414 Nicollet Mall, 5th Floor
Minneapolis, Minnesota 55401

May 5, 2016

--VIA ELECTRONIC FILING--

Mr. Daniel P Wolf
Executive Secretary
Minnesota Public Utilities Commission
350 Metro Square Building
121 7th Place East
St. Paul, MN 55101

RE: *IN THE MATTER OF THE FURTHER INVESTIGATION INTO ENVIRONMENTAL AND SOCIOECONOMIC COSTS UNDER MINN. STAT. §216B.2422, SUBD. 3*
EXCEPTIONS TO ALJ'S FINDINGS OF FACT, CONCLUSIONS AND RECOMMENDATIONS
MPUC DOCKET NO. E999/CI-14-643
OAH DOCKET NO. 80-2500-31888

Dear Mr. Wolf:

Northern States Power Company, doing business as Xcel Energy, submits the enclosed Exceptions to the Administrative Law Judge's *Findings of Fact, Conclusions and Recommendations* issued April 15, 2016 related to the CO_2 portion of the above-referenced proceeding.

If you have questions or need additional information, please contact me at (612) 215-4656 or at james.r.denniston@xcelenergy.com .

Sincerely,

/s/

JAMES R. DENNISTON
ASSISTANT GENERAL COUNSEL

Enclosures
c: Service List

STATE OF MINNESOTA
BEFORE THE OFFICE OF ADMINISTRATIVE HEARINGS
FOR THE
MINNESOTA PUBLIC UTILITIES COMMISSION

In the Matter of the Further Investigation into Environmental and Socioeconomic Costs Under Minnesota Statute 216B.2422, Subdivision 3	OAH Docket No. 80-2500-31888 MPUC Docket No. E-999/CI-14-643

XCEL ENERGY EXCEPTIONS TO ALJ'S FINDINGS OF FACT, CONCLUSIONS AND RECOMMENDATIONS REGARDING CO_2

May 5, 2016

James R. Denniston
Assistant General Counsel
NORTHERN STATES POWER COMPANY,
a Minnesota corporation
414 Nicollet Mall, 401 – 8th Floor
Minneapolis, MN 55401
Telephone: (612) 215-4656

TABLE OF CONTENTS

I. INTRODUCTION

Northern States Power Company, doing business as Xcel Energy respectfully submits these Exceptions and Clarifications to the Administrative Law Judge's *Findings of Fact, Conclusions, and Recommendations: Carbon Dioxide Values* (the ALJ CO_2 Report) in this proceeding. We recognize the magnitude and complexity of the evidentiary record and commend the ALJ for providing a comprehensive analysis. We disagree with certain of the ALJ's conclusions and recommendations, and respectfully request that the Commission consider our Exceptions and revise the ALJ conclusions and recommendations accordingly in its Final Order.

This document is organized as follows: Section II presents the ALJ's recommended values as we understand them; Section III gives an overview highlighting issues related to the practicability of applying the updated CO_2 environmental cost values in resource planning and related Commission decisions – issues that Xcel Energy has raised throughout this proceeding and that we believe are important for the Commission to consider as it evaluates the ALJ's recommendations. Section IV briefly reviews Xcel Energy's proposed range in order to provide context for the Exceptions that follow. Section V lists our specific Exceptions to the ALJ's conclusions, and clarifies our position on emission leakage. Section VI concludes. Attachment A to this document provides our suggested redlines to the ALJ's Conclusions and Recommendations.

II. ALJ's RECOMMENDED VALUES

The ALJ recommends that the Commission "adopt the Federal Social Cost of Carbon as reasonable and the best available measure to determine the environmental cost of CO_2, establishing a range of values including the 2.5 percent, 3.0 percent, and 5 percent discount rates," with the direction that "the FSCC values will be re-calculated to reflect a shortened time horizon extending to the year 2200," and "the

Commission will exclude the value derived from the 95th percentile at a 3 percent discount rate value from the range of values."[1]

The ALJ does not provide the explicit FSCC values on which she bases her recommendation, but from the record we may conclude that she is referring to the values presented in the executive summary of the latest (July 2015) Federal SCC Technical Support Document (TSD), which are the following:

Figure 1: FSCC Executive Summary Values from July 2015 Technical Support Document.[2]

Revised Social Cost of CO_2, 2010 – 2050 (in 2007 dollars per metric ton of CO_2)

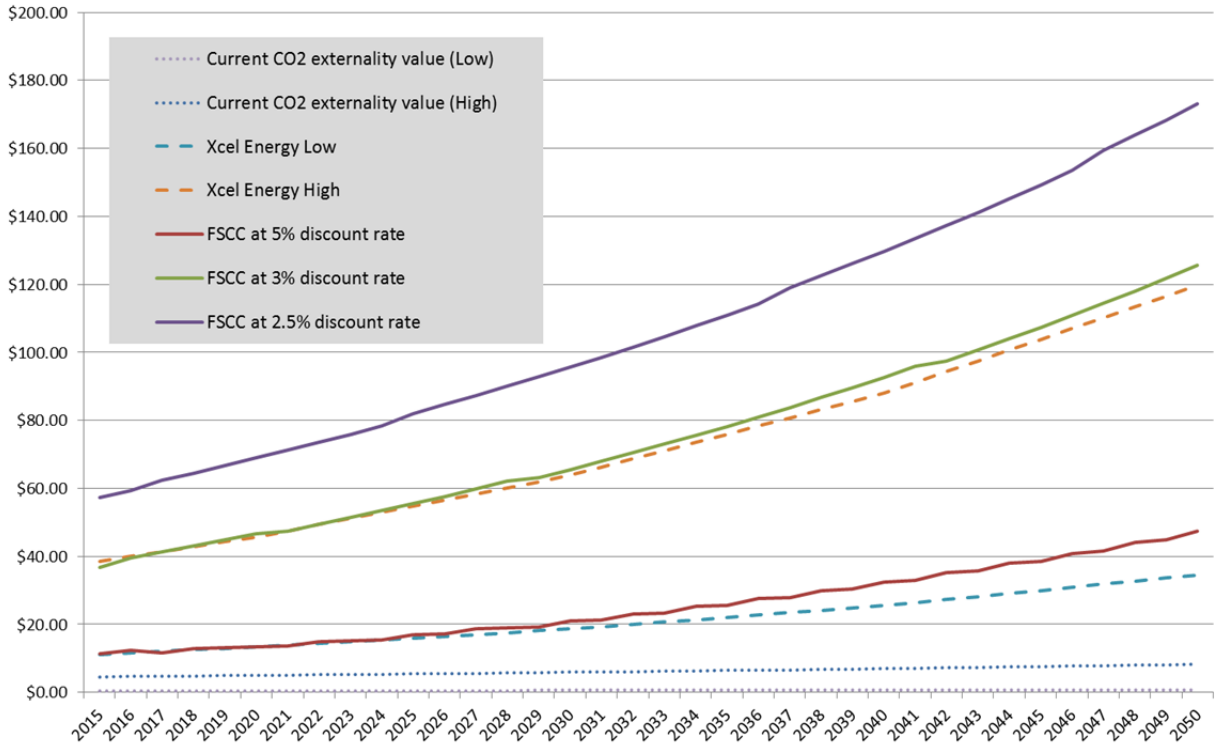
Discount Rate Year	5.0% Avg	3.0% Avg	2.5% Avg	3.0% 95th
2010	10	31	50	86
2015	11	36	56	105
2020	12	42	62	123
2025	14	46	68	138
2030	16	50	73	152
2035	18	55	78	168
2040	21	60	84	183
2045	23	64	89	197
2050	26	69	95	212

The ALJ recommends Commission adoption of the first three columns, which represent the simple average across all Integrated Assessment Model (IAM) results for the specified discount rate and emission year, but recommends that these values be recalculated to shorten the modeling horizon from the year 2200 to 2300. She recommends against Commission adoption of the fourth column, which represents the 95th percentile of IAM results at a 3 percent discount rate.

[1] ALJ CO_2 Report, Recommendation 1 at 123.
[2] Ex. 601 (Martin Rebuttal), Schedule 1 (July 2015 TSD) at 3.

These values are not directly comparable to either the Commission's current CO_2 externality values, or to the values proposed by Xcel Energy, since the FSCC values are presented in 2007 dollars per metric ton while the Commission's values are in current dollars (updated for inflation) per short ton.[3,4] For comparison, the following figure presents the FSCC values, the Commission's current externality values, and Xcel Energy's proposed range on the common basis of nominal dollars per short ton of CO_2 emitted, for the emission years 2015 through 2050.

Figure 2: FSCC Values, Commission's Current Externality Values, and Xcel Energy's Proposed Range (Nominal Dollars per Short Ton).



Note that this figure does not reflect the ALJ's proposed adjustment of these three FSCC executive summary values to shorten the modeling horizon from the year 2300 to 2200. The ALJ does not specify how, or by whom, this adjustment would be

[3] Minnesota utility emissions are generally reported in short tons rather than metric tons. A short ton is a unit of mass equal to 2,000 pounds, while a metric ton equals 2,206 pounds. 1 short ton = 0.907 metric tons.
[4] Xcel Energy presented its range both in 2014 dollars per short ton and in nominal dollars per short ton. Ex. 600 (Martin Direct), Schedules 3 and 4; Ex. 601 (Martin Rebuttal), Schedules 2 and 3.

made. Adjustment of the values would entail acquiring the IAMs; adjusting their internal code to eliminate damages after 2200 (but otherwise following the Interagency Working Group's (IWG) methodology); re-running the IAMs; and re-calculating the average across IAM results at each of the three discount rates. It is difficult to estimate, without actually re-running the models, by how much this shortening of the modeling horizon would affect the FSCC average values. Qualitatively we can say that shortening the modeling horizon to 2200 will reduce all three FSCC values, since it will eliminate the last 100 years of estimated damages; and that the higher the discount rate, the less impact there will be on the FSCC (since the far-distant damages being eliminated will be more heavily discounted).

Xcel Energy has two primary critiques of the ALJ's recommendation. First, the recommendation is based on the Federal SCC executive summary values, which we have argued throughout this proceeding are intended only for federal regulatory impact analysis and entail a degree of false precision that is inappropriate for resource planning and related Commission decisions. These are *point estimates* at three different discount rates; the fact that they fall at three different levels, simply because they reflect three different discount rates, does not make them a range. A range is required by the enabling statute,[5] and Xcel Energy's proposal represents a true range. Second, the FSCC executive summary values represent a simple average across 150,000 IAM results for a given discount rate and emission year, which we have argued tends to place undue emphasis on the extremely high, but in statistical terms relatively unlikely, damage estimates in the long right tail of the FSCC probability distributions.

[5] Minn. Stat. § 216B.2422, subd. 3.

Xcel Energy agrees, however, with the ALJ's recommendation that the Commission should not adopt the 95th percentile value at 3 percent discount rate, for the reasons stated in her Conclusion No. 21.[6]

III. PRACTICABILITY CONCERNS

The ALJ appears to have viewed her charge as determining reasonable and best available values for damages from CO_2 emissions, based purely on climate science and economic theory, without any consideration of the practical implications when those values are used in resource planning. However, as the focus of this proceeding now shifts from an ALJ-moderated contested case to a Commission decision, it would be reasonable and appropriate for the Commission to consider the practical implications of the ALJ's recommendations. This would be appropriate for three primary reasons.

First, practicability considerations are appropriate because the statute requires them. The enabling statute has only two pertinent requirements: adoption of a *range* of values for the externalized damages from pollutants, and that this range should be *practicable*.[7] We believe the ALJ's recommendation fails on both requirements. We address later in this document the fact that the FSCC point estimates at three discount rates do not represent a range. Here, we focus only on the question of practicability.

Second, practicability considerations are appropriate because of the Commission's role as a public policy body, and because the factors most influential in the FSCC are in fact public policy judgments informing the modeling approach, rather than matters of objective scientific fact. The Commission is a political and legal body, having both quasi-legislative and quasi-judicial authority, which has historically engaged in policy-based fact-finding and other public policy determinations. Xcel Energy explained throughout our testimony and at the evidentiary hearings that

[6] ALJ CO_2 Report at 118.
[7] Minn. Stat. § 216B.2422, subd. 3.

estimating the FSCC is only partly a matter of using the most up-to-date climate science and economics. It is at least as dependent on public policy decisions that have no one correct answer – decisions such as the geographic scope of damages, the modeling horizon, the discount rate choice, and how to model damages from a marginal ton of emissions.[8] Because the Commission will unavoidably be considering public policy questions with no single answer, it has a reasonable basis to apply its discretion and consider the practical implications of those decisions.

Third, practicability considerations are appropriate because of the intended purpose of the CO_2 environmental cost values. The updated CO_2 environmental cost values adopted by the Commission will be used in resource planning dockets as one factor, among others, to help the Commission determine which generating facilities utilities should retire and which type(s) of generating facilities should be built. To be practicable, we believe these values should not be considered in a vacuum. To do so would essentially treat this contested case proceeding as an academic exercise disconnected from questions of practical application. Xcel Energy has raised questions of practicability throughout our pre-filed testimony, at the evidentiary hearings and in legal briefs, for example by pointing to the impracticability of adopting both extremely low/negative and extremely high values. We argued that although such values are present in the FSCC results, they would not provide useful information for Commission decisions since they could merely point to – specifically, assign the lowest Present Value of Social Costs (PVSC) ranking to – diametrically opposed resource plans.[9] Unsupportably high or diametrically opposed (low/negative and very high) values would tend to create a tension that is difficult to reconcile between the Commission's consideration of the PVRR (Present Value of Revenue Requirements, reflecting the actual cost to utility customers) ranking of resource plan

[8] Ex. 602 (Martin Surrebuttal) at 13; Ex. 603 (Martin Opening Statement) at Hearing Transcript Vol. 3B at 106.

[9] Ex. 602 (Martin Surrebuttal) at 13, 15-16, 22, 33-34.

alternatives and the PVSC (i.e., the PVRR plus the value of estimated damages) ranking of resource plan alternatives. In our view, if the PVRR and PVSC rankings are entirely dichotomous and non-overlapping, the results fail on the practicability requirement because they could point to resource plan alternatives that do not overlap in a given docket. This is why Xcel Energy's proposal, rather than focusing on the relatively improbable low and high extremes, identifies a reasonable range within the more probable FSCC estimates that appropriately balances uncertainty, risk tolerance, and practicability.

As an illustration, consider emission year 2020, for which the ALJ recommends the FSCC average value at 5 percent discount rate ($12, in 2007 dollars per metric ton), the FSCC average value at 3 percent discount rate ($42), and the FSCC average value at 2.5 percent discount rate ($62). The corresponding values in nominal dollars per short ton are $13.34, $46.68, and $68.90 per short ton of CO_2 emitted in that year.[10] The PVRR ranking of resource plan alternatives, which does not consider externalities, would likely point toward (assign lowest PVRR to) a resource plan maintaining existing coal generation, maintaining existing and adding new gas generation, and adding some amount of renewables. The PVSC ranking using the ALJ's lowest recommended CO_2 externality value, $13.34, might favor a similar resource plan to the PVRR ranking. The PVSC ranking using her highest recommended CO_2 externality value, $68.90, would point in an entirely different direction, likely assigning the lowest PVSC to a resource plan retiring existing coal and gas generation, not building new gas, maintaining existing and even adding new nuclear capacity, and bringing on much more renewables. There would be relatively little overlap in the generating resource choices: the rankings, and therefore the Preferred Plans to which they point, would essentially be diametrically opposed and

[10] Without consideration of the ALJ's proposed re-calculation of these values shortening the modeling horizon to 2200, which would bring all the recommended values down by an unknown amount.

incompatible. This would place the Commission in the position of either prioritizing PVSC and ignoring potentially very high cost impacts on customers, or prioritizing PVRR and setting aside the PVSC rankings. We do not believe such an outcome is useful or practicable.

A related concern is that adopting unsupportably high or diametrically opposed CO_2 environmental cost values could exacerbate the energy policy divergence between Minnesota and neighboring states of North Dakota, South Dakota, Wisconsin and Michigan, which do not apply any such values. Xcel Energy operates an integrated system across these five states, and electricity is dispatched by a regional system operator (the Midcontinent Independent System Operator, MISO) over a much larger area. The other jurisdictions do not apply CO_2 externality values or have an equivalent PVSC analysis to Minnesota's. Too great a divergence between the ranking of resource plan alternatives (or specific resources) across jurisdictions could lead, in the near term, to generation shifts and emission leakage, if the CO_2 environmental cost values cause retirement of coal and gas resources in Minnesota whose generation is replaced elsewhere in the MISO system by power plants emitting as much or more CO_2 per megawatt-hour. In the longer term, it could lead to an escalation in electricity rates in Minnesota relative to other states, potentially causing relocation of businesses to other states or countries and thus another type of emission leakage.

A separate practicability consideration relates to the number of different CO_2 environmental cost values adopted for a given year. The ALJ concludes that Xcel Energy should not have equally weighted (she uses the term "averaged") the CO_2 environmental cost values calculated at different discount rates at each end of our proposed range.[11] We defended this decision by noting that because there is no consensus that one discount rate is more appropriate than another, we gave equal

[11] ALJ CO_2 Report, Conclusion 50 at 122.

weight to the SCC values calculated at each discount rate. We also argued it would have been impracticable to propose six different values – low and high values at each of three different discount rates – rather than the Commission's precedent of two values. Many of these values are quite similar, despite representing very different policy judgments, and we argued that assigning six different PVSCs to each of the many dozens of resource plan alternatives utilities typically model would not be practicable, i.e., it would not provide useful information for Commission decision-making.[12] The number of PVSC rankings across various resource plan options and sensitivities would quickly multiply, leading to confusion rather than clarity.

These concerns about practical implications, while raised by Xcel Energy, generally received little attention in the contested case proceeding, and receive virtually no attention in the ALJ CO_2 Report. We believe it is appropriate, however, for some consideration of practical implications to re-enter as this proceeding shifts from an ALJ-moderated contested case to a Commission decision. As noted above, the Commission is a public policy-interpreting body, and public policy judgments are unavoidable when setting the updated CO_2 environmental cost values. The Commission should exercise its discretion to consider practicability, rather than treating the assignment of CO_2 environmental cost values as a purely academic exercise. We continue to believe Xcel Energy's proposal remains a better choice than the FSCC executive summary values. Our proposal is based on the same climate science and economics as the IWG used to derive the FSCC, and retains all the IWG's core assumptions, but balances uncertainty, risk tolerance and practicability to derive a range that is more appropriate for use in resource planning.

Finally, we note that because it depends so heavily on public policy decisions, the FSCC is not immune from political influence. Under a more conservative

[12] Ex. 602 (Martin Surrebuttal) at 20-22.

Administration, a future update of the FSCC may adopt different policy judgments – a shorter modeling horizon, a focus on national damages, higher discount rates, etc. – that would drive the FSCC values down significantly. Would the Commission, having concluded in this proceeding that the FSCC represents the best available measure, accordingly revise its CO_2 environmental cost downwards? We argue the Commission should exercise more of its own discretion in adopting a range that is appropriately tailored to the proposed application. Xcel Energy's proposal provides such a range.

IV. SUMMARY OF XCEL ENERGY'S PROPOSAL

This section briefly reviews Xcel Energy's methodology and range to set the context for the Exceptions that follow.

The ALJ and all Parties agree that the IWG's methodology to develop the FSCC involves a significant amount of uncertainty, and that the IWG methodology is distinct from the three IAMs themselves because of modifications the IWG made to their input assumptions, the way the IWG ran the models, and the way the IWG summarized the model results. For instance, the IWG ran the DICE model in a simulation mode rather than in its native optimization mode, and used standardized exogenous input assumptions across IAMs for socio-economic and emissions trajectories, equilibrium climate sensitivity, and discount rates. The IWG based its exogenous population growth, GDP growth, and emissions trajectories on the Stanford Energy Modeling Forum (EMF-22) scenarios and extended the original EMF-22 scenarios from the year 2100 to 2300.[13] In addition, the IWG made several public policy judgments that are not matters of scientific fact, such as the selection of

[13] The IWG chose to use four of the EMF-22 scenarios: IMAGE, MERGE Optimistic, MESSAGE, and MiniCAM. The IWG itself created a fifth, "550 ppm Average" stabilization scenario. See Ex. 600 (Martin Direct) at 16, Schedule 6 (February 2010 TSD) at 15.

discount rates, the geographic scope of damages, the modeling horizon, and the treatment of marginal emissions.[14]

Xcel Energy argued it is not appropriate to use the FSCC executive summary values as the Commission's CO_2 environmental cost values for resource planning and related decisions. These are point estimates representing the average across 150,000 IAM results for a given emission year and discount rate, which raises significant issues of false precision that are more problematic in the context of Commission decisions than they may be in the context of the FSCC's intended purpose of federal regulatory impact analysis.[15] They do not represent a range, as required by the enabling statute, and do not focus on the more probable results.

Xcel Energy instead used the IWG modeling data as a starting point – retaining the results from all three IAMs and giving them equal weight – but applied well-accepted statistical methods to derive a true range that focuses on the more probable results.[16] For our initial range, we used symmetric percentiles – the 25th and 75th percentiles at each discount rate – which treats the IAMs' low and high damage predictions equally by eliminating the relatively improbable estimates at the lower end (below the 25th percentile) and at the higher end (above the 75th percentile).[17] We exercised no subjective judgment at this step to eliminate more low or more high damage predictions; we simply eliminated those estimates that, according to the IAMs themselves, are relatively unlikely to represent the future damages from climate change in the sense that they occur at relatively low frequency in the IAM results. We set the bounds of our initial range at the 25th percentile at 5 percent discount rate

[14] Ex. 300 (Smith Direct) at 15-16; Ex. 601 (Martin Rebuttal) at 26-27 and 37-47; Hearing Transcript Vol. 3B at 156-158 (Martin). See also Ex. 101 (Polasky Rebuttal), Schedule 1 containing the IWG's July 2015 Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, at 40-41.

[15] Ex. 602 (Martin Surrebuttal) at 7-9.

[16] A chart describing the steps in Xcel Energy's methodology is included as Ex. 600 (Martin Direct), Schedule 8.

[17] Ex. 600 (Martin Direct) at 53.

($2.48) and the 75th percentile at 2.5 percent discount rate ($67.08).[18] We believe this initial range reflects an appropriate level of risk tolerance, because it contains approximately 75 percent of all IAM predictions for a given emissions year, and symmetrically eliminates 25 percent of the predictions – the lowest and highest damage estimates – which have the lowest probability of occurring.[19]

Xcel Energy did not, as the ALJ maintains, "center" our selection of percentiles on the median. We simply eliminated from further consideration the same number of estimates on the low and high side of the FSCC probability distributions, based in part on a lack of evidence[20] how the omissions that could cause the IWG methodology to underestimate damages, and those that could cause it to overestimate damages, may ultimately balance out. We were explicit in testimony that we did not use the median to derive our range, and do not recommend adoption of the median or any other point estimate.[21]

Finally, to minimize subjective judgment as regards the fundamentally normative decision of discount rate choice, Xcel Energy equally weighted the SCC values for each discount rate at each end of the range. This enabled us to propose for Commission adoption a simple range from low to high, consistent with Commission precedent since the 1990s. Presenting low and high values separately for each discount rate would have been possible, but in our view was impracticable because a) it would simply have deferred to later dockets the decision on which discount rate to use, b) it would have meant recommending some values that are virtually identical despite representing entirely different policy judgments, and c) it would have meant

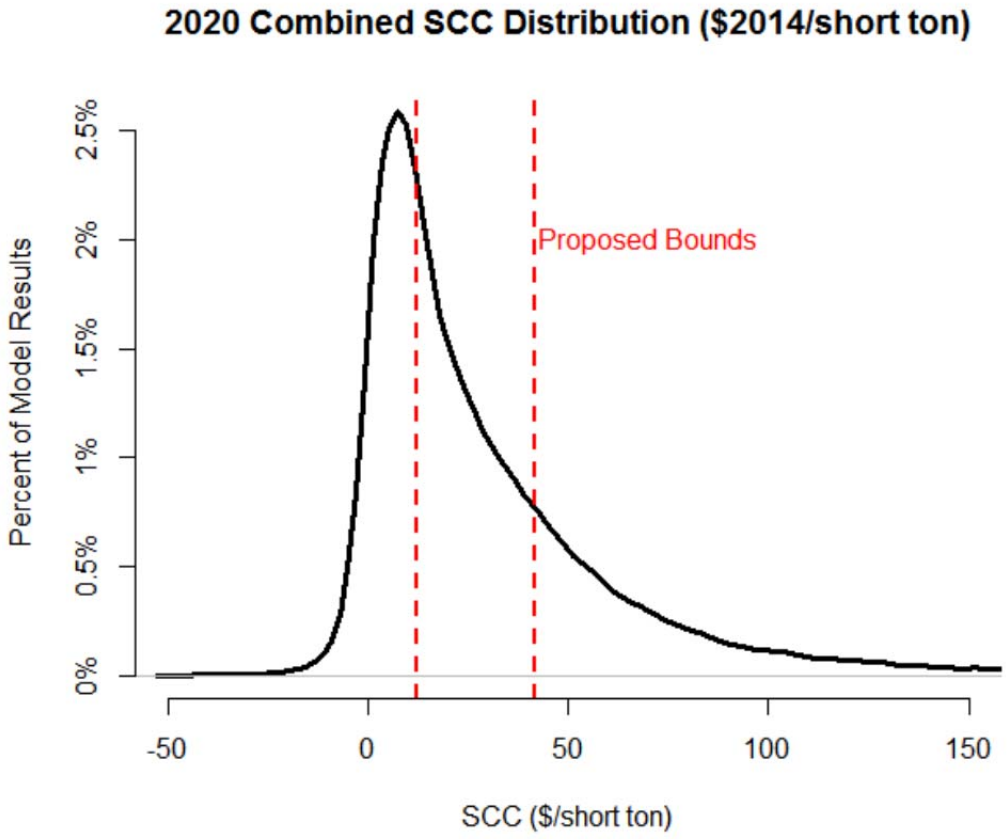
[18] In 2014 dollars per short ton, for emission year 2020. Ex. 600 (Martin Direct) at 58; Ex. 601 (Martin Rebuttal) at 6-8.
[19] Ex. 600 (Martin Direct) at 60-63; Ex. 602 (Martin Surrebuttal) at 12-13, 15, 34.
[20] Evidence in the record shows the uncertainty and incomplete modeling associated with both the high and low side of the distribution. Given no evidence in the record demonstrates how these may balance or offset each other, both sides should be treated equally.
[21] Ex. 602 (Martin Surrebuttal) at 9-10.

recommending six different CO_2 environmental cost values per emission year, which when multiplied by the large number of resource plan alternatives and sensitivities typically modeled by utilities, would quickly have become unwieldy and questionably useful.

As an artefact of the equal weighting of discount rates, Xcel Energy's proposed range became somewhat more risk-averse. Our final recommended range – e.g. $12.13 to $41.40 per short ton of CO_2 emitted in 2020[22] – corresponds to the 36th and 74th percentiles of the IWG's modeling results. It therefore excludes more low damage estimates than high damage estimates.[23] In total, 74 percent of all IWG damage estimates are at or below the high end of our proposed range, which in our view is an appropriate level of risk tolerance. Because of the skewed distribution of FSCC values, our range in fact excludes more low values with higher probability than high values with lower probability, as shown in Figure 3. Considering the climate change context and concerns that the IAMs do not adequately model damages from large temperature changes, we concluded it was appropriately risk-averse to eliminate more values from the low end of the distribution.[24] This was not the objective of equally weighting the values at different discount rates – which was driven by a desire to remain agnostic on the question of discount rate choice – but it was an artefact of that decision that we viewed as acceptable.

[22] In 2014 dollars per short ton.
[23] Ex. 600 (Martin Direct) at 63-64; Ex. 601 (Martin Rebuttal) at 8; Ex. 602 (Martin Surrebuttal) at 13-14.
[24] Ex. 600 (Martin Direct) at 63-64; Ex. 601 (Martin Rebuttal) at 5-8; Ex. 602 (Martin Surrebuttal) at 13-14.

Figure 3: Probability Distribution of IWG Modeling Results with Xcel Energy's Proposed Bounds[25]



The record in this proceeding demonstrates that Xcel Energy's methodology is reasonable and the best available measure for the environmental cost of CO_2. The ALJ advances only two critiques of our methodology – its selection of percentiles, and its equal weighting of discount rates – which we address below. Our approach uses all IWG estimates; gives equal weight to all three IAMs, and all three discount rates; assumes that the IWG's methodology may have poorly captured both high end and low end damages; treats both ends of the FSCC distribution equally by using symmetric percentiles (25^{th} and 75^{th} percentiles) initially, yet ultimately errs on the side of being more risk-averse; and creates a true range that is developed from a distribution, focusing on the more probable estimates of climate damages.

[25] Ex. 600 (Martin Direct) at 65.

V. EXCEPTIONS TO ALJ CONCLUSIONS AND RECOMMENDATIONS

Our specific Exceptions to the ALJ's conclusions follow.

A. Conclusions 55, 49, and 50 *(Reasonable and Best Available Measure)*

The ALJ concludes that Xcel Energy "failed to demonstrate by a preponderance of the evidence that its proposal for measuring CO_2 cost values is reasonable and the best available measure of CO_2 cost values."[26] She reaches this conclusion on the basis of only two stated objections: that Xcel Energy failed to show that its proposal to use the 25th and 75th percentiles of the IWG data distribution, which she characterizes as having "centered" on the 50th percentile or median, was reasonable;[27] and that Xcel Energy failed to demonstrate that it was reasonable to "average" the three FSCC discount rate values at the upper and lower ends of our range.[28] We address these objections in turn.

1. Selection of Percentiles (Conclusion 49)

According to the ALJ, our percentile-based approach – because she believes it to center on the median – "unreasonably exclude[s] information about the magnitude, as well as the likelihood of significant damages, as reflected in the higher end tails of the distribution."[29] The FSCC distribution, as Figure 3 shows, is a skewed, non-normal distribution with a long right tail of high cost damage estimates that have a very low probability of being the actual value of damages from an incremental ton – simply in the sense that these damage estimates appear with relatively low frequency in the IAM results. These high damage values, despite having a low probability of

[26] ALJ CO_2 Report, Conclusion 55 at 123.
[27] ALJ CO_2 Report, Conclusion 49 at 122.
[28] ALJ CO_2 Report, Conclusion 50 at 122.
[29] ALJ CO_2 Report, Conclusion 49 at 122.

occurring, pull the average (mean) estimate up. While the mean value takes into account the whole distribution, so does using percentiles as bookends. It is incorrect to state that selecting the 25th percentile and 75th percentile as bookends of our initial range excluded information about the magnitude and likelihood of significant damages at the higher end of the distribution, or ignored the high damage outcomes. We retained all predictions in the initial FSCC distribution – both high and low – and they affected where all percentiles landed in the distributions. If we had ignored the high end values, all percentiles would have landed at a lower damage value, and our bookends would have shifted to the left. Selecting the 25th and 75th percentiles did not ignore information about the high damage values, but treated them in the same manner as the low damage values. In the end, the decision whether to use an average or percentiles to summarize a non-normal distribution depends on how much importance one puts on probability: is it more important to describe the distribution with the more likely values or the less likely values? We believe it was appropriate to use symmetric percentiles to develop our initial range, because this approach treats low and high values equally and focuses on the damage estimates that are most likely.

We also disagree with the ALJ's contention that Xcel Energy's selection of percentiles "centers on" the median. Mr. Martin discussed in his direct testimony why using the simple average of all IAM results mischaracterizes the results and leads to false precision, and why this makes adoption of the FSCC executive summary values inappropriate.[30] However, he did not, there or in later testimony, propose using or "centering on" the median instead. When some Parties apparently misunderstood his testimony to be recommending the median for Commission adoption, Mr. Martin was explicit that he recommends *against* using the mean, median or any other single point estimate, and did not build Xcel Energy's proposal around the median.[31] He simply

[30] Ex. 600 (Martin Direct) at 25-29.
[31] Ex. 602 (Martin Surrebuttal) at 9-11.

eliminated from further consideration the same number of estimates on the low and high side of the FSCC probability distributions – i.e., those below the 25th percentile at 5 percent discount rate, and those above the 75th percentile at 2.5 percent discount rate. This methodological choice was based in part on a lack of evidence regarding how the omissions that could cause the IWG methodology to underestimate damages, and those that could cause it to overestimate damages, may ultimately balance out.

2. Treatment of Discount Rates (Conclusion 50)

The ALJ's second objection to Xcel Energy's proposal is that we failed to demonstrate "a reasonable basis on which to average the three FSCC discount rate values at the upper and lower ends of [our] range."[32] We have maintained that equally weighting the SCC values at each discount rate is an appropriate way to remain agnostic on a question that is fundamentally normative, subjective, and unresolved among economists, ethicists and others at this time. We also presented this equal weighting as a practical decision in order to provide the Commission a range – low and high for each emission year – instead of six separate CO_2 values, low and high at each discount rate. In short, recommending Commission adoption of six CO_2 environmental cost values per emission year would have been impractical, because some of the values were virtually identical ($13.10, the 25th percentile value at 3 percent discount rate, and $13.17, the 75th percentile value at 5 percent discount rate) despite representing very different policy judgments, and others were so far apart as to point in opposite directions for resource planning ($2.48, the 25th percentile value at 5 percent discount rate, and $67.08, the 75th percentile value at 2.5 percent discount rate).[33] Adopting six CO_2 environmental cost values for each emission year would be

[32] ALJ CO_2 Report, Conclusion 50 at 122.
[33] Ex. 602 (Martin Surrebuttal) at 21-22.

inconsistent with the statutory requirement of a range and Commission precedent since the 1990s of adopting two values, low and high.[34]

The ALJ's recommendation, by retaining the FSCC average values at 5, 3 and 2.5 percent discount rates rather than equally weighting them, merely leaves to the Commission to resolve in a later docket which of these discount rates is most appropriate considering all the economic and ethical issues involved. Nothing in the evidentiary record suggests this debate is resolvable in the near term. We continue to believe it is more practicable to retain all the IWG's discount rates and weight them equally.

B. Conclusion 51 (*Whether the FSCC Constitutes a Range*)

The ALJ maintains that Xcel Energy has "failed to demonstrate by a preponderance of the evidence that the FSCC does not offer a range of values. The FSCC chooses one cost based on an average of the values on the distribution scale, then creates a range of values from the single cost by offering that value at three different discount rates," as well as presenting a 95th percentile (which the ALJ does not recommend for adoption).[35]

Xcel Energy has maintained throughout this proceeding that the four FSCC executive summary values are single point estimates and do not constitute a range. In its typical meaning, a range has one specified beginning value and one specified end value, and the values between are not identified. The ALJ's recommendation merely represents point estimates with three different assumptions about a normative judgment – discount rate choice. Calling this a range does not make it a range; it remains a set of three point estimates based on different discount rate assumptions.

[34] Ex. 602 (Martin Surrebuttal) at 21-22.
[35] ALJ CO_2 Report, Conclusion 51 at 123.

The relevant statute in this proceeding requires that the Commission shall establish a *range* of environmental costs.[36] The burden of proof to show that the four single FSCC values in fact constitute a range therefore belongs to the proponents of FSCC – the Agencies and CEO – who have not presented any evidence or statements to demonstrate why or how FSCC point estimates at different discount rates can be seen as a range.

The ALJ recommends adopting three of the FSCC values, but does not discuss how these values could be applied as a "range." Would utilities apply only the lowest value (at 5 percent discount rate) and highest value (at 2.5 percent discount rate) in their resource plans, effectively ignoring the third value at 3 percent discount rate? This interpretation seems contrary to the IWG's recommendations, since it would discard the FSCC value which the IWG identified as "central" and "most consistent with the estimates provided in the economics literature and OMB's Circular A-4 guidance for the consumption rate of interest."[37] Would utilities run resource plan models with all three values, but without any direction how to weigh them against each other? The ALJ does not speak to these questions of practical application, essentially leaving the Commission to decide in future proceedings how her "range" should be interpreted and which discount rates to privilege. Xcel Energy's proposal, in contrast, provides a true range developed from a statistical distribution, rather than a series of point estimates, and equally weights the values calculated at different discount rates, recognizing the discount rate debate is not one the Commission is likely to be able to resolve.

C. Conclusions 13, 43 and 44 *(Uncertainties Regarding High Damages, Tipping Points, Mitigation, Adaptation and Endogenous Technological Change)*

[36] Minn. Stat. §216B.2422 subd. 3.
[37] Ex. 600 (Martin Direct), Schedule 6 at 23.

The ALJ concludes that the "preponderance of evidence demonstrates that the FSCC understates the full environmental cost of CO_2"; that the Agencies and CEOs "demonstrated by a preponderance of the evidence that, given the increased scientific certainty of the link between CO_2 emissions and climate change, uncertainties such as the potential danger of a 'tipping point' catastrophe reasonably require an initially high SCC until more is known about such uncertainties"; and that "the IWG adequately accounted for adaptation and mitigation in the FSCC."[38] These three conclusions are interrelated and speak to the debate, highlighted by Xcel Energy and other Parties, whether there are features of the IWG methodology that could cause it to underestimate climate damages, other features that could cause it to overestimate climate damages, and whether we know how these two types of omissions may ultimately balance out. The preponderance of the evidence shows that both types of omissions exist in the IWG methodology, and the proponents of the FSCC have not shown by a preponderance of the evidence that it is known how the omissions balance out.

Xcel Energy acknowledged some aspects of the IWG's methodology that may underestimate climate damages, since not all types of damages are included, and "tipping point" or catastrophic damages may be incompletely characterized. We also pointed to aspects that would cause the IWG's methodology to overestimate damages, for example if adaptation, mitigation, and endogenous technological change are incompletely captured.[39] We respectfully disagree with the ALJ's conclusion that the Agencies and CEOs have demonstrated that the IWG adequately accounted for adaptation and mitigation (Conclusion 44) – we do not believe the Agencies and CEO presented evidence to draw such a conclusion – and believe both types of factors, i.e.,

[38] ALJ CO_2 Report, Conclusion 13 at 116, Conclusions 43 and 44 at 121.
[39] Ex. 602 (Martin Surrebuttal) at 10-11.

those that may cause overestimation and those that may cause underestimation, should be treated in the same manner because they are equally uncertain.

There is significant evidence that the FSCC may not fully capture measures that may be taken by future generations and governments to enhance CO_2 mitigation. Four out of the five emissions scenarios used in the IWG's methodology, the four EMF-22 "business as usual" emission trajectories, assume no global coordination on mitigation by governments, while one (the "550 ppm average" scenario) assumes international coordination sufficient to contain CO_2 concentrations at 550 parts per million.[40] This means 80 percent of the damage estimates affecting where the FSCC average values land are built on the assumption of no coordinated governmental action on CO_2 mitigation. This seems contrary to many recent regulatory efforts in the United States, some of which Mr. Martin listed in his testimony.[41] It also seems contrary to recent international developments such as the United Nations Framework Convention on Climate Change (UNFCCC) 21st Conference of Parties in Paris, where 195 countries reached consensus on a global climate accord aimed at reducing global emissions of CO_2.[42]

Moreover, while the ALJ highlights that some of the IAMs do attempt to model some types of adaptation, she overlooks an important feature of the IWG methodology that limits the ability of the IAMs – *as run by the IWG* – to do this. The IWG did not run the IAMs in their native format, allowing them to use their own emission forecasts and (in the case of DICE) to optimize. Instead, as run by the IWG, the IAMs cannot capture endogenous technological change and innovation to reduce the CO_2 intensity of economic growth, because the EMF-22 emissions trajectories are

[40] Ex. 600 (Martin Direct) at 34-35; Ex. 601 (Martin Rebuttal) at 24-25, 47-49.
[41] Ex. 601 (Martin Rebuttal) at 48-49.
[42] See https://unfccc.int/paris_agreement/items/9485.php. The agreement was adopted by consensus of 195 countries in Paris on December 12, 2015, and opened for signature at a ceremony at the United Nations Headquarters in New York on April 22, 2016. To date 175 parties have signed the treaty.

set exogenously – fixed up front and not allowed to change in response to experienced climate damages. This means that future societies are assumed to take no further action to reduce CO_2 emissions over the next 285 years, despite experiencing significant warming and severe damages, beyond what is assumed up front in the EMF-22 emission trajectories.[43] This feature of the IWG methodology – the way the IWG chose to run the models, as opposed to the models themselves – means that emissions are likely overestimated and adaptation and mitigation underestimated. Indeed, the IWG itself recognized that the FSCC only partially captures adaptation and technological change.[44]

However, Xcel Energy has not claimed to know that the IWG's incomplete modeling of adaptation, global coordination on mitigation, and endogenous technological change results in the FSCC uniformly overestimating damages. Instead, we recognized that there are also features of the IWG methodology that likely underestimate damages, and did not claim to know how the omissions on the low side and those on the high side balance out. A preponderance of the evidence shows that both types of factors are uncertain and modeled incompletely. We believe this is reason to treat them equally and focus on the most probable damage estimates – according to the IAMs as they exist today – recognizing that over time the IAMs may improve to reduce both the underestimates and overestimates.[45] For this reason we selected symmetric percentiles (25^{th} and 75^{th}) that exclude low-probability FSCC estimates at the lower end and at the higher end.

Based on the same reasoning and evidence, the record does not support a conclusion that the FSCC understates the full environmental cost of CO_2 (Conclusion

[43] Ex. 601 (Martin Rebuttal) at 47-51.
[44] Ex. 600 (Martin Direct), Schedule 6 (February 2010 TSD) at 30; Ex. 601 (Martin Rebuttal) at 47.
[45] Ex. 601 (Martin Rebuttal) at 50.

13) or that the CO_2 cost value should initially be set high until more is known about uncertainties regarding tipping point or other catastrophic damages (Conclusion 43).

D. Conclusion 46 *(Use of FSCC Outside of Federal Regulatory Impact Analysis)*

The ALJ concludes that "the IWG has not taken a position regarding whether it is appropriate for a state to adopt the FSCC for purposes such as those outlined in Minn. Stat. §216B.2422, subd. 3," and "there was no evidence offered in this proceeding to demonstrate that the IWG's FSCC values are different than they would have been had the IWG developed an SCC specifically for the purpose of complying with Minn. Stat. §216B.2422, subd. 3."[46]

We are puzzled by this reasoning. Xcel Energy discussed throughout our testimony that the FSCC is designed solely for federal regulatory impact analysis under Executive Order 12866, and the differences between this and state-level Commission decisions.[47] When asked in public comments, the IWG specifically stated that the SCC estimates were developed for use in federal regulatory impact analysis and that the IWG "has not addressed the use of SCC estimates outside the [federal] regulatory context, such as in NEPA analysis, *state level decision making*, and 'pricing' carbon in the marketplace."[48] Based on this statement by the IWG, it does not seem logical to conclude that the IWG would support use of the FSCC for application under Minn. Stat. §216B.2422, subd. 3, or would calculate the FSCC no differently if asked to do so for Minn. Stat. §216B.2422, subd. 3. The IWG has never been asked whether the FSCC is appropriate for Minn. Stat. §216B.2422, subd. 3. When asked if it recommends use of the FSCC for applications other than federal regulatory impact

[46] ALJ CO_2 Report, Conclusion 46 at 121-22.
[47] Ex. 600 (Martin Direct) at 12-14; Ex. 601 (Martin Rebuttal) at 20-22; Hearing Transcript Vol. 3B at 156-158 (Martin).
[48] Ex. 101 (Polasky Rebuttal), Schedule 1 containing the IWG's July 2015 Response to Comments: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, at 40-41. Emphasis added.

analysis, the IWG stated that it "has not addressed" such applications, which cannot logically be read to mean it recommends such applications or would make no changes for such applications. This puts the burden of proof on proponents of the FSCC to demonstrate by a preponderance of the evidence that use of the FSCC in the proposed application is appropriate.

The Agencies and CEO have not provided such evidence. In fact, they never responded, and the ALJ does not respond, to the crux of Xcel Energy's argument about the differences between federal regulatory impact analysis and the proposed application to Minn. Stat. §216B.2422, subd. 3. Mr. Martin noted that in federal regulatory impact analysis, there may be greater tolerance for imprecise estimates, because the key point is whether the benefits of a regulation exceed its costs, not whether benefits (avoided climate damages) are precisely quantified. As long as benefits exceed costs, and exceed costs at all four FSCC executive summary values, the premise of federal regulatory impact analysis would be that a regulation is warranted regardless whether the FSCC is "correct" or precise. Mr. Martin demonstrated this with the example of the Environmental Protection Agency's (EPA) regulatory impact analysis of the Clean Power Plan, where in EPA's view the benefits exceeded costs at all four FSCC executive summary values, i.e., regardless whether the "correct" estimate of climate damages is $12 or $120 per metric ton. The FSCC played no role in dictating how states and regulated entities comply with the Clean Power Plan.[49] However, when transplanted to resource planning and related Commission decisions, these values could dictate resource decisions, and it matters a great deal whether the "correct" value is $12 or $120: these two values would point to dramatically different resource mixes, with different implications for customer costs, reliability, fuel diversity, and other factors.[50] The Agencies and CEO never responded

[49] Ex. 601 (Martin Rebuttal) at 20; Ex. 602 (Martin Surrebuttal) at 7-8.
[50] Ex. 602 (Martin Surrebuttal) at 8.

to this argument. The ALJ does not address it either, instead merely hypothesizing that the IWG might have derived the same FSCC values had it developed the FSCC for the purpose of complying with Minn. Stat. §216B.2422, subd. 3.

We respectfully suggest that the ALJ in this Conclusion reverses her own burden of proof. It is incumbent on the proponents of the FSCC executive summary values to demonstrate by a preponderance of the evidence that these are appropriate for resource planning.[51] The proponents have not done so. It would be an unusual task to attempt to speculate what kind of methodology and models the IWG would use if it had been asked to develop a CO_2 environmental cost range for Minn. Stat. §216B.2422, subd. 3, or how the resulting values would differ from the FSCC. In addition, the ALJ does not specify which Party should have presented this kind of evidence. Since the IWG states it has not recommended using the FSCC for state level decision making, it is not reasonable to assume that it sees no significant differences and would do nothing differently if asked to develop values for Minn. Stat. §216B.2422, subd. 3.

E. Conclusion 10 *(Updating the CO_2 Environmental Cost Values)*

The ALJ concludes that since more climate research continues to be published and "the IWG has expressed a commitment to continuing to pursue the most current research and to incorporate it as appropriate into future FSCC updates… if the Commission adopted the FSCC, the Commission could update its CO_2 environmental cost values in the future as the IWG revised the FSCC based on more current research."[52]

Since Xcel Energy's proposed CO_2 environmental cost range is also based on the IWG modeling results, we agree with the ALJ that the Commission should

[51] ALJ's March 27, 2015 Order, cited in ALJ CO_2 Report at 5.
[52] ALJ CO_2 Report, Conclusion 10 at 116.

evaluate future updates by the IWG of the FSCC estimates. However, we do not believe the Commission should, automatically and without developing a new evidentiary record, adjust its CO_2 environmental cost values each time the IWG changes the FSCC. The IWG could revise the FSCC for scientific reasons (e.g., use newer climate science, use newer versions of the IAMs, select new IAMs, update socio-economic and emissions trajectories, change equilibrium climate sensitivity values, etc.), or for political and policy reasons (e.g., use different discount rates, geographic scope, modeling horizon, or treatment of damages from marginal emissions). The FSCC is at least as powerfully influenced by policy judgments as by objective scientific evidence, and the Commission may or may not agree with the policy judgments of a new Administration or new IWG.

Therefore Xcel Energy suggests that the Commission continue the current practice of updating all its environmental cost ranges based on an annual index that measures inflation, such as the Gross Domestic Product (GDP) Price Deflator Index that is currently used. If the IWG significantly revises the FSCC methodology and estimates, the Commission could evaluate whether the updates are significant enough to justify a new proceeding, and if so, open a proceeding to review the changes and consider whether to update the CO_2 cost values accordingly.

F. Recommendation 2 *(Emission Leakage)*

The ALJ "recommends that the Commission open an investigation into the questions of how to best measure leakage, and whether and how to take leakage into account in other proceedings, as suggested by Xcel in this proceeding."[53]

We note that the issue of emission leakage was initially raised not by Xcel Energy but by Drs. Smith, Mendelsohn and Gayer in Direct Testimony, and it was

[53] ALJ CO_2 Report, Recommendation 2 at 124.

Dr. Smith in her Direct Testimony who first proposed the estimation of leakage in other proceedings.[54] Xcel Energy did agree with these expert witnesses that leakage is a potential issue, and could affect the total emission reductions achieved by a specific action, considering both emission reductions at sources in Minnesota and possible offsetting emission increases outside Minnesota. However, we noted that this would ultimately affect only the net emission reductions achieved, not the CO_2 environmental cost value (i.e., avoided damage estimate) assigned to each ton of CO_2 reduction. We therefore argued that any quantification of emission leakage is outside the scope of this proceeding.[55] We also stated that the amount of leakage will vary depending on the Commission decision in question, and the Commission could consider making case-by-case leakage adjustments in other proceedings where the CO_2 environmental cost values are used.[56]

However, Xcel Energy did not propose opening a separate, generalized investigation into how best to measure and take into account leakage in other Commission proceedings. We believe deriving a generalized method would be quite difficult and speculative. It would require dispatch modeling to estimate the short-term rebalancing response of the MISO system in response to the removal or addition of specific generating resources; medium-term capacity planning modeling to hypothesize what resources might be built outside Minnesota to compensate for changes in the generation mix within Minnesota; and longer-term economic modeling to hypothesize whether businesses would relocate operations in response to differential electricity rates between Minnesota and other states and/or countries. We believe this effort would be challenging and fairly speculative. We struggle to envision a practical way to model emission leakage in a separate investigative docket and applicable to a wide array of unknown future applications.

---

[54] Ex. 300 (Smith Direct) at 35; Ex. 302 (Smith Expert Report) at 100-102.
[55] Ex. 601 (Martin Rebuttal) at 51-53; Ex. 602 (Martin Surrebuttal) at 39-40.
[56] Ex. 601 (Martin Rebuttal) at 53; Ex. 602 (Martin Surrebuttal) at 39-40.

VI. CONCLUSION

Xcel Energy commends the ALJ for providing a comprehensive analysis of a complex and voluminous evidentiary record in this proceeding. We respectfully disagree with several of her conclusions, and contend that:

- Xcel Energy demonstrated by a preponderance of the evidence that its proposal for measuring CO_2 cost values is reasonable and the best available measure for the Commission's updated CO_2 environmental cost;
- Xcel Energy showed that its methodology to develop an initial range from the 25^{th} and 75^{th} percentiles of the IWG data was reasonable, and did not base this methodology on the median;
- Xcel Energy demonstrated that it was reasonable to equally weight the SCC values at each discount rate at each end of our proposed range;
- The FSCC executive summary values do not represent a range, as required by the enabling statute and Commission precedent;
- Proponents of the FSCC have not demonstrated that uncertainties on the high side of the IWG's methodology necessarily exceed those on the low side, or vice versa;
- Proponents of the FSCC have not demonstrated that the IWG methodology adequately accounts for adaptation, mitigation, and endogenous technological change;
- Proponents of the FSCC have not demonstrated that the executive summary values are appropriate for an application quite different from their intended purpose, and it is not logical to assume that the IWG would support such an application;
- The Commission should not automatically update its CO_2 environmental cost values whenever the IWG updates the FSCC without developing a new

evidentiary record, since such updates could reflect public policy judgments with which the Commission disagrees;

- The Commission should not open a docket to investigate development of a generalized method for how to address and measure emission leakage.

We continue to believe Xcel Energy's proposal remains a better choice than the FSCC executive summary values for the Commission's current update of its CO_2 environmental cost range. Our proposal is based in the same climate science and economics as the IWG used to derive the FSCC, and retains all the IWG's core assumptions, but balances uncertainty, risk tolerance and practicability to derive a true range that is more appropriate for use in resource planning and other Commission decisions.

Finally, we urge the Commission to consider issues of practical application as it evaluates the ALJ's recommendation and the exceptions of Parties. Adopting unsupportably high or diametrically opposed CO_2 environmental cost values could lead to dichotomous resource plan alternatives and PVRR/PVSC rankings that are non-overlapping, difficult to reconcile, and not useful for decision-making. Likewise adopting an impracticably large number of values may not be useful.

CONCLUSIONS[1]

I. Use of IAMs as Damage Cost Models

10. The Administrative Law Judge concludes that more studies, using new approaches, have been published since the last update of the FSCC and that the IWG has expressed a commitment to continuing to pursue the most current research and to incorporate it as appropriate into future FSCC updates. The Administrative Law Judge concludes that, if the Commission adopted the FSCC, the Commission could decide to open a separate proceeding to update its CO_2 environmental cost values in the future, including evaluating whether the Commission agrees with the scientific and public policy basis of the IWG's latest update. ~~as the IWG revised the FSCC based on more current research.~~ However, the Administrative Law Judge does not recommend an automatic adjustment to CO_2 environmental values each time the FSCC is updated or revised.

13. The Administrative Law Judge concludes that, based on unreported and underreported health and environmental impacts, along with the IWG's acknowledgement that the FSCC is not based on the most current research, the preponderance of the evidence demonstrates that the FSCC may understate~~s the full environmental cost of CO_2.~~ some of the future damages from climate change. However, a preponderance of the evidence also demonstrates that the IWG's methodology may fail to account fully for global coordination on CO_2 mitigation, adaptation to climate change, and endogenous technological change in response to climate change.

IX. Uncertainty

41. The Administrative Law Judge concludes that the preponderance of the evidence shows that the task of predicting the SCC is highly uncertain, because it is an exercise in predicting impacts of CO_2 emissions many years into the future. The process involves forecasting such uncertainties as changing temperatures, global GDP far into the future, adaptation and mitigation, and the possible occurrence of a "tipping point" event leading to irreversible, catastrophic damages.

43. The Administrative Law Judge concludes that it has been ~~the Agencies and CEOs~~ demonstrated by a preponderance of the evidence that the FSCC models incompletely tipping points, catastrophic damages, and some other factors that could

[1] This document reflects Xcel Energy's proposed revisions to the Conclusions and Recommendations of the ALJ CO_2 Report, but does not address the Findings of Fact.

increase the damage values.~~, given the increased scientific certainty of the link between CO2 emissions and climate change, uncertainties such as the potential danger of a "tipping point" catastrophe reasonably require an initially high SCC until more is known about such uncertainties.~~

X. Adaptation and Mitigation

44. The Administrative Law Judge concludes that it has been ~~the Agencies and CEOs~~ demonstrated by a preponderance of the evidence that the FSCC models incompletely global coordination on CO_2 mitigation, adaptation to climate change, and endogenous technological change, which if captured could decrease the damage values. This is true in part because even though the IAMs attempt to account for some types of adaptation and mitigation, the IWG methodology did not use the IAMs in their native format, and some aspects of its methodology – for example the IWG's decision to use exogenous, fixed emission trajectories and not allow these to change in response to experienced damages – results in the IWG's methodology not capturing adaptation and endogenous technological change even when the IAMs themselves do. ~~IWG adequately accounted for adaptation and mitigation in the FSCC. No other party demonstrated by a preponderance of the evidence that it is reasonable to account for adaptation or mitigation to any extent beyond that included in the FSCC. There was no specific evidence presented regarding the efficacy of any specific mode of adaptation or mitigation.~~

XI. Use of FSCC Outside of Federal Regulatory Setting

46. The Administrative Law Judge concludes that the preponderance of the evidence demonstrates that the IWG has explicitly noted, in response to public comments, that it has not recommended use of the FSCC for purposes other than federal regulatory impact analysis, including its use in state level decision making or ~~not taken a position regarding whether it is appropriate for a state to adopt the FSCC~~ for purposes such as those outlined in Minn. Stat. § 216B.2422, subd. 3. Therefore, there is no basis in the evidentiary record to conclude that the IWG would support such an application, nor to conclude that the IWG's methodology and FSCC values would be no different ~~The Administrative Law Judge concludes that the FSCC could provide the Commission with the information it requires to implement Minn. Stat. § 216B.2422, subd.3. There was no evidence offered in this proceeding to demonstrate that the IWG's FSCC values are different than they would have been~~ had the IWG developed an SCC specifically for the purpose of complying with Minn. Stat. § 216B.2422, subd.3.

XIII. Xcel Proposal

49. The Administrative Law Judge concludes that Xcel ~~failed to~~ demonstrated by a preponderance of the evidence that its proposal to calculate the upper and lower bounds of its initial range~~SCC values~~ at the 25th and 75th percentiles of the IWG data distribution was reasonable, because it reflects an appropriate level of risk tolerance and treats the low and the high damage estimates in an equal manner. Using symmetric percentiles incorporates ~~The Administrative Law Judge concludes that, by choosing the 25th and 75th percentiles, Xcel centered its SCC range around the 50th percentile, which is the median of the distribution. By choosing to center its range around the median value, Xcel unreasonably excluded~~ information about the magnitude~~,~~ as well as the likelihood of significant damages.~~, as reflected in the higher end tails of the distribution. These high damage outcomes are of great concern and it would be unreasonable to ignore them.~~

50. The Administrative Law Judge concludes that Xcel ~~failed to~~ demonstrated by a preponderance of the evidence that it had a reasonable basis on which to equally weight~~average~~ the three FSCC ~~discount rate~~ values calculated at different discount rates at the upper and lower ends of its range of values, when ~~to~~ establishing its final SCC range of cost values. This step was a practical decision to remain agnostic on the policy judgment of discount rate choice while still proposing for Commission adoption a true range instead of six separate CO_2 values. ~~Xcel presented no evidence of theoretical, practical or scholarly support for its idea that averaging the values of the three discount rates for each end of its distribution range is an appropriate way in which to account for the controversy among the parties regarding a proper discount rate in this proceeding.~~

51. The Administrative Law Judge concludes that the Agencies and CEO ~~Xcel~~ failed to demonstrate by a preponderance of the evidence that the four FSCC values ~~does not offer~~ constitute a range of values. Four point estimates calculated at different discount rates remain four point estimates.~~The FSCC chooses one cost based on an average of the values on the distribution scale, then creates a range of values from the single cost by offering that value at three different discount rates, and adding the 95th percentile as a fourth high-end value.~~

XIV. Reasonable and the Best Available Measure of CO_2

55. The Administrative Law Judge concludes that Xcel ~~failed to~~ demonstrated by a preponderance of the evidence that its proposal for measuring CO_2 cost values is reasonable and the best available measure of CO_2 cost values.

56. The Administrative Law Judge concludes that the Agencies and the CEOs failed to demonstrate~~d~~ by a preponderance of the evidence that the Federal Social Cost of Carbon executive summary values are~~is~~ reasonable and the best available measure to determine the environmental cost of CO_2~~., with the exceptions described in these findings regarding the 95th percentile and the time modeling horizon.~~

RECOMMENDATIONS

1. The Administrative Law Judge respectfully recommends that the Commission adopt Xcel Energy's proposed CO_2 environmental cost range ~~the Federal Social Cost of Carbon~~ as reasonable and the best available measure to determine the environmental cost of CO_2, as presented below in 2014 dollars per short ton of CO_2 emitted.[2]

Range proposed for Commission adoption	Emission year				
	2010	2020	2030	2040	2050
Low	$9.62	$12.13	$14.29	$16.62	$19.07
High	$33.43	$41.40	$49.02	$57.34	$66.22

2. If the Commission decides nonetheless to adopt the FSCC executive summary values, the Commission should apply ~~, establishing a range of values including the 2.5 percent, 3.0 percent, and 5 percent discount rates, with~~ the following amendments:

a. The FSCC values will be re-calculated to reflect a shortened time horizon extending to the year 2200.

b. The Commission will exclude the value derived from the 95th percentile at a 3 percent discount rate value from the range of values.

~~2. The Administrative Law Judge respectfully recommends that the Commission open an investigation into the questions of how to best measure leakage, and whether and how to take leakage into account in other proceedings, as suggested by Xcel in this proceeding.~~

[2] Table is from Ex. 601 (Martin Rebuttal) at 8.

CERTIFICATE OF SERVICE

I, SaGonna Thompson, hereby certify that I have this day served copies of the foregoing document on the attached list of persons.

xx by depositing a true and correct copy thereof, properly enveloped with postage paid in the United States mail at Minneapolis, Minnesota; or

xx by electronic filing.

Docket No: E999/CI-14-643

Dated this 5th day of May 2016.

/s/

SaGonna Thompson
Regulatory Administrator

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
David	Aafedt	daafedt@winthrop.com	Winthrop & Weinstine, P.A.	Suite 3500, 225 South Sixth Street Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Michael	Ahern	ahern.michael@dorsey.com	Dorsey & Whitney, LLP	50 S 6th St Ste 1500 Minneapolis, MN 554021498	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Marc	Al	marc.al@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
B. Andrew	Brown	brown.andrew@dorsey.com	Dorsey & Whitney LLP	Suite 1500 50 South Sixth Street Minneapolis, MN 554021498	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Hugh	Brown	N/A	Dorsey & Whitney LLP	Suite 1500 50 South Sixth Street Minneapolis, Minnesota 55402	Paper Service	No	OFF_SL_14-643_Official CC Service List
Carl	Cronin	carl.cronin@xcelenergy.com	Xcel Energy	414 Nicollet Mall Minneapolis, Minnesota 55401	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Leigh	Currie	lcurrie@mncenter.org	Minnesota Center for Environmental Advocacy	26 E. Exchange St., Suite 206 St. Paul, Minnesota 55101	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Patricia	DeBleeckere	tricia.debleeckere@state.mn.us	Public Utilities Commission	Suite 350 121 Seventh Place East St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
James	Denniston	james.r.denniston@xcelenergy.com	Xcel Energy Services, Inc.	414 Nicollet Mall, Fifth Floor Minneapolis, MN 55401	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Jessica	Dexter	jdexter@elpc.org	Environmental Law & Policy Center	394 Lake Avenue, Ste. 309 Duluth, MN 55802	Electronic Service	No	OFF_SL_14-643_Official CC Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Brian	Draxten	bhdraxten@otpco.com	Otter Tail Power Company	P.O. Box 496 215 South Cascade Street Fergus Falls, MN 565380498	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Tristan	Duncan	tlduncan@shb.com	Shook Hardy & Bacon, L.L.P.	2555 Grand Blvd. Kansas City, MO 64108	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Bret	Eknes	bret.eknes@state.mn.us	Public Utilities Commission	Suite 350 121 7th Place East St. Paul, MN 551012147	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Jim	Erickson	jim.g.erickson@xcelenergy.com	Xcel Energy	414 Nicollet mall 7th Flr Minneapolis, MN 55401	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Bruce	Gerhardson	bgerhardson@otpco.com	Otter Tail Power Company	PO Box 496 215 S Cascade St Fergus Falls, MN 565380496	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Emerald	Gratz	emerald.gratz@state.mn.us	Office of Administrative Hearings	PO Box 64620 Saint Paul, Minnesota 55164-0620	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Thomas J.	Grever	tgrever@shb.com	Shook, Hardy &Bacon L.L.P.	2555 Grand Blvd. Kansas City, MO 64108	Electronic Service	No	OFF_SL_14-643_Official CC Service List
J Drake	Hamilton	hamilton@fresh-energy.org	Fresh Energy	408 St Peter St Saint Paul, MN 55101	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Linda	Jensen	linda.s.jensen@ag.state.mn.us	Office of the Attorney General-DOC	1800 BRM Tower 445 Minnesota Street St. Paul, MN 551012134	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Kevin D.	Johnson	kdjohnson@stoel.com	Stoel Rives LLP	Suite 4200 33 South Sixth Street Minneapolis, MN 55402	Electronic Service	No	OFF_SL_14-643_Official CC Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Sarah	Johnson Phillips	sjphillips@stoel.com	Stoel Rives LLP	33 South Sixth Street Suite 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Hudson	Kingston	hkingston@mncenter.org	MN Center for Environmental Advocacy	26 East Exchange Street, Suite 206 St. Paul, Minnesota 55101	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Brad	Klein	bklein@elpc.org	Environmental Law & Policy Center	35 E. Wacker Drive, Suite 1600 Suite 1600 Chicago, IL 60601	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Kevin	Lee	kevin@kevinleelaw.com		400 S. 4th St. Suite 401-111 Minneapolis, MN 55415	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Jonathan	Massey	jmassey@masseygail.com	Massey & Gail LLP	1325 G Street NW Washington, DC 20005	Electronic Service	No	OFF_SL_14-643_Official CC Service List
David	Moeller	dmoeller@allete.com	Minnesota Power	30 W Superior St Duluth, MN 558022093	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Andrew	Moratzka	andrew.moratzka@stoel.com	Stoel Rives LLP	33 South Sixth St Ste 4200 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Jeff	Oxley	jeff.oxley@state.mn.us	Office of Administrative Hearings	600 North Robert Street St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Michelle	Rebholz	michelle.rebholz@state.mn.us	Public Utilities Commission	Suite 350121 Seventh Place East St. Paul, MN 55101	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Kevin	Reuther	kreuther@mncenter.org	MN Center for Environmental Advocacy	26 E Exchange St, Ste 206 St. Paul, MN 551011667	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Laureen	Ross McCalib	lrossmccalib@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 55369-4718	Electronic Service	No	OFF_SL_14-643_Official CC Service List
LauraSue	Schlatter	LauraSue.Schlatter@state.mn.us	Office of Administrative Hearings	PO Box 64620 St. Paul, MN 55164-0620	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Janet	Shaddix Elling	jshaddix@janetshaddix.com	Shaddix And Associates	Ste 122 9100 W Bloomington Frwy Bloomington, MN 55431	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Sean	Stalpes	sean.stalpes@state.mn.us	Public Utilities Commission	121 E. 7th Place, Suite 350 Saint Paul, MN 55101-2147	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Donna	Stephenson	dstephenson@grenergy.com	Great River Energy	12300 Elm Creek Boulevard Maple Grove, MN 55369	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Eric	Swanson	eswanson@winthrop.com	Winthrop Weinstine	225 S 6th St Ste 3500 Capella Tower Minneapolis, MN 554024629	Electronic Service	No	OFF_SL_14-643_Official CC Service List
SaGonna	Thompson	Regulatory.records@xcelenergy.com	Xcel Energy	414 Nicollet Mall FL 7 Minneapolis, MN 554011993	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List
Erin	Vaughn	evaughn@shb.com	Shook, Hardy &Bacon L.L.P.	2555 Grand Blvd. Kansas City, MO 64108	Electronic Service	No	OFF_SL_14-643_Official CC Service List

First Name	Last Name	Email	Company Name	Address	Delivery Method	View Trade Secret	Service List Name
Colin	Wicker	wicker.colin@dorsey.com	Dorsey & Whitney LLP	50 6th Street South Suite 1500 Minneapolis, MN 55402	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Alexis	Williams	williams@fresh-energy.org	Fresh Energy	408 St. Peter St Suite 220 St. Paul, MN 55102	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Cam	Winton	cwinton@mnchamber.com	Minnesota Chamber of Commerce	400 Robert Street North Suite 1500 St. Paul, Minnesota 55101	Electronic Service	No	OFF_SL_14-643_Official CC Service List
Daniel P	Wolf	dan.wolf@state.mn.us	Public Utilities Commission	121 7th Place East Suite 350 St. Paul, MN 551012147	Electronic Service	Yes	OFF_SL_14-643_Official CC Service List