BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application for the Certificate of Public Convenience and Necessity of Elk Creek Solar PV I, LLC to Construct a Solar Electric Generation Facility in the Town of Spring Brook, Dunn County, Wisconsin	Docket No. 9819-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, Suite 300, Madison, WI 53703.

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

A. I am employed by RENEW Wisconsin (RENEW). My current position is Clean Energy Deployment Manager.

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. I continued working for RENEW as its Policy Director, a position I held until early 2023. In my current capacity as RENEW's Clean Energy Deployment Manager, I engage in regulatory and permitting proceedings at the state and local level involving either approvals of individual renewable generation projects or broader issues affecting clean energy development across the state. 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 Elk Creek Solar and Battery Energy Storage project (Elk Creek 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 March 2023;
- Ex.-RENEW-Vickerman-3, an article in ***Agweek*** profiling Chippewa Valley Bean, a sister company to Doane Limited, the principal landowner hosting the Elk Creek Solar project; and

- Ex.-RENEW-Vickerman-4, a February 2023 article published by the ***Minneapolis Star Tribune*** reporting on the permanent closure of the Allen S. King plant in Stillwater, Minnesota, set for 2028.

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

A. 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 March 2023, the Commission approved 13 CPCN applications acounting for 2,399 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 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, four additional solar plants with CPCN permits—Badger Hollow (150 MW), Onion River (150 MW), Paris (200 MW), and Springfield (100 MW)—should become fully operational. All told, the seven CPCN-level solar plants that will be operational

by the end of 2023 will account for 1,000 MW of capacity. In addition, the Commission approved two applications from Wisconsin Power and Light to construct and operate eight solar plants that had already received siting approval from local jurisdictions. All eight plants, totaling 489 MW of capacity, are expected to be operational by the close of 2023. When distributed solar generation projects are added to the mix, Wisconsin could see more than 1,500 MW of new solar generation capacity come online before the end of this year.

Q. How does Elk Creek Solar fit into the solar and storage buildout underway in Wisconsin?

A. With the recent approval of Portage Solar, there are now six proposed solar generation projects presently undergoing review via the Commission's CPCN process, including Elk Creek Solar. The other five are Saratoga (9816-CE-100), Northern Prairie (9815-CE-100), High Noon Solar (9814-CE-100), Langdon Mills (9818-CE-100), and Silver Maple (9813-CE-100). If approved, the combined solar capacity of these projects would amount to 1,251 MW (see Table 1 on page 6), with Elk Creek Solar accounting for 300 MW of that total. All in all, I estimate that there are approximately 4,284.8 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 March 2023

Project	**Solar Capacity** (in MW(AC))	**BESS Capacity** (AC capacity except where noted)
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 (at POI)	76 MW(DC)/304 MWh
Silver Maple	200	None
Total	**1,251**	365 MW(AC)/1,420 MWh + 76 MW(DC)

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. In docket 5-RF-2021, the Commission staff's 2021 Renewable Portfolio Standard Report contains a breakdown of 2021 renewable generation between in-state and out-of-state sources.[1] In all of 2021, Wisconsin electric providers

[1] *See* Commission Memorandum, Appendix E, PSC REF# 441273.

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, according to the same report, 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.[2] 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 northwest Wisconsin, where Elk Creek 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 planned for later this decade.

[2] *See id.*

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 29 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 29 projects in the first group except the 417 kW project serving Superior Water, Light and Power will utilize 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 3,520.9 MW of capacity represented in that group should average 7,093,909 megawatt-hours (MWh) per annum over their first 10 years of operation, for a total of 70,939,090 MWh.

For the second group of projects (Nos. 30-58), 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 subtotals from each group are added together, the combined total should average 8,616,285 MWh per year over the projects' first 10 years of operation.

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

A. Acccording to the most recent State Electricity Profile of Wisconsin published by the U.S. Energy Information Administration (EIA), the state's electricity sector generated 64,276,480 MWh in 2021.[3] When the estimated 8,616,285 MWh of solar generation is divided by the statewide electric generation total in 2021, that increment of solar power would have accounted for 13% of the electricity produced in Wisconsin that 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 staff's Renewable Portfolio Standard Report for 2021,[4] annual retail sales reported by Wisconsin electricity providers over the 2018-2020 period

[3] *See* Wisconsin Electricity Profile 2021, Energy Information Administration (https: // www. eia.gov/ electricity/state/Wisconsin/).
[4] *See* Commission Memorandum, Appendix C-4, PSC REF# 441273.

averaged 69,181,062 MWh. When the estimated 8,616,285 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 also appear in the Commission staff's 2021 Renewable Portfolio Standard Report.[5]

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

A. To estimate Elk Creek Solar's output over its first 10 years, I used a capacity factor of 24%, reflecting the fact that the project will utilize single-axis traking devices and may use bifacial panels, which are more productive than monofacial panels. Assuming a 24% capacity factor, Elk Creek Solar would produce an average of 630,720 MWh/year over the first 10 years of its operating life, accounting for approximately 7.5% of the solar generation represented by the 58 projects listed in Ex.-RENEW-Vickerman-2.

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

A. Yes. EIA's 2021 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

[5] *See* Commission Memorandum, Appendix E, PSC REF# 441273.

per-MWh rates. In its most recent state electricity profile of Wisconsin, EIA reports that the state's electricity sector emitted a total of 36,408,000 metric tons of carbon dioxide in 2021.[6] That works out to an emissions rate of 1,246 pounds, or 0.566 metric tons, of carbon dioxide per MWh generated in Wisconsin. The emission rate reported in 2021 is higher than the numbers from the previous two years (1,188 lbs. in 2020[7] and 1,233 lbs. in 2019[8]). I estimate that it will take two more years before the cumulative impact from this wave of solar generation translates into lower CO_2 emissions as reported in EIA's electricity profiles for Wisconsin.

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

A. If EIA's emission rate of 1,246 lbs./MWh were multiplied by Elk Creek Solar's expected output over its first 10 years, the project would avoid or displace an average of 357,216 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

[6] *See* Wisconsin Electricity Profile 2021, Energy Information Administration (https: // www. eia.gov/ electricity/state/Wisconsin/).
[7] *See* Wisconsin Electricity Profile 2020, Energy Information Administration (https: // www. eia.gov/ electricity/state/archive/2020/Wisconsin/).
[8] *See* Wisconsin Electricity Profile 2019, Energy Information Administration (https: // www. eia.gov/ electricity/state/archive/2019/Wisconsin/).

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 Elk Creek Solar contribute to system reliability?

A. Utility-scale solar plants built 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 particularly valuable for utilities that have significant summer peaks, which tend to occur between 3:00 pm and 7:00 pm in those months. Along with 300 MW(AC) of solar generation, Elk Creek Solar also features a battery energy storage component totaling 76 MW (DC). The battery energy storage system enhances the solar output by storing excess production that occurs in the morning or early afternoon for use later that day. With the capability of providing grid support after sundown, a solar and storage project in Dunn County will reduce the need for generation from other utility sources during late afternoon peak periods. This particular atttribute will become more valuable to Wisconsin electricity customers given the volatility of natural gas prices experienced over the last 12 months and the effects of that fuel price volatility on wholesale electricity costs.

Q. What impact, if any, will this project have on local agriculture?

A. If approved, Elk Creek Solar would be constructed on more than 2,000 acres of actively cultivated farmland. All but 70 acres of the project site is owned by Doane Limited (Ex.-Elk Creek Solar-Application-Application: Pages 10-11).

Doane Limited is a sister company to Menomonie-based Chippewa Valley Bean, currently the world's largest processor and exporter of kidney beans (see company profile in Ex.-RENEW-Vickerman-3). The article explains that Doane Limited has provided value to Chippewa Valley Bean as a test ground for new equipment for new seed varieties and new techniques in the field. Chippewa Valley Bean has turned its attention to sustainability measures in recent years, including innovations to save energy and reduce its carbon footprint. As explained by Charles Wachsmuth, Sales and Marketing Manager for Chippewa Valley Bean:

> "I fully believe, maybe not in 2023, but by 2024 we'll have a full three scope carbon audit done, and we'll have set a neutrality date," he said. "And this stuff is important, in fact, one of our most important domestic customers has said, 'If you can come through with a carbon neutral bean, we will package that separately and it will have its own label.' Is anybody requiring the steps of us now? Not yet, but it's only a matter of time." (Ex.-RENEW-Vickerman-3)

It is evident from this article that Chippewa Valley Bean and Doane Limited believe that growing and processing beans in a sustainable fashion is key to producing a highly desirable product and maintaining a competitive edge vis-à-vis other companies in this agricultural space. Hosting a large-scale solar array on their farmland demonstrates a commitment to carbon neutrality, and will enable the companies to market themselves as industry leaders. This unique set of circumstances suggests that solar energy development and agriculture can not only coexist side by side in the rural landscape, they can become mutually beneficial elements of a healthier farm economy down the road.

Q. Does RENEW support approval of the Elk Creek Solar project?

A. Yes. RENEW Wisconsin wholeheartedly supports Commission approval of Elk Creek 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, Elk Creek Solar would create more than 650 new local jobs for the state of Wisconsin, according to the Economic Impact and Land Use Analysis prepared on behalf of this project (Ex.-Elk Creek Solar-Application-Appendix X: Page 1). The participation of skilled laborers and apprentices at the job site would increase expenditures and tax revenues for Dunn County and the state of Wisconsin by more than $90 million in total as project construction proceeds (Ex.-Elk Creek Solar-Application-Appendix X: Page 2). Second, Elk Creek 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. Utility-scale PV generating facilities built today are expected to have useful lives in excess of 30 years. For the foreseeable future at least, electricity generated by Elk Creek 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 Allen S. King coal-fired power plant in Stillwater, Minnesota. Assuming a CPCN permit is granted, the applicant expects to complete construction of Elk Creek Solar project by the spring of 2025 (Ex.-Elk Creek Solar-Application-Application: Page 35). The project should be online and operating by the time Xcel Energy permanently closes the King plant in 2028 (see Ex.-RENEW-Vickerman-4).

Q. Does this complete your direct testimony?

A. Yes, it does.