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For the Minnesota Public Utilities Commission
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In the Matter of the Further Investigation into Environmental and Socioeconomic Costs Under
Minnesota Statute § 216B.2422, Subdivision 3

MPUC Docket No. E-999/CI-14-643
OAH Docket No. 80-2500-31888

**Reply Brief of Great River Energy,
Minnesota Power, and Otter Tail Power Company**

Carbon Dioxide

December 15, 2015

TABLE OF CONTENTS

| | | |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| I. | INTRODUCTION | 1 |
| II. | ARGUMENT | 2 |
| A. | Based on a Preponderance of the Evidence, the Federal Social Cost of Carbon is Neither Reasonable nor the Best Available Measure to Determine Minnesota’s CO ₂ Value | 2 |
| B. | An Adjusted Federal Social Cost of Carbon is a Better Alternative..... | 9 |
| 1. | Modelling Horizons of 2100 and 2140 Should be Used..... | 11 |
| 2. | Discount Rates of 3 % and 5% Should be Used | 14 |
| 3. | The Average and First Tons Should be Used | 16 |
| 4. | Domestic U.S., not Global, Damages Should be Used..... | 17 |
| C. | The Commission Should Consider Leakage When Using the Environmental Cost Values for Carbon Dioxide | 20 |
| III. | CONCLUSION..... | 22 |

Great River Energy, Minnesota Power, and Otter Tail Power (“GRE/MP/OTP”) submit this reply in response to the arguments made by the other parties in their initial briefs.

I. INTRODUCTION

The proponents of the Federal Social Cost of Carbon have not shown by a preponderance of the evidence that it is reasonable to use the Federal Social Cost of Carbon as the measure to determine Minnesota’s environmental cost value for carbon dioxide (“CO₂”). Although they acknowledge the significant limitations of reliance on the Integrated Assessment Models (“IAMs”) used by the Interagency Working Group (“IWG”), the proponents fail to show the use of the Federal Social Cost of Carbon will produce values with sufficient precision to satisfy Minnesota statutory standards and Commission precedent. In fact, they ignore the applicable statutory standards and Commission precedent and advocate the adoption of values produced in major part, as they readily admit, by mere guesswork. The candid and repeated admissions by Dr. Hanemann and Dr. Polasky regarding the extreme uncertainty of values produced by the Federal Social Cost of Carbon -- a point that stands undisputed in the record -- provide all of the evidence necessary to demonstrate the Federal Social Cost of Carbon is not a reasonable measure to update Minnesota’s CO₂ value.

When the evidence is viewed in its entirety, a better alternative emerges. The best available measure offered in this proceeding to update Minnesota’s CO₂ values is for the Commission to use an adjusted version of IWG’s IAM-based process that is designed to reduce the degree of uncertainty and speculation in the updated values. This can be done, as shown by Dr. Anne Smith, by modifying the economic framing assumptions used by the IWG. In fact, it can be accomplished by replacing the IWG’s assumptions for the modeling horizon, discount rate, and marginal ton used with assumptions functionally the same as those used by the Commission in establishing the current values. With this straight-forward modification of the

IWG's process, the Commission can update the CO₂ value in a manner that will meet the statutory requirement that values be based on substantial evidence and avoid the extreme speculation in setting the values that the Commission has recognized will distort resource planning decision-making.

II. ARGUMENT

A. Based on a Preponderance of the Evidence, the Federal Social Cost of Carbon is Neither Reasonable nor the Best Available Measure to Determine Minnesota's CO₂ Value

The first issue referred by the Commission for this contested case was *NOT* whether the Federal Social Cost of Carbon was reasonable and the best available measure *for use in federal regulatory impact analyses*. The first issue referred by the Commission was whether the Federal Social Cost of Carbon was reasonable and the best available measure to determine the CO₂ environmental cost values *for use in resource planning in Minnesota*. But the proponents of the Federal Social Cost of Carbon base their case on the process and analysis undertaken by the IWG to develop the Federal Social Cost of Carbon for use in federal rulemaking. In doing so, they fail to show that the Federal Social Cost of Carbon, as proposed by the IWG is reasonable and the best available measure for determining Minnesota's CO₂ value.

The proponents of the Federal Social Cost of Carbon have not shown by a preponderance of the evidence that use of the Federal Social Cost of Carbon to quantify and establish Minnesota's CO₂ values will comply with statutory standards or Commission precedent. Indeed, what is striking is not only their failure to address statutory standards and Commission precedent but their support of an analysis that is so extremely tolerant, by their own admissions, of modeling imprecision and "large" uncertainty, even to the point that they defend estimates based on what they themselves characterize as guesses. The proponents are effectively urging the

Commission to disregard legislative requirements and put aside the sensible “conservative” approach previously adopted by the Commission to establish environmental cost values.

In support of their petition to reopen the environmental cost investigation, the Clean Environmental Organizations (“CEOs”) claimed that Minnesota environmental cost values were “no longer supported by scientific evidence. . . .”¹ It is now abundantly clear that the record in this proceeding does not support this claim with respect to the CO₂ values. The preponderance of the evidence established that the damage functions used by the IWG are based on quantitative relationships between temperature changes and economic damages that are almost identical to those relied upon by the Commission to establish the CO₂ values in 1997. No party has argued otherwise.

The primary change advocated by the proponents of the Federal Social Cost of Carbon is to use three IAMs DICE, FUND and PAGE -- with the economic framing assumptions selected by the IWG -- to update Minnesota’s CO₂ values. However, the proponents of the Federal Social Cost of Carbon have offered only limited and unpersuasive evidence to show the IWG’s methodology and assumptions are reasonable and appropriate for determining Minnesota’s CO₂ value in resource planning. They suggest there are no realistic alternatives, although several were offered by expert witnesses in this proceeding. They attempt to portray the Federal Social of Carbon as the “gold standard” but the record shows the Federal Social of Carbon was not subject to either the rigor of a public Federal rulemaking proceeding or peer-review. Instead, it was prepared by a committee composed only of staff from federal agencies, whose identities have not been disclosed, for the very specific purpose of use in federal regulatory impact analysis. And in their ultimate argument, the proponents contend the Federal Social Cost of

¹ Memorandum in Support of Clean Energy Organizations’ Motion to Update Externality Values for Use in Resource Decisions, Docket No. E-999/CI-93-583 (Oct. 9, 2013) at 13.

Carbon is a type of cost-benefit analysis² and suggest that this along with its IWG pedigree should provide sufficient grounds for its adoption as the measure to determine Minnesota's CO₂ values, without further scrutiny or adjustment.

Regardless of one's general opinion regarding the Federal Social Cost of Carbon, there is no dispute that the Federal Social of Carbon was not designed for use in a state resource planning process or state-level decision-making. Given this fact, the proponents of the Federal Social of Carbon cannot meet their burden by simply showing the "IWG employed a reasonable process, used reasonable models, and made reasonable assumptions in the development of the Federal SCC";³ they must show the Federal Social Cost of Carbon is reasonable and the best available measure to update Minnesota's range of environmental cost values for CO₂. Based on the evidence, as well as the arguments offered in their initial briefs, the proponents of the Federal Social of Carbon cannot meet this burden. In their initial briefs, they confirm they are prepared to overlook the many limitations of the Federal Social Cost of Carbon in their effort to find a "ready to use" measure to determine the CO₂ values. They make no attempt to tailor the Federal Social Cost of Carbon to meet Minnesota's needs and to comply with statutory standards and align with Commission precedent. They completely fail to explain how the Federal Social of Carbon can provide the type of precision required to quantify environmental cost values. And the record shows they cannot do so.

There is broad agreement that values produced by the IAMs, such as the Federal Social of Carbon, are significantly speculative. Nicholas Martin noted the Federal Social Cost of Carbon

² *E.g.*, Amended Initial Brief of the Minnesota Department of Commerce, Division of Energy Resources and Minnesota Pollution Control Agency, Docket No. E-999/CI-14-643 (Nov. 30, 2015) at 37-38 ("Agencies' Brief").

³ Initial Post-Hearing Brief of Clean Energy Organizations, Docket No. E-999/CI-14-643 (Nov. 24, 2015) at 10 ("CEOs' Brief").

is inherently uncertain and speculative.⁴ Nicolas Stern, whom the CEOs hold in high regard, concluded that IAM analysis “has very serious weaknesses” and provides “a very weak foundation for policy.”⁵ MIT Professor Robert Pindyck described IAM-based analyses as producing an “illusory and misleading” appearance of knowledge about the benefits of emissions reductions and observed that since “we know almost nothing” when the damage functions are created the developers of the IAMs “can do little more than make up functional forms and parameter values.”⁶ And the witnesses offered by the Department of Commerce and Pollution Control Agency (the “Agencies”) and the CEOs did not object to these characterizations of the values produced by the IAMs. Dr. Polasky simply clung to his argument that values should be adopted even though “uncertainty is large.”⁷ Similarly, Professor Hanemann admitted that there is uncertainty regarding how people 300 years from now will value climate impacts but he still insisted, like Professor Polasky, that values should be adopted even though “uncertainty is large.”⁸

The degree of speculation inherent in the values produced by the Federal Social Cost of Carbon has not been tolerated by the Commission in past proceedings, and is not allowed by the applicable statutory standards. The proponents of the Federal Social of Carbon cannot show why the result should be different in this case. The Commission has favored the use of the damage-cost approach because the damage-cost approach “focuses on actual damages from uncontrolled

⁴ Ex. 600 at 3:11-17 (Martin Direct).

⁵ Ex. 230 at 95 (Bezdek Report). Lord Stern is an economics professor at the London School of Economics, the lead author of a well-known 2006 report on global warming, *id.*, and has been discussed elsewhere in this docket in connection with his support for low discount rates.

⁶ Ex. 302 at 2 (Smith Report).

⁷ CEOs’ Brief at 24.

⁸ *Id.*; see Ex. 802 at 43:16-28, 45:1-9 (Hanemann Surrebuttal).

emissions.”⁹ As the Commission has required in prior proceedings, the focus in this matter should be on actual damages, and whether there is a sufficient evidentiary basis to reasonably estimate those damages.

The proponents of the Federal Social Cost of Carbon do not even try to argue that they are meeting the statutory standard and Commission precedent. They ignore them. Instead, they argue the Federal Social Cost of Carbon values should be adopted in spite of “large” uncertainty.¹⁰ As we discussed in our initial brief, the Commission has required more than “best guesses” to establish environmental cost values. As ALJ Klein explained, at some point the “degree of uncertainty associated with a proposed value becomes so great that there is insufficient evidence to meet the preponderance standard, and the proposed value cannot be adopted.”¹¹ This is the fundamental issue in this case – at what point does the level of uncertainty become so great that there is insufficient evidence for the adoption of a proposed value. The proponents of the Federal Social Cost of Carbon decline to seriously address this issue and by not doing so they fail to meet their burden.

Rather than confronting the issue of uncertainty, the proponents of the Federal Social Cost of Carbon argue that anything less than a full embrace of the Federal Social Cost of Carbon, all of its widely-recognized shortcomings notwithstanding, would mean the Commission is ignoring a substantial amount of the damages caused by CO₂ emissions.¹² But this is clearly not the case. As the Commission has noted before, even when there may not be sufficient evidence

⁹ See Notice and Order for Hearing, Docket Nos. E-999/CI-00-1636, E999/CI-14-643 (Oct. 15, 2014) at 4-5.

¹⁰ CEOs’ Brief at 24.

¹¹ Findings of Fact, Conclusions, Recommendation and Memorandum, Docket E-999/CI-93-583 (Mar. 22, 1996) at ¶ 31 (“ALJ Findings”).

¹² CEOs’ Brief at 20, 24; see Ex. 802 at 45:1-9 (Hanemann Surrebuttal).

to monetize damages, the possibility of those damages can be considered qualitatively.¹³ The proponents of the Federal Social Cost of Carbon at times seem to be suggesting that Minnesota's environmental cost values are the State of Minnesota's only policy response to CO₂ emitted in connection with electric power generation in Minnesota.¹⁴ But this also is clearly not the case. In addition to the use of environmental cost values in resource planning, Minnesota addresses climate issues by a range of measures set out in the Next Generation Energy Act, the solar energy legislation passed in 2013, and the state's developing plans to implement the Federal Clean Power Plan. Perhaps most importantly, pursuant to Minn. Stat. § 216H.06, the Commission also uses an estimate of future regulatory costs for carbon dioxide in resource planning.¹⁵ Minnesota's utilities, including GRE/MP/OTP, have played an important and cooperative role in Minnesota's efforts to address the risks of climate change, and will continue to do so. The Commission does not need to contort the CO₂ environmental cost values to include all possible damages, no matter how difficult such damages are to adequately quantify, out of a belief that such efforts are the only way to respond to the potential risks of climate change. Instead, the statute can and must be applied as written and previously interpreted, safe in the knowledge that the inclusion of environmental cost value ranges in utility resource planning is just one part of Minnesota's response to climate change.

¹³ Order Establishing Environmental Cost Values, Docket No. E-999/CI-93-583 (Jan. 3, 1997) at 13 ("January 3, 1997 Order").

¹⁴ The CEOs, for example, warn against ignoring uncertain outcomes by failing to include types or categories of damages in the range of values, CEOs' Brief at 24, but fail to acknowledge the other ways in which Minnesota addresses the risks and uncertainties of climate change.

¹⁵ The range of regulatory carbon dioxide costs for 2015 is \$9 to \$34 per ton emitted. Order Establishing 2014 and 2015 Estimate of Future Carbon Dioxide Regulation Costs, Docket No. E-999/CI-07-1199 (Apr. 28, 2014) at 3.

To justify higher cost values based on “large” uncertainty, the Agencies also suggest a risk premium should be included in Minnesota’s CO₂ environmental cost values.¹⁶ But the inclusion of a risk premium is clearly not consistent with Minnesota law or Commission precedent. Minn. Stat. 216B.2422, subd. 3(a) requires the quantification of environmental costs and does not suggest, require, or even allow that the values so quantified should then be adjusted upwards to incorporate some risk factor. In fact, the Commission rejected such an approach in the last proceeding when it refused to adopt the higher of the two damage functions proposed by the MPCA’s witness.¹⁷

The Agencies and CEOs claim the IAMs and the IWG’s work is acceptable because it underestimates actual damages and thus is “conservative.” However, the real issue is that no party really knows whether or not the models, taken as a whole, are conservative. The CEOs and Agencies point to certain categories of damages which were not included in the IAMs and suggest that such omissions mean the models are conservative, but the IWG also failed to consider the possibility (or probability, given the length of time under consideration) that there will be technological developments which reduce emissions and/or make the consequences of carbon dioxide emissions less harmful.¹⁸ No one today knows enough to be able to reasonably determine how those two factors may or may not offset each other. Moreover, the portion of the IAM damage functions addressing higher temperature changes are based on mere guesswork.¹⁹ Those guesses could be too high or too low. In the face of uncertainty, the appropriate response

¹⁶ Agencies’ Brief at 69, 105.

¹⁷ January 3, 1997 Order at 27.

¹⁸ Hearing Transcript (Sept. 28, 2015) Vol. 3B, 110:1-112:7 (Martin).

¹⁹ Hearing Transcript (Sept. 24, 2015) Vol. 1, 124:7-13 (Polasky).

is to default to conservative values. That was the approach taken by ALJ Klein in the last proceeding,²⁰ and it remains appropriate today.²¹

B. An Adjusted Federal Social Cost of Carbon is a Better Alternative

The preponderance of the evidence does not support a finding that the Federal Social Cost of Carbon is a reasonable and the best available measure to determine Minnesota's CO₂ values. The preponderance of the evidence shows instead that an adjusted Federal Social Cost of Carbon is a better alternative. Following its precedent, the Commission should evaluate the Federal Social Cost of Carbon and the proposed alternatives, including the range recommended by Dr. Smith, based on whether there is a sufficient evidentiary basis so as to make the estimated range of values sufficiently reliable. While some uncertainty is unavoidable, the great or "large" uncertainty resulting from a lack of evidentiary foundation must be avoided. The statute requires quantifiable costs, and the Commission has previously recognized that values that are too uncertain as a result of a lack of an evidentiary basis are not acceptable. As in the prior proceeding, conservative choices should be made in evaluating the proposed ranges of values and, crucially, the assumptions on which they are based.

The evidence shows the three IAMs used by the IWG can be run using different combinations of economic framing assumptions.²² The Agencies contend that PAGE and FUND are not readily available and that the Electric Power Research Institute is the only entity other than the IWG to have obtained access to all three models,²³ but the very existence of Dr. Smith's report disavows that claim. Nor has any party presented any testimony or other evidence

²⁰ ALJ Findings at 17-18 of PDF (Discussion of Policy Issues).

²¹ The Agencies and the CEOs use of the "conservative" label varies and can be distinctly different than how that term was used by ALJ Klein. ALJ Klein did not counsel for adopting higher environmental cost values in the face of uncertainty; instead, the conservatism he recommended was favoring lower values in order to avoid imposing undue costs. *Id.*

²² See Ex. 302 (Smith Report).

²³ Agencies' Brief at 25-26.

showing or even suggesting that Dr. Smith and her team made any technical errors in operating the IAMs. Dr. Smith explained how she and her team obtained, modified, and ran the three IAMs.²⁴ Her process was transparent, she provided multiple values,²⁵ not just those she recommended, and her report and the methodology explained within would facilitate later updates, as necessary.²⁶

GRE/MP/OTP are not sure why the Agencies persist in making the “not readily available” claim that is demonstrably inaccurate given Dr. Smith’s work. Perhaps they wish to make the Commission believe it must accept the Federal Social Cost of Carbon, warts and all, if it wants to have a range of values developed using all three of the IAMs chosen by the IWG (PAGE, DICE, and FUND). But that is simply not the case. The Commission can and should adopt Dr. Smith’s proposed range, which was calculated using the same three models as employed by the IWG. Moreover, unlike the Agencies, GRE/MP/OTP do not try to limit the Commission’s options. Dr. Smith has provided the values obtained after running PAGE, DICE, and FUND using a variety of assumptions, and the Commission can use those figures to establish a range of environmental cost values based on its determination of which assumptions are most appropriate given the statutory limitations and principles of economics and cost-benefit analysis.

Although the proponents of the Federal Social Cost of Carbon opened this matter by claiming the environmental cost values for CO₂ needed to be updated because of an improved scientific understanding, the differences between the values adopted in 1997 and the IWG’s values result primarily from the use of different economic framing assumptions. In 1997, the Commission used a 2100 horizon, average tons, 3% and 5% discount rates, and a global scope of

²⁴ Ex. 301 at 32-39, Appendix A (Smith Report).

²⁵ Ex. 307 (Smith’s Table 4A).

²⁶ Ex. 304 at 35:3-22 (Smith Surrebuttal).

emissions.²⁷ If similar economic framing assumptions were used now with the IWG's methodology, the updated range would be \$7.87 to \$18.85 per metric ton emitted in 2020 using 2007 dollars. That is a marked increase from the current CO₂ value, but also significantly less than the 2013 Federal Social Cost of Carbon values²⁸ of \$12 to \$129 (including the 95th percentile values) per metric ton emitted in 2007 dollars.²⁹ The significantly higher range that results from the use of the IWG's assumptions shows that most of difference between the range adopted in the 1990s and the Federal Social Cost of Carbon is actually the result of different economic framing assumptions, not changes in the science or in the empirical evidence of the impacts of warming on the economy.

The values produced by the IAMs are highly dependent upon the modeling assumptions. If it decides to use values produced by IAMs, the Commission must consider which assumptions best fit Minnesota's needs and the requirements of Minnesota law. The assumptions used to run the models largely determine the resulting values and it would be arbitrary and capricious for the Commission to adopt any range of values without carefully considering them before deciding on a range of values.

1. Modelling Horizons of 2100 and 2140 Should be Used

The Agencies, CEOs, Xcel Energy and GRE/MP/OTP all agree that it is appropriate to run the IAMs to at least 2100 or 2140. The disagreement is over whether to include damages predicted by the models to occur from 2140 to 2300, and that disagreement is not based on whether parties foresee damages from carbon dioxide emitted today that are experienced 150,

²⁷ January 3, 1997 Order at 5, 25-27; ALJ Findings at ¶¶ 102-114.

²⁸ The Agencies have urged the Commission to use the 2013 version of the Social Cost of Carbon. Agencies' Brief at 33.

²⁹ Ex. 800 Attachment 3 at 3 (Hanemann Direct).

200, and 250 years from now, but rather whether the amount of any such damages can be determined with sufficient accuracy.

All parties recognize that predicting future conditions is an uncertain exercise. The proponents of the Federal Social Cost of Carbon suggest there is no meaningful difference between making predictions out to 2100 or 2140 and making predictions out to 2300. The proponents reason that if the predictions over an 85 or 125 year period are acceptable, so must be predictions over a 285-year period. The issue, however, is not the number of acceptable years, but the degree of uncertainty. Even forecasting 125 years out is quite a stretch. After that point, many of the modelled temperature rises are beyond temperatures for which we have economic evidence. We are also beyond the technology cycles even for technologies currently being developed. As Dr. Polasky admitted, the uncertainty increases the farther into the future one seeks to predict.³⁰ Dr. Polasky and CEOs may be comfortable with the “large uncertainty” involved in forecasting over a 285-year period, but the ALJ and the Commission in the prior proceeding interpreted Minn. Stat. 216B.2422, subd. 3(a) as to require values that are not greatly uncertain, are not overly speculative, and that are based on sufficient evidence so as to be reasonably reliable.³¹

Dr. Smith proposed a range of values determined using modelling horizons of 2100 and 2140. Xcel Energy characterizes this as Dr. Smith assuming no damages after 2100 and 2140,³² but the real issue is whether there is a sufficiently reliable way to determine the amount of such damages that might be experienced after 2140 given the lack of evidence regarding the economic impacts of temperature changes above three degrees and the difficulty of predicting far-future

³⁰ Hearing Transcript (Sept. 24, 2015) Vol. 1, 90:8-11 (Polasky).

³¹ January 3, 1997 Order at 12, 26-27; ALJ Findings at ¶¶ 16, 31.

³² Xcel Energy Initial Post-Hearing Brief Regarding CO₂, Docket No. E-999/CI-14-643 (Nov. 24, 2015) at 27-28 (“Xcel Brief”).

conditions. Given our lack of knowledge of future economic conditions and the impact of temperature increases of more than three degrees on the economy, there is an inherent difficulty in predicting far-future impacts from carbon dioxide emissions and that difficulty and the resulting uncertainty is particularly great after 2100 and 2140. The IWG has made its predictions even less reliable by making the unrealistic assumption that new technologies will not be developed over the next 285 years which reduce the harm resulting carbon dioxide by decreasing emissions, changing the impact emissions have on the climate, or reducing the harm experienced as a result of rising temperatures.³³ We know technologies have been developed in the last 100 years which have made warm climates less harmful for people, including refrigeration, air conditioning, and treatments for malaria and other tropical diseases, but the proponents of the Federal Social Cost of Carbon ask the Commission to calculate its range of environmental cost values based on the assumption that no further adaptive technologies will be developed between now and 2300, let alone new technologies to reduce or eliminate emissions. This assumption is unrealistic and absurd.

CEOs try to suggest that Dr. Smith is merely arguing that there is not an empirical basis for the IAM damage functions after three degrees of warming, but do not then present any evidence showing her argument is incorrect.³⁴ Nor could they. As their expert admitted, all that is possible is a best guess.³⁵ It is appropriate to limit the modelling horizon to 2100 and/or 2140 because doing so reduces the speculation involved as “shortening the modeling horizon truncates the time period of the most uncertain results.”³⁶ The 2300 time horizon results in values that are

³³ Ex. 302 at 73 (Smith Report); Ex. 600 at 34:8-17 (Martin Direct).

³⁴ CEOs’ Brief at 23.

³⁵ Hearing Transcript (Sept. 24, 2015) Vol. 1, 124:7-13 (Polasky).

³⁶ Ex. 601 at 28:12-22 (Martin Rebuttal).

based on an unreasonable amount of ungrounded speculation, a problem which is compounded if the discount rate is too low as a lower discount rate results in more far-future damages.

2. Discount Rates of 3 % and 5% Should be Used

The Agencies, CEOs, Xcel Energy and GRE/MP/OTP all agree that 3% and 5% are appropriate discount rates to use in quantifying the range of environmental cost values for carbon dioxide. Those same rates were also accepted by the Commission in 1997.³⁷ The disagreement between those parties is thus limited to the acceptability of the 2.5% discount rate used by the IWG as one of its three rates.³⁸

As we discussed in our initial brief, the 2.5% rate should not be used because it is not based on empirical evidence and is not appropriate even if one is trying to give a great deal of weight to the welfare of future generations based on ethical considerations. The Agencies attempt to sidestep the question of whether the discount rate should be based on ethical concerns by suggesting the rate has an empirical basis;³⁹ however, the IWG itself was clear that the 2.5% rate was adopted partly in response to ethical concerns.⁴⁰ If a 2.5% rate is accepted on a supposedly ethical basis, then poorer, current or near-future generations could be forced to incur deprivations and losses to their welfare in order to benefit future generations which the models predict to be substantially wealthier regardless of whether or not emissions are reduced.⁴¹ The Commission previously rejected the argument that lower discount rates are appropriate when discounting across generations,⁴² and nothing in the intervening years has changed the basic

³⁷ January 3, 1997 Order at 27.

³⁸ The Agencies suggest (*see* Agencies' Brief at 120), that Dr. Smith is recommending a 7% rate, but that is not accurate. Dr. Smith's recommended range of values was determined using the 3% and 5% rates.

³⁹ *Id.* at 108-119.

⁴⁰ Ex. 800 Attachment 2 at 23 (Hanemann Direct).

⁴¹ Ex. 302 at 87-88 (Smith Report).

⁴² January 3, 1997 Order at 27.

argument between proponents of the descriptive approaches to discounting and those who argue for a lower discount rate on prescriptive grounds.

The Agencies claim there is an empirical basis for a lower rate, but that is based upon a single paper regarding the uncertainty of interest rates over time.⁴³ The argument based on the variability of interest rates cannot said to be well-supported in the literature, which was a consideration for the Commission when it responded to prior arguments regarding discount rates below 3%.⁴⁴ The approach of using a lower rate (and the resulting higher damages and current costs) in the fact of uncertainty is directly contrary to the conservative approach taken in the last proceeding in which care was taken to avoid imposing overly high values.⁴⁵ Even if that argument is accepted based on a single, cited paper, the rate is too low because it does not account for the opportunity costs associated with using capital to reduce emissions.⁴⁶ The capital investments that are made by Minnesota utilities to reduce emissions, such as re-powering plants, constructing additional wind or solar resources, enhanced energy efficiency, or making changes to the grid in response to increased generation from renewables, will be paid for using private capital. As the Minnesota Large Industrial Group (“MLIG”) has shown, the actual costs of capital of Minnesota utilities, and the discount rates they use in their resource plans, are higher than the rates used by the IWG.⁴⁷ In performing cost-benefit analyses, such as the analyses done in resource planning, both the costs and benefits of a resource or policy choice must be considered, and in this case the costs of obtaining the benefits of carbon reductions include capital investments made by utilities. If those capital costs are given adequate consideration in

⁴³ Agencies’ Brief at 121-22; Ex. 800 Attachment 2 at 1 (Hanemann Direct).

⁴⁴ January 3, 1997 Order at 27; *see also* ALJ Findings at ¶ 113.

⁴⁵ ALJ Findings at 17-18 of PDF (Discussion of Policy Issues).

⁴⁶ Ex. 304 at 26:17-28:8 (Smith Surrebuttal).

⁴⁷ Minnesota Large Industrial Group’s Post-Hearing Brief Regarding Phase I (CO₂ Track), Docket No. E-999/CI-14-643 (Nov. 24, 2015) at 24-26.

the discount rates, then the rates must be adjusted upwards from purely consumer rates and the 2.5% rate is too low.⁴⁸

The Commission should use the same discount rates it used last time: 3% and 5%. Those rates are widely accepted and have an evidentiary basis rooted in how people actually discount between future and current consumption.

3. The Average and First Tons Should be Used

At first glance, there is not even a partial agreement on this factor as with the two discussed above. GRE/MP/OTP propose the range of values should be determined using the first ton and average ton, and the Agencies and CEOs favor the IWG's last ton methodology in which Minnesota emissions are treated as more harmful than any other emissions. However, GRE/MP/OTP note that neither Xcel Energy nor the Agencies in their briefs offered any critique of the average of first and last ton used by Dr. Smith in her recommended range of values and the options she provided the Commission.⁴⁹ In considering what assumptions are appropriate to use, the Commission should recognize that even some of those parties who criticize Dr. Smith's approach, such as the Agencies and Xcel Energy, have focused largely or exclusively on the "first ton" approach and apparently have trouble, at least in the first instance, in critiquing her use of the average of the first and last marginal tons.

The CEOs point out that the average of the first and last ton is not an optimal marginal ton,⁵⁰ and we agree. However, as Dr. Smith explained in her testimony, the average of the first and last ton is much closer to the optimal marginal ton than either the first or last ton⁵¹ the latter

⁴⁸ Ex. 304 at 26:17-28:8 (Smith Surrebuttal).

⁴⁹ Agencies' Brief at 40-41 (section criticizing the "first ton," but no similar section for the average of first and last); Xcel Brief at 28-29 (criticizing first ton modelling approach of excluding post-2020 emissions).

⁵⁰ CEOs' Brief at 30.

⁵¹ Ex. 302 at 64 (Smith Report).

of which the CEOs are suggesting should be used. Also, the average of the first and last ton is closer to the average ton used by the Commission in the prior proceeding,⁵² and thus closer to the damage properly attributable to a given ton of emissions in Minnesota.

As for the first ton calculation, which was much criticized, Dr. Smith is not predicting carbon dioxide emissions are going to halt after 2020. No party or witness is suggesting that will happen. Rather, the first ton modelling was done as an analytical exercise to separate out the damage associated with current and past emissions from that resulting from future emissions, which will mostly occur outside of Minnesota's boundaries and control.⁵³ As with the geographic scope of damages issue discussed below, the first ton was included in the lower range of the values proposed by Dr. Smith to respond to the question of whether Minnesota should choose to bear the costs associated with future, overwhelmingly non-Minnesota emissions outside of its control when making its resource planning decisions.

The Commission should reject the "last ton" approach used by the IWG and recommended by the Agencies and the CEOs. Minnesota's emissions are no more harmful than emissions elsewhere and the quantification contemplated under Minnesota law does not require the state to exaggerate the harm resulting from its emissions. Instead, the Commission should use the first and/or average ton measures, the values for which are set out in Dr. Smith's Table 4A.⁵⁴ This would produce an outcome consistent with the Commission's precedent in the initial environmental costs.

4. Domestic U.S., not Global, Damages Should be Used

Unlike the factors discussed above, on this point GRE/MP/OTP are asking the Commission to make a different decision than it did last time. Nonetheless, sound principles of

⁵² *Id.*

⁵³ Ex. 304 at 22:2-23:4 (Smith Surrebuttal).

⁵⁴ Ex. 307 (Smith's Table 4A).

cost-benefit analysis suggest only domestic damages should be considered when setting the range of environmental cost values for carbon dioxide. Interestingly, Dr. Hanemann does not suggest that either the statute or economic principles dictate the use of global damages, as Dr. Polasky does.⁵⁵ Instead, the Agencies' expert Dr. Hanemann simply deferred to precedent and the decisions made by the IWG and its analysts.⁵⁶ But the Commission is not faced with a choice of either fully including or fully excluding non-United States damages. The Commission could choose to place some weight, but less than 100% weight, on damages from outside the United States.

CEOs, in contrast, offer two principle arguments for global damages: (1) carbon dioxide does not have only a localized impact, and (2) if all jurisdictions consider only local or national damages in their planning then the result would be an insufficient account of externalities.⁵⁷ The first point is not disputed, but does not mandate that global damages be considered. As Dr. Smith and Dr. Ted Gayer have explained, it is common practice, including at the Federal level, to consider costs and benefits at a jurisdictional level.⁵⁸ If that were not the case and policy decisions were made which gave equal weight to the welfare of those in and outside a jurisdiction, we would see vastly different policies at the state and federal levels. Nor is the second factor persuasive, as the concern presented is entirely hypothetical. No party has presented evidence suggesting that it is likely in the near-term that countries around the world will incorporate externality values into their resource planning, and Dr. Hanemann has testified that such concerted global action is "fraught with problems."⁵⁹ Even if global action is a

⁵⁵ Agencies' Brief at 61.

⁵⁶ Ex. 801 at 15:9-25 (Hanemann Rebuttal).

⁵⁷ CEOs' Brief at 33-34.

⁵⁸ Ex. 301 at 92-96 (Smith Report); Ex. 400 at 7, 9 (Gayer Direct).

⁵⁹ Ex. 801 at 26:9-11 (Hanemann Rebuttal).

possibility, it is one the Federal government, not Minnesota, will pursue. While it may, perhaps, be appropriate for the Federal government to use a global measure of damages as a show of good faith in negotiations with other countries, that rationale does not apply to Minnesota.⁶⁰

The situation is not one in which most jurisdictions are considering externality values in resource planning, and the danger is that consideration of only domestic damages will result in an undercounting. The actual scenario Minnesota faces is that it will be one of the few state jurisdictions to consider externality values in its resource planning and adopting high values to account for global damages could impose costs on it, in the form of more costly resource decisions which could result in rate increases or exporting necessary future energy resources to surrounding states, while providing little or no benefit to the state or the rest of the world. By urging the use of global damages, the proponents of the Federal Social Cost of Carbon are pushing not for effective altruistic policy decisions, which could be admirable, but rather for a situation in which Minnesota makes sacrifices which do not actually benefit the rest of the world. Since the statute does not speak to the geographic scope of damages to be included, we request the Commission reverse its prior decision and limit its quantification to only domestic damages. Such a decision is consistent with sound principles of cost-benefit analysis and would serve the interests of Minnesota residents and ratepayers. If the State is to act altruistically, it should do so in those circumstances when it will actually benefit non-Minnesotans. In the absence of effective global agreement, Minnesota's sacrifices will likely increase electricity rates on Minnesota's own industries and citizens without any meaningful reduction in overall CO₂ emissions.

⁶⁰ Ex. 302 at 94 (Smith Report).

C. The Commission Should Consider Leakage When Using the Environmental Cost Values for Carbon Dioxide

The Agencies argue that leakage should not be considered when applying the environmental cost values for carbon dioxide claiming that it should not do so because the Commission only regulates utilities in Minnesota.⁶¹ This recommendation misses the point. The evidence in the record shows leakage is a genuine phenomenon. Even Dr. Polasky admitted that leakage is a “legitimate concern”, that it “should be looked at” in resource planning, and that leakage may affect the net tons to which the environmental cost of carbon should be applied.⁶² Dr. Polasky’s reluctant admissions echoed points affirmatively made by Dr. Smith and Dr. Mendelsohn, and Mr. Martin.⁶³ Though he suggested the Commission ignore it when actually using the environmental cost values in resource planning, Dr. Hanemann did not deny that leakage is a real issue and even provided a definition of the phenomena, explaining that in the context of regulations to limit greenhouse gas emissions, “leakage refers to the phenomenon that some of the reduction in the emissions produced by the regulation may be offset by increased emission in other jurisdictions, not controlled by the regulator.”⁶⁴

The parties, even the Agencies, appear to agree that leakage will be a factor. There also appears to be agreement that leakage should not impact the amount of the environmental cost values themselves. The disagreement regarding leakage is on the question of whether leakage should be taken into account when the environmental cost values are actually used in individual resource planning dockets at the Commission. When the Commission is considering a decision which could reduce emissions, perhaps an option to retire or re-power a plant, should the extent

⁶¹ Agencies’ Brief at 130.

⁶² Hearing Transcript (Sept. 24, 2015) Vol. 1 at 126:2-9, 191:17-192:1 (Polasky).

⁶³ Ex. 300 at 28:4-22 (Smith Direct); Ex. 301 at 100-102 (Smith Report); Ex. 214 at 5:1-16 (Mendelsohn Direct); Ex. 218 at 3-4 (Mendelsohn Rebuttal Report); Ex. 601 at 52:14-53:25 (Martin Rebuttal).

⁶⁴ Ex. 801 at 29:17-24 (Hanemann Rebuttal).

to which emissions reductions from that decision will be partially or wholly offset by responsive increases be considered so that environmental cost values are applied to the net reduction and the true net benefits are considered?

The Agencies, which elsewhere strenuously argue for consideration of impacts outside of Minnesota when measuring damages, are asking the Commission to ignore the extent to which particular resource decisions will actually reduce overall emissions. The suggestion is nonsensical. If the environmental cost values are meant to lead to a consideration of costs and benefits from emissions and emissions reductions in resource planning, the Commission should focus on net benefits. If the Agencies' suggestion were followed, the Commission could end up promoting resource planning decisions which drive generation, and the associated jobs and tax base, into surrounding states while disadvantaging Minnesotans and providing little or no environmental benefit to Minnesota or the rest of the world. Minnesota-based utilities would also be forced to look outside the State to find the best values for its ratepayers. The Commission cannot ignore or be indifferent to the profound and significant practical results of decisions made in this docket. As the Agencies admit, the Commission is free to consider actions that may be taken in other jurisdictions when it applies the environmental cost values.⁶⁵

The Commission may consider the actual consequences of resource planning decisions, and the Agencies have not offered any compelling reason why it should not do so. If the Commission were to blindly set high values and then not consider the regional net effect on emissions of particular resource decisions, it would render the entire environmental cost value exercise illusory and of little real environmental value, and could harm Minnesota's economy with less reliable and cost effective resources. The Dakotas, Wisconsin, and Iowa would gladly

⁶⁵ Agencies' Brief at 130.

host new generation that Minnesota regulation could drive across the border. To meet their obligations to serve customers and ratepayers, Minnesota utilities would need to look closely at the costs and benefits of adding new generation resources in these states.

III. CONCLUSION

In considering whether the Federal Social Cost of Carbon is a reasonable measure of Minnesota's CO₂ values and whether there is a better measure, the first step is to identify and apply the applicable standards taken from Minn. Stat. § 216B.2422, subd. 3(a) and prior Commission precedent. The proponents of the Federal Social Cost of Carbon ignore those standards and Xcel Energy has proposed its own set of standards without reference to the statute or precedent. But the focus should be on whether measures are tied to the evidence, whether they are overly speculative or uncertain as a result of a lack of evidence, and whether conservative choices among alternatives have been made. The Commission should also consider principles of economics and cost-benefit analysis, and the particular use for which the values are intended.

The Federal Social Cost of Carbon was developed for uses other than state-level resource planning decisions. It must be independently evaluated to see if it is appropriate for use in updating Minnesota's CO₂ value. It cannot be accepted merely because it comes from the Federal government and was created using models discussed in the academic literature. Minnesota's standards must be applied to the assumptions underlying any of the modelling presented to the Commission, including that done by the Federal Government and Dr. Smith. As Dr. Smith's work shows, the assumptions drive the results. The Commission should consider which assumptions are appropriate given Minnesota's statutory requirements, principles of economics and cost-benefit analysis, and the context in which the values will be used.

Once the Commission applies the appropriate standards, it should determine the following economic framing assumptions are warranted:

- Discount rates of 3% and 5% as used in the prior proceeding and consistent with evidence of how people actually discount between current and future benefits.
- Modelling horizons of 2100 and 2140, because including damages from past 2140 requires too much speculation regarding future social and economic conditions and relies heavily on the portions of the damage functions for which there is no empirical basis. The 2100 horizon is also consistent with what was used in the last proceeding.
- Marginal ton values that are the first ton or the average of the first and last ton because such measures avoid the unrealistic and unwarranted assumption that emissions in Minnesota are more harmful than emissions anywhere else. Also, the average of the first and last ton is closer to the optimal marginal value than other measures and is the measure closest to the average ton approach used in the last proceeding.
- Domestic U.S. damages rather than global damages because it is contrary to common principles of cost-benefit analysis and against Minnesota's interests to take on the burden of global damages unless there is reciprocity. If global damages are used, Minnesota risks imposing significant costs on its citizens without providing any real benefit to its residents or those of the rest of the world.

Using those assumptions, Dr. Smith has recommended a range of \$1.62 to \$5.14 per net metric ton. Should the Commission wish to substitute alternate framing assumptions, Dr. Smith has set forth the methodology to do so. GRE/MP/OTP urge the Commission to adopt Dr.

Smith's values or use the tools she has provided to establish an acceptable range of environmental cost values for CO₂ emissions. Once environmental cost values are established, the Commission's use of those values should be made in recognition of any corresponding leakage that may result from application of the CO₂ values.

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