

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

**In the Matter of the Investigation into the Environmental and Socioeconomic Costs
Under Minn. Stat. § 216B.2422, Subd. 3**

MPUC Docket No. E-999/CI-14-643, E-999/CI-00-1636

OAH Docket No. 80-2500-31888

REPLY BRIEF

OF

CLEAN ENERGY ORGANIZATIONS

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INTRODUCTION

In this Reply Brief, the Clean Energy Organizations (“CEO”) respond to arguments presented in the Initial Briefs of Minnesota Large Industrial Group (“MLIG”), Xcel Energy, Great River Energy, Minnesota Power, Otter Tail Power (“GRE/MP/OTP”) and Peabody Energy. CEO already addressed several of these arguments in their Initial Brief and will not repeat or belabor what has already been submitted or argued elsewhere. For responses to the alternative proposals submitted by these parties, please see CEO’s Initial Brief, pp. 25-39.

I. MLIG HAS FAILED TO SHOW THAT THE EVIDENCE OFFERED IN SUPPORT OF THE FEDERAL SCC IS INSUFFICIENT TO AMOUNT TO A PREPONDERANCE OF THE EVIDENCE.

A. MLIG Has Failed To Show That The Federal SCC Is Inappropriate For Resource Planning.

- 1. The purpose of the SCC is to determine a best estimate of the damage cost of a ton of carbon—the same purpose as Minnesota’s externality value.**

MLIG, along with several other parties, argues that the Federal SCC is for a different “purpose” and therefore not appropriate for use in Minnesota. The argument lacks merit. These parties conflate two separate objectives—(1) the identification of the appropriate external cost of a ton of carbon and (2) the use of that value in regulatory decision-making. This proceeding concerns only the first objective—finding the best estimate of the external cost of a ton of CO₂. How that value may be used by federal agencies evaluating proposed regulations and how the value may be used by the Commission in regulatory proceedings in Minnesota are not relevant to the task of estimating what the value is.

Dr. Polasky, an expert in environmental economics, found this “purpose” argument neither “relevant [n]or persuasive.” Ex. 101 at 33. As he explained,

The SCC is an estimate of external damages associated with emissions of a ton of CO₂. Such estimates are applicable to a wide range of applications including cost-benefit analysis as well as the task of the Commission, which is to establish external CO₂ costs that can be used “when evaluating and selecting resource options.” Minn. Stat. 216B.2422, subd. 3. **It is irrelevant if there are other differences between cost-benefit analysis and the task facing the Commission.** In actuality, I see the fundamental logic applied in cost-benefit analysis and integrated resource planning to be quite similar. Both. . . are tools that help inform decision-makers about the relative merits of different alternative choices. **The SCC is directly relevant for cost-benefit analysis and integrated resource planning and is in fact exactly the information needed by the Commission to establish the external costs of CO₂ emissions.**

Id. (emphasis supplied).

2. MLIG misapprehends the reason for discounting.

As part of its argument that the Federal SCC was designed for different purposes, MLIG points to the IWG’s decision not to include a 7 percent discount rate. According to MLIG, the “model designed by the IWG expressly includes a discount rate deemed appropriate to that analysis, but not appropriate to Minnesota resource planning and other resource-selection proceedings under Minn. Stat. § 216B.2422.” MLIG cites no authority for its statement. And it makes no sense.

As explained by Dr. Polasky, discounting is a way to “aggregate damages that occur at different times into a single measure of the ‘present value’ of damages. Present value represents the sum of values across all time periods measured in current dollar terms.” Ex 100 at 10. In this case, the damages caused by CO₂ emissions will result over a long time-frame and the value/cost of future damages must be discounted to account for the fact that a dollar received today is typically worth more than a dollar received tomorrow. *Id.* In other words, what is being discounted is the value/costs of the future *damage* that is being caused by climate change.

MLIG offers no cogent argument for why the 7 percent discount rate should be applied to the future aggregate *damages* caused by CO₂ emissions. Instead, it offers a confusing and

irrelevant example of a discount rate applied by Xcel in its most recent Integrated Resource Plan. See MLIG Initial Br. at 26. Xcel used the weighted cost of capital—6.62 percent—to discount future *expenses on capital* in order to report the present value of its revenue requirement. How Xcel calculates the present value of its revenue requirement for a 15-year resource plan is not relevant to discounting damages over a 300-year time horizon. MLIG seeks to compare apples and oranges.

The IWG clearly explained why, in the context of climate damages, it would not be appropriate to use a 7 percent rate which, as MLIG shows in its example, reflects returns on corporate capital. Ex. 101 sched 1 at 21-22. Climate damages are measured in terms of consumption. *Id.*, at 22. This calculation seeks to answer the question how much less/more money will society have in the future due to climate change. As the IWG explains: “OMB’s guidance in Circular A-4 . . . states that when a regulation is expected to primarily affect private consumption—for instance, via higher prices for goods and services—it is appropriate to use the consumption rate of interest to reflect how private individuals trade-off current and future consumption.” *Id.* Moreover, the Circular explains that with longer time frames involving more uncertainty, lower discount rates should be used. *Id.*

Future damages are not the same as a 15-year investment decision. The majority of damages from climate change will occur to people outside any individual utility’s investment decision far in the future. These damages are manifest in the form of reduced consumption. The question raised by the discount rate, in this context, is how much weight do we as a society place on the reduced consumption of future generations. MLIG has offered no compelling argument that the discount rate used to calculate the present value of utility investments should answer that question.

B. The Federal SCC Is Not Unreasonable Or “Out Of Date,” As Alleged By MLIG, Because It Relies On IPCC Assessment Report 4.

MLIG asserts, erroneously, that because the IWG has not yet updated its modeling with climate sensitivity values correlated with the IPCC’s 5th Assessment Report, it must be rejected. MLIG’s argument fails for several reasons.

First, at the time the last update of the Federal SCC was released in 2013, the IPCC’s 4th Assessment Report was the most authoritative statement on climate sensitivity. Ex. 101 at 44-46. There have been two corrections to the 2013 SCC, but no further updates since the 2013 calculations. The IWG’s reliance on the IPCC’s 4th Assessment Report was therefore reasonable.

Second, the IWG has committed to updating the climate sensitivity based on the best available research. Specifically, it has stated that it “will continue to follow and evaluate the latest science on the equilibrium climate sensitivity and seek external expert advice on the technical merits and challenges of potential approaches prior to updating the ECS distribution in future revisions to the SCC estimates, including (but not limited to) using the AR5 climate sensitivity distribution for the next update of the SCC.” Ex. 101 sched. 1 at 12. The IWG should not be faulted for failing to incorporate new information that was not yet available when it provided its last update to the Federal SCC in 2013. A two-year delay does not make the value unreasonably “outdated” as MLIG argues. Moreover, MLIG misstates the record, MLIG Initial Br. at 33: Dr. Polasky did not testify that the ECS was “outdated.” He stated, and repeated, that he hoped the IWG “would update the numbers to the most recent IPCC” – something the IWG has committed to doing. Hr’g Tr. vol. 1 at 165:10-11.

Third, the ECS used by the IWG is a distribution and includes the lower values that opponents of the Federal SCC advocate. MLIG and others opposed to the Federal SCC ignore

that the IWG used a distribution of values for the ECS rather than a single value. The distribution includes values on the very low end. Ex. 801 at 32-33.

Finally, Dr. Andrew Dessler, the most credible witness to testify on the topic of ECS, stated that in his opinion the best, most recent evidence, suggests that the climate sensitivity is likely more closely aligned with the findings of the 4th Assessment Report than the 5th Assessment Report. Dr. Dessler explained that at the time the 5th Assessment was being written “a series of new papers estimating climate sensitivity from the 20th century observational record had recently come out, and these concluded that the climate sensitivity was on the lower end of previous estimates. . . The experts evaluating climate sensitivity for the Fifth Assessment gave considerable weight to this evidence and moved the low end of the range down by half a degree Celsius in response.” Hr’g Tr. vol. 3A at 17:5-17. Even though the authors of the 5th Assessment adjusted the lower bound of the distribution slightly in response to the research between the 4th and 5th Assessment Reports, Dr. Dessler clarified that, in his opinion, “if IPCC were written today, 2° C would be the lower bound.” *Id.* at 112:6-7. Thus, Dr. Dessler, the most credible witness testifying on climate sensitivity, concludes: “my opinion as an expert is that the IWG’s choice of the Fourth Assessment’s climate sensitivity range is a reasonable one.” *Id.* at 18:5-7.

In sum, the preponderance of the evidence does not support MLIG’s claim that the climate sensitivity distribution used by the IWG is “outdated” or otherwise unreasonable. To the contrary, the evidence shows that the IWG based the climate sensitivity on the best available science at the time it last updated the Federal SCC, that the IWG has committed to updating the sensitivity distribution in subsequent updates of the Federal SCC, and that the lower bound of the climate sensitivity range in the 4th Assessment, even today, is likely more accurate than the lower bound reported in the 5th Assessment.

C. Uncertainty Inherent In The Damage Functions Of The Models Does Not Render Them Unreasonable As MLIG Contends.

MLIG asserts that the Federal SCC should be rejected because the damage functions in the IAMs are “unreliable” for temperature increases above 3° C. MLIG supports its argument with testimony from Dr. Smith who alleges that the long time-horizon for damages leads to excessive speculation in the models. MLIG’s argument fails. All witnesses have agreed that modeling damages from CO₂ unavoidably involves making predictions about an uncertain future. That does not make the models unreasonable as a measure of CO₂ external costs.

As Dr. Polasky explained in his rebuttal, the “excessive speculation” that troubles Dr. Smith is more accurately identified as “uncertainty.” Ex. 101 at 6. Dr. Polasky, Dr. Hanemann, and the IWG have all acknowledged that there is uncertainty in the damage projections. Indeed, Dr. Polasky states that “[u]ncertainty in assessing the social cost of carbon cannot be avoided.” *Id.* But he further notes that “it is not valid to say that because uncertainty is large that attempts to deal with it are excessively speculative. It is also not valid to conclude that the proper response to large uncertainty is to just ignore it.” *Id.*

Dr. Polasky notes that decision science and economics have a standard approach to decision-making with uncertainty. That approach involves assembling the best available evidence and assessing the range of possible outcomes considering both the likelihood and the degree of each potential outcome. *Id.* at 7. The IWG used this approach. “The IWG made reasonable attempts to estimate the SCC given this uncertainty. Because we cannot know what the future will be with certainty, this does not mean that we should ignore it. The most appropriate method to employ will account for the range of possible outcomes in the future, and apply the best estimates of how likely those future outcomes may be. In my opinion,” Dr. Polasky testified, “that is what the IWG has attempted to do.” *Id.*

In their attacks on the damage functions of the models used by the IWG, opponents of the Federal SCC have all cited MIT Professor Robert Pindyck. But Dr. Pindyck, while pointing out short-comings and uncertainties inherent in the task of calculating an externality value for CO₂, actually *supports* the use of the Federal SCC. Pindyck writes:

My criticism of IAMs should not be taken to imply that, because we know so little, nothing should be done about climate change right now, and instead we should wait until we learn more. Quite the contrary. ***

As I have argued elsewhere, even though we don't have a good estimate of the SCC, it would make sense to take the Interagency Working Group's \$21 (or updated \$33) number as a rough and politically acceptable starting point and impose a carbon tax (or equivalent policy) of that amount. This would help to establish that there is a social cost of carbon, and that social cost must be internalized in the prices that consumers and firms pay. (Yes, most economists already understand this, but politicians and the public are a different matter.) Later, as we learn more about the true size of the SCC, the carbon tax could be increased or decreased accordingly.

Ex. 801 at 36-37 (*citing* Pindyck (2013a)¹ at 870).

Dr. Polasky has made the same point in response to Dr. Smith's suggestion that damages after 2100/2140 should simply be ignored. That is not reasonable. As Dr. Polasky states: "While we cannot know damages from CO₂ emissions with absolute certainty, assuming that damages are zero simply because they are uncertain is surely the wrong answer and surely would be an illegitimate and unscientific approach." Ex. 101 at 7.

In sum, the IWG and those witnesses who support adoption of the Federal SCC have been transparent in acknowledging the uncertainties inherent in the task of estimating CO₂ damage costs. The IWG's approach to uncertainty is grounded in decision science. It has taken the best available information and calculated values that reflect both the degree and likelihood of

¹ Robert S. Pindyck, "Climate Change Policy: What Do Models Tell Us?" (2013a) *Journal of Economic Literature* 51(3), 860-872.

possible damages. This is a reasonable approach, and certainly more reasonable than simply ignoring potentially significant future damage costs.

D. MLIG's Criticism Of The IWG's Marginal Ton Analysis Is Unpersuasive.

CEOs explain in their Initial Brief, pp. 16-18, 29-31, why Dr. Smith's "first ton" analysis lacks merit and why the IWG's decision to apply standard marginal ton analysis using peer-reviewed future emission scenarios was reasonable.

E. MLIG Fails To Show That The IWG's Decision To Include In The Federal SCC A Value Based On A 2.5 Percent Discount Rate Is Unreasonable.

MLIG states that the IWG's inclusion of a 2.5 percent discount rate is "problematic" because it leads to a higher externality value. MLIG Initial Br. at 46. But MLIG fails to point to any evidence, beyond the opinions of its hired expert, that supports its position to exclude a 2.5 percent discount rate value. It simply sets out some arguments for higher discount rates while ignoring arguments for the lower discount rates. Drs. Polasky and Hanemann explained these arguments in their testimonies. Ex. 100 at 11-12; ex. 101 at 20-21; ex. 800 at 53-54, 68; ex. 801 at 86-87.

That MLIG's position is not consistent with the preponderance of the evidence is probably best shown in the literature by Peabody's witness Dr. Tol who himself conducted a meta-analysis of climate change studies. Dr. Tol summarized the discount rates used in studies on the social cost of carbon through 2006 and found that only two papers out of thirty-nine used a discount rate above 5 percent. In contrast, he found that 10 studies used a discount rate below 3 percent. And among those, six studies used a discount rate of 1 percent or less. Ex. 101 at 22. Dr. Tol's analysis (not cited by Peabody or any other party opposed to the Federal SCC) shows that the IWG's decision to include a 2.5 percent discount rate value is reasonable.

F. MLIG’s Criticism Of The IWG’s Use Of Global Damages Rather Than U.S. Damages For CO₂, A Global Pollutant, Is Unpersuasive.

CEOs explain in their Initial Brief, pp. 33-34, why the proposal to limit damages from CO₂, a global pollutant, to only the United States is unreasonable.

G. It Is Reasonable For The IWG To Report The 95th Percentile Value In The Federal SCC.

MLIG’s arguments against adoption of the 95th percentile value (at 3 percent discount rate) of the Federal SCC lack merit. Drs. Polasky and Hanemann do not suffer from the “Ellsberg Paradox.”

MLIG’s entire argument on this point is based on the false premise that the IWG (and witnesses supporting the Federal SCC) recommend using the 95th percentile value in lieu of the other three values identified. No one has made such a suggestion.

According to the IWG the 95th percentile value “is included to represent the higher-than-expected impacts from temperature change further out in the tails of the SCC distribution.” Ex. 100 sched. 2 at 33. The IWG noted that the IAMs do not capture all possible adverse consequences of climate, or catastrophic impacts. *Id.* at 31. By reporting the 95th percentile figure, the IWG provides policy-makers additional information about possible consequences from climate change.

MLIG’s argument might have some value if the IWG or a witness to this proceeding were suggesting that the 95th percentile value be adopted as the sole externality value for CO₂ in Minnesota. No party takes that position. Instead, the 95th percentile value should be adopted for the same reason the IWG reports it—to provide information about possible, higher-than-expected impacts from climate change.

Moreover, as stated below in response to Xcel Energy, *infra* p. 13, it is appropriate for the Commission to have the 95th percentile figure available to it as a counterbalance to the zero-value scenarios all utilities provide when doing resource planning.

II. XCEL ENERGY HAS FAILED TO SHOW THAT THE EVIDENCE OFFERED IN SUPPORT OF THE FEDERAL SCC IS INSUFFICIENT TO AMOUNT TO A PREPONDERANCE OF THE EVIDENCE.

A. The Federal SCC Meets The Statutory Requirements Identified By Xcel.

Xcel correctly notes that the governing statute obligates the Commission to establish “a range” of externality values “to the extent practicable.” The Federal SCC meets these requirements.

Using the Federal SCC is practicable. Indeed, relying on the federal government’s analysis is the most practicable alternative. The IWG has stated that it will continue to update the Federal SCC based on the best available science and peer-reviewed literature. Ex. 101 sched. 1 at 10. Relying on the IWG’s analysis rather than conducting its own – whether it be Mr. Martin’s computation, Dr. Smith’s re-working of the IAMs, or another method – is far more practical, especially given the resource constraints the Commission faces.

Additionally, the IWG’s approach of reporting values across three discount rates along with a fourth value to represent potential catastrophic consequences establishes a range of values and satisfies this statutory requirement. Adopting the full suite of values will also allow the Commission to compare the relative weight of carbon damages as a sensitivity. For example, in the resource planning context, it can compare resource plans that incorporate a high carbon externality value to plans using a low value. This information will help the Commission to

understand the influence the externality value is having on resource planning and can be used to inform its ultimate decisions.²

B. Xcel Has Not Shown That The Federal SCC Is Unreasonable.

Xcel concedes that, despite having considered a number of options, it was not able to identify an approach that was superior to the IWG's analysis. Xcel Initial Br. at 13; *see also* Hr'g Tr. vol. 3B at 121-122 (Martin testifying "we believe the fundamental climate science underlying the IWG methodology and modeling is sound. It's peer-reviewed, well accepted.") Its criticism is limited, therefore, to an allegation that the SCC values "give a false impression of precision." *Id.* Additionally, it asserts that the Federal SCC was not developed for state-level utility regulation. *Id.* at 14. These arguments do not outweigh the preponderance of the evidence in favor of the Federal SCC.

First, Xcel's objection to the Federal SCC because it provides "false precision" is a red herring. There is no difference between a range, as Martin has presented, and the range of values adopted by the IWG. Indeed, the IWG has been completely transparent in explaining the uncertainties and assumptions that are inherent in the calculation of the Federal SCC and its reporting of four different values is a clear indication to all that there is no "precise" and known external cost value for CO₂. Any concern about "false precision" is resolved by the Commission adopting the full range of the IWG's values, which is what the parties advocating the Federal SCC have recommended. Ex. 101 at 35 ("By adopting this range of values, the Commission would also avoid the perception of 'false precision' that is central to Martin's objection").

² That the Federal SCC is comprised of a set of values rather than on a sliding scale is immaterial. In practice, an individual lower point, middle point, and higher point of any sliding scale are used to measure the "low," "mid," and "high" points of a range. The values reported by the IWG for the Federal SCC similarly provide a low, middle, and high value that give the Commission a reasonable range of externalities.

Second, Xcel's argument that because the Federal SCC was developed for regulatory impact analysis it should not be used in state utility proceedings, fails for the reasons set out above. *See supra* pp. 1-2. In addition, however, Xcel's argument is premised on implementation decisions that are within the purview of the Commission, not Xcel or even the ALJs. Xcel's Initial Brief argues, for example, that "[i]n resource planning, the imprecise SCC would impact decisions regarding specific resource allocations and options." Xcel Initial Br. at 14. It later states "[the values] will directly affect what kind of resources Minnesota utilities will rely on and build in the future." *Id.* at 25. But how the Commission will use the externality values in specific resource planning contexts is unknown and the record evidence shows it is very unlikely that the values will dictate specific resource decisions. Indeed, Mr. Martin when testifying on the stand acknowledged that there is no direct link between an externality value and a specific resource decision: "Q. ...that externality value alone is not going to be the thing that determines whether or not a power plant is modified or replaced? A. No. The commission would consider at least also direct rate impacts to customers, reliability, fuel diversity, a number of other things." Hr'g Tr. vol. 4 at 227:21-25; *see also* Hr'g Tr. vol. 4 at 14:9-12 ("the externality value, or the present value of soci[etal] cost [based on that value], that's not going to be the Commission's only consideration in a big decision like retiring a coal unit.")

Further, Xcel alleges, misleadingly, that "the IWG has not recommended the [Federal SCC estimates'] use in state-level decision-making." Xcel Initial Br. at 14. What the IWG actually said is that it "has not addressed the use of the SCC estimates outside the regulatory context, such as in NEPA analysis, state level decision making, and 'pricing' carbon in the marketplace." Ex. 101 sched. 1 at 41. The IWG goes on to explain that the Council on Environmental Quality *has endorsed* the use of the Federal SCC in project-specific

environmental review. *Id.* fn. 14. In any case, the IWG has neither recommended nor discouraged the use of the Federal SCC in state regulatory proceedings. The most credible voices in this case, however, see no reason why the values should not be adopted for use by the Commission in resource planning. Ex. 101 at 33; ex. 801 at 16-17.

Finally, Xcel's arguments against adoption of the 95th percentile value are unpersuasive. The IWG included the value in order to provide decision-makers with more information. That rationale holds true in this context. No one is recommending adopting the 95th percentile value divorced from what it represents. Moreover, Xcel's purported concern that over-estimates of the SCC will somehow unduly influence the Commission is disingenuous given that in *every proceeding* Xcel provides the Commission with scenarios in which Xcel inputs *zero* as the external cost for CO₂. *See, e.g.,* Xcel Energy 2016-2030 Upper Midwest Resource Plan, Appendix J at 38-39, Pub. Util. Comm'n Docket No. E002/RP-15-21 (reporting as the "North Dakota" plan the present value of societal costs for all sensitivities with zero CO₂ external costs). All other utilities that are party to this proceeding do the same. *See* Great River Energy Resource Plan 2013-2027 at 37, Pub.Util. Comm'n Docket No. ET2/RP-12-1114; Minnesota Power 2015 Integrated Resource Plan at 48, Pub.Util. Comm'n Docket No. E015/RP-13-53; Otter Tail Power Company Application for Resource Plan Approval 2014-2028 at 2-4, Pub.Util. Comm'n Docket No. E017/RP-13-961. If it is, as Xcel states, "equally undesirable" to overestimate as to underestimate damages from CO₂, Xcel Initial Br. 25, then the Commission needs information about potentially high damages to balance what it already receives from the utilities.

In sum, Xcel has not shown that the evidence offered in support of adopting the full Federal SCC is insufficient to amount to the preponderance of the evidence.

III. GRE/MP/OTP HAVE FAILED TO SHOW THAT THE EVIDENCE OFFERED IN SUPPORT OF THE FEDERAL SCC IS INSUFFICIENT TO AMOUNT TO A PREPONDERANCE OF THE EVIDENCE.

A. The Evidentiary Basis For Establishing The Federal Social Cost Of Carbon Is Detailed And Sound.

GRE/MP/OTP appear to argue that there is an insufficient evidentiary basis underlying the Federal SCC, analogizing to the Commission's 1997 decision not to adopt an externality value for mercury. GRE Initial Br. 5-8. The mercury example is inapposite. If anything, the contrast between the record on mercury in 1997 and the record here demonstrates that the evidentiary basis for adopting an externality value for CO₂ is strong—scientists have, today, a profoundly better understanding of anthropogenic emissions of CO₂ and their effect on the environment than was had for mercury in the 1990s.

The Commission's order finding it impracticable to quantify values for mercury, for example, stated that "[c]urrent models do not exist to account for the complexity of the atmospheric chemistry of mercury and its deposition." *In the Matter of Quantification of Env. Costs*, Docket No. E-999//CI-93-583, Order (Jan. 3, 1997), at 22 ("1997 Order"). No such limitation applies to CO₂. In fact, how CO₂ acts in the atmosphere and its warming effect on the planet is settled science. As Dr. Abraham put it: "This is not new science, it is well understood." Hr'g Tr. vol. 3B at 65:15-16.

Likewise, in 1997 when the Commission rejected a value for mercury, it found that "the record contains insufficient data regarding the amount and form of mercury emissions from coal combustion." The Commission found it was limited because mercury comes in different forms and the form determines how it can be controlled and also what health and environmental effects it has. In addition, the record lacked information on how much mercury is "from natural as compared to anthropogenic sources." 1997 Order at 22. No such limitations apply here. There is

no dispute regarding the amount or form of CO₂ emissions from fossil fuel combustion. That these anthropogenic sources are causing CO₂ concentrations in the atmosphere to rise (and, thus contributing to global warming) is well-settled science. Ex. 803 at 8.

Further, the 1997 Commission found that there were “no data or models” available to estimate mercury concentrations in fish. *Id.* And it found that “no model has been developed to quantitatively link mercury based fishing advisories to recreation choices” and that “no data has been developed that allows monetization of health damages from mercury emissions.” *Id.* at 23. The proposed value that the 1997 Commission rejected was developed through an extrapolation of value based on mercury’s position on the air toxics index relative to other pollutants rather than any analysis of the impacts of mercury itself. *Id.*

Here, the exact opposite is true. Thousands of peer-reviewed scientific studies form the foundation upon which the Federal SCC is built. Thousands of scientists have been working for over 20 years to identify and quantify the effects anthropogenic CO₂ emissions are having on climate and the environment. Several models and enormous amounts of data exist that monetize the impacts of CO₂ emissions. It is astounding that GRE/MP/OTP would suggest that the record on CO₂ is similar to the record on mercury in 1997. The comparison is ludicrous.

In sum, GRE/MP/OTP’s review of the Commission 1997 Order misses the forest for the trees. In 1997, the Commission determined, on much less evidence and science than is available today, that the uncertainties in calculating externality values for CO₂ constituted “reasonable uncertainty.” *Id.* The IWG and parties supporting the Federal SCC have not sought to hide uncertainty. To the contrary, the uncertainties in the Federal SCC estimates have been identified and acknowledged. As Dr. Polasky states, “decision science and economics have a standard approach for decision-making with uncertainty, which involves assembling the best available

evidence and assessing a range of potential outcomes considering both the likelihood (probability) and the net impacts (costs and benefits) of each potential outcome.” Ex. 101, at 7. That is exactly what the IWG has done in developing the Federal SCC.

B. GRE/MP/OTP Have Failed To Show That The Federal SCC Is Inappropriate For Resource Planning.

GRE/MP/OTP generally make the same arguments as MLIG and Xcel Energy alleging that the purpose of the Federal SCC for regulatory impact analysis makes it unsuitable for resource planning. These arguments lack merit as set out above. *See supra* pp. 1-2; p. 12.

GRE/MP/OTP focus considerable attention on supposed “higher bills for consumers” and “rate increases” – allegations that lack support in the record. GRE/MP/OTP cite to the hearing testimony of Xcel witness Nicholas Martin, but Mr. Martin’s testimony regarding rate impacts from high externality values was completely speculative: “Well, the general concern is that to the extent that adopting higher CO₂ externality values does translate into higher cost resource options being selected . . . And, again, the Commission will consider many things before deciding what resource options . . . But if it does, that will ultimately translate into rate impacts for customers.” Hr’g Tr. vol. 4 at 17:5-14. That testimony does *not* establish a relationship between higher externalities and higher costs; it simply speculates. Indeed, Mr. Martin confirmed that there was no record evidence showing a relationship between externality values and rates: “Q. And so there isn’t any evidence that you’re aware of in this record showing that a high social cost of carbon value would lead to higher rates, is there? A. We haven’t done that analysis.” *Id.* at 217:9-12.

In contrast, there *is* record evidence showing that to the extent a high SCC is adopted and leads the Commission to approve low-carbon resources, the utilities (and presumably ratepayers) will benefit. Mr. Martin confirmed that Xcel’s investment in four renewable, carbon-free wind

projects, is saving the utility \$225 million over the life of the projects as compared to a natural gas alternative. *Id.* at 218-219.

Thus, GRE/MP/OTP's speculation about "tremendously expensive" investments and "higher bills for consumers" is without record support and should be disregarded.

C. GRE/MP/OTP's Have Failed To Show That The Damage Function, Emission Projections, Discount Rates, Or Marginal Ton Analysis Used By The IWG Renders The Federal SCC Unreasonable.

Clean Energy Organizations showed in their Initial Brief, pp 16-21; 29-31, why the decisions made by the IWG with regard to IAM damages functions, emission scenarios and horizon, discount rates, and marginal ton analysis were reasonable.

We note, in addition, that GRE/MP/OTP's arguments are internally inconsistent. These utilities, for example, criticize the IWG for using the damage functions built into the IAMs because they are overly simplified and speculative. GRE Initial Br. at 15 – 18. Yet, they laud the analysis underlying the Commission's 1997 CO₂ values. That analysis involved an MPCA staff member's simple calculation of a per-ton figure based on an assumption of 1 percent decrease in global GDP. 1997 Order at 21.

IV. PEABODY ENERGY'S POSITION IN THIS PROCEEDING IS NOT CREDIBLE.

Linber Anej waded out in low tide to haul concrete chunks and metal scraps to shore and rebuild the makeshift sea wall in front of his home. The temporary barrier is no match for the rising seas that regularly flood the shacks and muddy streets with saltwater and raw sewage, but every day except Sunday, Mr. Anej joins a group of men and boys to haul the flotsam back into place.

“It’s insane, I know,” said Mr. Anej, 30, who lives with his family of 13, including his parents, siblings and children, in a four-room house. “But it’s the only option we’ve got.”

Standing near his house at the edge of a densely packed slum of tin shacks, he said, “I feel like we’re living underwater.”

Davenport, C., “The Marshall Islands are Disappearing: Rising Seas Are Claiming A Vulnerable Nation,” New York Times, December 2, 2015.³

As world leaders gathered in Paris to confront the real challenges of climate change, and hear the real stories of people suffering real loss, such as Mr. Anej, Peabody Energy, the world’s largest private-sector coal company, continued its campaign of climate change denial and misinformation. To wit, Peabody’s recommendation for the external cost of CO₂ emissions: “[A] ‘zero value’ is appropriate. In fact, . . . the evidence even supports a negative value.” Peabody Initial Br. at 13.

Peabody Energy’s position in this proceeding is not credible. Its objective is transparent—Peabody seeks to protect its own interest as the world’s largest coal company. Its interests in the most carbon intensive fossil fuel is threatened by exposure of the true costs of burning coal. Thus, it contends that there is no cost to CO₂ emissions, or worse, that CO₂ emissions are actually beneficial.

³ Courts—and certainly administrative agencies—may consider information not part of a trial record when it is in the public domain and germane to the issues. *See Camacho v. Todd & Leiser Homes*, 706 N.W.2d 49, 56 (Minn. 2005), as modified (Dec. 20, 2005)(“the article lies in the public domain and provides pertinent information to this court's consideration of public policy concerns...”)

Peabody's position is simply out of step with reality. It recalls the decades-long efforts of tobacco companies to combat the truth about the ill from which they profited. Millions of dollars were spent on scientists and lawyers to seed doubt while millions became sick and died. And so it is with the fossil fuel industry.⁴ Even as the effects of increased CO₂ emissions are beginning to have direct and harmful impacts on humans and the environment throughout the world, Peabody Energy presses its denial theories in this Minnesota proceeding.

CEOs submit that the Administrative Law Judges should give no weight to Peabody's arguments. Its witnesses are academic outliers, scholars who have, in some instances, selectively cited and misrepresented facts and adopted theories and positions wholly rejected by mainstream scientists. Peabody's position—that CO₂ has no external cost, or a negative external cost (i.e. a benefit)—is ridiculous and should not be taken seriously.

A. Peabody Has Not Provided The Commission With Credible Testimony Or Reasonable Alternative Externality Values.

Peabody provided testimony from six witnesses on the Federal SCC in this proceeding. Four of those witnesses purported to testify about the science of climate change:

- Dr. William Happer (physics) - "purpose is to explain that atmospheric CO₂ is not a pollutant but a benefit to the earth"
- Dr. Richard Lindzen (applied mathematics) - challenges the global temperature predictive models used by the IPCC
- Dr. Roy Spencer (meteorology) - challenges the global temperature predictive models
- Dr. Roger Bezdek (economics) - "environmental benefits of carbon dioxide emissions are enormous"

⁴ See, e.g., Gillis, J. and C. Kraussnov, "*Exxon Mobil Investigated for Possible Climate Change Lies by New York Attorney General*" *New York Times*, Nov. 5, 2015

The other two witnesses offered alternative measures of the social cost of carbon based on their individual runs of the IAMs DICE and FUND:

- Dr. Robert Mendelsohn (economics) - challenges several aspects of IWG's Federal SCC and provides an alternative figure based on his own model run of DICE.
- Dr. Richard Tol (economics) - criticizes Agency and CEO witness testimony and supplies results of the FUND model with climate sensitivity values proposed by Dr. Mendelsohn.

The record evidence shows that the testimony of witnesses Happer, Lindzen, Spencer and Bezdek is unreliable. Professors Mendelsohn and Tol offer alternative values for the social cost of carbon based on runs of the IAMs DICE and FUND. But the weight of the evidence favors the IWG's Federal SCC which combines results from all three of the main IAMs and makes more reasonable judgments and assumptions.

1. Peabody's "science" witnesses are not credible.

Peabody witnesses Happer, Lindzen, Spencer and Bezdek are not reliable witnesses and the ALJs and Commission should give their testimony little if any weight. Each of these witnesses purports to challenge aspects of the "science" underlying the IWG's Federal SCC. Their specific claims, however, have been refuted in the surrebuttal testimony of Drs. Abraham, Dessler and Gurney. *See Issues Matrix ## 4, 5, 6, 7, 8, 15, 16, 24 and referenced testimony.* These specific allegations and counter-allegations will not be repeated here.

What is clear from the testimony taken as a whole, is that the Peabody witnesses do not report on reliable science. As Dr. Abraham summarized, for example, the claims made by Drs. Happer, Lindzen, Spencer and Bezdek regarding a hiatus in warming, the calibration of climate models, and the beneficial effects of climate change "are inaccurate and misleading." Ex. 102 at

2. Further, Drs. Spencer and Lindzen's assertions that the climate is not as sensitive to CO₂ emissions as assumed in the models is "made using faulty information," relying on studies that have been later corrected in peer-reviewed literature. *Id.* These witnesses likewise misstate the evidence about the Earth's temperature by "ignoring 99.8 percent of the Earth climate system" and presenting their findings in a misleading manner. *Id.* at 3. Dr. Abraham concludes that the Peabody witnesses "rely upon non-scientific sources of information; many are from advocacy groups or political news organizations," and that "[o]ther statements are made without justification." *Id.*

Dr. Dessler also reviewed the testimony of the Peabody witnesses and found that it was not credible because the witnesses fail to "employ ... unbiased and rigorous scientific methods."

Ex. 103 at 3. As Dr. Dessler explained:

One of the guiding principles of science is to use *all* of the available data when testing hypotheses. Reliable science does not throw out the vast majority of the data that disagrees with a hypothesis, and then use the remaining tiny fraction to conclude that the sought-after result is correct. This type of "cherry picking" is how Drs. Spencer, Lindzen, and Happer reach the conclusions in their testimony. *Id.*

Dr. Gurney had a similar response to Peabody's witness testimony. In his surrebuttal testimony, Dr. Gurney set out in detail what he described as "argument patterns [that] reflect biased or flawed reasoning." Ex. 804 at 2. These patterns included, as Dr. Abraham and Dessler also noted, selective citation that relies on non-peer-reviewed literature or only narrow slices of peer-reviewed literature on a topic that supports their positions. *Id.* at 3-8. Dr. Gurney also noted, as did Drs. Abraham and Dessler, that the Peabody witnesses misapprehended or mis-reported the cited literature. *Id.* at 9 - 11.

In short, the preponderance of the evidence shows that the Peabody "science" witnesses are not credible and their testimony should be given no weight.

2. The alternatives offered by Drs. Tol and Mendelsohn are not preferable to the Federal SCC.

Like Peabody's "science" witnesses, Drs. Tol and Mendelsohn have been criticized for some of the statements made in their testimony. For example, Dr. Tol argued that the Cook et al. study, which is often cited to support the notion that a consensus of scientists agree with the basic notion that CO₂ is causing climate change, is faulty. *See* Peabody Initial Br., at 91. But Dr. Abraham explains that Tol's assertions about the Cook study are wrong, and have been shown to be wrong in the peer-reviewed literature. Ex. 105 at 16-17. According to Dr. Abraham, "many of the claims in Tol's testimony are outright falsehoods." *Id.* at 16:4-5.

Professor Mendelsohn has also offered testimony in this proceeding that is criticized for lacking scientific support. Underlying Mendelsohn's modeling which results in a lower externality range for CO₂ is his assumption that some amount of warming (1.5° to 2° C) above the pre-industrial period is beneficial. Dr. Mendelsohn made statements in his testimony alleging, for example, that warming would benefit Minnesota's forests. Ex. 214 at 4; ex. 220 at 4-5.

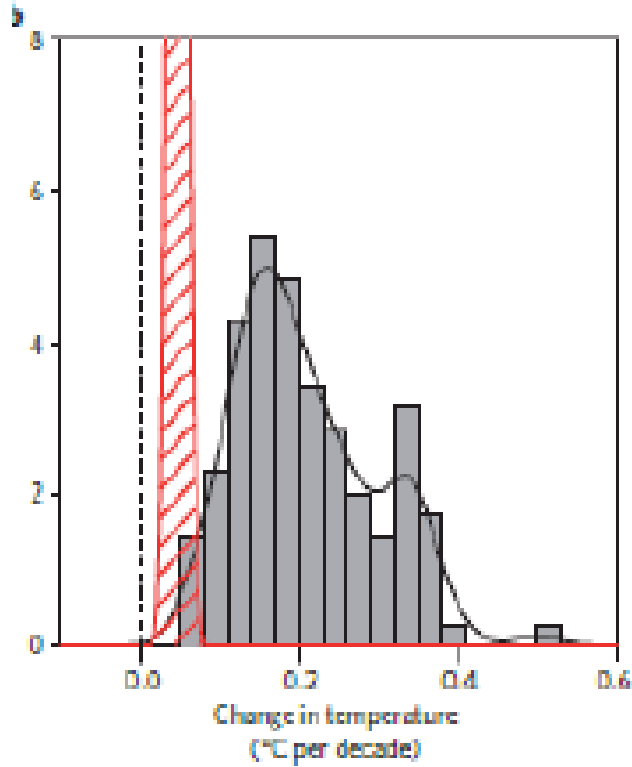
Minnesota's leading forest researcher, Dr. Peter Reich, one of only a handful of scientist in the world able to authoritatively comment on Minnesota's forests, disagrees with Mendelsohn. Dr. Reich is a Regents Professor (the highest award possible) at the University of Minnesota. He has published over 500 papers, including dozens in the leading journals such as Nature, Science, and the Proceedings of the National Academy of Sciences. During the past 15 years he has been among the 10 most cited researchers in the world in the field of environmental science and ecology. He was named the BBVA Foundation Frontiers of Knowledge Laureate in 2010 for Ecology and Conservation Biology. There is no Nobel Prize in ecology and the BBVA Award is considered one of a handful that most closely resembles the Nobel Prize. Ex. 107 at 1-2.

According to Dr. Reich, Mendelsohn's assertion about warming benefiting Minnesota's forests is wrong. In fact, Dr. Reich testified that the effect of a warming climate will bring both positive and negative impacts to Minnesota's forests with the *negative effects likely outweighing the positive effects in the near term*. *Id.* at 4. Moreover the "aggregate impact [will] become increasingly negative looking further into the future." *Id.* at 4:5.

Thus, both Drs. Tol and Mendelsohn have offered testimony in this case that was shown to be false and unreliable. Regardless of whether the ALJs assign less weight to these witnesses testimony because of these errors, however, the alternatives that they offer are not supported by the preponderance of the evidence. As shown in CEO's Initial Brief, pp. 35-39, Dr. Mendelsohn changed the damage function in the DICE model to calculate significantly lower values, but he provided no evidentiary support for the change he made. Dr. Tol apparently made the same, unsubstantiated, adjustments when running the FUND model to reach the recommendations contained in his report. In any case, the preponderance of the evidence does not support adoption of externality values calculated by one run of one model by one researcher. The Federal SCC, which benefits from the expertise of several federal agencies and incorporates the results of three models, is clearly more reasonable and preferable.

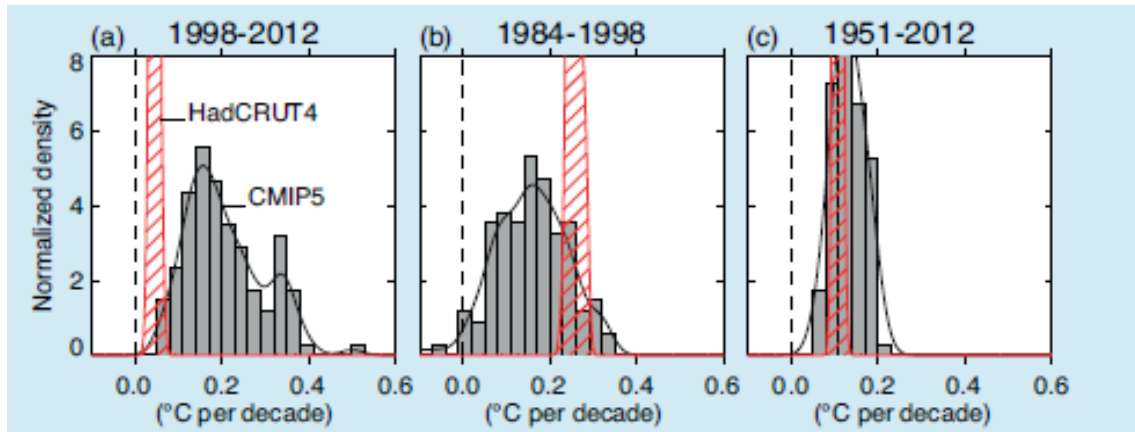
3. Peabody Energy's Initial Brief employs the same misleading tactics as its witnesses.

Peabody's witnesses engaged in a pattern of putting misleading information into the record—a pattern that continues with Peabody Energy's Initial Brief. For example, Peabody Energy included this figure in the Direct Testimony of its witness, Dr. Happer, and highlighted it in the opening statements of more than one witness (Ex. 202 at 7; ex. 255; ex. 257):



This graph shows trends in global mean surface temperature between 1998 and 2012 (red hatching) compared to models. Peabody displayed this figure several times to support its claim that models are not accurately predicting climate change. But this is a deliberately misleading representation.

Peabody's witnesses cherry-picked this one figure from the IPCC's 5th Assessment Report, taking it out of context. The IPCC put this figure together with figures of trends during a different 14-year period and trends over a 61-year period (Ex. 405 at 771):



When displayed in context rather than in a misleading way, the figure used repeatedly by Peabody to demonstrate misalignment between models and temperature data actually shows the opposite: that models and temperature trends align very well over the long term.

Similarly, Dr. Lindzen testified that the so-called hiatus in warming has shifted the central value of the ECS range from 3° C (as found in AR4) to 2° C. (Ex. 213 at 17.) But on cross-examination, he was forced to admit that the study he relied on for this assertion in fact said nothing of the sort. Hr’g Tr. vol. 2A at 27:4-12. The study concluded that 2° C remained the “lower bound” of the ECS range (as found in AR4) and that it was too early to conclude whether any “hiatus” had an impact on the ECS range one way or another. *Id.* at 27:25- 28: 1-2; Ex. 109.

Peabody continues these types of misleading tactics in its Initial Brief. For example:

- Rather than refer to the above-referenced graphs that were shown by Dr. Abraham to be highly misleading (Hr’g Tr. vol. 3B at 84-89), Peabody refers to another model/temperature comparison graph along with an enlargement of a misleading subsection of the graph *that was specifically excluded by the ALJs from this record*. Peabody Initial Br. at 45; ex. 258.
- Peabody again cites a paper on page 60 of its Initial Brief (Bjorn Stevens, Rethinking the Lower Bound on Aerosol Radiative Forcing, 28 J. Climate 4794 (2015), available at <http://journals.ametsoc.org/doi/abs/10.1175/JCLI-D-14-00656.1>) for a proposition that has been explicitly rejected by its author. As explained by Dr. Dessler in

surrebuttal, the author issued a public statement that “although others have used [Stevens’] findings to suggest that Earth’s surface temperatures are rather insensitive to the concentration of atmospheric CO₂. *I do not believe that my work supports these suggestions, or inferences.*” Ex. 106 at 6:1-4 (emphasis supplied).

- Peabody’s Initial Brief continues to cite to Dr. Tol’s testimony for the proposition that the scientific “consensus” related to climate change is a “manufactured myth” (referring to Cook et al.) Peabody Initial Br. at 90. Peabody Energy simply ignores the public statements by Dr. Tol that “There is no doubt in [Tol’s] mind that the literature on climate change overwhelmingly supports the hypothesis that climate change is caused by humans. [Tol has] very little reason to doubt that the consensus is indeed correct.” Ex. 105 at 18:8-10. Tol has also stated that “The literature has been overwhelming pro-[Anthropogenic Global Warming] for 20 years or more. The people who I know that disagree with the consensus are well aware that they are a tiny minority.” *Id.* at 18:12-14. Peabody’s own witness agrees that there is a scientific consensus about anthropogenic global warming and yet Peabody is still trying to mislead the Commission.
- Peabody tries to find sympathy by claiming that its witnesses were victims of “schoolyard antics such as name-calling . . . during trial.” Peabody claims that its witnesses were called “deniers,” “contrarian,” and “conspiratorial.” But the transcripts show that the only person to use the word “denier” was Peabody’s attorney and nobody used the word “conspiratorial.” Drs. Abraham and Dessler described the views of Peabody witnesses as contrarian, but even Dr. Tol admits that these views form the “tiny minority” of scientists, making “contrarian” an apt descriptor.

The list of these tactics could go on, but the point is simple: Peabody Energy is trying to steer the ALJs and the Commission away from the record as a whole and focus attention on disproven and unreliable “evidence” that it thinks will be sufficient to show that the Federal SCC is not reasonable or is not the best available damage cost measure for Minnesota to use.

The reality is that the record, when viewed as a whole, contains a preponderance of the evidence supporting the Federal SCC.

4. Peabody’s suggestion that a commission decision to adopt the Federal SCC would violate the statutes or constitution is meritless.

Peabody’s argument that “speculation and unsubstantiated assumptions about climate change” prevent the Commission from acting based on statutory or constitutional grounds is without merit. The fact that Peabody doesn’t agree with the consensus science on climate change or appreciate the Minnesota Legislature’s mandate that the Commission adopt and use pollutant externality values in resources planning does not establish a statutory or constitutional violation.

The Minnesota appellate courts reviewed and rejected Peabody’s line of argument after the Commission adopted the initial externality value for CO₂. Matter of Quantification of Envntl. Costs, 578 N.W.2d 794 (Minn. Ct. App. 1998) rev. denied (August 18, 1998). In that case, a trade association representing coal interests from North Dakota made the same arguments Peabody advances here, including that the adopted values were “grounded in incomplete data, speculation, conjecture, and uncertainty” and that “there is no substantial evidence that CO₂ causes or contributes to serious environmental damage.” *Id.* at 799. The court rejected the challenge. It noted that the Commission in fact had relied on a contested case proceeding in which several parties had participated, that the ALJ relied on information from reputable sources such as the IPCC, that the ALJ fully considered the acknowledged uncertainties and assumptions inherent in calculating an externality value, and that the ALJ and Commission had determined which recommendations were most strongly supported by the evidence. The court noted, with approval, the Commission’s argument that “it should attempt to do what was practicable, given the uncertainties, instead of doing nothing as [the coal industry’s] argument implies.” *Id.* at 800. It further stated that, while acknowledging concerns with regard to uncertainty and speculation, it

was “disinclined to prohibit the state from directing its instrumentalities to engage in environmentally-conscious planning strategies.” *Id.*

Here, the record support for the Federal SCC is significantly stronger than what was before the Commission in the mid-1990s, when it was forced to rely on the calculations of just one MPCA staff person in establishing its externality value for CO₂. The Federal SCC has been developed over years of work by experts at several federal agencies. Ex. 100 scheds. 2, 3. The IWG relies on the best available academic literature on climate change and environmental economics. Ex. 101 sched. 1 at 16. The IWG has been completely transparent about the steps it has taken to calculate the Federal SCC and the assumptions and uncertainties inherent in those steps. Ex. 100 scheds. 2, 3. And the IWG has provided its reasoning and justifications for its decisions. Ex. 101 sched. 1.

In addition, in this proceeding, the IWG’s work has been subject to rigorous analysis. Drs. Polasky and Hanemann have thoroughly reviewed and explained the steps taken by the IWG Ex. 100 at 5-17; ex. 800 at 44-56. They have acknowledged uncertainties and explained why, despite uncertainty, adopting an externality value for CO₂ is reasonable. (Ex. 101 at 6-8; ex. 801 at 31-33. Central pieces of the IWG’s modeling and decision-making, such as climate sensitivity, socio-economic scenarios, and discount rates have been thoroughly reviewed and discussed in the testimony. Ex. 100 at 9-12, 20-21; ex. 101 at 20-21, 34; ex. 800 at 66-69; ex. 601 at 23-26, 85-87; *see also* ex. 100 sched. 3 at 15-23 (the IWG also explained its decisions in the 2013 update). Indeed, the parties opposing the Federal SCC have had every opportunity not only to attack the Federal SCC but also to offer alternatives. This record is robust and provides more than enough evidence to support the Commission’s adoption of the Federal SCC.

CONCLUSION

Opponents of the Federal SCC have failed to show that the evidence offered in support of the Federal SCC is insufficient to amount to a preponderance of the evidence. The Federal SCC is the best available and reasonable measure of the external cost of CO₂ emissions. CEOs urge the ALJs to recommend to the Commission that it adopt the Federal SCC as externality values under Minnesota Statutes Section 216B.2422.

Dated: December 15, 2015

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