- *Section VI:* Comparison with Other Jurisdictions
- *Section VII:* Conclusion

II. NEED FOR CARBON REDUCTION PIMS

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

A. In this section of my testimony, I provide background on the design and role of PIMs plus Minnesota's ongoing proceeding to consider performance metrics and PIMs for Xcel Energy. I also provide context on targeted incentives used historically and currently to achieve policy goals including for carbon reduction.

Q. WHAT IS A PIM?

A. A Performance Incentive Mechanism, or PIM, is a complementary tool to the existing regulatory framework that is designed to encourage the utility to commit to and achieve a goal in a specific area. The PIM does so by identifying a metric or a quantifiable target, defining the method of measurement, and specifying a reward, penalty, or both. PIMs are very useful when the natural incentive for a utility is weak, but the performance area is important or time-sensitive.

Q. ARE PIMS CURRENTLY UNDER CONSIDERATION BY THE COMMISSION?

A. Yes. Following Xcel Energy's November 2015 general electric rate case filing in Docket No. E002/GR-15-826, the Commission opened an Investigation to Identify and Develop Performance Metrics, and Potentially, Incentives for Xcel Energy's Electric Utility Operations, Docket No. E002/CI-17-401. In addressing Xcel Energy's general rate case filing, the Commission noted that "[p]erformance metrics are an important tool to preserve service quality and align utility incentives with ratepayer interests" but found that the record was insufficient to "determine the adequacy of Xcel Energy's proposed performance metrics." The Commission opened the current investigation as "the best venue for determining what combination of metrics and incentives, in addition to those already in Xcel Energy's QSP Tariff, would appropriately align utility and ratepayer interests."[3]

Q. WHAT IS THE STATUS OF THE CURRENT METRICS AND PIMS INVESTIGATION?

A. In January 2019, the Commission issued an Order in the proceeding that

[3] FINDINGS OF FACT, CONCLUSIONS, AND ORDER, Docket E002/GR-15-826 at 23 (June 12, 2017).

established a Performance Incentive Mechanism (PIM) process, and set out Goals, Outcomes, and Metric Design Principles. Following additional stakeholder input, the Commission issued an Order in September 2019 establishing performance metrics in the general outcome categories established in the January 2019 Order: affordability, reliability, customer service quality, environmental performance, and cost-effective alignment of generation and load.

In April 2020, the Commission issued its most recent Order in the proceeding which approved Xcel Energy's proposed metric calculation methodologies with a few modifications and annual reporting schedule. Xcel Energy is to report the metrics annually by April 30th beginning in 2021. The Order also directs Xcel Energy to work with stakeholders to develop evaluation criteria and benchmarks and to file them at a later date. This information will be utilized in the final step of the Performance Incentive Mechanism Process to consider whether to introduce new performance incentive mechanisms. The Order requires Xcel Energy to develop and file a demand response financial incentive mechanism for Commission consideration by the end of the first quarter of 2021.

Q. WHY DO YOU RECOMMEND SETTING PIMS FOR XCEL ENERGY HERE, WHILE THE WORK OF THE BROADER PBR DOCKET CONTINUES?

A. This rate case provides a timely opportunity to advance objectives that are consistent with the ongoing g docket. Given the fact that the state is lagging behind statutory GHG mitigation targets, it is reasonable to seek the most immediate path to codify Xcel Energy's carbon emission targets and to encourage additional beneficial electrification action.

Q. HOW DO YOUR RECOMMENDATIONS FURTHER THE OBJECTIVES OF THE COMMISSION'S ONGOING PBR DOCKET?

A. The recommended PIMs and Long-Term Framework that I describe in this testimony support the Commission's PBR docket in a number of ways:

- The Framework incorporates two of the five metric categories, the Environmental Performance and Cost-Effective Alignment of Generation to Load metric categories, approved by the Commission in its September 2019 Order in Docket No. 17-401. The Framework provides a platform for metric and incentives development in these policy categories that supplement existing affordability, reliability, and customer service metric categories that are addressed extensively in the Service Quality, Safety, and Reliability docket.
- The timing of establishing the Framework and PIMs within Xcel Energy's MYRP would follow two cycles of annual metric reporting and aligns with the docket's final steps to consider incentive mechanisms.
- The direct focus on immediate carbon reductions with a long-term broadly-defined PIM framework responds to stakeholder interests in decarbonization incentives that have been voiced during the proceeding.

Q. HAVE REGULATORS IN OTHER JURISDICTIONS IMPLEMENTED PIMS FOR CARBON REDUCTION?

A. Yes. In New York and Rhode Island, beneficial electrification is incentivized through specific programmatic targets that quantify carbon abatement directly. New York's PIMs, which are the most developed, quantify carbon abatement from the adoption of heat pumps, electric vehicles, and other technologies. In these jurisdictions the estimated avoided carbon emissions are based on standardized assumptions of avoided fuel use and then converted to a lifecycle carbon-savings metric based on the expected useful lifetime of the end-use.

Q. WHAT ARE THE KEY LESSONS LEARNED FROM OTHER JURISDICTIONS THAT MOTIVATE YOUR RECOMMENDATIONS TO PROVIDE PIMS FOR DECARBONIZATION IN MINNESOTA?

A. A list of key lessons learned appears below:

1. We know from both the extensive experience with the wholesale gas pipeline sector in North America and from applications in the United Kingdom (RIIO) that targeted incentives are effective in reducing costs, improving performance or complying with state policy goals.
2. We have also completed a number of decarbonization pathways projects, including one for Minnesota (as part of Xcel Energy's latest Upper Midwest resource planning process), which all provide very clear evidence that meeting the statewide goals requires coordinated decarbonization of the power, transportation and building sectors. We find that individual consumer action in both the transportation and building sectors will not be sufficient to meet state goals.
3. Utilities are being increasingly directed to operate and make investments consistent with clean energy policy. While this began in earnest in the 1970s with the Arab Oil Embargo and the Public Utility Regulatory Policy Act, it has grown from simple energy efficiency programs that began in the 1980s to include Renewable Portfolio Standards, Demand Response, Efficient Pricing and the wide range of services now being proposed in jurisdictions like New York and California. Note that most utilities responding to these policy directives still operate under cost of service regulation, with the PIMs acting to either increase performance

in key operating metrics or to target specific actions that would traditionally not be considered a core part of utility business functions.

III. PIMS PROPOSAL IN THE ELECTRIC GENERATION SECTOR

Q. PLEASE DESCRIBE WHAT XCEL ENERGY IS CURRENTLY DOING OR HAS COMMITTED TO DO TO HELP MEET OR EXCEED MINNESOTA'S CLEAN ENERGY GOALS IN THE ELECTRIC GENERATION SECTOR.

A. Xcel Energy is already working to decarbonize generation faster than state law requires. In 2007, Minnesota Governor Tim Pawlenty signed the Next Generation Energy Act (NGEA), which set GHG emission reduction targets relative to 2005 levels: 15 percent reduction by 2015, 30 percent reduction by 2025, and 80 percent reduction by 2050. Minnesota's Renewable Energy Standard (RES) mandates that by 2020 at least 31.5 percent of Xcel Energy's total retail electricity sales must be from renewable energy technologies, 1.5 percent of which must come from solar energy.

Xcel Energy has set its sights higher than Minnesota's statutory mandates, and plans to exceed the GHG emission reductions implied by NGEA and renewable energy targets required by Minnesota's RES. The Company's 2020-2034 Upper Midwest Integrated Resource Plan (IRP) submitted to the Minnesota Public Utilities Commission (Commission) on July 1, 2019 and updated on June 30, 2020 in Docket No. E002/RP-19-368 lays out an ambitious vision for continuing its clean energy transition with plans to:

- Retire its final remaining coal units, Sherco 3 and AS King, by 2030,
- Add a new combined cycle plant at the site of the existing Sherco coal facility,

- Extend operations at the Monticello nuclear plant, whose license expires in 2030, through 2040,
- Add 5,750 megawatts (MW) of new renewable resources by 2034,
- Add an average of 780 GWh of energy efficiency savings annually and 400 MW of incremental demand response resources to build out a larger demand-side management (DSM) portfolio by 2023,
- Add firm load-supporting resources as needed by 2034 in order to ensure reliability while supporting cost-effective integration of renewable resources.

Q. IS IT REASONABLE TO PROVIDE INCENTIVES FOR XCEL ENERGY TO UNDERTAKE CARBON REDUCTION MEASURES WHEN IT HAS ALREADY PUBLICLY COMMITTED TO GO BEYOND STATUTORY TARGETS?

A. Yes. The voluntary goals that Xcel Energy has embraced are consistent with the carbon reductions that Minnesota must eventually achieve. They are also very ambitious, and meeting them will require sustained, focused effort that can be more efficiently achieved with consistent incentives.

The incentives proposed take the steps of codifying these ambitious goals and introducing accountable year-to-year tracking of progress towards them. Moreover, I believe that the adoption of the proposed PIM will increase the likelihood that Xcel Energy will meet or exceed its stated carbon reduction targets.

Q. PLEASE GIVE AN OVERVIEW OF THE ELECTRICITY PORTFOLIO CARBON EMISSIONS PIM.

A. I recommend that the electricity portfolio PIM be set based on the percent reduction in total carbon emissions achieved, relative to a baseline year. Setting a GHG reduction PIM for the electricity sector is relatively straightforward and has several advantages over technology-specific policies or metrics. Total electricity sector carbon emissions can be measured and tracked, using agreed-upon third-party verified methods through The Climate Registry.

Q. PLEASE DESCRIBE YOUR RECOMMENDED METRIC AND MEASUREMENT METHOD FOR THE CLEAN ELECTRICITY PORTFOLIO CARBON EMISSIONS PIM.

A. The method for computing the electricity portfolio carbon emissions PIM is as follows:

1. Metric: The carbon emissions metric would be based on the total carbon emissions associated with serving Xcel Energy's load, including owned generation, power purchase agreements, and net carbon from wholesale power purchases and wholesale market sales. This metric would use the carbon accounting framework established for reporting to The Climate Registry to ensure third-party verification of measurements.
2. Calculation: The metric is based on percent reduction in Xcel Energy's carbon emissions relative to 2005 emission levels of 28 million short tons. The achieved reductions would be compared to a straight-line projection from 2019 actual emissions to Xcel Energy's 2030 carbon goal of 80 percent below 2005 levels.
3. Data source(s): Xcel Energy currently publishes annual carbon emissions in an annual report to The Climate Registry, which is verified by an independent third-party verifier. The incentive would be paid out only after this process of reporting and verification completes each year.

Q. PLEASE DESCRIBE HOW YOU PROPOSE THAT THE ELECTRICITY PORTFOLIO PIM BE IMPLEMENTED.

A. Implementation of the electricity portfolio PIMs would take the following elements into account:

1. Carbon emissions reductions would be benchmarked against 2005 emissions as described above.
2. I recommend an upside-only incentive in which the value of the incentive increases linearly with increasing carbon reductions, subject to an incentive floor and ceiling. No incentive would be earned for emissions reductions that fall more than 8 percent short of a straight-line projection from 2019 actual emissions to Xcel Energy's 2030 carbon goal announced in December 2018 (80 percent below 2005 levels). A maximum incentive of $10.5 million would be received for emissions reductions that exceed the straight-line projection by more than 8 percent. Within the *working zone* bounded by the no-incentive and max-incentive regions, the incentive would reward $656,250 for each percentage point of reductions achieved beyond the no-incentive region. This method of a linear slope with a ceiling and floor provides continued marginal reduction incentives around the target range and mutes the effect of year-to-year volatility.[4] Figure 6 below displays the evolution of the working zone, no-incentive region, and max-incentive regions over time. An illustration of the incentive structure for 2021, 2022, and 2023 is shown in Figure 7 below and further described by Table 1 below. As an example, if Xcel Energy were to achieve carbon reductions of 45

[4] See, for example, Lowry and Woolf, "Performance-Based Regulation in a High Distributed Energy Resources Future," Lawrence Berkeley National Laboratory, January 2016; 77 Whited, Woolf and Napoleon, "Utility Performance Incentive Mechanisms: A Handbook for Regulators," Synapse Energy Economics, prepared for the Western Interstate Energy Board, March 2015.

percent relative to 2005 levels in 2021, they would receive an incentive of $2.6 million. If Xcel Energy then achieved no additional reductions in the next two years, the incentive would shrink to $0.4 million in 2022 and $0 in 2023.

3. This PIM would be assessed annually, with the expected lag for third-party verification described above.

Figure 6

Incentive Regions for the Electricity Portfolio PIM

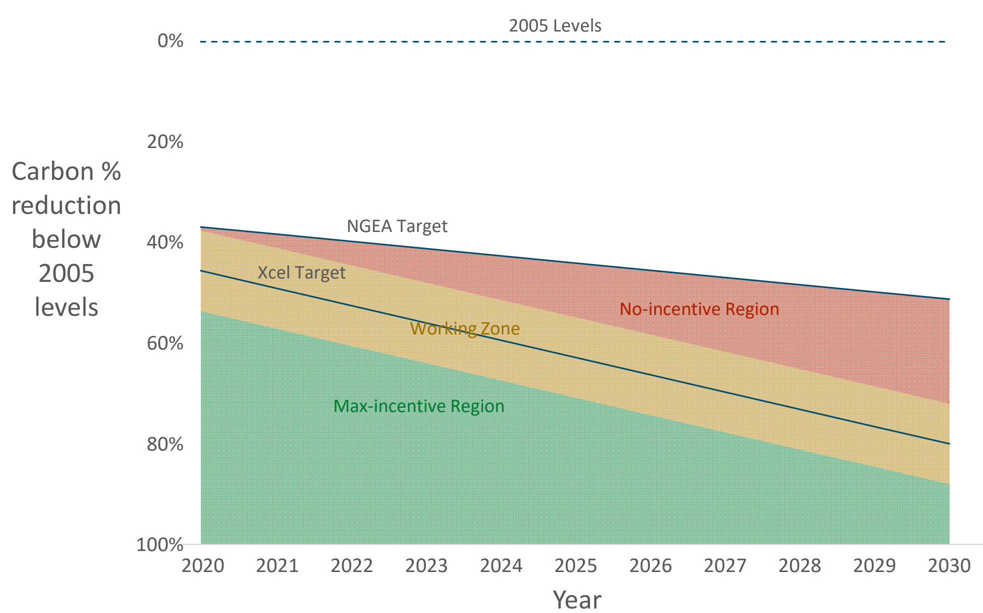


Figure 7

Relationship Between Incentive Dollars and Carbon Reductions

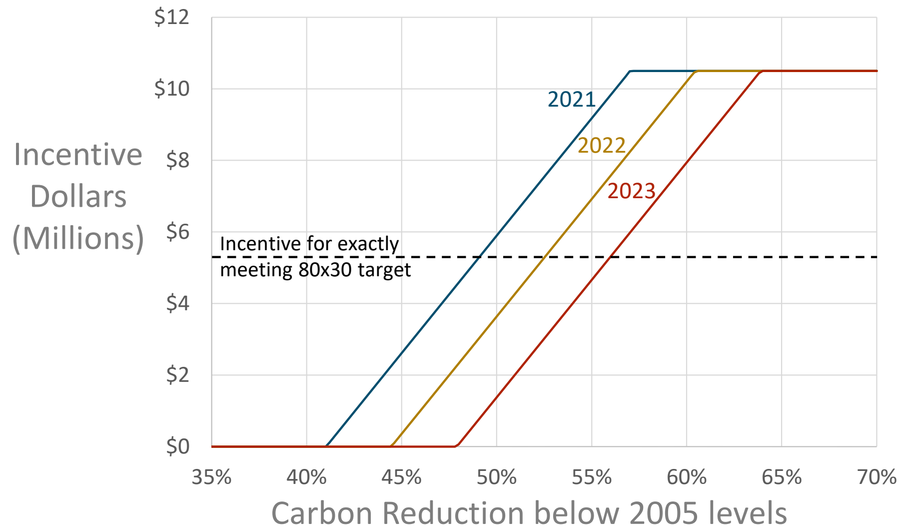


Table 1

Boundaries of Electricity Portfolio Incentive by Year

Year	Top of no-incentive region (% below 2005 carbon)	Bottom of max-incentive region (% below 2005 carbon)
2021	41.0%	57.0%
2022	44.4%	60.4%
2023	47.9%	63.9%

Q. WHY SHOULD THE INCENTIVE REGION EXTEND BOTH ABOVE AND BELOW THE TRAJECTORY SET BY XCEL ENERGY'S TARGET EMISSIONS?

A. As previously discussed, a PIM *working zone* is needed between the incentive floor and ceiling to provide consistent marginal reduction signals over a range of emission levels.

Q. HAS THE PROPOSED WORKING ZONE CHANGED FROM WHAT WAS PROPOSED IN THE WITHDRAWN 2019 RATE CASE FILING IN DOCKET NO. E002/GR-19-564?

A. Yes. The proposed working zone has been increased from 4 percent to 8 percent based on additional analysis to ensure the *working zone* is broad enough to cover the following two sources of emissions output variation: changes in emissions caused by variations in annual energy consumption; and changes in emissions due to variations in the timing of resource retirements and additions. The PIM *working zone* should, in spite of this variation, maintain a non-zero consistent incentive for Xcel Energy to continue to reduce its emissions.

Q. HOW DID YOU ESTIMATE THE SIZE OF THE "WORKING ZONE" FOR THE ELECTRICITY PORTFOLIO PIM?

A. I looked at several scenarios where Xcel Energy could exceed or fall short of a straight-line projection to their committed 2030 target. These scenarios included carbon forecasts based on different retirement dates for several resources from the Company's 2020-2034 Upper Midwest IRP. Across the scenario carbon forecasts between now and 2030, 85 percent of the datapoints fall within the proposed 8 percent band. I also looked at historical weather data and found that close to 85 percent of the annual variation in total degree days (heating degree days, cooling degree days) falls within an 8 percent band around the mean.

One additional consideration is that the band should be small enough to avoid incentivizing Xcel Energy in a year when they fall short of their proportional share of the NGEA target. Based on the data above and this constraint, an 8 percent *working zone* will in most years and under a range of plan uncertainties maintain consistent non-zero signal to promote emissions reduction.

Q. WHY ARE UPSIDE-ONLY DECARBONIZATION PIMS WARRANTED AT THIS STAGE?

A. The decarbonization PIMs I propose are focused on new performance expectations that align utility incentives with state policy objectives as compared to incentive mechanisms that are focused on basic service requirements. Unlike basic service requirements, these expectations require new methods of utility operation, innovation, and coordination with third parties. Upside-only PIMs are useful for activities that are new and, if achieved, have clearly defined positive societal value above what is captured or valued directly by the utility's customers.

Q. IS THE UPSIDE-ONLY RECOMMENDED DECARBONIZATION PIMS APPROACH ALIGNED WITH ACTIONS IN OTHER STATE JURISDICTIONS?

A. Yes. New York has the most advanced PIMs across the nation, where the Public Service Commission implemented upside-only incentives for the initial implementation of decarbonization PIMs across the New York utilities (Case 17-E-0459, June 14, 2018). The upside-only approach has also been proposed in Rhode Island and Hawaii and appears to be an early theme in proceedings in other jurisdictions where policy-driven PIMs are being advanced.

IV. PIMS PROPOSAL IN THE TRANSPORTATION SECTOR

Q. PLEASE DESCRIBE WHAT XCEL ENERGY IS CURRENTLY DOING OR HAS COMMITTED TO DO TO HELP MEET OR EXCEED MINNESOTA'S CARBON REDUCTION GOALS IN THE TRANSPORTATION SECTOR.

A. Xcel Energy Minnesota has a number of existing EV programs in place that are aimed at addressing the barriers to transportation electrification and encouraging the adoption of EVs throughout Minnesota. These programs target home charging, fleet charging, and public/fast charging and include a variety of tools, ranging from rates and other managed charging programs to infrastructure initiatives and advisory services.

- Xcel Energy also has a residential EV Charging Tariff in place that stimulates discounted off-peak charging with a dedicated service line and meter, which is used by 707 EV participants across Xcel Energy Minnesota territory.[5] In 2018, this program was extended with the residential EV Service Pilot, which encourages customers to charge on discounted off-peak hours without the upfront costs of a dedicated service line and meter. This program was recently approved to be offered to all customers through Xcel Energy's EV Home Service program which is expected to launch in 2021.
- With regard to infrastructure, Xcel Energy provides charging equipment to residential customers as part of the EV Home Service and EV Subscription Service pilots and has separate Fleet Charging and Public Infrastructure Pilots in place that provide the necessary make-ready infrastructure (and optionally charging equipment) for fleets and public charging specifically.
- In addition, Xcel Energy has been active across its territory in Minnesota to create awareness among customers on the benefits of EVs and to improve access to information about electric transportation. For instance, the Company has put substantial efforts into social media and online resources for educational purposes, continues to be active in public EV events, and works together with a number of local dealerships

[5] Xcel Energy (June 2020). Transportation Electrification Plan. Docket No. E999/CI-17-879.

to incentivize the purchase of EVs and hybrids for Xcel Energy customers.

- In its recent Transportation Electrification Plan (TEP), Xcel Energy announced it will be filing a proposal geared towards EV charging for multi-dwelling units to make EV charging more accessible for a larger number of customers. The Company is also developing an offer to support the use of electric school buses and is orienting on larger fleet electrification efforts in cooperation with Metro Transit. Finally, Xcel Energy is exploring opportunities to serve electric trucking and non-road vehicles in the next two years and will be looking at ways to aid the state in recovering from the economic impact of the COVID-19 pandemic.
- In August 2020, Xcel Energy announced a goal to have 1.5 million EVs within their combined service territories by 2030. If achieved, this would reduce carbon emissions by nearly 5 million tons annually by 2030.
- Xcel Energy recently filed proposals for a $150 million EV rebate program for the purchase of light-duty vehicles, transit buses, and school buses and a Company-owned Public Fast Charging Stations. The rebate effort is tied to participation in a time varying rate or managed charging program tariff and intended to kickstart the growth of EV adoption in Minnesota. The public fast charging plan will install 21 direct current fast charging stations throughout the Company's service area and serve as a vital resource to encourage increased EV adoption.

Q. PLEASE PROVIDE AN OVERVIEW OF THE ELECTRIC VEHICLE PIMS YOU PROPOSE FOR THE TRANSPORTATION SECTOR.

A. In this rate case, I recommend a two-part EV PIM that would be based upon:

1. the percentage of EVs in Xcel Energy territory on managed charging rates, and
2. the percentage of managed charging customers' EV charging energy occurring during off-peak hours.

Q. PLEASE DESCRIBE YOUR RECOMMENDED METRIC AND MEASUREMENT METHOD FOR THE ELECTRIC VEHICLE PIMS.

A. The method for computing the first EV PIM (managed charging enrollment) is as follows:

1. Metric: Percent of EVs in Xcel Energy's Minnesota service territory participating in managed charging programs or on whole-house Time of Use (TOU) rates.
2. Calculation: The numerator would be composed of customers on EV-specific managed charging programs (including Residential Electric Vehicle Service and Residential Electric Vehicle Pilot Service) and customers on whole-house TOU rates (Residential Time of Day Service and Residential Time of Use Pilot Service) who have self-identified as EV owners/lessors. The denominator would be the number of EVs registered in Xcel Energy's service territory.
3. Data source(s): The sources for the numerator would be Xcel Energy's Customer Resource System (CRS) and the results of customer surveys for customers who opt into whole-house TOU rates. The denominator would be computed using the most reliable source of vehicle registration data from the Commission, the Minnesota Pollution Control Agency (MPCA), or the Minnesota Department of Transportation (MN DOT).

The method for computing the second EV PIM (off-peak charging) is as follows:

1. Metric: Percentage of managed charging customers' residential EV charging energy consumed during off-peak hours.
2. Calculation: Both the numerator and the denominator are measured as cumulative annual MWh. The numerator is the total annual energy consumed (MWh) by EVs charging during off-peak hours at the residences of customers enrolled in Xcel Energy's EV TOU rates or other managed charging programs. The denominator is the total annual energy consumed (MWh) by EVs charging at the residences of customers enrolled in Xcel Energy's EV TOU rates or other managed charging programs. EV charging for customers on whole-house TOU rates cannot be tracked independently using the metering technology currently deployed. This includes customers enrolled in the EV DR program, since interval kWh data is not collected for those customers. If usage data that allows for tracking off-peak EV charging becomes available for these customers, future calculations should include their load as well.
3. Data source(s): Hourly customer billing data extracted from Xcel Energy's billing system.

Q. PLEASE DESCRIBE HOW YOU PROPOSE THAT THE ELECTRIC VEHICLE PIMS BE IMPLEMENTED.

A. Both PIMs would be upside-only and assessed on an annual basis. The rationale for the EV PIMs being upside-only is the same as for the clean electricity portfolio PIM.

The first EV PIM (managed charging enrollment) will be benchmarked against targets that encourage managed charging participation improvement well beyond current levels of 8 percent to 10 percent of all customers with electric vehicles. The incentive range starts above Xcel Energy's current enrollment level and provides space for dramatic improvement before the incentive ceiling. The wide incentive working zone encourages Xcel Energy to make steady progress in enrolling customers in managed charging through continuous improvement in program design and delivery.

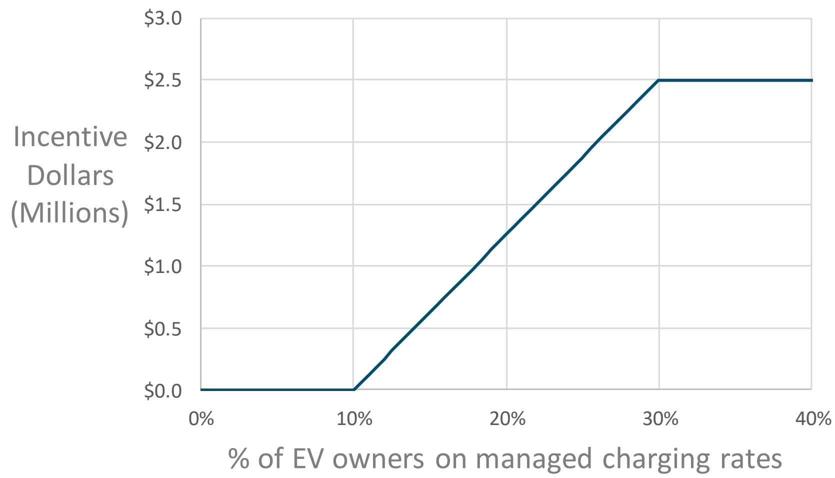
It is difficult to benchmark Xcel Energy's performance against that of other utilities due to varied incentives to induce customer enrollment, program and tariff designs, and approaches to calculate participation. However, the enrollment levels seen in the two largest California IOUs fall within the working zone of the proposed incentive.[6]

The value of the incentive increases linearly with the percentage of EV owners enrolled in managed charging rates, subject to an incentive floor and ceiling. No incentive is earned if the percentage of EV owners enrolled in managed-charging rates is less than 10 percent. A maximum incentive of $2.5 million would be received if the percentage is more than 30 percent. Within the region bounded by the no-incentive and max-incentive regions, the incentive would reward $125,000 for each percentage point of improvement beyond the no-incentive region. An illustration of the incentive structure is shown in Figure 8 below.

[6] SCE's and PGandE's participation rates in their managed charging programs are 14 percent and 23 percent, per: California Energy Commission, *Joint IOU Electric Vehicle Load Research--7th Report*, April 2, 2019.

Figure 8

EV Rate Participation PIM Structure

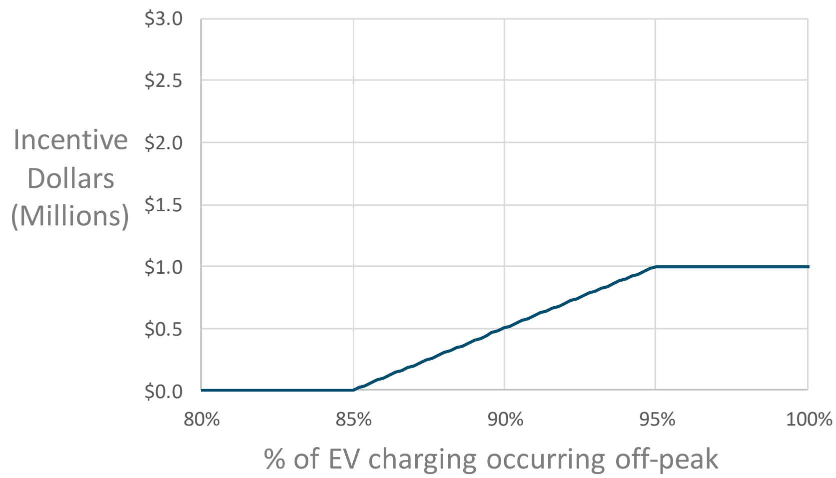


The second EV PIM (off-peak charging) would benchmark the percent of off-peak charging occurring in Xcel Energy's territory against similar results reported by the California IOUs. This metric is easier to benchmark against other utilities since it is meant to encapsulate the effectiveness of managed charging rate design and communication with customers. The higher penetrations of EVs in California makes the state a good benchmark for future EV penetrations in Minnesota.

The value of the incentive increases linearly with the percentage of at-home EV charging occurring off-peak, subject to an incentive floor and ceiling. No incentive is earned if less than 85 percent of EV charging occurs off-peak. A maximum incentive of $1.0 million would be received if more than 95 percent of EV charging occurs off-peak. Within the region bounded by the no-incentive and max-incentive regions, the incentive would reward $100,000 for each percentage point of charging load occurring off-peak beyond the no-incentive region. For the purposes of the PIM, "Off-peak" would include both off-peak and super off-peak periods for three-part TOU rates. An illustration of the incentive structure is shown in Figure 9 below.

Figure 9

EV Charging Shift PIM Structure



The 85 percent performance target is based on the approximate median performance of the California IOUs from 2014 to 2018. Xcel Energy has achieved high percentages of off-peak EV charging in early pilots (>90 percent). As seen in the more mature California market, this level of success is unlikely to continue as swaths of the population outside of highly-engaged early adopters purchase EVs. This target range would incentivize Xcel Energy both to maintain current off-peak charging levels in the face of broader EV adoption, and to increase the current off-peak charging level to as much as 95 percent.

The managed charging enrollment incentive is set to have a higher maximum value than the off-peak charging incentive to highlight relative need in the near term. Xcel Energy has historically done well to get customers on managed charging rates to respond to price signals, but the effectiveness of this load shift is limited by the number of customers participating in the rates.

Q. IF THE PROPOSED EV REBATE PROGRAM WERE APPROVED, WOULD THAT CHANGE YOUR RECOMMENDATIONS REGARDING THE TRANSPORTATION PIMS YOU PROPOSE HERE?

A. Yes. Xcel Energy's request to provide rebates to customers for the purchase of light-duty vehicles, transit buses, and school buses is contingent on the customers participating in Xcel Energy's managed charging programs or Time of Use rates. Were the Commission to approve that rebate program, there would be no need for the first EV PIM, which also is designed to incentivize Xcel Energy to encourage participation in such rates, as the proposed program and PIM are largely duplicative.

Q. HOW DO YOU ENVISION THIS MECHANISM WOULD EVOLVE OVER TIME?

A. The PIMs I propose in this rate case provide an incentive for Xcel Energy to stimulate managed charging for early EV adopters. This will help Xcel Energy figure out how to increase participation and design incentives that increase its flexible loads while at the same time developing the goals and metrics necessary to track carbon emissions in the transportation sector. Ultimately, I envision the PIMs in the transportation sector will contribute to carbon avoided by the adoption of electric vehicles, for example through a "gross avoided carbon per EV" metric. I describe this broader transportation sector PIM in Section V.

V. RECOMMENDED LONG-TERM FRAMEWORK FOR CARBON REDUCTION PIMS FOR XCEL ENERGY

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

A. In this section of my testimony I introduce the Long-Term Framework for carbon reduction PIMs for Xcel Energy that I propose for the electricity, transportation, and building sectors. Not only does this provide a recommended longer-term road map, but it helps to explain why the PIMs proposed here are a constructive and beneficial first step.

Q. WHY IS IT IMPORTANT TO ADOPT A LONGER-TERM CARBON REDUCTION RRAMEWORK?

A. Having a long-term vision or framework in place provides a line of sight between near-term actions and longer-term objectives. This is helpful to gain stakeholder support and to provide a more efficient process for the evolution of PIMs over time. Establishing supported and efficient processes now can avoid accounting and attribution problems for present and future decarbonization PIMs. Establishing the Framework within Xcel Energy's MYRP also aligns with the timing of the PBR docket's final steps to consider incentive mechanisms. To be clear, Xcel Energy is not yet in a position to request clearly-defined clean energy goals, metrics and PIMs in the Transportation and Building sectors as of the filing of this testimony. The Company anticipates continuing to work with key stakeholders to develop a long-term Electrification of Transportation plan accompanied by metrics, budget and the appropriate PIM proposal.

Q. DID YOU FOLLOW A COMMON SET OF GUIDING PRINCIPLES IN DEVELOPING THE PROPOSED LONG-TERM CARBON REDUCTION PIMS FRAMEWORK?

A. I used the following guiding principles to develop the PIMs Framework and initial proposed PIMs for carbon reduction that have the following attributes in order of priority:

1. The potential for an outsized social benefit with a comparatively small financial payment;
2. Broadly defined to be useful as platforms for a broad array of activities and programs;
3. Transparent and simple to measure, without the need for attribution;
4. Focused on roles and activities where Xcel Energy is uniquely qualified or well suited to have impact.

Q. ARE YOUR PRINCIPLES CONSISTENT WITH THE COMMISSION'S GUIDING PRINCIPLES FOR CARBON REDUCTION PIMS?

A. Yes, I believe that the principles I used are entirely consistent with the principles established by the Commission in its September 2019 Order in Docket No. 17-401. The Commission's guidance to Xcel Energy and stakeholders was as follows:

a. Utility performance metrics should be focused on results and outcomes. Metrics should not prescribe detailed or specific tools or tactics. This will provide the utility the opportunity to be flexible and tailored to its unique system and customers' needs.
b. Metrics should not support the deployment of specific technologies such as only one type of electric generation, unless such information is needed for a utility to comply with statutes.

c. Metrics identified to gauge environmental performance should directly measure environmental emissions and impacts.

d. Parties should develop measurement methodologies and future metrics with an eye toward development of a utility performance dashboard.

e. Metrics directed by the Commission at this stage of the process are not to be viewed as the final, exclusive list. As stakeholders work forward through the PIM process, they may propose reshaping or adding to the metrics outlined above.[7]

Q. DO ANY OF YOUR RECOMMENDED PIMS DIVERGE FROM THE COMMISSION'S GUIDING PRINCIPLES FOR CARBON REDUCTION PIMS?

A. Yes, the two managed charging EV PIMs do not directly measure environmental emissions and impacts. These PIMs are meant to be a first step in PIMs for transportation electrification that promotes both carbon reduction and load flexibility. Over time, a sector-level transportation PIM would directly measure carbon reductions from transportation, and the need for these programmatic PIMs would be reassessed.

Q. PLEASE DESCRIBE YOUR LONG-TERM FRAMEWORK.

A. The framework I propose for carbon reduction PIMs is illustrated in Figure 10 below. I identify three sector level platforms that would each have their own targets, programs and budgets. I propose that tracking of metrics for PIMs occur at these high levels and be based on total carbon reductions in each sector. Given this broad framework, PIMs can be established for individual programs (energy efficiency) and at the sector level (electricity).

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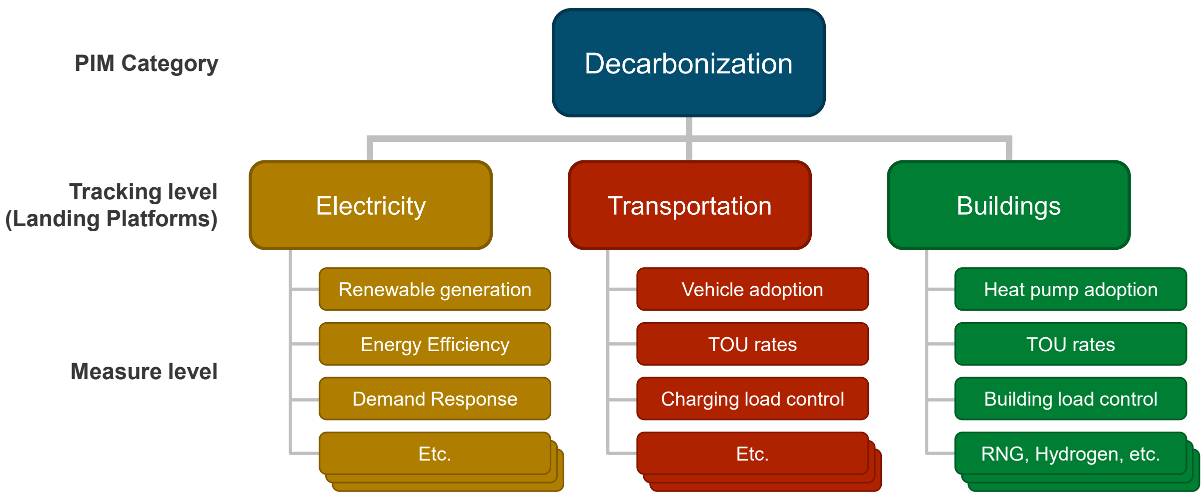
[7] ORDER ESTABLISHING PERFORMANCE METRICS, Docket No. E002/CI-17-401 (September 18, 2019).

Focusing on total reduced carbon satisfies the Commission's Order that metrics be focused on outcomes and measure environmental emissions. Tracking at this high level satisfies the Commission's Order that metrics not prescribe specific tactics or support specific technologies. Finally, establishing sector level platforms for future programs and PIMs satisfies the Commission's Order that metrics presented now not be viewed as final and exhaustive.

Figure 10

Structure of Proposed Decarbonization PIMs



Below this tracking level appear lists of potential measures and programs that contribute to carbon reduction within each sector. These lists provide examples of actions that Xcel Energy may choose to take to affect the total carbon tracked within each sector.

Q. SHOULD THERE BE PIMS AT THE PROGRAM AND SECTORAL LEVEL IN YOUR FRAMEWORK?

A. Yes, in the initial phase of setting up sectoral level metrics, targets, and PIMs, it is useful to have a combination of programmatic and overall sectoral level tracking and incentives. If approved, Xcel Energy would have combinations of programmatic PIMs for energy efficiency and demand response that will both contribute to reducing carbon emissions on a program level and under the clean energy portfolio PIM. This approach allows Xcel Energy to utilize a balanced portfolio of measures with varied attributes.

Over time, as the technologies and successful programs become more defined, I anticipate the need for programmatic PIMs would decline, providing more flexibility for the utility to reduce costs and improve performance by reallocating its resources among a broader set of programs within each sector. This includes actions focused on electrification of end-uses, fuel switching to carbon-free and low-carbon fuels, and promotion of load flexibility. This indifference to technology encourages comprehensive programs that include all types of actions that encourage an end goal such as EV adoption. EV adoption programs, for example, could include offering TOU rates, customer education, building public charging stations, vendor outreach, and more.

Q. WHY IS THE CONCEPT YOU DESCRIBED ABOVE BENEFICIAL IN THE CONTEXT OF DECARBONIZATION PIMS?

A. This multi-sector framework based on broad outcomes is beneficial for the following reasons, each of which is described in more detail below. This concept:

- Encourages policies and actions in each sector required to achieve economy-wide carbon reduction targets;
- Enables a simpler, transparent method of PIM measurement;

- Potentially allows for finding low-cost solutions across sectors to minimize ratepayer impacts; and
- Creates a balanced approach in which Flexible Load can be co-prioritized with carbon reduction.

Q. WHY IS A MULTI-SECTOR FRAMEWORK NEEDED IN MINNESOTA?

A. A multi-sector economy-wide framework lowers the costs of meeting reduction targets. In Minnesota, I could imagine a system in which initially-defined sectoral level targets and budgets evolve with a flexible accounting or administrative process to allow one sector to offset their own goals with reductions from another. At that point, it would be beneficial for Xcel Energy to also have the ability to flexibly reallocate its efforts across sectors. Given the focus of other jurisdictions on programmatic PIMs both within the power sector for utility actions in other sectors, adoption of a flexible multi-sector framework would establish Minnesota as a leader in advancing broadly-defined flexible decarbonization PIMs that could encourage a variety of multi-sector programs.

To see why this flexibility is necessary to reduce compliance costs, Table 2 below shows a subset of the carbon-reducing options and the basic unit for reductions tracking associated with each. Decarbonization of the economy requires all of these actions, so it is beneficial to have a Carbon Reduction PIMs Framework that promotes them all and values them for their respective contributions to the desired outcome of reduced carbon.

Table 2

Example Carbon Reduction Measures

Measure	Basic Unit
Coal replacement with gas generation	tons/GWh
Gas replacement with renewable generation	tons/GWh
Typical EE program (based on 2019 CIP)	tons/GWh
ICE LDV replacement with EV*	tons/EV
ICE HDV replacement with EV*	tons/EV
Gas furnace replacement with heat pump*	tons/HP
LPG furnace replacement with heat pump*	tons/HP
Gas water heater replacement with heat pump*	tons/HP
LPG water heater replacement with heat pump*	tons/HP
Gas end-use supply with RNG or hydrogen	tons/MMBtu

* Carbon reductions attributable these measures depend on the carbon intensity of the electricity associated with EV charging and heat pump operation.

Q. How does the Framework enable a simpler, transparent method of PIM measurement?

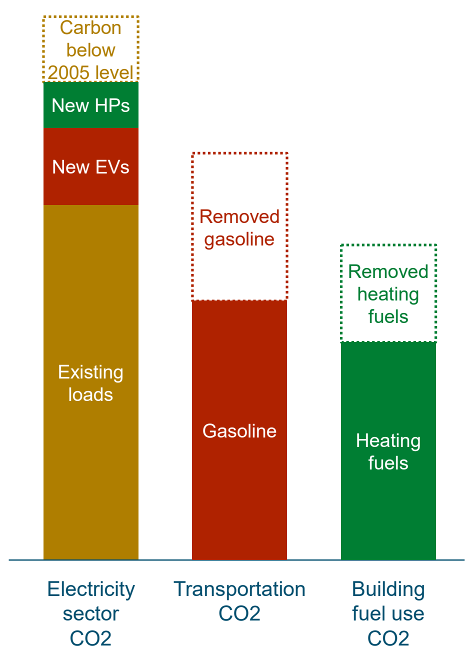
A. The Framework measures carbon reduction at the economy-wide level by adding the reductions in each sector. Under this approach, the transportation and buildings sector decarbonization are measured at a gross level versus net level, eliminating the complexity of accounting for the dependency of transportation and building electrification decarbonization on the electricity sector decarbonization. Quite simply, if Minnesota tracks and provides incentives to reduce carbon dioxide produced by electricity plants, automobile tailpipes and the carbon embedded in the fuel burned to heat and cool buildings, it can avoid myriad difficult accounting and attribution problems.

Figure 11 below provides an illustration of carbon counting across sectors. It shows that new EVs, for example, will reduce the carbon from transportation more than the increase in the electricity sector. Similarly, assisting customers to purchase and operate heat pumps efficiently will increase electricity emissions but reduce building sector emissions.

The approach eliminates the complexity of counting carbon reductions at the measure level; attribution of savings to individual measures requires complex calculations such as determining the emissions attributable to an EV or heat pump. This unneeded complexity creates barriers in the approval process due to lack of transparency and differing viewpoints on detailed calculations. Also, understanding tradeoffs between actions at the measure level is unclear due to the different native units of replacement (GWh, EVs, HPs, etc.). Focusing on total carbon at a higher level avoids this confusion.

Figure 11

Example Carbon Counting Across Sectors



Q. CAN EARLY ACTION BY XCEL ENERGY HELP MINNESOTA REACH ITS GHG MITIGATION GOALS ON TIME AND IN A COST-EFFECTIVE MANNER?

A. Yes. Over the past years, Xcel Energy has demonstrated that it can be a key driver behind emission reductions in the electricity sector in Minnesota. Continued focus in this sector will be key in reaching the State's GHG mitigation goals. Xcel Energy's voluntary goal of an 80 percent carbon reduction attributable to serving its customers by 2030 is critical to the statewide picture. In addition, efforts that Xcel Energy can make in the next years five to 10 years to stimulate the switch to low-carbon electricity in other sectors will have a direct effect on economy-wide GHG reductions.

Q. CAN YOU PROVIDE A SIMPLE EXAMPLE TO SHOW THAT THERE IS VALUE IN INCENTIVIZING CARBON REDUCTIONS ACROSS SECTORS?

A. Yes. Consider two carbon reduction measures in the electric sector, one implemented today and the same measure implemented in 2030. In the near term, utility scale solar is a relatively low-cost option for carbon-free electricity. Assume the solar has a levelized cost of $50/MWh and an energy value of $30/MWh and 0.4 tons per MWh of avoided carbon emissions.[8] These assumptions lead to a cost of carbon emission reduction of approximately $50/ton (=(50-30)/0.4).

Now assume that by 2030, the integration of higher levels of renewable generation becomes more expensive. To maintain the same level of reliability, the low-cost solar must be paired with energy storage to deliver the energy when it is needed and provide reliable capacity. This increases the cost of delivered

[8] The levelized cost refers to lifetime costs divided by lifetime energy production, and the energy value refers to the benefit of avoiding running a generator with non-zero fuel cost.

carbon-free electricity to $120/MWh, making the corresponding cost of carbon emission reduction much higher at $225/ton (=(120-30)/0.4).

Now consider carbon reduction measures in the transportation sector. A new light-duty electric vehicle has an incremental cost today of approximately $8,000 over a similar gasoline powered vehicle. This translates to an incremental cost of about $1,000 per year, assuming the vehicle has a 12-year life.[9] The EV also is likely to save $1,150 per year in lower fuel and O&M costs, for a net cost savings of $150 per year. The typical new light-duty EV also saves over two tons of carbon, net of electric sector emissions from today's system. Providing both net savings and carbon reductions yields a carbon reduction of negative $70/ton (=150/2.2).

A similar story can be told for the building sector. In new construction, efficiency and electrification measures can provide carbon reduction at a cost of approximately -340 $/ton, based on earlier work E3 performed on Building Electrification in California.[10]

These examples show that there are low-cost carbon reduction measures in the transportation and building sectors that are less expensive than in the electric sector today. Furthermore, these multi-sectoral cost differences are likely to increase as it becomes more difficult to integrate renewable resources into the bulk power grid.

[9] Assumes a 7 percent discount rate.
[10] Mahone et al, 2019, Residential Building Electrification in California: Consumer Economics, Greenhouse Gasses, and Grid Impacts.

Q. HOW DO THE COSTS OF YOUR PROPOSED PIMS COMPARE TO THE COMPLIANCE COSTS STATED ABOVE?

A. My proposed clean energy portfolio PIM targets emissions reductions of just over one million tons per year. Given the proposed incentive ceiling of $10.5 million, this translates to approximately $10/ton. This is much smaller than the $50/ton and $225/ton compliance costs described in my simple example above. Though those examples were hypothetical, they are based on real measures and provide a meaningful cost comparison.

Q. HOW DO THE COMPLIANCE COSTS COMPARE TO THE COSTS OF YOUR TWO PROPOSED MANAGED CHARGING PIMS?

A. Given that the primary goal of the programmatic transportation PIMs is to provide load flexibility and not to directly reduce carbon, I do not provide a similar carbon reduction cost comparison for these small program-focused PIMs.

VI. COMPARISON WITH OTHER JURISDICTIONS

Q. HAVE REGULATORS IN OTHER JURISDICTIONS IMPLEMENTED PIMS FOR GHG REDUCTION?

A. Yes. In New York and Rhode Island, beneficial electrification is incentivized through specific programmatic targets that quantify GHG abatement directly. New York's PIMs, which are the most developed, quantify abatement from the adoption of heat pumps, electric vehicles, and other technologies. In these jurisdictions, the estimated avoided GHG emissions from an electric vehicle are based on standardized assumptions of avoided gasoline or diesel use per vehicle and then converted to a lifecycle carbon savings metric based on the expected useful lifetime of the end-use. These carbon savings form the basis for the PIMs seen in these jurisdictions. A similar approach is applied for building electrification and rooftop solar PV.

Q. HOW DOES YOUR PROPOSED DECARBONIZATION PIMS FRAMEWORK DIFFER FROM PROPOSALS IN OTHER JURISDICTIONS?

A. There are two key differences between this proposal and the proposals of New York and Rhode Island utilities. The first is that this proposal includes a PIM directly focused on electric sector carbon reduction. This difference arises because both New York and Rhode Island have deregulated electricity supply and encourage electricity portfolio emission reductions through the Regional Electricity Greenhouse Gas Initiative (RGGI) cap and trade program. Minnesota lacks a similar program to financially incentivize electric sector decarbonization, hence the need for a clean electricity portfolio PIM.

The second key difference is that the long-term structure proposed here is simpler and more comprehensive than what has been proposed elsewhere. While my proposal emphasizes high-level carbon tracking as the basis for decarbonization PIMs, the New York utilities have taken a more programmatic approach that incentivizes specific actions. While programmatic PIMs are effective in starting the process of market transformation, they require complicated accounting and attribution and inherently lack the flexibility needed to cost-effectively comply with aggressive carbon reduction targets.

VII. CONCLUSION

Q. PLEASE SUMMARIZE YOUR DIRECT TESTIMONY.

A. As an initial step in progressing carbon reduction PIMs, I recommend that three PIMs be included in Xcel Energy's proposed multi-year rate plan for 2021-2023 in order to better align the utility's financial incentives with both the state's and the utility's long-term carbon reduction goals. The clean electricity portfolio PIM incents Xcel Energy to reduce carbon emissions from its generation supply portfolio faster than a straight-line constant percentage reduction to meet the goals already committed to by the Company and required to meet state carbon reduction targets. The two transportation PIMs incent Xcel Energy to increase the percentage of electric vehicles on managed charging rates and the level of charging load occurring during off-peak hours. The targets for the EV metrics may change over time as EV programs and adoption evolve. Indeed, the time lag between the filing of this testimony and rate case hearings may necessitate that the targets change prior to implementation of the PIMs.

I also propose a Carbon Reduction Framework to provide a comprehensive, transparent, and relatively simple platform for the evolution of Carbon Reduction PIMs over time that can incorporate developments in the PBR docket or other dockets. The Framework includes a platform for the electricity sector, transportation electrification and building decarbonization PIMs. The Framework envisions that PIMs in each sector evolve from programmatic PIMs to a single carbon PIM over time as markets and Xcel Energy's role matures in each sector. For example, the Transportation PIMs I propose in this rate case provide an incentive for Xcel Energy to stimulate managed charging for early EV adopters. This will help Xcel Energy in setting the stage for effective load control while at the same time developing the goals and metrics necessary to track carbon emissions in the transportation sector.

I anticipate similar developments in the building electrification sector, which is in the early stages of exploration in Minnesota. To help shape the future of gas decarbonization in the state, Xcel Energy is an active member of the "Decarbonizing Minnesota's Natural Gas End-Uses" initiative, a stakeholder initiative supported by the Great Plains Institute and the Center for Energy and Environment (CEE) that aims to develop a Minnesota-specific view on different approaches to reducing carbon emissions from natural gas end-uses.

Minnesota is well positioned to act as a leader for defining innovative carbon reduction PIMs that consider the current stage of economy-wide decarbonization across multiple sectors, while properly incentivizing the utility company to accelerate electrification and decarbonization necessary to meet state-wide goals. The initial PIMs, Framework, and phased approach to decarbonization PIMs that I describe in my testimony will incentivize steady progress and attention to the most impactful initiatives resulting in lower-cost achievement of the state's decarbonization targets.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?
A. Yes.

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ENERGY AND ENVIRONMENTAL ECONOMICS, INC. San Francisco, CA
Managing Partner

Dr. Orans founded Energy and Environmental Economics, Inc. (E3) in 1989. An economist and engineer, he has focused throughout his career on the challenges facing the electricity industry. He is a trusted advisor to a broad range of clients that have included government agencies, utilities, system operators, regulators, independent power producers, energy technology companies, public interest organizations, and investors. He has led E3 teams on numerous high-impact and high-profile projects that have required both rigorous technical analysis and the ability to effectively distill actionable insights to help E3's clients make informed decisions as they develop innovative projects, programs, or policies.

Dr. Orans' pioneering work in utility planning has centered on the design and use of area and time-specific (ATS) marginal costs for both pricing and evaluation of grid infrastructure alternatives. This seminal work has led to detailed area costing applications in pricing, marketing, and planning for many utilities throughout North America. He is an expert in designing wholesale transmission tariffs and has served as an expert witness in regulatory proceedings on retail rate design and wholesale transmission pricing, including for Canada's three largest utilities: BC Hydro, TransEnergie, and Ontario Power Generation.

In a recent forward-looking study, Dr. Orans provided his expertise to California's energy and environmental regulators in evaluating the operational challenges, feasibility, and cost consequences of a higher Renewables Portfolio Standard (RPS) in California by 2030.[1] This assessment included technical input from the California Independent System Operator (CAISO) as well as independent reviews from a distinguished four-member advisory panel and utilized E3's best-in-class Renewable Energy Flexibility (REFLEX) model. Additionally, in consultation with advisors to California's Governor and principals and staff from the energy agencies and the CAISO, Dr. Orans and E3 staff developed a set of technology deployment scenarios that meet California's goal of reducing greenhouse gas (GHG) emissions to 80 percent below 1990 levels by 2050.[2] This analysis leveraged E3's California PATHWAYS model, an economy-wide, infrastructure-based GHG and cost analysis tool that captures interactions among the buildings, industry, transportation, and electricity sectors in a low-carbon future.

Dr. Orans has also guided E3's national deep decarbonization analysis, most notably in the influential report *Pathways to Deep Decarbonization in the United States*.[3] Co-authored with Lawrence Berkeley National Laboratory (LBNL) and Pacific Northwest National Laboratory (PNNL), its principal finding is that multiple pathways exist to achieving deep decarbonization by midcentury at manageable cost. The report was published for the Deep Decarbonization Pathways Project (DDPP), an initiative led by the United Nations Sustainable Development Solutions Network (SDSN) and the Institute for Sustainable

[1] https://www.ethree.com/projects/modeling-californias-50-percent-renewables-portfolio-standard/
[2] https://ethree.com/public_projects/energy_principals_study.php
[3] http://unsdsn.org/wp-content/uploads/2014/09/US_DDPP_Report_Final.pdf

Development and International Relations (IDDRI) to explore how countries can transform their energy systems by 2050 to achieve needed greenhouse gas reductions. These models continued to be used by leading jurisdictions in Hawaii, New York, California and Minnesota to facilitate the transition to clean energy.

Dr. Orans is a respected thought leader who is often asked to share his expertise and vision for the energy industry. He regularly publishes in refereed journals and has twice taught a graduate course on electric utility planning at Stanford University and continues to give guest lectures. He received his Ph.D. in Civil Engineering from Stanford University and his B.A. in Economics from the University of California at Berkeley.

DEPARTMENT OF ENERGY Washington, DC

Lead Consultant 1989 – 1990

Dr. Orans was the lead consultant on a cooperative research and development project with the People's Republic of China. The final product was a book on lessons learned from electric utility costing and planning in the United States.

ELECTRIC POWER RESEARCH INSTITUTE Palo Alto, CA

Consultant 1987 – 1989

Dr. Orans developed the first formal economic model capable of integrating DSM into a transmission and distribution plan; the case study plan was used by PG&E for a $16 million pilot project that was featured on national television and the approach and method was published by EPRI and used by several leading utilities to integrate efficiency and other distributed resources into their distribution planning processes.

PACIFIC GAS & ELECTRIC COMPANY San Francisco, CA

Research and Development Department 1984 – 1991

Dr. Orans's first application of his targeted evaluation approach shows that targeted, circuit-specific, localized generation packages or targeted DSM can in some cases be less costly than larger generation alternatives. PG&E used the new approach to develop a 500kW photovoltaic (PV) facility at their Kerman substation. This is the only PV plant ever designed to defer the need for distribution capacity.

Corporate Planning Department *1986-1992*

Dr. Orans was the lead consultant on a joint EPRI and PG&E research project to develop geographic differences in PG&E's cost-of-service for use in the evaluation of capital projects. The approach was filed and adopted by the California Public Utilities commission. He also designed and implemented the first version of the shared savings DSM incentive mechanism that was ultimately used for all investor owned utilities in California and is still used today.

Rate Department Economist *1981-1985*

As an economist at PG&E, Dr. Orans was responsible for the technical quality of testimony for all electric rate design filings. He was also responsible for research on customers' behavioral response to conservation and load management programs. The research led to the design and implementation of the first and largest residential time-of-use program in California and a variety of innovative pricing and DSM programs.

Education

Stanford University Palo Alto, CA
Ph.D., Civil Engineering

Stanford University Palo Alto, CA
M.S., Civil Engineering

University of California Berkeley, CA
B.A., Economics

Citizenship

United States

Refereed Papers

1. *Orans, R., F. Kahrl, and D. Aas (2017) "Envisioning the Electric Utility in 2030: 'Fat' or 'Skinny'?" Public Utility Fortnightly, March 2017.*

2. *Li, M., R. Orans, J. Kahn-Lang and C.K. Woo (2014) "Are Residential Customers Price-responsive to an Inclining Block Rate? Evidence from British Columbia, Canada," The Electricity Journal, 27(1), 85-92.*

3. *Orans, R., A. Olson, J. Moore, J. Hargreaves, R. Jones, G. Kwok, F. Kahrl and C.K. Woo (2013) "Energy Imbalance Market Benefits in the West: A Case Study of PacifiCorp and CAISO," The Electricity Journal, 26(5), 26-36.*

4. *Woo, C.K., I. Horowitz, B. Horii, R. Orans, and J. Zarnikau (2012) "Blowing in the wind: Vanishing payoffs of a tolling agreement for natural-gas-fired generation of electricity in Texas," The Energy Journal, 33:1, 207-229.*

5. *Mahone, A., B. Haley, R. Orans, J. Williams (2011) "Electric Vehicles and Gas-Fired Power: A Strategic Approach to Mitigating Rate Increases and Greenhouse Price Risk," Public Utilities Fortnightly (Dec 2011) 42-50, available at: http://www.fortnightly.com/exclusive.cfm?o_id=918*

6. *Alagappan, L., R. Orans, and C.K. Woo (2011) "What Drives Renewable Energy Development?" Energy Policy, 39: 5099-5104.*

7. *R. Orans, F. Pearl, A. Mahone (2010) "A Modest Proposal: After Cap and Trade," Brookings Institute.*

8. *Orans, R., C.K. Woo, B. Horii, M. Chait and A. DeBenedictis (2010) "Electricity Pricing for Conservation and Load Shifting," Electricity Journal, 23:3, 7-14.*

9. *Olson A., R. Orans, D. Allen, J. Moore, and C.K. Woo (2009) "Renewable Portfolio Standards, Greenhouse Gas Reduction, and Long-line Transmission Investments in the WECC," Electricity Journal, 22:9, 38-46*

10. *Orans, R., M. King, C.K. Woo and W. Morrow (2009) "Inclining for the Climate: GHG Reduction via Residential Electricity Ratemaking," Public Utilities Fortnightly, 147:5, 40-45.*

11. *Woo, C.K., E. Kollman, R. Orans, S. Price and B. Horii (2008) "Now that California Has AMI, What Can the State Do with It?" Energy Policy, 36, 1366-74.*

12. *Orans, R., S. Price, J. Williams, C.K. Woo and J. Moore (2007) "A Northern California - British Columbia Partnership for Renewable Energy" Energy Policy, 35:8, 3979-3983.*

13. *Lusztig, C., P. Feldberg, R. Orans and A. Olson (2006) "A Survey of Transmission Tariffs in North America," Energy - The International Journal, 31, 1017-1039.*

14. *Woo, C.K., A. Olson and R. Orans (2004) "Benchmarking the Price Reasonableness of an Electricity Tolling Agreement," Electricity Journal, 17:5, 65-75.*

15. *Orans, R., Woo, C.K., Clayton, W. (2004) "Benchmarking the Price Reasonableness of a Long-Term Electricity Contract," Energy Law Journal, 25: 2, 357-383.*

16. *Orans, R., Olson, A., Opatrny, C. (2003) "Market Power Mitigation and Energy Limited Resources," Electricity Journal, 16:2, 20-31.*

17. *Woo, C.K., D. Lloyd-Zannetti, R. Orans, B. Horii and G. Heffner (1995) "Marginal Capacity Costs of Electricity Distribution and Demand for Distributed Generation," The Energy Journal, 16:2, 111-130.*

18. *Pupp, R., C.K. Woo, R. Orans, B. Horii, and G. Heffner (1995) "Load Research and Integrated Local T&D Planning," Energy - The International Journal, 20:2, 89-94.*

19. *Chow, R.F., Horii, B., Orans, R. et. al. (1995) "Local Integrated Resource Planning of a Large Load Supply System," Canadian Electrical Association.*

20. *Feinstein, C., Orans, R. (1995) "The Distributed Utility Concept," The Annual Energy Review.*

21. *Woo, C.K., R. Orans, B. Horii and P. Chow (1995) "Pareto-Superior Time-of-Use Rate Options for Industrial Firms," Economics Letters, 49, 267-272.*

22. *Woo, C.K., B. Hobbs, Orans, R. Pupp and B. Horii (1994) "Emission Costs, Customer Bypass and Efficient Pricing of Electricity," Energy Journal, 15:3, 43-54.*

23. *Orans, R., C.K. Woo, R. Pupp and I. Horowitz (1994) "Demand Side Management and Electric Power Exchange," Resource and Energy Economics, 16, 243-254.*

24. *Woo, C.K., R. Orans, B. Horii, R. Pupp and G. Heffner (1994) "Area- and Time-Specific Marginal Capacity Costs of Electricity Distribution," Energy - The International Journal, 19:12, 1213-1218.*

25. *Orans, R., C.K. Woo and B. Horii (1994) "Targeting Demand Side Management for Electricity Transmission and Distribution Benefits," Managerial and Decision Economics, 15, 169-175.*

26. *Orans, R., C.K. Woo and R.L. Pupp (1994) "Demand Side Management and Electric Power Exchange," Energy - The International Journal, 19:1, 63-66.*

27. *Orans, R., Seeto, D., and Fairchild, W., (1985) "The Evolution of TOU Rates," Pergamon Press.*

Research Reports

1. *R. Orans, Woo, C.K., L. Alagappan, M. Madrigal, Creating Renewable Energy-Ready Transmission Networks, World Bank, September 2010*

2. *CPUC Staff, Olson, A., Orans. R., 33% Renewables Portfolio Standard Implementation Analysis Preliminary Results, California, June 2009.*

3. *Orans, R., Olson, A., Load-Resource Balance in the Western Interconnection: Towards 2020, Western Electricity Industry Leaders Group, September 2008.*

4. *Orans, R., Olson, A., Integrated Resource Plan for Lower Valley Energy, December 2004.*

5. *Orans, R., Woo C.K., and Olson, A., Stepped Rates Report, prepared for BC Hydro and filed with the BCUC, May 2003.*

6. *Woo, C.K. and R. Orans (1996) Transmission: Spot Price, Reliability Differentiation and Investment, report submitted to Ontario Hydro.*

7. *Orans, R., Woo, C.K., and B. Horii (1995) Impact of Market Structure and Pricing Options on Customers' Bills, Report submitted to B.C. Hydro.*

8. *Horii, B., Orans, R., Woo, C.K. (1994) Marginal Cost Disaggregation Study, Report submitted to PSI Energy.*

9. *Woo, C.K., L. Woo and R. Orans (1995) Rationing and Area-Specific Generation Costs, Report submitted to Pacific Gas and Electric Company.*

10. *Orans, R., Woo, C.K., and C. Greenwell (1994) Designing Profitable Rate Options Using Area- and Time-Specific Costs, Report No. TR-104375, Electric Power Research Institute.*

11. *Singer, J., Orans, R., Energy Efficiency Lending, A Business Opportunity for Fannie Mae, Report submitted to Fannie Mae.*

12. *Orans, R., Feinstein, C., et. al. (1993) Distributed Utility Valuation Study, submitted to the Electric Power Research Institute, the National Renewable Energy Laboratory, and PG&E.*

13. *Orans, R., Pupp, R. (1993) Menomonee Falls Case Study, Submitted to Wisconsin Electric Power Corporation.*

14. *Orans, R. and C.K. Woo (1992) Marginal Cost Disaggregation Study, Report submitted to Wisconsin Electric Power Corporation.*

15. *Orans, R., C.K. Woo, J.N. Swisher, B. Wiersma and B. Horii (1992) Targeting DSM for Transmission and Distribution Benefits: A Case Study of PG&E's Delta District, Report No. TR-100487, Electric Power Research Institute.*

16. *Orans, R., Swisher, J., Duane, T. (1989) Lessons Learned from U.S. Electric Utilities, Prepared for the Department of Energy for the People's Republic of China.*

17. *Orans, R. (1989) Area-Specific Marginal Costing for Electric Utilities: A Case Study of Transmission and Distribution Costs, Ph.D. Thesis, Stanford University.*

18. *Orans, R. (1987) The Risk of Sales Forecasts: Controllable through Indexation and Careful Disaggregation, Submitted to Stanford University and Pacific Gas and Electric Company.*

19. *C.K. Woo and R. Orans (1983) Transferability of Other Utilities' Time of Use Experiments to PG&E's Service Schedule D-7, Pacific Gas and Electric Company Reports filed with the California Public Utilities Commission.*

Conference Papers

1. *Orans, R. (2011) "Getting to 2050, Pathways to Deep Reductions in GHG Emissions," CFA Society Presentation, San Francisco, CA, October 25, 2011.*

2. *Orans, R. (2010) "Renewable Resource Opportunities in the West," Law Seminars International, British Columbia, August 2010.*

3. *Orans, R. (2009) "California's 33% RPS Implementation Plan," Law Seminars International, San Francisco, September 2009.*

4. *Orans, R. (2009) "Comparable Treatment of Resource Options," FERC Technical Conference, Phoenix, AZ, September 2009.*

5. *Orans, R. (2008) "A GHG Compliant World in 2050," Law Seminars International, San Francisco, CA, September 2008.*

6. *Orans, R. (2007) "Gaps in State Energy Policy Coordination: A View from the Cheap Seats," CFEE, Napa, California, September 2007.*

7. *Orans, R. (2004) "Evaluating Generating Resources based on an Equivalent Reliability Methodology," 2nd Annual Resource Planning Symposium, January 2004, Vancouver, Canada.*

8. *Martin, J., Orans, R., Knapp, K. (2000) "DG Economics and Distribution Rate Design," Western Electric Power Institute, Distributed Generation and the Utility Distribution System Conference, Reno, NV, March 22-23, 2000.*

9. *Orans, R. (1997) "Getting the Transmission Prices Right," Facilitating Cross Border Trade, New Mexico.*

10. *Orans, R. (1997) "Deregulation on the Mainland: What is Happening and What is Not," PCEA Conference, Hawaii.*

11. *Swisher, J., Orans, R. (1995) "A New Utility DSM Strategy Using Intensive Campaigns Based on Area Specific Costs," ECEEE 1995 Summer Study.*

12. *Orans, R., Greenwell, C. (1995) "Designing Profitable Rate Options Using Area and Time-Specific Costs," Prepared for EPRI, Annual DSM Review, Dallas, Texas.*

13. *Orans, R. (1995) "Integrated Local Area Planning," Prepared for NELPA and presented in Calgary.*

14. *Orans, R. "Local Area Planning for Profit: Annual Review of Distributed Resource Studies," Prepared for EPRI, Lake George, New York.*

15. *Orans, R., C.K. Woo, B. Horii and R. Pupp (1994) "Estimation and Applications of Area- and Time-Specific Marginal Capacity Costs," Proceedings: 1994 Innovative Electricity Pricing, (February 9-11, Tampa, Florida) Electric Research Power Institute, Report TR-103629, 306-315.*

16. *Heffner, G., R. Orans, C.K. Woo, B. Horii and R. Pupp (1993) "Estimating Area Load and DSM Impact by Customer Class and End-Use," Western Load Research Association Conference, September 22-24, San Diego, California; and Electric Power Research Institute CEED Conference, October 27-29, St. Louis, Missouri.*