BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

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David C. Boyd	Commissioner
Nancy Lange	Commissioner
Dan Lipschultz	Commissioner
Betsy Wergin	Commissioner

In the Matter of Establishing a Distributed Solar Value Methodology under Minn. Stat. § 216B.164, subd. 10 (e) and (f)

ISSUE DATE: April 1, 2014

DOCKET NO. E-999/M-14-65

ORDER APPROVING DISTRIBUTED SOLAR VALUE METHODOLOGY

INTRODUCTION

In 2013, the Legislature amended Minn. Stat. § 216B.164, a statute governing how Minnesota electric utilities treat electricity cogeneration and small power production—common types of distributed generation facilities.[1] The amended statute requires the Minnesota Department of Commerce (the Department) to establish a methodology for valuing distributed solar photovoltaic (solar PV) electricity generation, and to submit the methodology to the Commission for approval.[2]

In this order, the Commission approves a method of valuing distributed solar PV electricity generation—a way to calculate the "Value of Solar." A correctly calculated Value of Solar should compensate solar PV customers in a way that does not advantage or disadvantage them relative to other customers or other forms of generation.

Utilities will have the opportunity to file tariffs based on the Value of Solar methodology. Utilities implementing a Value of Solar tariff would do so in lieu of the existing compensation method, commonly known as "net metering." The Department intends for the methodology to avoid cross-subsidies and disincentives for conservation inherent in net metering.

The methodology values distributed solar PV by considering each utility's solar PV fleet in the aggregate; determining the fleet's value to the utility, customers, and society; and establishing a

[1] In addition to state policy, Minn. Stat. § 216B.164 and Minn. Rules Ch. 7835 implement the federal Public Utility Regulatory Policies Act (PURPA) and related federal regulations, which define cogeneration and small power production facilities. Cogeneration facilities produce electric energy as well as useful thermal energy such as heat or steam. 16 U.S.C. § 796(18)(A); 18 CFR § 292.202. Small power production facilities are facilities under 80 megawatts that use as a primary energy source "biomass, waste, renewable resources, or any combination thereof." 16 U.S.C. § 796(17)(A).

[2] Minn. Stat. § 216B.164, subd. 10(e).

bill credit for solar PV customers based on that value. A Value of Solar tariff, if approved, would apply to future solar PV interconnections.

The Commission will first discuss the statutory and procedural background of this proceeding. Then, it will provide a summary of the proposed Value of Solar Methodology. Finally, it will approve the methodology, as modified with the consent of the Department, and address concerns raised about the methodology in comments to the Commission.

PROCEDURAL HISTORY

I. The Statutory Requirement to Develop a Distributed Solar Value Methodology

The 2013 amendments to Minn. Stat. § 216B.164 require the Minnesota Department of Commerce (the Department) to establish a methodology for valuing distributed solar PV electricity generation, and submit the methodology to the Commission for approval.[3] The Commission must within 60 days approve, modify with the Department's consent, or disapprove the methodology.

Under the statute, Minnesota utilities will be able to use the approved methodology in applications for a tariff "that compensates customers through a bill credit mechanism for the value to the utility, its customers, and society for operating distributed solar photovoltaic resources interconnected to the utility system and operated by customers primarily for meeting their own energy needs."[4]

The Department undertook to develop a "Value of Solar" methodology, and on January 31, 2014, submitted its recommended methodology to the Commission.

II. Minnesota Department of Commerce Public Engagement

Before making its recommendation to the Commission, the Department engaged with stakeholders interested in the Value of Solar Methodology.[5] The Department conducted a series of public workshops and received written comments and other input from public participants. The following is a summary of the Department's public engagement process.[6]

On August 9, 2013, the Department issued a memorandum to solar, distributed generation, and net metering stakeholders outlining a draft schedule for engagement as the Department developed the Value of Solar Methodology.

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[3] Minn. Stat. § 216B.164, subd. 10(e).

[4] Minn. Stat. § 216B.164, subd. 10(a).

[5] As required by Minn. Stat. § 216B.164, subd. 10(e).

[6] A more detailed account of the background informing the Department's proposal and the Department's stakeholder engagement process can be found in its comments dated January 31, 2014, and, as of the date of this order, stakeholder comments are available at https://mn.gov/commerce/energy/topics/resources/energy-legislation-initiatives/value-of-solar-tariff-methodology%20.jsp.

The Department conducted workshops on September 17, October 1, October 15, and November 19, 2013. According to the Department, each workshop was attended by between 100 and 150 participants. At the workshops, the Department provided an overview of solar photovoltaic cost/benefit studies, engaged in question and answer sessions, offered proposals for methodology development, and identified issues that needed additional attention.

At the November 19 workshop, the Department presented a draft methodology for comment. The Department took written comments following the September 17, October 1, and November 19 workshops. Over the course of its engagement efforts, the Department received comments from the following entities and individuals:

- Abengoa Solar
- The Alliance for Solar Choice
- Dave Baker
- Center for Energy and Environment
- CR Planning
- Environmental Law and Policy Center
- Fresh Energy
- Geronimo Energy
- Harvest Energy Solutions
- Institute for Energy Research and Environmental Research
- Institute for Local Self Reliance
- Interstate Renewable Energy Council
- Izaak Walton League of America – Midwest Office
- Kandiyo Consulting, LLC
- Greg Midghall
- Minnesota Chamber of Commerce
- Minnesota Community Solar LLC
- Minnesota Power
- Minnesota Renewable Energy Society
- Midwest Renewable Energy Tracking System
- Minnesota Rural Electric Association
- Minnesota Solar Energy Industries Association
- Mouli Engineering
- Novel Energy Solutions
- Otter Tail Power Company
- Powerfully Green
- Stuart Rauvola
- Renewable Energy Services
- Brendon Slotterback
- Solar Rate Reform Group
- Southern Minnesota Municipal Power Agency
- Charlie Stark
- SunEdison
- Sundial Solar
- Ethan Torrey
- Union of Concerned Scientists
- Vote Solar Initiative
- WindLogics
- Xcel Energy

III. Proceedings Before the Commission

On January 31, 2014, the Department submitted its recommended Value of Solar Methodology to the Commission for approval, along with explanatory comments. Also on the 31st, the Commission issued a Notice of Expedited Comment Period, seeking comments on whether the recommended methodology is consistent with Minn. Stat. § 216B.164, subd. 10(e) and (f), and whether it is reasonable.

The Commission received initial comments from Minnesota Power, Xcel Energy, the Alliance for Solar Choice, Otter Tail Power Company, the Environmental Law and Policy Center, Fresh Energy, the Interstate Renewable Energy Council, the Institute for Local Self-Reliance, the Izaak Walton League of America, SunEdison, the Vote Solar Initiative, the Minnesota Rural Electric Association, the Minnesota Solar Energy Industries Association, the Union of Concerned Scientists, and several individuals.

The Commission received reply comments from the Minnesota Renewable Energy Society, the Solar Energy Industries Association, Xcel Energy, the Environmental Law and Policy Center, Fresh Energy, the Interstate Renewable Energy Council, the Institute for Local Self-Reliance, the Izaak Walton League of America, SunEdison, the Vote Solar Initiative, Minnesota Power, the Alliance for Solar Choice, Otter Tail Power Company, the Cooperative Network, and the Center for Resource Solutions.

The Department also submitted reply and supplemental comments. In these comments, the Department addressed a wide range of concerns and questions expressed in comments about the proposed Value of Solar Methodology, including the following issues:

- the assumed 25-year lifespan for solar PV installations;
- the method of calculating and attributing to solar PV avoided costs related to: generation, transmission, and distribution capacity; fuel; line loss; and environmental harm;
- the source of the most appropriate value of avoided CO_2 emissions;
- the financial calculations discounting future solar costs and benefits to present value; and
- the treatment of solar renewable energy credits.

The Department responded to many issues raised in the comments by clarifying or providing additional explanation. It also recommended some technical changes to its recommendation related to the calculation of avoided fuel costs and avoided distribution capacity costs.

On March 4, 2014, the Department gave a public presentation to the Commission describing its approach to developing the methodology and describing the methodology itself.

On March 11, 2014, the Department submitted supplemental comments in support of its recommendation to use Social Cost of Carbon values developed by federal agencies in the methodology's calculation of avoided environmental costs.

On March 12, 2014, the Commission met to consider the Department's proposed Value of Solar Methodology. At the Commission meeting, the Commission received oral comments from several organizations that had provided written comments and from interested members of the public.

FINDINGS AND CONCLUSIONS

I. Summary of Commission Action

In this order, the Commission will review the Department's proposed Value of Solar Methodology as described in its January 31, 2014, initial filings, and as revised by its February 20, 2014, reply comments.

The Commission will approve, with three modifications, the Department's proposed methodology, because the modified methodology satisfies the requirements of Minn. Stat. § 216B.164, subd. 10(e) and (f), and because the Department has reasonably supported the methodology.

Finally, the Commission will require utilities filing a tariff under Minn. Stat. § 216B.164, subd. 10, to apply the methodology as filed and modified, and to work with the Department to clarify questions they may have about the required spreadsheets and tables.

II. The Statutory Requirements

Minn. Stat. § 216B.164, subd. 10, requires the Department to develop and submit a Value of Solar Methodology, and requires the Commission to review the methodology within 60 days of submission. It states:

> (e) The department must establish the distributed solar value methodology . . . no later than January 31, 2014. The department must submit the methodology to the commission for approval. The commission must approve, modify with the consent of the department, or disapprove the methodology within 60 days of its submission. When developing the distributed solar value methodology, the department shall consult stakeholders with experience and expertise in power systems, solar energy, and electric utility ratemaking regarding the proposed methodology, underlying assumptions, and preliminary data.
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> (f) The distributed solar value methodology established by the department must, at a minimum, account for the value of energy and its delivery, generation capacity, transmission capacity, transmission and distribution line losses, and environmental value. The department may, based on known and measurable evidence of the cost or benefit of solar operation to the utility, incorporate other values into the methodology, including credit for locally manufactured or assembled energy systems, systems installed at high-value locations on the distribution grid, or other factors.

A. Approval Framework

Unlike most Commission proceedings arising under its jurisdiction, in this case the Commission may not substitute its judgment for that of the Department. The Commission may only approve the Department's proposal, modify it with the Department's consent, or reject it. The Commission construes the unique statutory limits on the Commission's review—the limited time for review and the limited power to modify—to reflect the Legislature's intent that the Department's recommendations be accorded a degree of deference.

Accordingly, the Commission reviews the Department's proposed Value of Solar Methodology to answer the following questions: did the Department satisfy its statutory obligations under Minn. Stat. § 216B.164, subd. 10(e) and (f)? And, did the Department reasonably justify the proposed methodology—with regard to the public interest and in light of specific objections raised before the Commission?

B. The Department's Mandate to Develop a Methodology

The Legislature's direction to the Department to develop a methodology was not open-ended. The statute sets minimum requirements for the methodology, and provides limited discretion to exceed them.

The statute requires that Value of Solar tariffs compensate customers for "value to the utility, its customers, and society" for solar PV facilities. It directs the Department to develop a methodology that considers, at a minimum, "the value of energy and its delivery, generation capacity, transmission capacity, transmission and distribution line losses, and environmental value." The statute further allows that the methodology may accommodate other values only if they are "based on known and measurable evidence . . . ."

While reviewing the Department's proposed methodology, the Commission keeps these statutory constraints in mind.

III. Overview of Proposed Methodology

The Department proposes a methodology to calculate the value of distributed Solar PV installations, expressed as a dollars-per-kilowatt-hour ($/kWh) figure,[7] for utilities to apply in Value of Solar tariffs filed under Minn. Stat. § 216B.164, subd. 10. The methodology comprises several formulas, a set of assumptions that would apply to all utilities, and two tables of supporting information that utilities must include in a Value of Solar tariff filing.

The tables are intended to make calculation of a utility's Value of Solar Figure transparent for regulators and the public. Because the Department developed the tables to facilitate understanding of the methodology's application, the Commission will first describe the methodology's required data and data tables, and then describe the proposed Value of Solar formula and its components.

A. Assumptions Common to All Utilities

The Department recommends that some values be applied consistently to all utilities filing a Value of Solar tariff. Some values the Department expects to update "in future years as necessary." Assumptions include 25 years of forecasted natural gas fuel prices, the value of avoided environmental costs attributable to solar PV generation, and the assumed lifespan of a solar PV installation. The Department's proposal describes the basis and sources of its assumptions and proposed (initial) values.

The Department's proposed initial values can be found on pages 9 and 10 in the Department's *Minnesota Value of Solar: Methodology*, which is attached to this order as Appendix A.

B. Value of Solar Data Table for Utility-Specific Data

Under the Department's proposal, certain input values for the Value of Solar calculation will be unique for each utility. The methodology's Value of Solar Data Table is a specified format for disclosing economic assumptions and technical calculation results used in the Value of Solar methodology. An example of the Data Table can be found on page 12 of Appendix A.

According to the Department, the Value of Solar Data Table filing requirement is intended to enhance the transparency of Value of Solar tariff filings under the statute.

[7] The result of the Value of Solar Methodology calculation, a figure expressed in $/kWh, has been commonly referred to as a "Value of Solar rate." However, use and meaning of the term "rate" varies in relevant state and federal laws. This order uses "Value of Solar Figure" or "Value of Solar bill credit amount" to describe the result of the Value of Solar Methodology calculation, instead of "Value of Solar rate," to reduce confusion arising from the use of the term "rate."

C. Value of Solar Calculation Table

The proposed methodology also describes a Calculation Table utilities must submit as part of a Value of Solar tariff filing. The Calculation Table is intended, like the Data Table, to promote transparency in the calculation of a utility's Value of Solar Figure.

A utility filing a Value of Solar tariff would file a Calculation Table filled out with the relevant values—based on values depicted in its Data Table—as a way of showing its work in the course of calculating a final Value of Solar Figure. The Calculation Table depicts the component values of the proposed formula and the resulting computed Value of Solar Figure. An example of the Calculation Table can be seen in Figure 1. The formula and the formula components are described in greater detail below.

25 Year Levelized Value	Economic Value ($/kWh)	X	Load Match (No Losses) (%)	X (1+	Distributed Loss Savings (%)	) =	Distributed PV Value ($/kWh)
Avoided Fuel Cost	E1				DLS-Energy		V1
Avoided Plant O&M - Fixed	E2		ELCC		DLS-ELCC		V2
Avoided Plant O&M - Variable	E3				DLS-Energy		V3
Avoided Gen Capacity	E4		ELCC		DLS-ELCC		V4
Avoided Reserve Capacity Cost	E5		ELCC		DLS-ELCC		V5
Avoided Transmission Capacity Cost	E6		ELCC		DLS-ELCC		V6
Avoided Dist. Capacity Cost	E7		PLR		DLS-PLR		V7
Avoided Environmental Cost	E8				DLS-Energy		V8
Avoided Voltage Control Cost							
Solar Integration Cost							
							Levelized Value of Solar

Figure 1

D. Proposed Value of Solar Formula

To calculate a utility's Value of Solar Figure, a set of avoided cost "components" are each multiplied by a "load match factor," if one is appropriate, and a "loss savings factor." Adding the results of these separate component calculations produces the utility's Value of Solar Figure. Expressed as an equation, the formula looks like this:

$$\sum Avoided\ Cost_{component} \times Load\ Match\ Factor_{component} \times (1 + Loss\ Savings\ Factor_{component}) = Value\ of\ Solar$$

Because the Value of Solar Figure incorporates the Department's assumption of a 25-year lifespan, the Department proposes that the Value of Solar Figure be converted into an equivalent amount that tracks inflation. Tracking inflation results in a Value of Solar bill credit amount that would vary annually in nominal $/kWh but would remain constant in real $/kWh.

1. Avoided Cost Components

As illustrated in Figure 1, the proposed Value of Solar formula comprises eight component values:

- Avoided Fuel Cost
- Avoided Plant Operation and Maintenance – Fixed
- Avoided Plant Operation and Maintenance – Variable
- Avoided Generation Capacity Cost

- Avoided Reserve Capacity Cost
- Avoided Transmission Capacity Cost
- Avoided Distribution Capacity Cost
- Avoided Environmental Cost

Taken together, the Department asserts that these components account for the statutorily-required value streams (benefit net of cost) accruing to utilities, utility customers, and society from distributed solar PV electricity generation.

The Department has also proposed two "placeholder" components: Avoided Voltage Control Cost and Solar Integration Cost. The Department recommended placeholder components for costs and benefits that, in its view, are not presently known and measurable, but are likely to be known and measurable in the foreseeable future.

2. Factors Affecting Avoided Cost Components: Load Matching and Loss Savings

Solar PV installations that qualify for a Value of Solar tariff will be interconnected to the utility's system. Generation facilities connected to a utility's system contribute to the system's total capacity to handle electrical demand. However, by its nature, solar PV contributes most to system capacity during certain times of day and in the summer months.

The Department's proposed formula captures the time-dependent aspect of avoided capacity costs; it applies a factor representing the *effective* capacity-related contributions from solar PV. The methodology calls for load-matching factors to be applied to the following components: Avoided Plant Operation and Maintenance – Fixed, Avoided Generation Capacity Cost, Avoided Reserve Capacity Cost, Avoided Transmission Capacity Cost, and Avoided Distribution Capacity Cost.

Distributed generation also provides a benefit to utility systems by reducing energy loss. Transmitting electricity from a remote generation source involves the loss of a measurable quantity of energy through, e.g., the electrical resistance of power lines and transformers. Locating generation directly adjacent to the load it serves avoids incurring those losses.

The Department's methodology calls for a Loss Savings factor to be applied to each formula component to capture this benefit. Different Loss Savings Factors apply depending on whether a component relates to capacity, energy, or peak-load related costs.

IV. Commission Action

For the reasons set forth below, the Commission will approve the Department's proposed methodology, as modified with the Department's consent. The Commission concludes that the modified methodology satisfies the requirements of Minn. Stat. § 216B.164, subd. 10(e) and (f), and that the Department has reasonably supported the methodology it has proposed.

A. The Department's Proposal Meets the Requirements of Minn. Stat. § 216B.164, subd. 10(e) and (f)

The statute required the Department to engage in a process to develop a methodology and required that the methodology, at a minimum, account for certain value streams attributable to distributed solar PV. The Commission concludes that both the engagement process and the proposed

methodology presented by the Department meet the standards established in Minn. Stat. § 216B.164, subd. 10(e) and (f).

1. The Department's Stakeholder Engagement Process Satisfies the Consultation Requirement of Subdivision 10(e)

The statute required that the Department "consult stakeholders with experience and expertise in power systems, solar energy, and electric utility ratemaking regarding the proposed methodology, underlying assumptions, and preliminary data."

The Department contracted with Clean Power Research to help develop the methodology. Clean Power Research has experience analyzing and developing solar PV valuation methodologies for other public agencies, and for utilities. The Department also implemented a public engagement process involving four public workshops and solicitation of written comments over a period of months. Dozens of individuals and entities participated in the Department's process, including utilities, solar power installers, renewable energy advocates, and other organizations with relevant experience and expertise.

The Department did not adopt every suggestion or recommendation made by participants. However, the Department did modify its proposal in response to some recommendations, and adequately justified its reasons for not doing so in response to others.[8] The Commission received no complaints about the process and several participants in the process commended the Department for its open, transparent approach. The Commission concludes that the Department's extensive engagement efforts fulfilled its obligation to consult.

2. The Department's Proposed Methodology Conforms to the Scope and Content Requirements of Subdivision 10(f)

Subdivision 10(f) established minimum requirements for the Value of Solar Methodology, and stated a standard for determining what other values, if any, could be incorporated. It directed the Department, to "at a minimum, account for the value of energy and its delivery, generation capacity, transmission capacity, transmission and distribution line losses, and environmental value." It limited additional values to those that could be established "based on known and measurable evidence of the cost or benefit of solar operation to the utility."

The Department's proposed methodology identifies eight relevant components of value:

- Avoided Fuel Cost
- Avoided Plant Operation and Maintenance – Fixed
- Avoided Plant Operation and Maintenance – Variable
- Avoided Generation Capacity Cost
- Avoided Reserve Capacity Cost
- Avoided Transmission Capacity Cost
- Avoided Distribution Capacity Cost
- Avoided Environmental Cost

[8] See section IV.B., below.

Each of these components addresses value streams required by the statute. Together, they account for the value of energy and its delivery, generation capacity, transmission capacity, transmission and distribution line losses, and environmental value attributable to solar PV. Therefore, the Department's proposal satisfies the statute's minimum requirements.

The Department also proposed two placeholder components: Avoided Voltage Control Cost and Solar Integration Cost. These components are not part of the Value of Solar calculation at this time, but the Department anticipates that these categories of costs and benefits will be known and measurable in the future. Because these components will not affect the Value of Solar calculation until evidence establishes them as measurable, this is consistent with the statute's standard.

Some commenters advocated additional value components for inclusion. Examples include a component corresponding to the "compliance" value of Solar Renewable Energy Credits, and a component representing the value of increased economic development. To the extent that these values are not already incorporated in the methodology, the Commission is persuaded that they are not known and measurable at this time. The Commission agrees with the Department's decision to exclude additional value components that are not based on known and measurable evidence.

The Department anticipates that the Value of Solar Methodology will be subject to modification in future years as more data and analysis becomes available about distributed solar and its costs and benefits. When additional value components can be established consistent with the statutory standard, their inclusion may be appropriate.[9]

B. As Modified with the Department's Consent, the Proposed Methodology is Reasonable

In this section, the Commission will discuss several specific objections to the methodology and proposed alternatives raised in comments to the Commission. To a large degree the Commission agrees with the Department's reasoning in support of the proposal. Except where it is inconsistent with this order, the Commission adopts the Department's supporting rationale, as expressed in its comments, reply comments, and supplemental comments.

Having reviewed the proposed methodology and the comments, reply comments, and supplemental comments, the Commission concludes that, with some modifications, the Department's modified proposed methodology is reasonable and consistent with the public interest.

A number of comments raised issues that are more appropriately addressed in response to a specific tariff filing under the statute. Because these tariff-related issues are not yet ripe, the Commission does not address them here. And, the Commission only decides here whether the methodology recommended by the Department reasonably fulfills the statutory mandate for a Value of Solar methodology. Approval of the Department's methodology, and its components, is limited to this factual and procedural context.

[9] The Department stated at the Commission meeting that changes to the methodology would be presented to the Commission for approval.

The Commission recognizes the tradeoffs inherent in developing the Value of Solar methodology. Precision and transparency are both important goals. Precision through analytical rigor is important to ensure the methodology is sound and produces a reasonable result. Transparency through simplicity is important to aid public understanding and regulatory oversight of the methodology's application. The Department asserts that it kept these goals in mind.

When the goals of precision and transparency are not aligned, it is important to strike a reasonable balance while adhering to the methodology's statutory requirements. Many criticisms of the Department's proposal were paired with recommendations to shift this balance. As explained below, the Commission determines that the modified methodology appropriately balances precision and transparency.

1. Assumptions Common to All Utilities

Several comments criticized aspects of the assumptions that would apply to all utilities. Assumptions challenged include:

- the solar PV lifespan,
- avoided CO_2 environmental cost values,
- avoided non-CO_2 environmental cost values,
- avoided fuel cost values, and
- the marginal generation unit.

The Solar PV Lifespan: The methodology assumes a 25-year life span for solar PV installations. The Department states that this is an appropriate length of time, because it is consistent with the expected service life of a solar PV panel. Minnesota Power objected to the assumption, arguing that the typical life of a solar power purchase agreement is 20 years, and 20 years is the minimum contract term allowed for by the statute.

The Commission agrees with the Department that the methodology's assumed lifespan should correspond to the expected useful life of the solar PV equipment. The Department's recommended 25-year period is justified because it corresponds to the equipment's expected useful life. If the methodology were instead designed around a 20-year contract term, the five year difference between the contract term and the average useful life would not be accounted for. Because the statute specifies a minimum, and not a maximum, the 25-year period is consistent with the statute.

Avoided CO_2 Environmental Cost Values: The methodology relies on established environmental costs to calculate the value of environmental harm avoided by solar PV. Utilities and others objected to the methodology's use of federal Environmental Protection Agency-established values for the cost of harms caused by CO_2. Those objecting recommended alternative values, such as the Commission's externality cost values established under Minn. Stat. § 216B.2422, subd. 3,[10] or its regulatory planning values established under Minn. Stat. § 216H.06.[11]

[10] See Docket Nos. E-999/CI-93-583 and E-999/CI-00-1636.

[11] See Docket Nos. E-999/CI-07-1199 and E-999/CI-13-796.

The Department did not support adopting an alternative. It stated that the externality cost values are not an analytically suitable substitute, and that the regulatory planning values do not represent the values called for by the statute. The Department recommended approval of the methodology using the EPA's "Social Cost of Carbon" values. In support of its recommendation, the Department filed supplemental comments with extensive supporting appendices.[12]

The Department stated in its supplemental comments, and again at the Commission meeting, that the marginal nature of the Social Cost of Carbon values was "the key reason" to recommend them over other suggested values. Marginal values pertain to the incremental cost of an additional unit of emissions. The Department described the difference between values articulating marginal costs and values articulating average costs to be like "apples and oranges." The Department also supported its choice by arguing that the chosen values are more up-to-date.

The methodology computes avoided environmental cost using the avoided *marginal* costs of CO_2. The Commission concludes that it is not analytically appropriate to replace the Department's chosen marginal values with the Commission's § 216B.2422, subd. 3, environmental cost values, which are a range of values (often simplified by referring to their midpoint) representing an *average* cost per ton.

It would also not be appropriate to replace the chosen values with planning values established under Minn. Stat. § 216H.06. The planning values–also a range–are similarly not analytically a proper substitute for values that represent the marginal costs of CO_2. The Commission establishes values under Minn. Stat. § 216H.06, which requires "an estimate of the likely range of costs of future carbon dioxide regulation on electricity generation." Whether the values presently established for this statutory purpose account for marginal "value to the utility, its customers, and society" of avoided CO_2 emissions better than the Department's recommended values has not been established in this record.

The Commission would ordinarily prefer values that underwent a local vetting process. Because federal marginal avoided CO2 environmental cost values are available, the Department-selected values most closely and reasonably capture the statutorily required "value to the utility, its customers, and society" of avoided CO_2 emissions, while appropriately satisfying the proposed methodology's analytical reliance on values that pertain to marginal costs. The Commission concludes that the Social Cost of Carbon values are suitable for use in the Value of Solar Methodology, and that neither of the proposed alternatives are adequate drop-in substitutes for the Department's chosen values.

The Commission is currently re-evaluating its environmental externality costs.[13] The Commission only decides here the narrow question of whether the values recommended by the Department reasonably fulfill the statutory mandate for a Value of Solar methodology. Approval of the

[12] Supplemental Comments of the Minnesota Department of Commerce, Division of Energy Resources (March 11, 2014). These comments were filed by the Department outside the comment filing period. They are relied upon by the Commission to the extent that they restate the Department's rationale and can be found elsewhere in the record.

[13] *In the Matter of the Investigation into Environmental and Socioeconomic Costs Under Minn. Stat. § 216B.2422, Subd. 3*, Order Reopening Investigation and Convening Stakeholder Group to Provide Recommendations for Contested Case Proceeding, Docket No. E-999/00-1636 (February 10, 2014).

Department's methodology and the values it contains does not prejudge the outcome of that investigation, or any other pending or future Commission proceeding.

Avoided non-CO_2 Environmental Cost Values: The methodology relies on established values for non-CO_2 environmental costs as well. As initially proposed, the methodology relied on the midpoint of Commission-established values for urban areas. In response to an objection by the Minnesota Rural Electric Association, the Department stated that it "is agreeable to allowing utilities to select the set of non-CO_2 [avoided cost] values most appropriate to their service territory."

The Commission agrees that, because they are available, utilities should apply non-CO_2 avoided cost values most appropriate to their service territory. The Department has consented to this modification. The Commission will modify the methodology accordingly.

The Avoided Fuel Cost Values: The methodology accounts for avoided fuel costs. It offers three ways a Value of Solar tariff could calculate avoided fuel costs, one of them based on projected natural gas prices. As initially proposed, this projection relied on New York Mercantile Exchange (NYMEX) natural gas futures prices for the first twelve years, and used that data to project prices for years 13 through 25 using a "line of best fit." In response to comments, the Department recommended that the methodology be revised as follows:

> Fuel price escalation factor: 30-day averages are used for the NYMEX Natural Gas Futures contract prices for years 1 through 12; For years beyond year 12, the general escalation rate is used as the guaranteed fuel price escalation.

The Department asserts that the modification makes projected fuel price values less subject to volatility in near-term natural gas prices, and then assumes, in the years beyond which there is useful future-price data, that the cost of natural gas will increase at the methodology's generally-applicable escalation rate.

Some commenters preferred substitute, utility-specific, or more complex fuel cost projections. However, substituting utility-specific forecasts or formulas based in part on proprietary data or more complex calculations would reduce the transparency and accessibility of Value of Solar tariffs. The Commission concludes that the possible corresponding (small) increase in precision over the Department's modified proposal would not justify the reduction in transparency.

In addition, the methodology provides two alternative methods to ascertain avoided fuel costs. The Commission agrees with the Department that the three fuel cost component options appropriately capture the relevant avoided costs, including the avoided cost to utilities and customers of fuel price volatility.

The Marginal Generation Unit: To determine avoided generation capacity costs, an appropriate next-best-alternative generator type must be identified. The methodology calculates avoided generation costs by assuming that the avoided generation facilities are a weighted blend of combustion turbine and combined cycle gas turbine generation facilities. Some comments indicated that this assumption does not correspond to a utility's "next" planned generation facility in type or in timing.

The Commission agrees with the Department that the assumed marginal generation unit is appropriate. Because the statute requires Value of Solar tariffs to contemplate contracts of 20 years or more, it is appropriate for the methodology to anticipate the likely mix of avoided generation costs over the relevant period, including purchased power, and not just a utility's "next" anticipated facility at the time a tariff is filed.

Forecasting generation that far in the future necessarily involves some degree of uncertainty. The Department's chosen blend of generation units is a reasonable estimate of likely future generation resources suitable for all utilities over the relevant period. Using the same assumption for all utilities also serves the goal of reducing unwarranted complexity in the calculation.

2. Avoided Cost Components

As discussed in section IV.A.2., above, the proposed value components are consistent with the methodology standards established in Minn. Stat. § 216B.164, subd. 10(f). Each component represents a category of costs—to the utility, its customers, or society—that grid-connected solar PV installations can avoid. The selected components represent "value of energy and its delivery, generation capacity, transmission capacity, transmission and distribution line losses, and environmental value" as required by the statute.

Each component value is calculated using formulas set forth in the methodology.[14] Some comments raised objections to aspects of the methodology's component calculations. With respect to these objections, the Commission agrees with and adopts the Department's reasoning in support of the methodology as proposed.

In response to the comments concerning the avoided distribution capacity cost component, the Department has recommended the following modification:

> Avoided Distribution Capacity Cost: Set the distribution peak load growth rate based on the utility's estimated future growth over the next 15 years. If the result is zero or negative (before adding solar PV), set the avoided distribution capacity cost to zero.

The proposed methodology allows for avoided distribution capacity costs to be calculated on a system-wide basis, or on a location-specific basis. Allowing location-specific distribution cost calculation permits the methodology to reflect the value of "systems installed at high-value locations on the distribution grid," which is one of the statute's permitted value considerations.

But the initially-recommended distribution-capacity-cost calculation used historical peak-load growth data. In response to objections, the Department now recommends that the calculation be based on projected peak-load growth rates, and recommends how to handle the component when the projected peak-load growth (before adding solar PV) is zero or below.

Including the Department's recommended modification, the Department has reasonably defended the component calculation choices made in the proposed methodology. The Commission concludes that the methodology's calculations of these values best balances the goals of precision and transparency.

[14] See Appendix A at pages 21 – 40.

3. Filing Requirements

Concerns identified in comments to the Commission pertained mostly to the underlying assumptions, calculations, and data embedded in the methodology, and not to its procedural aspects. Specifically, the Department recommends that utilities filing a Value of Solar tariff be required to file two tables in specified formats—the Data Table and the Calculation Table—in order to promote transparency in the application of the methodology.

The Commission agrees that these filing requirements are warranted. The required filings promote understanding and oversight of the application of the Value of Solar Methodology. Organizing relevant utility-specific values in a consistently formatted Data Table will facilitate review and analysis of tariff filings. The Calculation Table provides similar transparency for computing the Value of Solar formula.

The Commission will require utilities filing a tariff under Minn. Stat. § 216B.164, subd. 10, to comply with the filing requirements described in the methodology, and that they work with the Department to resolve any questions they have about generating and using the required data tables.

C. Conclusion

The Commission appreciates the efforts of the Department and the many stakeholder-participants in the development of this methodology. The expertise and experience of those who provided input are reflected in the record's detailed and thorough consideration of the value that solar PV can provide to utilities, to ratepayers, and to society.

Economic analysis as complex as the approved methodology inevitably involves choices between several reasonable alternatives. On balance, the Commission concludes that the Department's proposal satisfies the statutory mandate with analytical rigor and clarity. For this reason, and the reasons articulated above, the Commission will approve the proposed methodology with the modifications that have received the Department's consent.

ORDER

1. The Commission hereby approves the methodology described in the January 31, 2014 *Minnesota Value of Solar: Methodology* with the following modifications:

    a. Fuel price escalation factor: 30-day averages are used for the NYMEX Natural Gas Futures contract prices for years 1 through 12; For years beyond year 12, the general escalation rate is used as the guaranteed fuel price escalation.

    b. Avoided distribution capacity cost: Set the distribution peak load growth rate based on the utility's estimated future growth over the next 15 years. If the result is zero or negative (before adding solar PV), set the avoided distribution capacity cost to zero.

    c. Utilities may select the set of Commission-established non-CO_2 avoided environmental cost values most appropriate to their service territory.

2. Utilities filing a tariff under Minn. Stat. § 216B.164, subd. 10, shall apply the methodology as revised, and shall work with the Department to clarify questions regarding generating and using the required spreadsheets and data tables.

3. This order shall become effective immediately.

BY ORDER OF THE COMMISSION

Burl W. Haar
Executive Secretary

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