BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application for the Certificate of Public Convenience and Necessity of Northern Prairie Solar, LLC, to Construct a Solar Electric Generation Facility in the Town of Cylon, St. Croix County, Wisconsin	Docket No. 9815-CE-100

DIRECT TESTIMONY OF MICHAEL J. VICKERMAN

ON BEHALF OF RENEW WISCONSIN

Q. Please state your name and business address

A. My name is Michael J. Vickerman, and my business address is 214 N. Hamilton St. Madison, WI 53703.

Q. By whom are you employed, and in what capacity?

A. I am Policy Director for RENEW Wisconsin (RENEW).

Q. On whose behalf are you testifying?

A. I am testifying on behalf of RENEW.

Q. Please describe your educational background.

A. I have a Bachelors of Arts degree in History and Art History from the University of Wisconsin-Madison.

Q. **Please describe your work experience.**

A. I began working for RENEW Wisconsin in October 1991 as its Advance Plan 6 intervention manager. I became RENEW's Executive Director in 1994, and served in that capacity until 2012. Since then, I have been RENEW's Policy

Director. My work with RENEW today focuses on renewable energy policy development at the regulatory, legislative, and municipal level. My professional qualifications are further summarized in Ex.-RENEW-Vickerman-1.

Q. Please describe RENEW.

A. RENEW is a domestic, nonprofit corporation headquartered in Madison that works to advance the renewable energy goals adopted by the State of Wisconsin over the years. Since its founding in 1991, RENEW has worked to increase access to and development of renewable energy sources in Wisconsin to power homes, businesses, and vehicles. To that end, RENEW formulates and advocates for policies and programs to expand the use of solar power, wind power, renewable natural gas, local hydropower, ground-source and air-source heat pumps, energy storage, and electric vehicles.

Q. How does RENEW advance solar power as a general policy matter?

A. In recent years, solar generation has emerged from the margins of the electric power landscape to become a reliable and cost-effective energy resource for a wide variety of applications and circumstances. Solar power's emergence owes much to its remarkable scalability, unmatched by any other generation source today. Many RENEW members are active in solar electric development. They include contractors and consultants specializing in behind-the-meter installations for retail customers, solar arrays directly feeding utility distribution systems, and large-scale solar power plants supplying multiple electric providers. To a degree unmatched by any other state-based organization, RENEW works to increase the accessibility of solar energy, in all sizes and configurations, to all citizens of the

state. In furtherance of that aim, RENEW became the Wisconsin state chapter of the Solar Energy Industries Association in 2020.

Q. What is the purpose of your testimony in this proceeding?

A. The principal purpose of my direct testimony is to discuss the importance of the Northern Prairie Solar project (Northern Prairie Solar), as a utility-scale source of zero-carbon renewable electricity, to the ongoing transition to replace older fossil generation sources with in-state renewable generation. I will also provide an estimate of the project's likely impact on carbon dioxide emissions attributable to Wisconsin's electric power sector.

Q. Have you prepared any exhibits with your direct testimony?

A. Yes. In addition to Ex.-RENEW-Vickerman-1 referenced above, I am sponsoring the following exhibits:

- Ex.-RENEW-Vickerman-2, RENEW's Solar Project Tracker dated November 2022;
- Ex.-RENEW-Vickerman-3, excerpts from the Commission's 2021 Renewable Portfolio Standard Report issued in July 2022; and
- Ex.-RENEW-Vickerman-4, a 2020 profile of Wisconsin's electricity sector published by the U.S. Energy Information Administration (EIA); and

Q. Please describe the advances that utility-scale solar power has achieved in recent years as a base generation source in Wisconsin.

As a component of our public education efforts, RENEW tracks solar development activity occurring in Wisconsin and periodically publishes updates

on our website. As indicated in Ex.-RENEW-Vickerman-2, the state is in the early stages of a significant buildout of solar generating capacity. Though the scale of the buildout was modest at first, it has been accelerating since 2020. The largest category of solar power projects—those totaling a minimum of 100 megawatts (MW) of capacity--require a Certificate of Public Convenience and Necessity (CPCN) issued by the Public Service Commission (Commission) before they can proceed to construction. From April 2019 through October 2022, the Commission approved 12 CPCN applications acounting for 2,149 MW of solar generating capacity. Several of these solar project proposals are paired with battery energy storage systems (BESS) designed to provide grid support during the late afternoon and and early evening hours. As of today, three of the solar farms that received CPCN approval—Two Creeks, Point Beach, and Wood County—are fully operational, totaling 400 MW. Over the next 14 months, five additional solar plants with CPCN permits—Badger Hollow, Paris, Grant County, Onion River, and Springfield—should become fully operational. All told, by the close of 2023, the eight solar plants listed above will account for 1,350 MW of capacity, In addition, the Commission approved two applications from Wisconsin Power and Light to construct and operate eight solar plants that had received siting approval from local jurisdictions. All eight plants, totaling 489 MW of capacity, should also be operational by the close of 2023.

Q. How does Northern Prairie Solar fit into the solar buildout underway in Wisconsin?

Northern Prairie Solar is one of six proposed solar generation projects presently undergoing review via the Commission's CPCN process. The other five are Portage (9810-CE-100), Saratoga (9816-CE-100), High Noon (9814-CE-100), Langdon Mills (9818-CE-100), and Elk Creek Solar (9819-CE-100). The combined solar capacity in all six projects total 1,301 MW if approved (see Table 1 below), with Northern Prairie Solar accounting for 101 MW of that total. All in all, I estimate that there are approximately 4,153 MW of utility-scale or front-of-meter solar generation projects in Wisconsin today that are either (1) operational, (2) under construction, (3) permitted but not yet under construction, or (4) under siting review by either the Commission or a local jurisdiction.

Table 1

Solar (and storage) projects undergoing Commission review as of November 2022

Project	**Solar Capacity** (in MW(AC)	**BESS Capacity** (AC capacity except where noted)
Portage	250	137.5 MW/550 MWh
Saratoga	150	52.5 MW/210 MWh
Northern Prairie	101	None
High Noon	300	165 MW/660 MWh
Langdon Mills	200	50 MW/200 MWh
Elk Creek	300	76 MW(DC)
Total	**1,301**	365 MWAC/1,420 MWh + 76 MWDC

Q. How important are in-state sources of utility-scale solar power to the broader policy aims of Wisconsin's energy policy?

A. In RENEW's view, the solar projects listed in Ex.-RENEW-Vickerman-2 will serve the public interest by tilting Wisconsin's renewable generation portfolio, now weighted in favor of out-of-state sources, firmly in the direction of in-state facilities. Appendix E in Ex.-RENEW-Vickerman-3 contains a breakdown of 2021 renewable generation between in-state and out-of-state sources. In all of 2021, Wisconsin electric providers derived only 39% of their supplies of renewable electricity—two out of every five MWh—from sources located in Wisconsin, while a remarkable 61% of the renewable electricity sold in Wisconsin that year originated from another state. Indeed, more than half (55%) of Wisconsin's renewable electricity came from windpower projects located in Illinois, Iowa, Minnesota and South Dakota, some of which are owned by or are operating under contract to Wisconsin electric providers (See Appendix E in Ex.-RENEW-Vickerman-3). This outsourcing of renewable power results in the export of manufacturing opportunities, local government revenues, landowner income, and workforce participation that could otherwise yield direct and indirect economic benefits to Wisconsin communities.

The emergence of solar energy as a reliable, low-cost source of electric power presents an opportunity to build a geographically dispersed portfolio of zero-emission plants within Wisconsin's borders. As noted earlier, this portfolio has already started to take shape. In western Wisconsin, where Northern Prairie Solar would be located, there is sufficient land and transmission infrastructure to

accommodate additional bulk sources of solar power, whereupon they would cost-effectively serve rural and urban communities across the state. Solar power at this scale and in this region can contribute substantially to the generation transition underway to fill in the capacity holes created by retiring fossil generating plants.

Q. How much electricity do you estimate will be generated by this group of projects over their first 10 years of operation?

A. In calculating the future output from these projects, I must make several assumptions regarding their productivity. For the first 27 projects listed in Ex.-RENEW-Vickerman-2, I used a capacity factor of 23%, even though the applications for a substantial portion of these projects assumed higher capacity factors. While that capacity factor may seem conservative, it was selected to internalize the slight degradation factor that will occur over the course of a solar panel's operating life. That degradation factor is assumed to be 0.5%/year, or 5% over a 10-year period. That said, all of the 27 projects in the first group except the 417 kW project serving Superior Water, Light and Power will utilitize single-axis tracking devices to maximize the capture of the solar resource in the early morning and late afternoon hours. Most of these projects will make use of bifacial panels, which should result in increased output in the winter months relative to fixed-mount arrays. With these assumptions in mind, the combined output from the 3,389.9 MW of capacity represented in that group should average 6,829,970 megawatt-hours (MWh) per annum over their first 10 years of operation, for a total of 68,299,700 MWh.

For the second group of projects (Nos. 28-56), I reduced the capacity factor to 22.75% to account for the handful of installations in operation that rely on fixed-mount racking, which is slightly less productive relative to projects that use single-axis tracking devices. However, since most of the solar capacity represented in the second group operates with single-axis tracking devices, the reduction in aggregate output should be slight. With that assumption in mind, the combined output from the 763.9 MW of capacity represented in the second group should average 1,522,376 MWh per annum over the projects' first 10 years of operation, for a total of 15,223,760 MWh.

When the the subtotals from each group are added together, the combined total should average 8,352,346 MWh per year over the projects' first 10 years of operation.

Q. What percentage of Wisconsin power generation do those numbers represent?

A. According to the most recent State Electricity Profile (Ex.-RENEW-Vickerman-4) published by the U.S. Energy Information Administration (EIA), the electric power sector in Wisconsin generated 61,448,545 MWh in 2020. When the estimated 8,352,346 MWh of solar generation is divided by the statewide electric generation total in 2020, that increment of solar power would have accounted for 13.5% of the electricity produced in Wisconsin that year. EIA plans to publish its 2021 Wisconsin electricity profile before the end of this year.

Q. What percentage of Wisconsin electricity sales do those numbers represent?

A. A comparison of the estimated output from the solar projects listed in Ex.-RENEW-Vickerman-2 to Wisconsin electricity sales yields a similar though smaller percentage, as Wisconsin is a net importer of electricity. According to the Commission's Renewable Portfolio Standard Report for 2021, which can be accessed from docket 5-RF-2021 (see page C-4 in Ex.-RENEW-Vickerman-3), annual retail sales reported by Wisconsin electricity providers over the 2018-2020 period averaged 69,181,062 MWh. When the estimated 8,354,563 MWh of solar generation is divided by the the electricity sales average cited above, that increment of solar capacity would have accounted for 12% of the electricity sold in the state of Wisconsin during that three-year period.

To put the above numbers in perspective, in-state solar generation accounted for 0.5% of total electricity sales in Wisconsin in 2021 (364,283 MWh out of 69,537,075 MWh). These numbers appear in Appendix E of the 2021 Renewable Portfolio Standard Report (see Ex.-RENEW-Vickerman-3).

Q. What is your estimate of Northern Prarie Solar's expected contribution to that total?

A. To estimate Northern Prairie Solar's output over its first 10 years, I used a capacity factor of 23%, even though the project will utilize single-axis traking devices and may use bifacial panels, which are more productive than monofacial panels. Assuming a 23% capacity factor, Northern Prairie Solar would produce an average of 203,495 MWh/year over the first 10 years of its operating life, accounting for approximately 2.5% of the solar generation represented by the 56 projects listed in Ex.-RENEW-Vickerman-2.

Q. Does the EIA report emissions data attributable to Wisconsin's electricity sector?

A. Yes. EIA'S 2020 profile for Wisconsin tracks carbon dioxide emissions, sulfur dioxide emissions and nitrogen oxide emissions from electricity generators in the state. The profile expresses the emissions both in terms of annual volumes and per-MWh rates. In Ex.-RENEW-Vickerman-4, EIA reports that Wisconsin's electricity sector emitted a total of 33,174,000 metric tons of carbon dioxide in 2020. That works out to an emissions rate of 1,188 pounds, or 0.54 metric tons, of carbon dioxide per MWh generated in Wisconsin.

Q. As a zero-carbon source of renewable electricity, how much carbon dioxide would Northern Prairie Solar displace through its operation?

A. If EIA's emission rate of 1,188 lbs./MWh were multiplied by Northern Prairie Solar's expected output over its first 10 years, the project would avoid or displace an average of 109,887 metric tons of CO_2 per year over its first 10 years of operation, all other things being equal. While this is admittedly a crude methodology that does not take into account expected power plant retirements in the next five years, it is a reasonable approach for producing a ballpark estimate of emissions reductions from a power plant fueled by a noncombustible renewable energy source. Moreover, the calculation I provide can be updated each year when EIA publishes a new state electricity profile for Wisconsin, and can be cross-checked with every new iteration of the Strategic Energy Assessment.

Q. How will Northern Prairie Solar contribute to system reliability?

A. Utility-scale solar plants equipped with single-axis tracking devices are designed to follow the sun's daily path during daylight hours, starting with the first minutes of sunrise and continuing through to the final minutes of sunset. This design feature optimizes the solar plant's ability to capture sunshine in the early morning and in the late afternoon/early evening hours. The latter attribute is particular valuable for utilities that have significant summer peaks, which tend to occur between 3:00 pm and 7:00 pm in those months. A utility-scale solar project of this design will reduce the need for generation from other utility plants during late afternoon peak periods. This particular atttribute will become more valuable to Wisconsin electricity customers as fuel prices increase, as they have been doing this year.

Q. Does RENEW support approval of the Northern Prairie Solar project?

A. Yes. RENEW Wisconsin wholeheartedly supports Commission approval of Northern Prairie Solar. In our view, this project, like other large solar generating facilities that the Commission has approved, would protect human health and the natural environment while strengthening the state's economy. The economic benefits would come in two forms. Initially, during its construction phase, the Northern Prairie project would create more than 180 well-paying jobs for the state of Wisconsin, according to Northern Prairie Solar witness David Loomis (Direct-NPS-Loomis-4). The participation of skilled laborers and apprentices at the job site would increase expenditures and tax revenues for St. Croix County and the state by as much as $24 million in total as project construction proceeds. Second, Northern Prairie Solar will, once energized, provide rental income to participating

landowners as well as payments in lieu of taxes to local jurisdictions hosting the installation. Consistent with Wisconsin's Energy Priorities Law, this project will provide these benefits by converting a locally available, noncombustible renewable energy resource—sunshine---to electricity, and feeding its output into existing power lines. Electricity generated by Northern Prairie Solar should displace fossil-fueled generation at all times, which will measurably reduce the volume of airborne pollutants and greenhouse gases discharged from fossil generation sources in the area, including the A.S. King plant in Stillwater, Minnesota.

Q. Does this complete your direct testimony?

A. Yes, it does.